

# The Limitations of the Quantified Self for Persuasive Self-Optimization Apps

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## Abstract

This paper explores how the quantified self and the use of persuasive apps influence various activities, such as sports, cooking and eating, sleeping, and reading. We aim to find out how the experiencing self and remembering self differ in terms of considerations for these activities and how these differences could influence a person's expectations and experiences. We conducted a scenario-based survey, where a group of 51 participants was divided into two groups associated with both perspectives. The results show how these considerations align with those reported in the literature and those implemented in currently available persuasive apps. With this study, we provide insights in the use of current apps and for the design of future apps that are built upon the quantified self.

## CCS Concepts

• **Human-centered computing** → **Empirical studies in HCI**; *HCI theory, concepts and models*; • **Social and professional topics** → *User characteristics*.

## Keywords

quantified self, persuasive systems, experiencing self, reflecting self

## 1 Introduction

It is becoming more and more common for people to measure their performance during activities. When going for a run, many people use their smartphones to measure the distance they run, their speed and their heart rate. These metrics can be used by apps to evaluate performance and to aid in setting future goals.

For, running, it makes a lot of sense to measure performance. But for other activities, such as reading, more qualitative values concerning the reading experience seem to be more important. However, reading apps that are focused on quantitative reading goals may transform the actual reading experience – possibly resulting in users feeling urged to read faster or more.

An even more urgent example where quantification is reported to be detrimental are sleep apps, which may actually cause anxiety

and insomnia<sup>1</sup>. In general, it can be observed that the quantified-self movement, with persuasive apps that support our daily activities by translating them into measurable outcomes, has great potential, but also comes with – sometimes unforeseen – drawbacks [7, 20].

One of these downsides is that the act of measuring performance for certain activities may make these activities less enjoyable. Furthermore, as will be discussed in the next section, measuring is highly context-dependent: one metric might be appropriate for an activity such as sports, but not suitable for supporting reading. As a final consideration, the theory of 'two selves' states that an activity is perceived differently while planning and performing it (the so-called 'experiencing self') than when looking back on that activity (the 'remembering self') [11, 23]

In order to shed further light on this topic, we carried out a scenario-based study on the quantified self for the following activities: sports, cooking and eating, sleeping, and reading. We divided our participants in two groups, the 'experienced self group' and the 'remembering self group'. Both groups were asked which considerations they had for the above-mentioned activities, seen from both different perspectives.

The study is guided by the following main research questions:

- (1) *R1*: What do the experiencing self and remembering self value when gathering data about various activities?
- (2) *R2*: What is the influence of specific metrics on the experiencing self and remembering self during a certain activity?
- (3) *R3*: What are the limitations of measuring in certain activities?

The results show where both perspectives align with one another and where they do not. We also provide insights in the benefits and drawbacks of supporting and persuasive apps that exploit the quantified self for various activities. Particularly, we show and discuss how the experiencing self is more inclined to reach particular outcomes, whereas the remembering self is more concerned about the actual experience and enjoyment.

This paper is structured as follows. In the upcoming section 2, we introduce relevant theories of well-being, the theory of bounded rationality that separates the experiencing and remembering self, and give a brief introduction to the quantified self. Following the methodology in section 3, we present the results in section 4, with subsections for each separate activity. The discussion in section 5 follows the same structure, while interpreting the results and the



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<sup>1</sup><https://www.theguardian.com/lifeandstyle/2019/jun/07/sleep-apps-backfire-by-causing-anxiety-and-insomnia-says-expert>

alignment with currently available apps that support these activities. In the concluding section 6, we discuss general observations, implications and future directions.

## 2 Related Work

In this section, the relevant literature is presented. First, we explore theories and measures of well-being. Then we will explain the theory of bounded rationality and the influence it has on our experiences and choices. Finally, we will delve into the quantified self and its influence on reaching goals.

### 2.1 Theories of Well-Being

There are many definitions of well-being [4], and most people have an intrinsic intuition on what it could mean. A few very general ways for describing well-being include: 'quality of life', 'prosperity', and 'something intrinsically valuable to someone'. Another aspect of well-being is how to actually measure it. For this, there are basically three trains of thought.

First, the *hedonistic way* sees well-being as the total sum of pleasure and pain in life. A classic hedonistic theory is Epicureanism, with as a main core value that living a moderate life would lead to the highest well-being [12]. Modern thinkers drew inspiration from Epicureanism and a current hedonistic theory that was derived from it is utilitarianism, which creates a theoretical sum of all the positive and negative consequences of an action, and dictates that the highest ranked action is the most moral action to take [5].

Second, *desire theories*, consider well-being as a list of desires. Desire theories are different from hedonistic theories in that they ground their well-being in fulfillment minus frustration of personal desires [4]. Desire theories take a more individualistic worldview than utilitarianism, which is rooted in a more collectivist worldview.

Third, *objective list theories* are very different from hedonistic and desire theories, because they do not measure well-being as one value, but instead it regards different aspects – such as happiness, relationships, achievement, aesthetic appreciation, creativity, and knowledge – as intrinsically valuable [15]. Perhaps one of the most popular objective list theories is Maslow's pyramid of self-actualization [8], which states that humans have a few basic needs that they need to satisfy, ranked in order of importance: first come physiological needs, followed by safety and security needs. If these two needs are satisfied, the next steps are love and belonging, esteem and finally self-actualization.

### 2.2 Bounded Rationality

The theory of bounded rationality aims to explain how human beings make choices and how we pay attention to our surroundings [10]. Bounded rationality aims to improve upon the rational agent model, which assumes that persons always make the optimal decision for their subjective goals, based upon the information that is available to them.

A core aspect of bounded rationality is that we experience events differently than how we remember them. A familiar example is a party that finishes with a heavy argument at the end of the evening. While the party prior to the argument could have been great, the memory of the party is likely to be ruined by the argument. This

illustrates the difference between the *experiencing self* and the *remembering self*.

The experiencing self considers an experience or activity at the very moment it is happening. The remembering self evaluates experiences and activities by a proven rule, called the peak-end rule [11]. This means that the remembering self judges activities based on how they experienced its peak and how they experienced the end of an activity [23]. Our choices are thought to be largely based upon judgments from the remembering self.

### 2.3 The Quantified Self

The quantified self (QS) is a way of thinking about a person or a group of people by gathering metrics to define them in terms of data [13]. Additionally, the QS is a practice where persons feel a need for information about themselves, and then decide to gather data to gain insight in order to self-improve [3].

Multiple categories of variables can be distinguished in terms of the QS: physical activities, diet plans, psychological states and traits, mental and cognitive states, as well as environmental, situational and social variables [20]. Some QS'ers collect their data manually, others use off-the-shelf devices to gather data, and some of the most dedicated QS'ers build their own hardware and software.

A common application of QS is found in (gamified) persuasive systems. These are systems that use gaming elements in non-gaming fields – like education, healthcare, sustainability, and fitness – to motivate users to achieve their goals. These systems try to persuade users to change behavior by letting them set specific goals for their intended behavior [9]. Persuasive strategies include the use of rewards and competitive elements such as leaderboards. Such strategies makes sense in the context of a sporting activity, but in the context of book reading, for instance, they have been reported to lead to a false sense of competition [21].

## 3 Methodology

The study was conducted as an online scenario-based Qualtrics survey with two conditions: the experiencing self and the reflecting self. After an elaborate example scenario, in which users were given several considerations that may be relevant when planning a movie night (for the experiencing-self group), or when thinking back about that evening (the reflecting-self group). Following the movie example, both groups of participants were prompted to think about their considerations for the following activities: sports, cooking and eating, sleeping, and reading. These activities were chosen because they varied from more common activities to measure, such as sports, to less common activities to measure, such as reading.

The scenario for each activity was introduced concisely, without steering users into a particular direction. For instance, the experiencing self participants were given the following scenario for the activity 'sleeping': "*Imagine that you are going to bed right now. Please try to think about considerations you have when you are going to sleep.*" Conversely, the remembering self participants were prompted: "*Imagine that you are evaluating your sleep from last night. Try to think about the outcomes that you would evaluate your night of sleep on.*"

We explicitly asked for 'considerations', to invite both qualitative considerations (such as the movie genre, or having sufficient food

and drinks) as well as quantitative considerations and measures (such as the movie length or movie rating). Participants were asked to give between three and five considerations, in any way they wished – varying from concrete measures and keywords to full sentences with deliberations.

To analyze the results, an open coding approach with Nvivo 14 was used. Each individual answer for each activity was put into a code. During a thematic analysis, the codes were subsequently grouped into axial codes. To analyze the results, graphs were created for each activity, where the experiencing and remembering self were put together in order to compare them.

Participants were recruited with targeted online announcements in the private and professional environments of the researchers. Before participants could start, they needed to agree with a standardized consent form. The study has been evaluated using the obligatory university-provided privacy and ethics quick scan, which did not indicate any specific concerns. All participants remained anonymous and no demographic data was collected.

## 4 Results

The study was completed by 51 participants, of which 24 participated in the experiencing self group and 27 participated in the reflecting self group. The slight imbalance was caused by a small number of participants who did not complete the survey. All participants chose to reveal their gender: there were 26 female participants and 25 male participants. One third of the participants were between 18 and 24 years old, another third between 25 and 34, and the remaining third was 35 years or older.

In total, the participants provided 1119 considerations, which were grouped in 234 individual codes. These codes were grouped into 9 axial codes, of which 7 were assigned to at least two activities: personal considerations, social considerations, mental well-being, physical well-being, comfort, enjoyment, and practical considerations. The axial codes for experience as a whole and quality factors were dropped due to too little overlap.

In this section, all activities are discussed in separate subsections: sports, cooking and eating, sleeping, and reading. Each subsection starts with an overview of the axial codes, followed by a discussion of the considerations behind these axial codes.

### 4.1 Sports

Figure 1 provides an overview of all axial codes derived from the considerations provided by the participants. It may seem striking that the axial code ‘enjoyment’ has remained empty, but from the discussion below it will become clear that, for sports, mere enjoyment rather involved more specific issues, such as comfort, physical and mental well-being. We will discuss the codes first from the perspective of the experiencing self, followed by the perspective of the remembering self.

*Experiencing self.* From the perspective of the experiencing self, most considerations involved physical well-being, adding up to 42 references. Most considerations involve physical training goals or achievements, such as being able to run or ride a certain distance or maintaining a certain speed. Other goals include improving one’s condition, muscles, flexibility, and losing weight. Some participants also wanted to learn new techniques and skills.

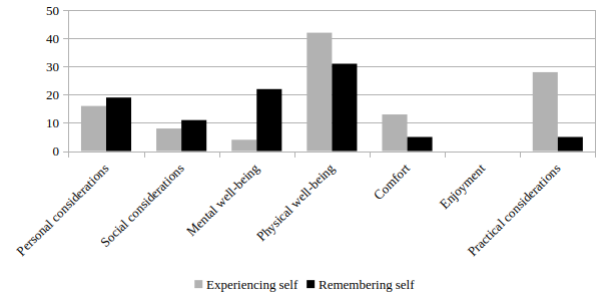


Figure 1: Axial codes for sports

Practical considerations received 28 references. 14 of those references were about how much time it would cost and how much time they would want to spend. Other considerations included whether participants would need to wear special attire or having to prepare anything for training.

There are also many personal considerations, adding up to 16 references. The largest considerations for this category is that participants wanted to have fun and whether they actually felt like sporting. Further considerations include desire to win, to play a good game, and to have a fun competition. People also consider that they aim to develop a sport into a habit and hope that the activity brings variety to their days.

Some comfort considerations are also mentioned, adding up to 13 references. The most mentioned consideration is the weather and the influences it has on the sport. There are also 8 references to social consideration, which are mostly about the company they will be doing the activity with.

*Remembering self.* When looking at the practical considerations for sport from the remembering self, it becomes apparent that the amount of references is far lower than for the experiencing self, with only 5 of them. All of these references are about the time spent on the activity.

Physical well-being is still the most referenced, with 31 references, largely involving evaluative measures, which mostly involve performance goals, such as speed, distance and how many goals were scored. Participants also considered whether they were in shape or suffered any pain during the sports activity.

The mental well-being category received 22 references. Participants considered how they felt generally or whether they feel tired. They also considered whether the activity cost or gave energy. Other considerations mentioned by the participants were relaxation, satisfaction, educational value, and clearing the mind.

Personal considerations received 19 references. Participants considered whether they had fun, found the activity exciting, how much they had laughed, and whether the time was well spent.

### 4.2 Cooking and Eating

During the analysis of these related activities, it turned out that cooking and eating both evoked different responses. The experiencing self was mainly involved with the cooking process, while the reflecting self mainly evaluated the dining experience. The axial codes for this activity are summarized in figure 2.

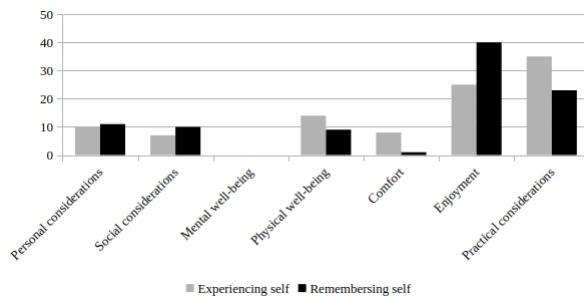


Figure 2: Axial codes for cooking and eating

*Experiencing self.* For cooking, practical considerations were with 35 references the highest contributing factor, including considerations regarding preparation time, ingredients at home, and costs.

The second largest consideration was the enjoyment of the food, with 25 references. Participants were primarily considering the taste of the food. Some participants also stated that they wanted to prepare something new. Mental well-being involved the difficulty of a recipe, or how much energy they would have for cooking. Lastly, a small amount of the considerations was social in nature, considering whether they were eating alone and one person referencing that the meal had to be impressive.

Another consideration for cooking and eating is physical well-being. With 14 references, participants considered the healthiness of the food. Some participants considered whether their meal contained enough vegetables. Others specifically mentioned some quantitative aspects of food like proteins and calories.

*Remembering self.* Reflecting upon the practical aspects of the cooking process, participants asked themselves practical questions like “Did it take me long?” or “Would I do this differently next time?”. The number of practical considerations for the remembering self was considerably lower than for the experiencing self, though.

The majority of comments, 40 in total, fell in the enjoyment category, focusing on the presentation and taste of food, and with particular attention for the satisfaction of the guests and social enjoyment. Comfort received in both groups only a few considerations, which suggests that comfort is considered a given, as a premise for the enjoyment associated with this activity.

There is a slight increase in social considerations from 7 to 10, with most considerations being about opinions about the food.

### 4.3 Sleeping

For sleeping, the axial codes are summarized in figure 3. From the numbers, it becomes immediately clear that the experiencing self is occupied with practical considerations before going to sleep, with the remembering - awakening - self merely reflecting on their sleep.

*Experiencing self.* The sleeping activity evoked 27 references that involved practical considerations. The most common of these references are about wondering when they need to wake up, setting an alarm, waking up, and thinking about what needs to be done tomorrow. Other kinds of considerations involved preparational activities associated with going to sleep, like brushing their teeth, getting a glass of water, or putting nose spray on their nightstand.

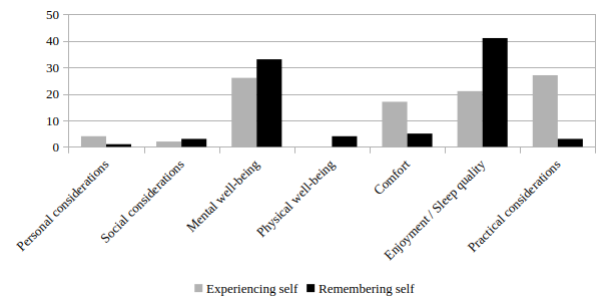


Figure 3: Axial codes for sleeping

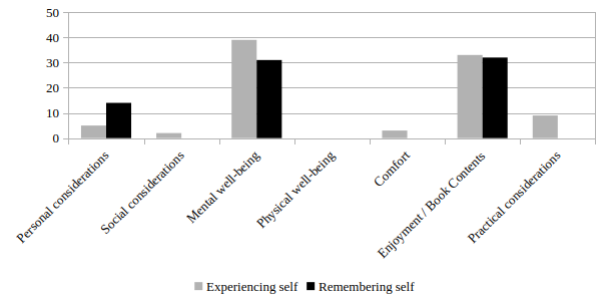


Figure 4: Axial codes for reading

The second-largest group of consideration, with 26 references, involves mental well-being. People considered how tired they feel, whether they achieved their goals for the day, and stated the wish to wake up well rested.

Other considerations are goals in terms of sleep quality, which received 21 references. People stated how many hours they hoped to sleep, and that they wanted to rest deep, fall asleep quickly and not wake up during the night.

*Remembering self.* The largest consideration for the remembering self is sleep quality, which received 41 references. Strikingly, more than a third of these references are about how often they had woken up during the night. The participants also often evaluated how long they slept. Other considerations were about how fast they fell asleep, whether they had to leave their bed during the night, how they perceived the depth of their sleep, how easy it was to get up in the morning, and whether they had dreamed.

Mental well-being is also a large consideration for the remembering self, with 33 references. Two thirds of these references concerned whether the participant felt rested. Some participants also wanted to evaluate whether they had nightmares or had worrisome thoughts during the night. The other categories received far fewer references. For instance, physical well-being received 4 comments, considering stiffness, pain and sweat.

### 4.4 Reading

As can be observed in figure 4, reading is an activity largely associated with mental well-being and enjoyment.

*Experiencing self.* For this activity, people did not have many practical considerations, with only 9 references. People considered

whether they had sufficient time to read and which books they had on their reading list. Finally, one participant considered whether they still had a loaned book that they needed to finish.

With 39 references, mental well-being is the largest consideration for reading. Many participants considered the educational value of their books. Several also mentioned that when they are going to read, they wanted it to be a relaxing activity. Another consideration is that the participants will want to concentrate. Some further considerations, all with one reference, were that people wanted to be inspired or emotionally touched by the book.

People also considered content aspects, such as the genre, author, reviews, writing style, subject, and realism of a book. They also considered the number of pages in the book, its entertainment value and quality. Personal considerations involved questions such as how many pages they plan to read, or whether there were sequels or other books from the same writer. The only social consideration was about the popularity of the book they were going to read.

*Remembering self.* From the perspective of the remembering self, we can see that there are no practical considerations at all. The largest considerations involve the book contents, with 32 references addressing aspects such as writing style and quality, which together make up more than half of the references. A further interesting consideration is the ending of the book, which received 4 references. Two other considerations involve the character development and whether the story was based on a true story. Both of these considerations were mentioned just once.

Mental well-being was the second-large category, with 31 references from the remembering self perspective. A large part of these considerations evaluate the educational value of the book, just like the experiencing self perspective. The second largest consideration was whether participants were able to keep their focus while reading. Some participants also valued being able to identify with the characters. Some people also considered whether the book affected their mood, emotions or perspective.

The last category for evaluations were personal considerations. People considered whether a book was worth the time it took to read and whether it lived up to its expectations.

## 5 Discussion

As discussed in the related work, research has shown how the quantifying self can help people improve various aspects of peoples' lives. Ultimately, the goal of this research is to draw different perspectives of the quantifying self, by highlighting its opportunities as well as aspects to pay attention to.

In this section, we will explore how the various considerations – from the experiencing and the remembering self – relate to the quantification and persuasive support provided by apps that are currently available for these activities. The apps mentioned in this section are selected from several hand-picked lists of currently popular apps for the various activities. Similar to the result section, we discuss each activity in a separate subsection. We will draw overall conclusions in the final section of this paper.

### 5.1 Sports

From the participants' responses, it became clear that the most important consideration for sports involved physical well-being,

followed by the practical considerations, such as preparing for the activity, deciding what kind of things to bring, as well as cost and time. However, these practical considerations were far less relevant for the remembering self, arguably because they do not really matter once the activity is over.

Also, for the remembering self, mental well-being considerations saw a large increase compared with the experiencing self. This indicates that participants care how a sports activity makes one feel afterwards, while the experiencing self is still mainly concerned with performance. Further, the participants indicate that sports is also often seen as a social activity.

When comparing the participants' considerations with available fitness apps, there appears mainly a focus on the physical aspects. Wearables such as the Apple watch<sup>2</sup> or the Garmin watch<sup>3</sup> help to keep track of performance indicators such as the number of steps taken and calories burned, making use of sensors like a heart rate sensor, blood oxygen measurements and an accelerometer.

Other popular wearables and apps include Strava, Nike Training Club, FitOn and Gymshark. From the specifications, it becomes apparent that they make use of similar sensors and measures, in order to provide appropriate sports challenges and workout programs. These plans help recreational athletes achieve a sense of competence, autonomy and relatedness [19]. However, these social and reward functionalities can also behave like a double-edged sword, as particularly people with a lack of self-efficacy can feel demotivated by these applications [16].

Our participants also showed how they considered the social aspects of sports, such as team play and pleasantness on the field. Such considerations are not mentioned in the feature overviews of the apps that we inspected. Similarly, the personal considerations about wanting to enjoy the activity are also less represented.

### 5.2 Cooking and Eating

The results for cooking and eating showed that for the experiencing, cooking self, practical considerations were considered important, with enjoyment and healthiness as relevant considerations as well. Also for eating, the experiencing self was concerned with practicalities, such as the table setup. By contrast, the reflecting self was largely concerned with enjoyment - of food and company.

Popular food-related applications for the quantified self include MyFitnessPal<sup>4</sup> and MyNetDiary<sup>5</sup>. From the specifications, it becomes apparent that these apps largely focus on nutrition, health and weight loss. They allow users to monitor their food and water intake, and provide meal planning functionality. Functionality provided by other apps include allergen warnings and diet plans.

Interestingly, even though educational content about nutrition has been shown to teach people to eat healthy, those studies were not able to show actual improvements in health [14, 17]. Another concern has to do with eating disorders [14, 17]. In a qualitative study on the effects of quantifying nutrition, participants indicated that apps with a high level of quantification led to obsession, fixation on numbers, and extreme negative emotions [6]. Arguably,

<sup>2</sup><https://www.apple.com/watch/>

<sup>3</sup><https://www.garmin.com/en-US/c/wearables-smartwatches/>

<sup>4</sup><https://www.myfitnesspal.com/>

<sup>5</sup><https://www.mynetdiary.com/>

these studies suggest the need for some more focus on the actual enjoyment of food, to compensate for these issues.

In summary, available applications cater to practical considerations by making shopping lists and tracking leftovers and to healthiness by providing dietary filters when searching for recipes and assembling a meal plan. By doing so, they relieve users from having to think or worry about these aspects, but it might be useful to strengthen the link with aspects related to enjoyment.

### 5.3 Sleeping

For the participants, sleep quality and mental well-being were considered most important. These categories saw an increase in considerations when moving from the experiencing self to the remembering self, with factors like whether users fell asleep quickly, woke up often, and whether it was easy to come out of bed. Naturally, this is important, as feeling well-rested improves the rest of the day, making one feel more productive and less stressed [1].

By contrast, when looking at applications and hardware for sleeping, emphasis lies on the tracking of quantitative measures related to our sleep. Wearables and apps such as the Oura Ring Horizon<sup>6</sup> and the Apple Watch<sup>7</sup> provide sensors for monitoring, among others, heart rate, body temperature, sleep time, sleep stages, and respiration. Other apps<sup>8</sup> also aim to help in falling asleep using soundscapes and meditations.

Sleeping apps may provide useful measures for evaluating one's sleep, but exactly the quest for sleep optimization has been reported to cause anxiety and insomnia<sup>9</sup>. Other experts claim that the sensors used are not accurate enough and that sleep simply cannot be summarized in quantitative outcomes [2]. These observations are quite in line with the considerations that our participants reported, so at this point in time, it seems to remain an open question whether sleeping apps are beneficial or detrimental for our sleeping habits.

### 5.4 Reading

For reading, the participants' primary concerns for both the experiencing self and remembering self were considerations about the book contents and mental well-being considerations. In line with these observations, Schutte and Malouff [18] argue that readers' main motivation is the act of reading and recognition of reading time. The quantified self largely does not play a role for reading to the participants. The only reference to it in the survey answers were that some people mentioned contemplating how quickly they would have finished a book.

In line with these observations, reading devices, apps and websites such as Kindle<sup>10</sup> and Goodreads<sup>11</sup> mainly focus on book recommendation, reading support, and reflection by means of book reviews and ratings. The apps provide persuasive gamification based on the quantified self as well, such as a yearly book reading goal (Goodreads), number of pages vs time spent reading (Bookly<sup>12</sup>) and

rewards for reaching reading goals. However, quantifying reading 'performance' has been argued to be counterproductive. Yoo et al [22] evaluated a prototype e-reader application similar to Bookly. Some participants indicated that they liked the reminders and goal measuring of the application, while others said they made them feel pressured and stressed about reading. Furthermore, Etkin shows how quantifying reading does help increasing quantitative reading output, but at the cost of enjoyment in reading [7].

## 6 Conclusion

In this paper, we analyzed the different considerations of our participants for a wide range of activities: sports, cooking and eating, sleeping, and reading. This study aimed to find how the perspectives of the experiencing self and the remembering self differed from one another. The considerations from both groups were then compared, interpreted and related to the functionality offered by recommended apps for the associated activity, supported by relevant background literature. By doing so, this study highlighted upsides as well as downsides associated with supportive and persuasive technology that exploit the quantified self for these activities.

The considerations of our participants showed how, for all activities, the remembering self was far less concerned with practical considerations than the experiencing self, who needs to ensure that everything is in place while preparing and executing a particular activity (*R1*). The results also show how for the activities for which quantification is easier – sports, cooking and eating, and sleeping – there is a larger emphasis on quantitative measures compared to reading. In the context of Maslow's hierarchy of needs (as discussed in section 2.1), one could say that these applications are mostly associated with the physiological needs of the users. These considerations are arguably also more easily quantifiable in terms of objective list theory.

However, a strong focus on quantification can also make users lose track of what is important for certain activities (*R2*). One conclusion about measuring performance for these various activities is that the measurements – as well as the act of measuring – should be appropriate for the activity. It should also be taken into account that activities that a person does for enjoyment may not benefit from quantification and by doing so could even diminish enjoyment. For instance, it has been observed that quantification could have a negative impact on sleep and may even cause anxiety among users.

Considerations that are only minimally covered by persuasive apps are those about enjoyment, social considerations, mental well-being and personal considerations (*R3*). These aspects have been shown to be important to people, but they are more difficult to quantify. It may be hard to define objective (or even subjective) measures whether one enjoyed reading a book, had a good conversation during a meal, or felt challenged during a football match, but it still might be useful for users to take these aspects into account when evaluating these activities.

Overall, the predominant conclusion of this research is to be mindful about quantifying certain activities. Self-quantification can help in supporting or changing behavior, but needs to be treated with care to avoid unintended consequences.

<sup>6</sup><https://ouraring.com/product/rings/oura-gen3>

<sup>7</sup><https://support.apple.com/guide/watch/track-your-sleep-apd830528336/watchos>

<sup>8</sup><https://www.forbes.com/health/wellness/best-sleep-apps/>

<sup>9</sup><https://www.theguardian.com/lifeandstyle/2019/jun/07/sleep-apps-backfire-by-causing-anxiety-and-insomnia-says-expert>

<sup>10</sup><https://www.amazon.com/Amazon-Kindle-Ereader-Family/b?ie=UTF8&node=6669702011>

<sup>11</sup><https://www.goodreads.com/>

<sup>12</sup><https://getbookly.com/>



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