From Quantified Self to Qualified Self:

Creating a Happier User

Graduation Project Creative Technology
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31-01-2020

Abstract

Smart and wearable self-tracking devices have been a quintessential part of society ever since they have been brought to the mainstream market. Fitbits and smartwatches have been a fundamental part of the self-tracking culture, some more successful than others. These devices belong to what is generally known as the Quantified Self. The Quantified Self refers to the adoption of self-tracking wearables and applications that allow a user to quantify bodily functions such as step count, heart rate, sleep, caloric intake and much more.

The Quantified Self has received several points of critique over the years. In this paper, the argument is made that these points of critique can be solved by applying concepts from the Qualified Self, providing the user with more context and bringing the user closer and more in alignment with their data. Specifically using “mood” as additional data is a way to bridge the gap between Quantified and Qualified self and provided context for the tracked data. I.e. how a user felt at the time.

A product is proposed using these concepts. The product is a tool that measures the user’s mood, as well as factors that possibly influence mood. These factors are divided into three main categories: Social, Physical health and self care, and Productivity, and the user can attach a numerical value to these using a scale. In addition, water intake, coffee intake, alcohol intake, energy drink intake and cigarettes are tracked as well as step count and heart rate. This has the goal of showing the correlations between mood and these factors, and helping the user reflect in order to provide the tools that the user needs to improve their moods. This system was tested on seven female university students over the course of one week.

The results and feedback show that dividing the list of factors into categories was effective for showing correlation between the categories and mood and increasing data granularity. However, the factors were chosen through existing state-of-the-art applications and not through literature, which leaves some doubt whether these were the most appropriate design choices. Additionally, feedback indicated that tracking mood and these factors increased personal reflection and awareness in users, allowing them to be more in control of their wellbeing.

Acknowledgements

First of all, I would like to extend my thanks to the people that made this graduation project possible, my two supervisors who provided expert support and guidance through every step of the way.
Alma Schaafstal, who contributed honesty, anecdotes about her Quantified Self experiences, and great insight. Also, Randy Klaassen, who's feedback, wisdom and judgement helped tremendously. In addition, Randy Klaassen supplied the smart watches that were used for the user testing, for which I am grateful.

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Chapter 1: Introduction

This chapter is divided into two parts: the first part will discuss Quantified Self and why it is insufficient in helping users to achieve general wellbeing. The second part will discuss Qualified Self and propose that it might fill the gaps left in the Quantified Self movement, with the specific goal of helping users to achieve a high level of well-being.

1.1 Quantified Self

The Quantified Self as a concept has existed for a very long time. In its essence, quantifying the self means counting some sort of individual process, such as age, length, or weight. This can be done with very crude and simple tools. Age, for example, is measured by observation and memory. Humans quantify themselves in order to gain some sort of new understanding and self-knowledge. Nowadays, however, the Quantified Self has come to mean something more specific: it is the name of a movement that was started in 2007 by Gary Wolf and Kevin Kelly (Schurer, 2016). It comes to mean self-knowledge through self-tracking, specifically through but not limited to wearable technology. So, Quantified Self refers to the practice of using applications and self-tracking devices to collect data about oneself, likely automatically. Almost anything can be tracked as part of the Quantified Self, such as sleep, respiration, heart rate, stress, exercise, calories burned and consumed, steps taken or alcohol consumed. The philosophy is that once you gain this self-knowledge, you are in a position where you are able to improve the data to live a healthier life. Take more steps, eat healthier foods, or keep a consistent and appropriate sleeping schedule. This self-improvement through self-knowledge does require a certain type of motivation or goal-setting to achieve.

The movement has grown considerably since 2007 and in 2012 the Quantified Self Institute (QSI) was founded. The QSI has stated that they had over 70.000 members in 2016 and were still growing.

Smart wearable sales are ever increasing, as CCS Insight, a global analyst company, predicted that smartwatch sales would tripled between 2016 and 2020 (Bridgland 2016).

This indicates that consumers are becoming more and more interested in the Quantified Self, and self-tracking has become something for the mainstream consumer rather than just a select group of enthusiasts.

1.2 Qualified Self and well-being

The Qualified Self is usually used when referencing the context and meaning behind the data collected through these tools. An understanding or a picture, not so much a measurement as it is a description. Adding the context of being at a party on a day where more calories were consumed, or adding locational data to understand that the 10000 steps taken that day were because of an afternoon shopping in a big city. Adding these small pieces of context can make the data much easier to understand and process for a user - compared to the abstract information provided by a list of data points. The traditional view of the Qualified Self is the perfect digital doppelgänger that emerges from our Quantified Self data, a view of oneself that has achieved the goals that have been set, specifically in the data being tracked, such as maintaining a constant heart rate during a run. This version of the Self is perpetually in the future, as we are constantly working to attain that vision, as Bode et. al. (2015) and Davis (2019) state. However, another view of the Qualified Self is put forward by Humpfrey (2019), who argues that journalling and social media accounting results in self-reflection, creating a more and ever-changing rounded view of oneself. Engaging in documenting qualitative and emotional accounting, online for example, is healthy and helps us understand ourselves and how we want others to perceive us. Adding context and personal stories to our tracked data can therefore be a significant aid in the self-reflection and knowledge wished to achieve.
When the goal is to improve mental well-being, implementing Qualified Self concepts into a new Quantified Self tool may be the answer.
A specific way of doing this is asking the user to reflect on their well-being, and using this as the Qualified Self data for the application. (e.g.: On a day where more calories were burned, I felt better).

1.3 Challenges

Data can be represented in a close to infinite number of ways. This problem already exists in the Quantified Self movement. However, the challenge I will focus on in this research project is knowing what to track, and how to track it. Well-being is a broad and unclear term, so in order to know how to track it, it must be properly defined first. In addition, knowing the scope of the factors that influence one’s well-being is important, as it will give the user valuable insight into regulating their well-being. How important are day-to-day activities v.s. personal health factors?

By comparing the state-of-the-art applications, it will shine some light on what users need to know.

1.4 Goal and research question

The goal of this research is to design a Quantified Self tool with a specific focus on well-being. By allowing the user to track their body and their mental states, the gap between Quantified and Qualified Self is bridged and the user is more in unison with their data. Therefore, the main research question is:

1. How to design a tool that combines Quantified and Qualified Self concepts to aid the well-being of students?
    a. What are the major critiques of the Quantified Self, and how can the Qualified Self improve upon them?
    b. How to define and track a user's well-being?
    c. What are the factors that contribute to one's well-being?
    d. What is the state of the art of Qualified Self tracking applications?

1.5 Structure of the report

In Chapter two, background research will be laid out and discussed. Then, the state-of-the-art of Qualified Self applications will be compared and analyzed. Finally, a conclusion will be drawn of the literature research.

In Chapter three, the ideation phase will be described based on the literature research. Chapter four will contain the product specifications, after which the realization phase will be laid out in Chapter five. Finally, Chapter six and seven will contain the evaluations, results, conclusions and recommendations for further research.

Chapter 2: State-Of-The-Art

In the first part of Chapter two, the background research will be discussed, covering benefits and critiques of the Quantified Self movement, and a proposed method of measuring well-being. In the second part of Chapter two, the state-of-the-art of Qualified Self tracking applications will be reviewed and analyzed. Finally, a conclusion will be drawn.

2.1 Background research

2.1.1 Benefits and critiques of Quantified Self

The popularity of the Quantified Self movement has shown that self-tracking definitely has several benefits. Users themselves have shared through talks and meetups of the movement their insights and lessons from personal experience, helping each other navigate and process their data. Choe et. al. (2014) reviewed 52 video posts to the Quantified Self blog in which users share such experiences. They found that users commonly gained insight in correlation between factors: either high correlation or low correlation where they expected high. They describe pitfalls but show that they were able to achieve their goals through the self-knowledge they gained: increasing healthy behaviour, identifying and eliminating negative triggers. In addition, the self-trackers noted that the act of tracking made them more mindful of their state of mind and behaviour. Stiglbauer et. al. (2019) found that the use of Quantified Self technologies has a small but positive effect on health consciousness, perceived physical health and physical health accomplishments and psychological well-being. This may be supported by the question-behaviour effect which describes that simply by asking the question, the specific behaviour is altered. Indeed, as Meissner (2016) states, the act of tracking does not simply represent the reality, it also changes this reality: providing knowledge in place where there first was not.

There are two main points of critique of the Quantified Self movement. Both points of critique center around the plain data that is collected using the applications and self-tracking devices. The first point of critique is that users find it hard to understand and connect the data to their personal identity and therefore, abandon the devices. Positive engagement with one's data is a requirement in order to reap the benefits of self-tracking, as Stiglbauer et. al. (2019) also

reported that when a user was more engaged with their self-tracking, positive results were more distinct. Furthermore, using an app in addition to a wearable increased benefits, as just using a smartwatch doesn't allow for processing and analysis of the data. However, the work it takes to keep up with these devices and the data they provide do not always weigh up against each other, which has been found in Whooley et. al. (2014) and Lupton (2013) and users might not feel that the data they are tracking is useful or helpful, as described by Lazar et. al. (2015). These reasons all stem from the basis that the facts and figures do not provide them with personal context, or a good way to display this data. This leads the user to become disengaged with their data, losing all benefits of self-tracking. The second point of critique is the "data-fetishist" case, as described by Sharon and Zandbergen (2016) which highlights an issue in the opposite direction: users who have become addicted to tracking their data, and hold the data points to a higher accuracy than how their body may feel. In its core, the Quantified Self movement promises ultimate truths about oneself through numbers, possibly leading users to stop trusting their body, only relying on what their devices tell them how to feel (Wijninga, 2019).

2.1.2 Well-being

In order to know how to define and track well-being, we turn to psychology. Well-being has been defined in terms of mental health by the World Health Organization (WHO) as:

> "*mental health is a state of well-being in which the individual realizes his or her abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community*" (2005)

In 2002, Corey L. Keyes developed the following model to describe well-being, dividing it into three clusters. There are three clusters to the MHC-SF and they each have several symptoms. According to Keyes "individuals must report that they experience 'every day' or 'almost every day' at least seven of the symptoms, where one of the symptoms is from the hedonic (i.e., EWB) cluster (i.e., happy, interested in life, or satisfied)." (Keyes, 2014).

1. Hedonic — emotional well-being
    a. happy (Item 1)
    b. interested in life (Item 2)
    c. satisfied with life (Item 3)

2. Eudaimonic — social well-being
    a. Social Contribution (Item 4)
    b. Social Integration (Item 5)
    c. Social Actualization (i.e., Social Growth) (Item 6)
    d. Social Acceptance (Item 7)
    e. Social Coherence (i.e., Social Interest) (Item 8)
3. Eudaimonic — psychological well-being (6)
    a. Self Acceptance (Item 9)
    b. Environmental Mastery (Item 10)
    c. Positive Relations with Others (Item 11)
    d. Personal Growth (Item 12)
    e. Autonomy (Item 13)
    f. Purpose in Life (Item 14)

To know the general well-being of the patient, a survey can be taken in order to establish the level of well-being, ranging from “languising” to “flourishing”. This is a reliable way to measure well-being, as proven by Franken et. al. (2018), and can possibly be drawn from when designing a way to track well-being in a qualitative self tool. However, Wolf (2009) in an article describes multiple mood tracking models, and goes on to state that the model need only be as intricate as the goal requires. If the user's goal is to, for example, quit smoking, but one wants to prevent the negative emotions that come with withdrawal to cloud one’s judgement, tracking when these specific negative feelings usually set in and knowing when to anticipate them might be enough. However, if the goal is to create a detailed log of one’s mental states over the course of a year, a more complicated model is called for. One of the more simple models Wolf (2009) describes is the Circumplex Model of Affect, by James A. Russell (1980), with unpleasant and pleasant feelings at opposite ends of an axis and activation and deactivation at opposite ends of an axis. This model is used widely, because it is easy to track or measure mood, and does not require a long survey to be answered.

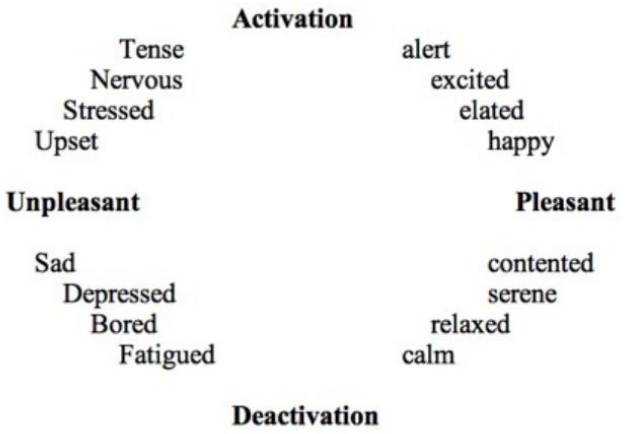


Figure 1: the Circumplex Model

2.1.3 Conclusion

The primary conclusions from the Quantified Self movement is that tracking your data is beneficial in several ways. Self-tracking does indeed produce new and valuable insight and allows the tracker to discover correlations or the lack of correlation between factors. Self-tracking has a positive impact on health and psychological well-being, and it aids the user in becoming more mindful of themselves and their surroundings. The main disadvantages are that the user can feel either disconnected or overly connected to their data in unhelpful ways. The proposed solution for these disadvantages is designing a tool that asks the user to self-reflect on their level of well-being, thus bringing them more in harmony with their body and their data. Self-reflection on well-being can be done by using concepts from the MHC-SF in scale format, or using the Circumplex model.

2.2 State-of-the-art review

In the state-of-the-art review, several Qualified Self tracking applications will be described and compared. Each application will have mood or mental well-being as a main focus. The following five applications is a selection of the top rated mood-tracking apps on the Google Play store. The selection is based on functionality, and the requirement that a user can track their mood and connect some sort of factor or activity to said mood.

2.2.1 Description of the systems

For the Qualified Self applications, each table will compare the approach of measuring of mood or well-being. In addition, the standard variables or factors attributed to these moods are compared. Finally, a qualitative assessment is made of these.

Table 1: Reflectly

Name:	**Reflectly**
Description	Reflectly is a journal utilizing artificial intelligence to help you structure and reflect upon your daily thoughts and problems.
Main measure	“How was your day?” really terrible - super awesome. “how did you feel throughout the day? Question of the day

	 *Figure 2: Screenshot from Reflectly app*
Variables/factors	Activities: - Work - Family - Relationship - Education - Food - Traveling - Friends - Exercise Feelings 1. Happy 2. Blessed 3. Lucky 4. Good 5. Confused 6. Stressed 7. Angry 8. Anxious 9. Down
Evaluation	Reflectly is easy to use and nice to look at, however, it limits the user in the activities and factors available to choose. A user should

	combine their entry with a short note in order for the list of activities to be useful. In addition, it is unclear why this is the list of feelings a user can choose from.

Table 2: Youper

Name	**Youper**
Description	An emotional health assistant powered by AI. Documents mood through conversation and provides guided meditations.
Main measure	 emotion/mood: 25 different options *Figure 3: Screenshot from Youper app*
Variables/factors	Activities/factors, editable by user: • Work • School • Outdoors • Being by myself • Partner • Family • Friends • Social media • Good sleep • Bad sleep

	● Sedentary ● Exercise ● Body ● Health ● Sex ● Cleaning ● Weather ● good
Evaluation	Youper is pleasant, the conversational assistant is both pleasant and tedious, because when a user wants to create an entry, first, they have to click through a "conversation". The grouped list of emotions to choose from is not excessive enough to be overwhelming and not small enough to be limiting, which is nice. The list of factors or activities is fine, but needs to be used in combination with a note to really tell a user something.

Table 3: Daylio

Name	**Daylio**
Description	Private journal app, allowing a user to create quick and dirty journal entries.
Main measure	emotion/mood: Great, Good, Meh, Bad, Awful
Variables/factors	Activities, editable by user:

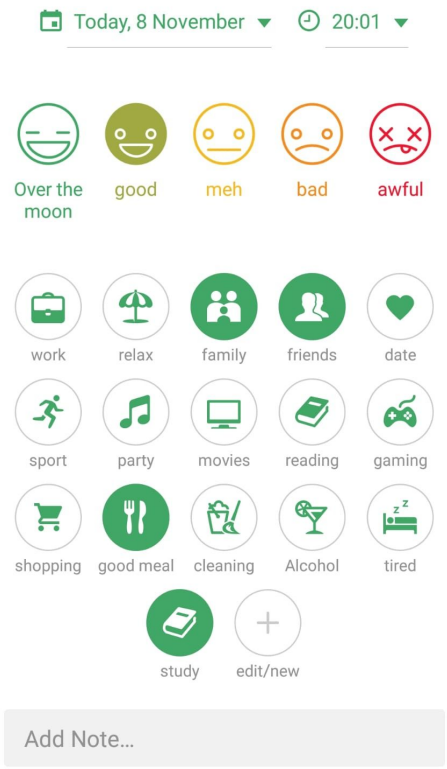
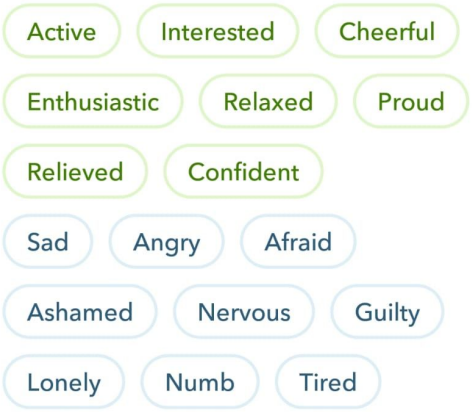
	 *Figure 4: Screenshot from Daylio app. Note: Alcohol, Tired, and Study were added by this user, and are not standard.*
Evaluation	Daylio's simple mood entry options makes it easy and fast to create a log. However, since it only prompts the user once a day, a single mood entry is not enough to capture the ups and downs. Again, the activities are only useful in combination with a short note.

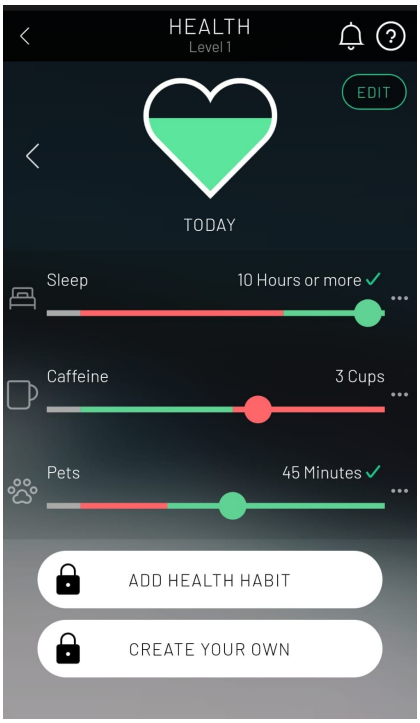
Table 4: Moodpath

name	**Moodpath**
Description	Moodpath is a daily mental health assessment tool. It allows the user to track and reflect on their mood.
Main measure	mood: ● Very good ● Very bad ● Good ● Moderate ● bad
Variables/factors	● Emotion:  *Figure 5: Screenshot from Moodpath app* ● Experiences (y/n): ○ Good time with someone ○ Achievement ○ Relaxation ○ Conflict with someone ○ Overwhelming task ○ Emptiness or boredom

Evaluation	Moodpath's mood tracking function is fine, although it is unclear why it asks a user to track it twice. The difference between mood and emotion is not clear. In terms of "experiences", the six options seem to encompass most things, however upon closer inspection it is very limiting. Does a sports training constitute an "achievement?"

Table 5: Sanvello

Name	**Sanvello**
Description	Sanvello self-describes as a "health care solution", including daily mood tracking, guided journeys, coping tools, and progress assessment
Main measure	mood: ● Great ● Very good ● Good ● Okay ● Not good ● Bad ● Awful
Variables/factors	● Feelings: ○ Joyful ○ Peaceful ○ Powerful ○ Angry ○ Scared ○ Sad ○ Other Note: these are groups of feelings. The user can select any number of feelings. Some "joyful" feelings include: happy, inspired, hopeful, optimistic, amazing, creative, etc. The total list of feelings a user can select from is extremely long. ● Health: ○ Sleep ○ Exercise ○ Eating ○ Water

	○ Caffeine ○ Alcohol ○ Outdoors ○ Family ○ Friends ○ Pets ○ Relationship ○ Hobbies ○ Cannabis ○ Cigarettes ○ Meditation ○ Medication ○ Hygiene ○ Menstruation Note: out of this list, a user can choose which to keep track of. Each health item has a custom scale to track it. An example below:  *Figure 6: Screenshot from Sanvello app*
Evaluation	Sanvello is very highly rated online and in the app store. It is easy to see why, as it gives much freedom in tracking emotion, and activity tracking is very pleasant. One note on emotion tracking, is that the long list of emotions is a little overwhelming. The activity tracker only allows a user to track three factors in the free version, but even then it is clear that their system is preferable. Yes, a user might have seen their friends, but was it for half an hour

	or for five hours? This nuance is nice to note. Only one complaint: the user cannot add their own factor.

2.3 State-of-the-art Discussion and Conclusion

Based on the state of the art review, it is clear that the general method to track mood is on a simple visual-analog scale (VAS), such as “Very good” - “Good” - “Moderate” - “Bad” - “Very bad” . However, each application has a way to add some depth to this quick scale: choosing which feeling or emotion suits the user best. Reflectly, Moodpath, and Sanvello each allow the user to add more descriptive words, such as happy, blessed, joyful, lucky, relieved, proud, confident, etc. Youper skips over the initial good-bad scale and goes straight to the descriptive emotional words. These descriptors would indicate that these applications follow a version of the circumplex model. Daylio keeps it simple and only has the simple mood scale.

When it comes to variables and factors that may influence your happiness, moodpath seems to be the only tool to limit what a user can add. All others allow a user to indicate which they would like to track. Only Sanvello does not have an “add activity” option, but this seems to be because the method of tracking each “activity” or factor is unique. Caffeine: the user indicates how many cups they had to drink. Exercise: the user indicates how many minutes were spent exercising. The desirable amount for each trackable item can be edited and through the heart icon the app indicates to the user how the general “health” was for that specific day. It is no surprise that Sanvello is rated highly as a mood tracking application: it is closer to a Quantified Self tool than the others, giving the user more insight and self-knowledge than the rest.

The primary conclusion on tracking variables is that it is personal for the user, depending on their initial goals or curiosities when starting to monitor their emotions. From this research it is conceivable that there is room for improvement in combining more accurate Quantified Self tracking methods with a well-being tracker to result in a higher level of self-awareness and insight, depending on the relevance of the tracked data.

Chapter 3: Ideation phase

The following chapter will contain a series of product ideas created through a brainstorm process.
Through the evaluation of the state-of-the-art research, tracking well-being evidently had three main solutions: using a visual analog scale (VAS), using the Circumplex Model, or using a questionnaire for the MHC-SF. The Circumplex Model is simply the best combination of detail and ease of use, so all product ideas will be assumed to use this method.

All other data has several different options to be tracked. One main design choice deals with the details of the self-reported variables. Should each trackable activity have a yes/no quality like many of the state-of-the-art applications do, as visible in Figure 4? Or should they be recorded in more detail, with a slider like Sanvello uses, for example? The following concepts contain these options.

3.1 Concept 1: Random prompts

This idea focuses on asking the user for their mood at several (fixed) times a day. The system will pull Google Fit data and prompt the user for their self-loggable data, similar to the Sanvello app, such as: cups of coffee and glasses of alcohol, quality time with friends or family, minutes spent being productive, screen time, or time spent at a fun event or activity.
This will allow the user to see both their average mood throughout the day and which activities are connected to certain emotions. Asking at fixed times, which the user can set themselves, will motivate the user to be reflective every few hours, creating a more self-aware person. Figure 7 shows the way the self-tracking would work, using the Circumplex model for mood and sliders for the other factors in order to incorporate more detail. Figure 8 shows what a possible visualization could look like.

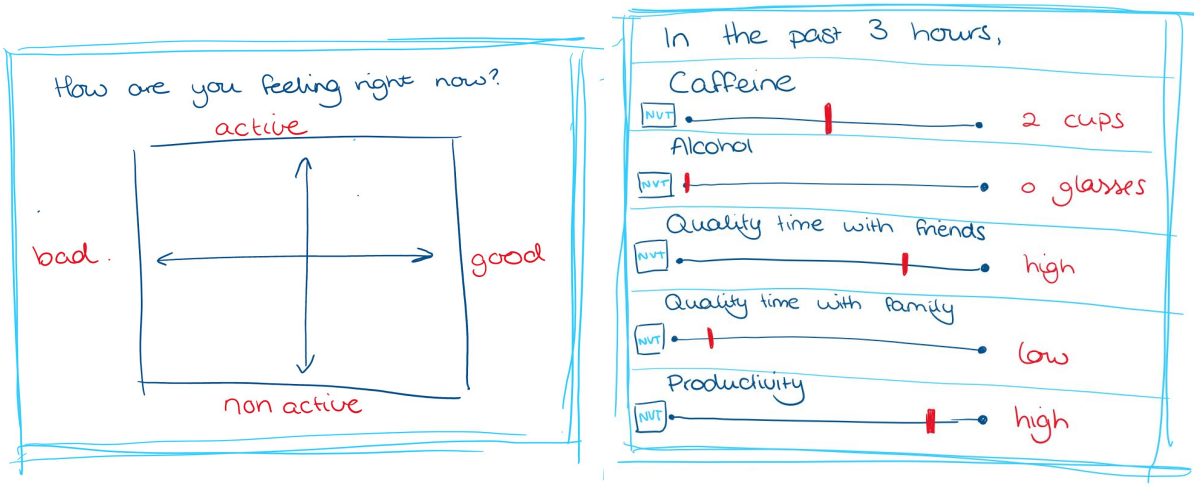


Figure 7: concept 1 sketch

Figure 8: concept 1 sketch

3.2.1 Concept 2a: Google calendar-based prompts

This concept is similar to 1 in the way it tracks the user, but the prompts for the user will come after events planned in a user's Google calendar rather than at fixed time points.

Figure 9: concept 2a sketch

Figure 9 shows an example prompt. Instead of prompting the user at scheduled times, the system will use Google calendar to determine when to ask how the user feels. It will produce similar data to concept 1.

3.2.2 Concept 2b: location-based prompts

This idea takes a more locational approach to emotion, and it will prompt the user when they arrive at a new place, asking both how they feel and to confirm some things that the system will already know, such as sport when at a gym or productivity when at a university, social time at a cafe. This idea was inspired by F. Stolk (2019). In figure 10 some example screens are depicted, as well as a possible visualization: location based, not time based.

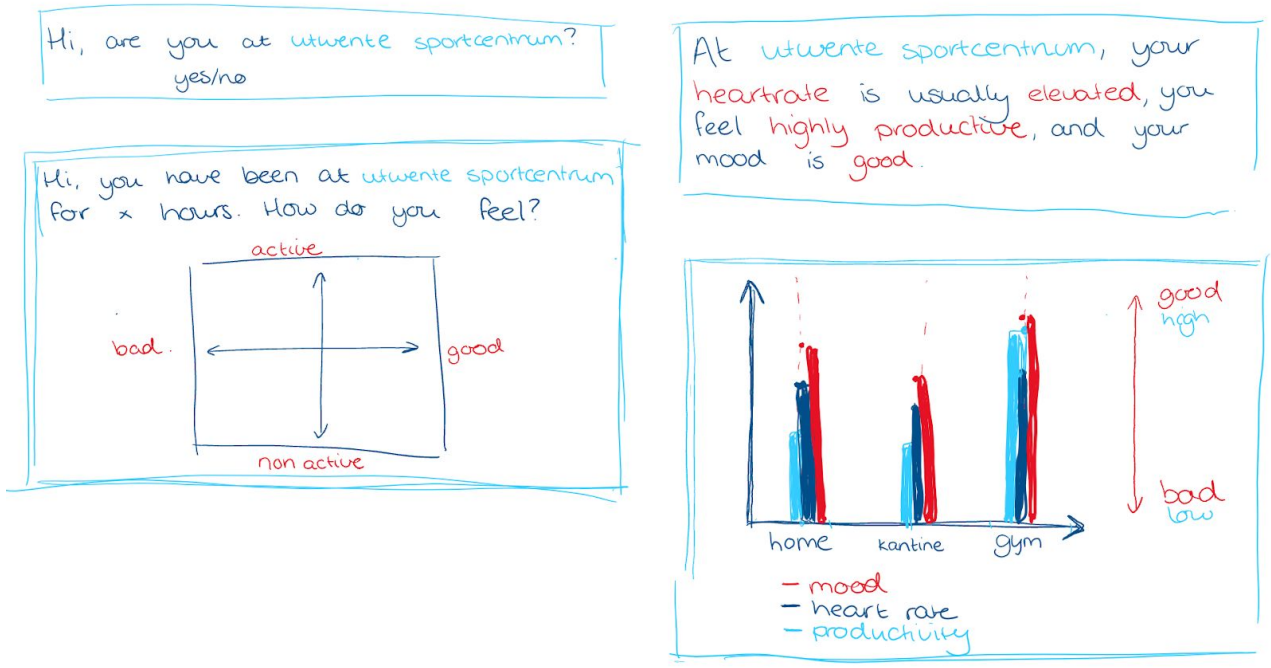


Figure 10: concept 2b sketches

3.3 Concept 3: Journaling prompts

This concept takes journaling as its central focus, asking a user to reflect more through writing. Basic questions can provide some support and even just using keywords for their answers can be enough. This concept is closer to the more simple tracking applications, such as Daylio or Reflectly. Activity tags can be added to entries and Google Fit data can still be recorded, to gain more insight. Since filling in these entries will take more time, the system will only ask for it at the end of the day. Throughout the day the user will only be prompted with the mood slider shown in figure 11. Figure 12 shows some examples of journal prompts from the application.

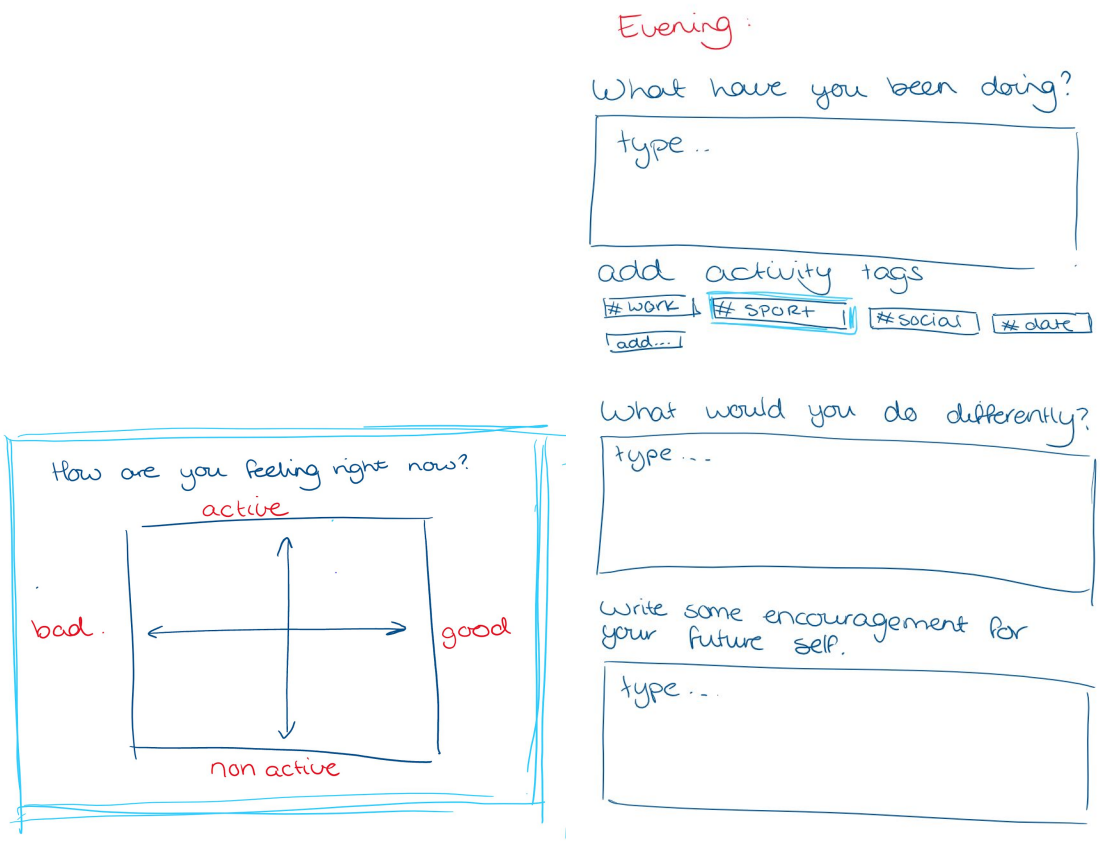


Figure 11 & 12: concept 3 sketches

3.4 Concept 4: combination of 1 and 3

Finally, having more detailed qualified self data is nice, as well as asking the user to reflect via journal entries. Since this is a lot of work in one day, there will still be constant prompts throughout the day to enter data in the style of concept 1, and journal prompts only every few days. This combination will produce interesting data for visualization whilst still creating the opportunity for the user to sit back and reflect on how they are doing.

3.5 Conclusion

Table 6: comparing the concepts in Chapter 3

	Level of reflection and insight gained	Amount of effort required from user	Completeness and level of detail in possible visualisation
1: Random prompts	x	x	xx
2a: Calendar-based	x	xx	
2b: location-based	x	xx	x
3: journaling	xx	x	
4: Random prompts with journaling every few days	xx	x	xx

In Table 6, a comparison is made between the concepts created in Chapter 3. The first requirement, which is ‘allows users to reflect on their well-being, and learn something about themselves’ is best achieved through journaling prompts, such as “what effect did that have on you? How can you feel better when this happens next time?” However, these prompts take more time than simply tracking your activities with a few clicks. Concepts 2a and 2b are least cumbersome, because the application does some of the work for the user already. However, concept 2a might not create very complete visualisations, as times when there is nothing planned and a user spends a day alone in their room will not be documented. Having a consistent amount of prompts a day, and allowing the user to choose when these are (either at fixed times, or random) would presumably give a somewhat complete visualisation, with time on the x-axis. This leaves the conclusion that concept 4 should be chosen, with the possibility to further develop it to incorporate locational data in the future.

Chapter 4: Specification phase

The following chapter will describe the specifications of the proposed product. It will move us from concept to tangible product, by defining the requirements and user scenario. This way, the final concept will emerge, following the state-of-the-art and ideation.

4.1: Requirements

In order to design this product, the requirements need to be clear and precise. These requirements include:

- The purpose of the tool
- The goals it must achieve
- Which data to track
- How to collect this data
- How to visualise

In order to describe these requirements, first a user scenario is described.

4.1.1 User Scenario

Ashley is a busy university student. She is studying full-time, and tries to keep up with sports and friends whilst also balancing a side-job at a café. Her health is fine, but she sometimes struggles with staying positive or being in a good mood. Ashley has days when she feels nothing can go right and she doesn't want to do anything, but she also has days which are great and feel really positive. She wants to be happier, but doesn't see what she can do to achieve that. She started keeping a diary in order to record these moods, but she often forgets to use it. Ashley discovered this new app that helps her to track what kind of things affect her mood, and she is motivated to find out. After using the app for two weeks, she is accustomed to pause, reflect and think about how she feels, and why that might be the case several times a day. This alone has started helping understand herself, and consciously noting her emotions has helped her to regulate them.
Additionally, after reviewing the data and graphs showing her mood and the factors that she has been tracking, she noticed that she consistently felt happy and excited when she was with friends in the evening. She also noted that she usually felt better after a workout, or after

rigorously cleaning her room. Days that she didn't move much and scrolled facebook endlessly were worse. Also, when she worked for more than 5 hours in a day she came home more stressed or fatigued. Upon seeing these correlations, she wasn't necessarily surprised, but she realized she hadn't thought about how much of an affect her day-to-day choices had on her well-being. Now she tries to meet with her friends at least once a week, and also makes her bed every morning, because a small simple task like tidying her room makes her feel good. Even on things that she can't easily change, like her workload or her busy schedule, knowing how to feel better has made life easier.

4.1.2 Data

The data to be tracked will be decided through a process in which the state-of-the-art applications are compared and compiled. All factors from the state-of-the-art applications will be noted and sorted by how often they are used. Following this, the factors are sorted into categories. These categories will be used in the final product and the least-used factors will be discarded, producing a final list. In addition to the manually tracked factors, a requirement for the final product is that automatically tracked data is also used. This data will be trackable by a smart watch.

Google fit data includes the following:

1. Distance travelled
2. Latitude and longitude
3. Speed
4. Calories burned
5. Heart rate
6. Step count
7. Weight
8. Inactive time
9. Walking duration
10. 'Move minutes'
    a. This is time spent doing physical activity.
11. 'Heart points'
    a. These points are awarded when the heart rate goes up for at least a minute. (Google, 2020)

In order to keep it simple, yet accurate, the data that will be tracked for this project is heart rate and step count, as most basic wearables are able to track these. Also, this data is a good indication for physical activity and intenseness of physical activity.

Qualitative data is transformed into quantitative data through the recording process. Due to the subjective nature of personal mood and emotion, and what causes a subject to have a positive or negative response, the list of possible self-report variables should not be too brief. In addition, each variable should have a specific scale, to increase the data detail. The following list of factors has been pulled from the state-of-the-art examples.

Table 7: all factors from the state-of-the-art

Factor	**Source**	**Factor**	**Source**
Family	Reflectly, Youper, Daylio, Sanvello	sports/exercise	Reflectly, Youper, Daylio, Sanvello
Friends	Reflectly, Youper, Daylio, Sanvello	Food	Reflectly, Youper, Daylio, Sanvello
Relationship/date	Reflectly, Youper, Daylio, Sanvello	Work	Reflectly, Youper, Daylio
Sleep (good/bad)	Youper, Sanvello	education/study	Reflectly, Youper
Outdoors	Youper, Sanvello	Gaming	Daylio
Cleaning	Youper, Daylio	travel	Reflectly
Social media	Youper	Hobbies	Sanvello
solitude	Youper	Alcohol	Sanvello
Sex	Youper	Caffeine	Sanvello
Weather	Youper	Water	Sanvello
Sedentary	Youper	Cannabis	Sanvello
Health	Youper	Meditation	Sanvello

Body	Youper	Pets	Sanvello
Relax	Daylio	Cigarettes	Sanvello
Reading	Daylio	Medication	Sanvello
Shopping	Daylio	Menstruation	Sanvello
Movies	Daylio	Hygiene	Sanvello
Party	Daylio		

4.1.3 Choice of Data

In order to make a selection of the data being tracked, the possible factors will be divided into categories.

Table 8: sorted factor list. In brackets behind the factor is the amount of applications in the state-of-the-art that shared this factor

Socialization	**Health and Self Care**	**Recreation**	**Career or responsibilities**	**Intake**	**Movement**
Family (4)	Sleep (good/bad) (2)	Outdoors (2)	Work (3)	Food (4)	Sports/ exercise (4)
Friends (4)	Sex (1)	Relax (1)	Education/ study (2)	Alcohol (1)	Sedentary (1)
Relationship/ date (4)	Cleaning (1)	Reading (1)	Travel** (1)	Caffeine (1)	
Solitude (1)	Health (1)	Shopping (1)		Water (1)	
Pets (1)	Body (1)	Movies (1)		Cannabis (1)	
Social media (1)	Meditation (1)	Gaming (1)		Medication (1)	
	Hygiene (1)	Party (1)		Cigarettes (1)	

Weather* (1)	Menstruation (1)	Hobbies (1)			
	Weather* (1)				

*Whilst weather does not directly impact personal health, it seems to fit best in this category
**Travel here has been interpreted as daily travel, but it may also be used for vacational travel

Based on Table 8, we can see that all tracking applications value information about socialization, exercise, and career/responsibilities, and food intake.
Firstly, the “Movement” column can be disregarded, as movement and exercise data will be taken from Google Fit. Based on this sorted table, and on the frequency of factors used in the state-of-the-art applications, the new list of factors is:

1) Socialization
    a) Family
    b) Friends
    c) Relationship/date
    d) Solitude
2) Health and Self care
    a) Sleep
    b) (Cleaning)
    c) Sex
    d) Health
    e) Meditation
    f) Hygiene
    g) Weather
    h) Menstruation (if applicable)
    i) Food
    j) Stimulants
        i) Medication
        ii) Caffeine
        iii) Alcohol
        iv) Drugs
        v) Cigarettes

3) Recreation
    a) Outdoors
    b) Recreational activity
4) Responsibilities
    a) Work
    b) Education
5) Self-image
    a) Productivity
        i) Work
        ii) Education
        iii) cleaning
    b) Stress
    c) Self-love

Note: Intake was combined with health and self care, and additionally a new category was added based on the World Health Organization of mental health, as described in Chapter two:

> "*mental health is a state of well-being in which the individual realizes his or her abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community*" (World Health Organization, 2005)

4.1.4 Use requirements

Based on the user scenario and the literature study, the following user requirements can be identified:

1. Should help the user reflect on their well-being
2. User should gain insight about themselves through the tool
3. Using the tool should not take more than 10 minutes per day
4. The visualisation of the data should be able to show possible correlations between well-being and factors, and be as complete as possible
5. The well-being measurement should be done using the Circumflex model
6. The tool should be designed and usable for university students

Chapter 5: Realization

In this chapter, the realization phase of the prototype will be described. First, the data collection will be discussed, following this the software will be explained and the data visualisation. Finally, the journal-like questions will be described.

5.1 Technology and data

5.1.1 Dataset

The dataset of the prototype consists of the questionnaire and Google Fit data. These will be collected by creating an anonymous Google account for each participant. The questionnaire will be sent by email to these accounts and the Google Fit data will be automatically tracked on this account through the use of a smartwatch. The questionnaire activities and factor data have been described in Chapter 4, based on the state-of-the-art. Where possible, a scale or a numerical value has been attached to the factors. Physical activity data will be measured through step counts and heart rate, which are also expressed in numerical values.This has been done in order to compare the mood level with the factors, to create a more complete and information-rich visualization.

Automatically tracked data

- Step count
- Heart rate

Manually tracked data

Table 9: Manually tracked data

Mood	Activities	Factors
● Excited (9) ● Cheerful (8) ● Relaxed (7) ● Calm (6) ● Neutral(5) ● Bored (4) ● Sad (3)	● Work ● Study ● Recreation ● Sport ● Other	● Socialization (0-10) ● Physical health and self care (0-10) ● Level of productivity (0-10) ● Cups of coffee (#) ● Glasses of water (#) ● Energy drinks (#) ● Glasses of alcohol (#)

• Irritated (2) • Tense (1)		• Cigarettes (#)

Physical activity data will be automatically tracked using a smartwatch. The manually tracked data will be tracked using a questionnaire, three times per day, at predefined moments, morning, afternoon and evening. The values for mood are based upon the circumplex model, specifically the pick-a-mood model as seen in figure 13. The full questionnaire can be found in Appendix C.

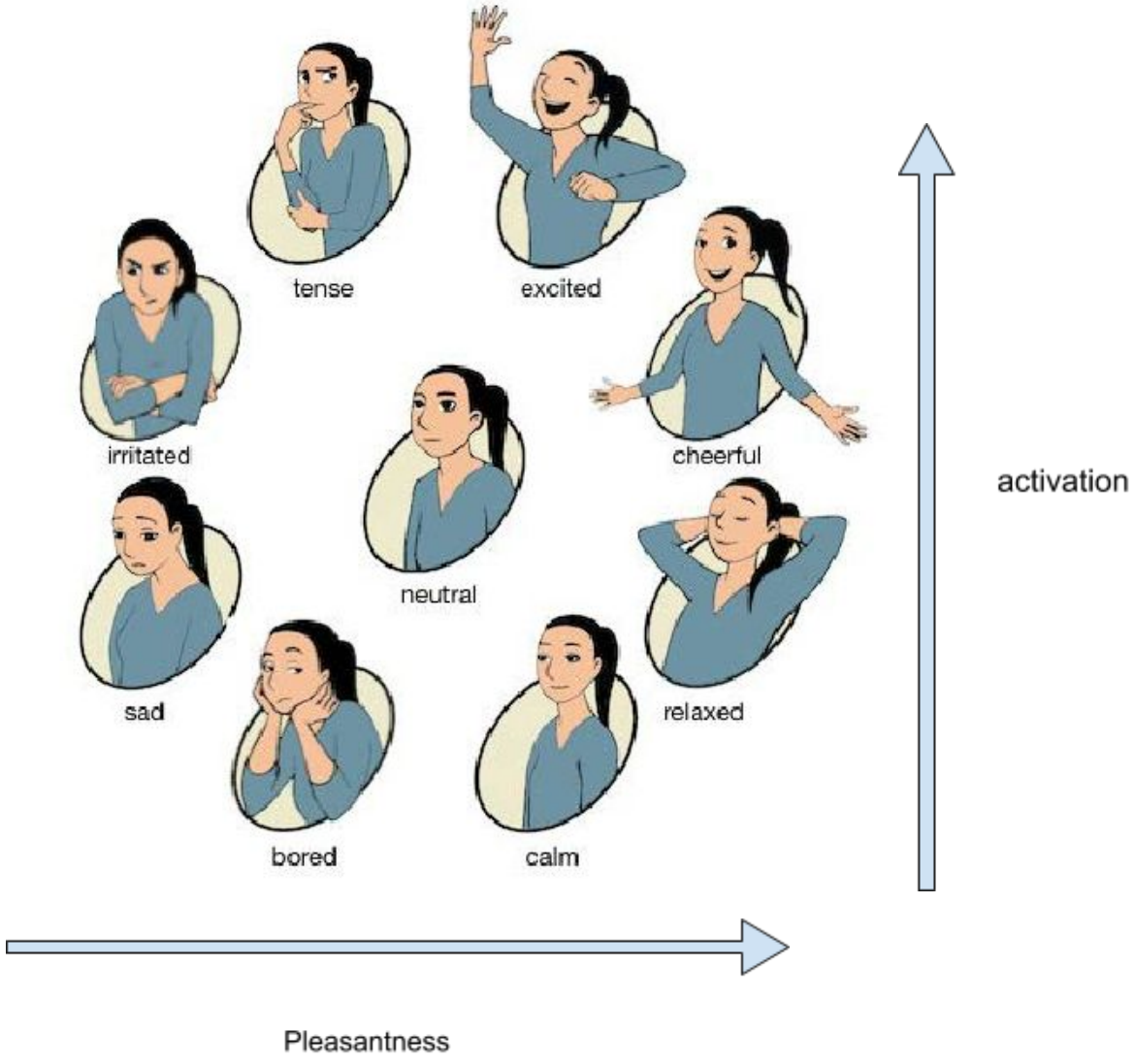


Figure 13: Pick-a-mood expressions of eight mood types by Desmet et. al. (2012)

In order to rank the moods for the visualization, each mood is given a numerical value, based on activation and pleasantness, highest activation with highest pleasantness is a 9, highest activation with highest unpleasantness is a 1. (1-9)

In order to present this collected data, it should be stored in a comma separated file. As shown in figure 14, this comma separated file can be downloaded from the Google data archive and the SurveyMonkey database. These files will be joined by the timestamp and presented using the software Tableau Desktop.

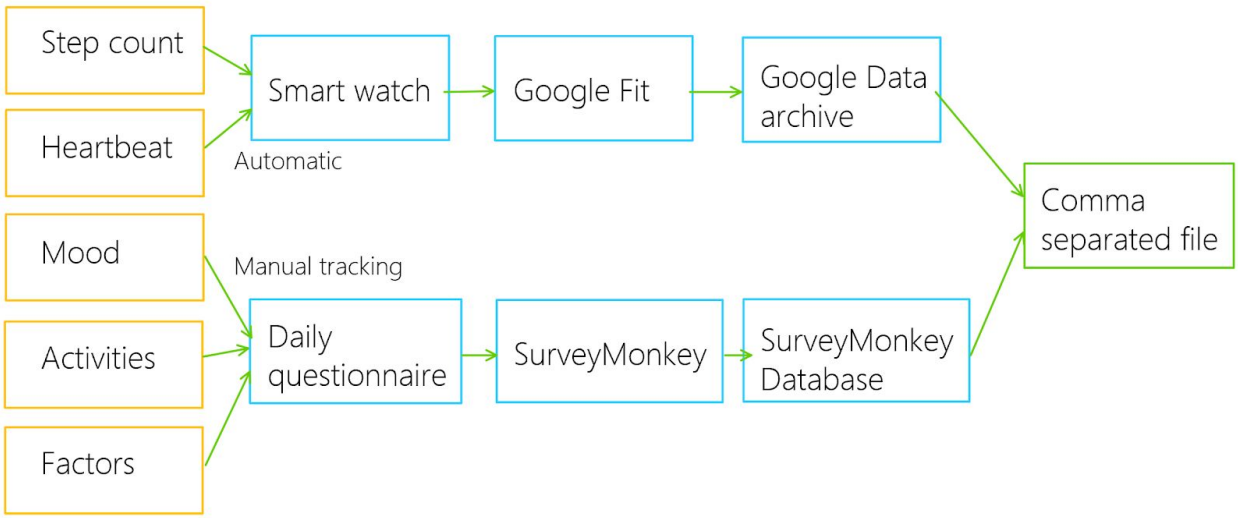


Figure 14: data collection flow

5.2 Journal questions

The goal for the journal questions is to help the user reflect more by providing pointed questions about their recent well-being.

For that reason, the first question will be:

1) What were the three best moments of the past few days, and what were the three worst moments?

In order to create more reflection of these moments, the next question will be:

2) Can you describe what effect these moments had on you, on your mood and generally on your day?

To help a user handle these types of moments in the future, question three will be:

3) Describe ways in which others and yourself might be able to help you deal with the worst moments.

Finally, to end these questions on a positive note and to look ahead, question four will be:

4) Please write some advice and some kind words for your future self:

These questions will purely be for added self-reflection, and their answers will not be visible in the data visualisation. However, if the user gives an accurate account of their best and worst moments, the data should already be visible in the visualisation. The final journal questionnaire can be seen in Appendix D.

5.3 Visualisation software

5.3.1 Software

In order to simulate the product's data visualization,Tableau Desktop (Figure 15) will be used to present the data for the prototype. The comma separated value files (CSV) will be checked and cleaned in Microsoft Excel, to prepare them for analysis before being joined in Tableau Desktop. The SurveyMonkey CSV and Google Fit CSV will be joined using the End Time/End Date values. The End Date is the time and date that each questionnaire was completed, and the End Time is the time and date that the heart rate and step count was recorded.
The software gives the possibility to have multiple values on the same axis, as seen in Figure 15. This gives the possibility to compare each factor with mood to find correlations. In addition, the software allows for the feature MouseOver. By adding tooltips, the tags can be added to the visualisation to increase the detail.

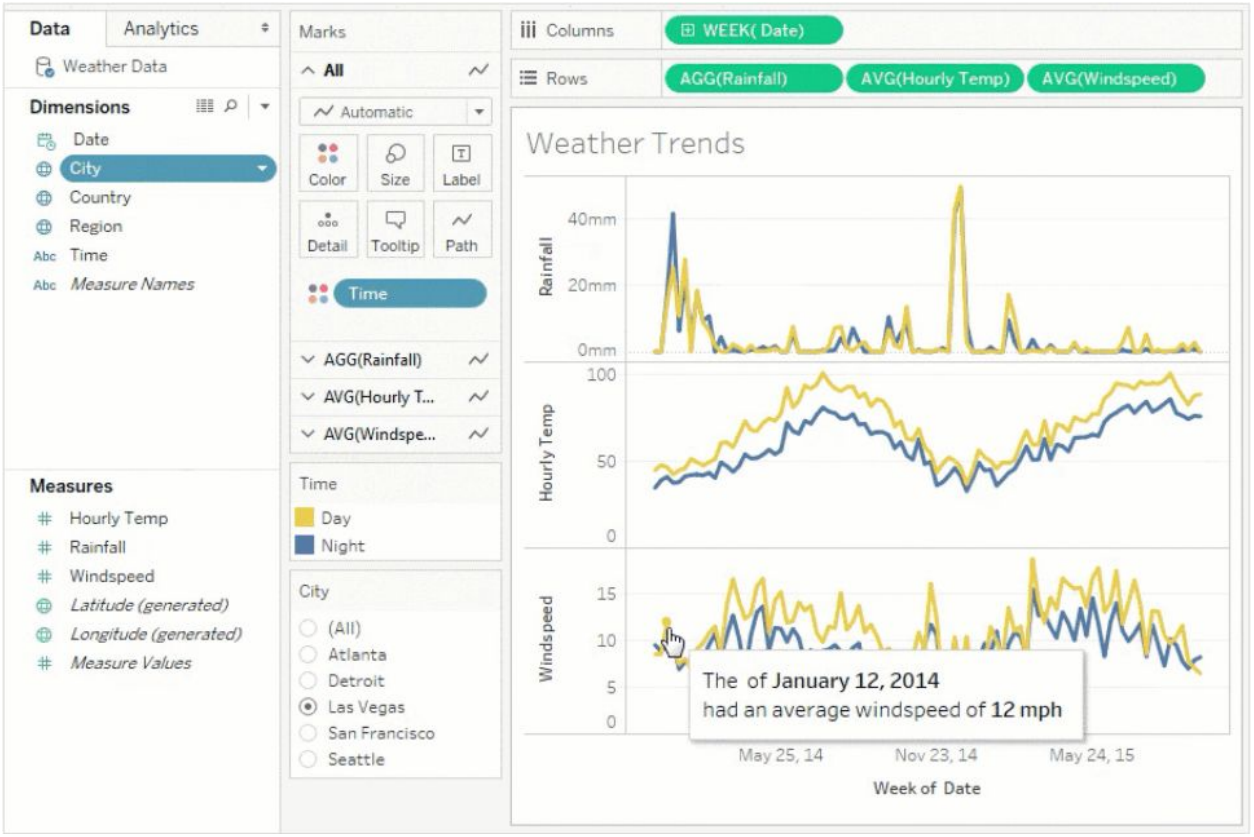


Figure 15: Example view of Tableau Desktop

5.3.2 Visualisation

The visualisation of the final prototype will be mood and the factors as a function of time. This can be achieved using Tableau's dashboard and story function. After uploading the data into Tableau, each factor (social, physical health and self care, productivity, water, coffee, alcohol, cigarettes, and energy drink intake, step count and heart rate) can be put on the same axis as mood as a function of time. This will have the goal to immediately see which factor has the strongest impact per participant. In figure 15, an example of this is given. This participant has the strongest correlation of mood with social. Her physical health and self care is relatively steady. An interesting note is that productivity seems to have a negative correlation with mood. When mousing over the graph, a user can discover who the social time has been spent with, what the precise emotion was at the time, and a note about their day if they gave one. In Figure 16, such a tooltip is shown. Figure 17 shows an example of water and alcohol intake compared to mood, and step count compared to mood.

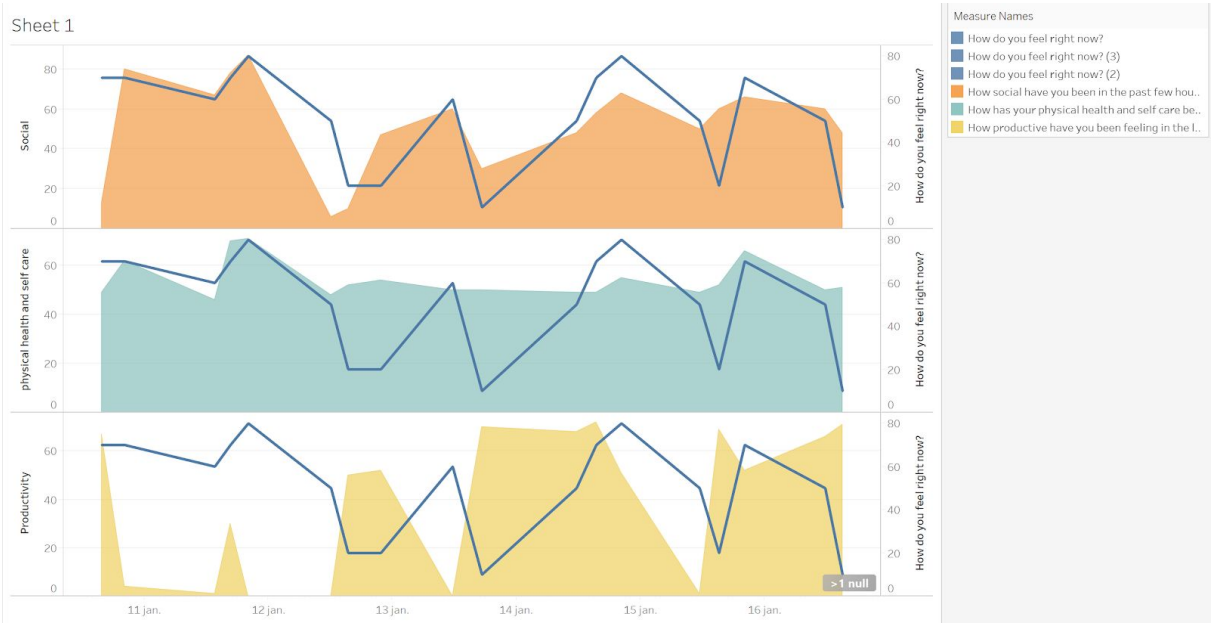


Figure 16: a single participant's results as shown in Tableau Desktop. From top to bottom: Social v.s. Mood, Physical health and self care v.s. Mood, Productivity v.s. Mood.

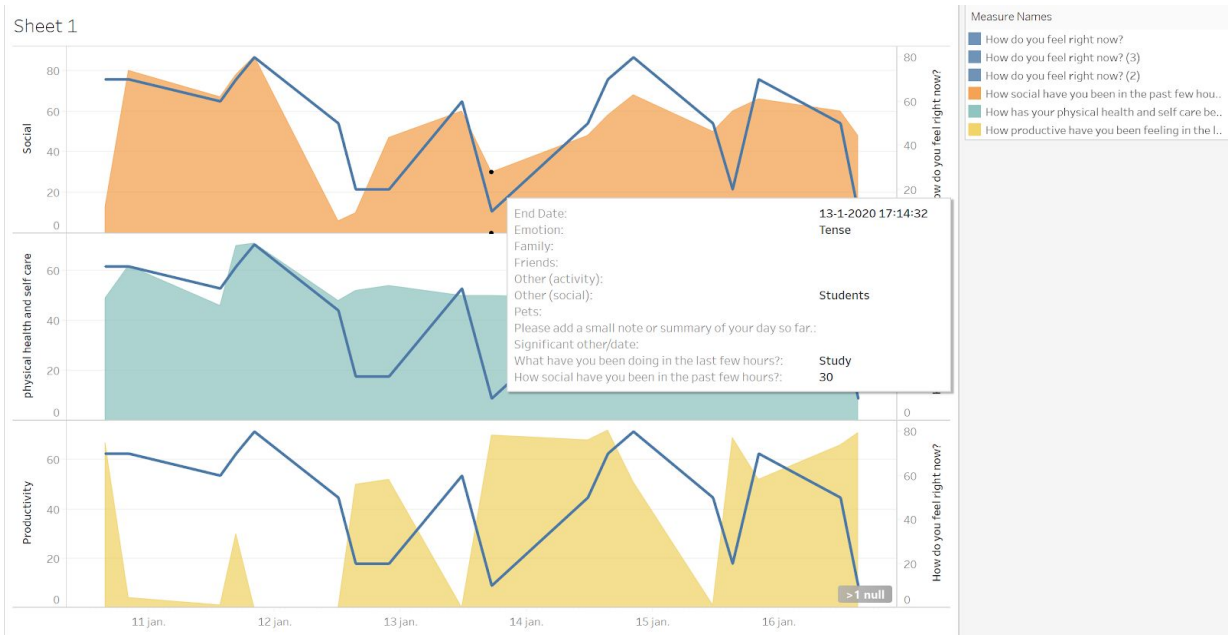


Figure 17: Tooltip for Social 13-1-2020 at 17:14:32. Participant has been social with fellow students whilst studying. She was tense.

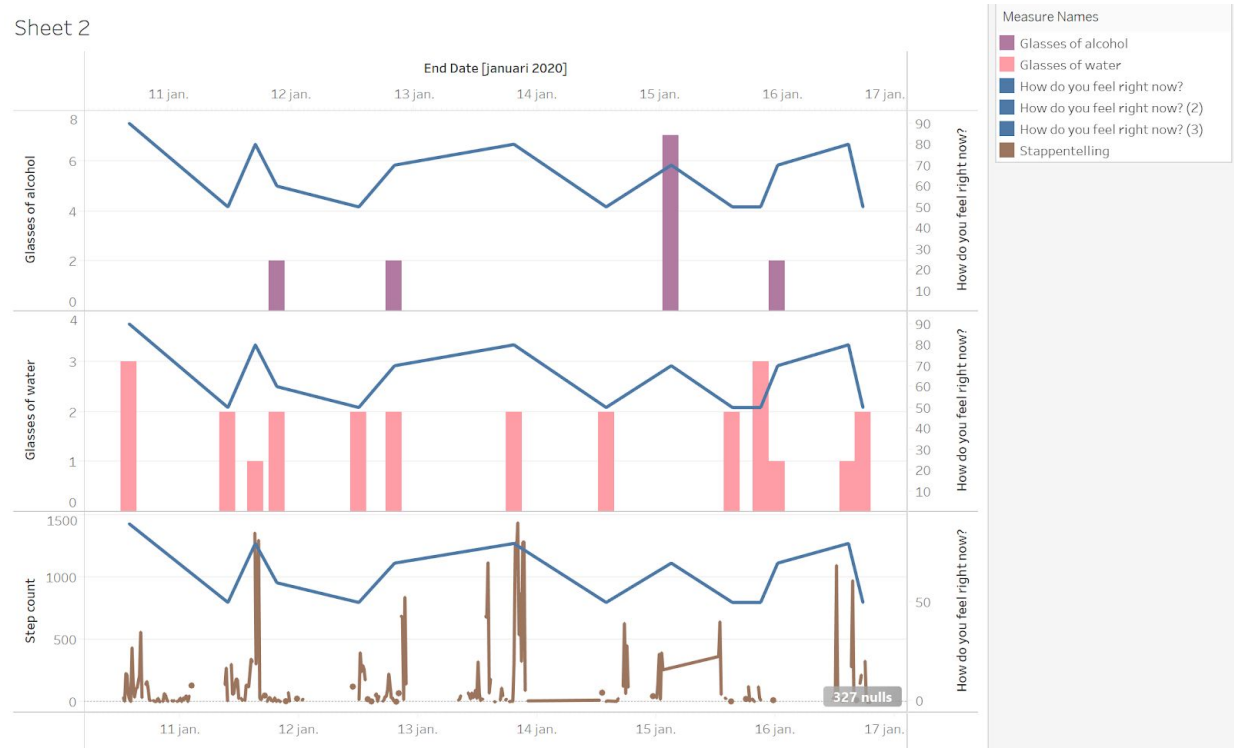


Figure 18: A participants results for alcohol, water and step count v.s. mood.

Chapter 6: Evaluation

In the evaluation phase, the prototype that has been designed in Chapter 5 will be tested. The evaluation is designed to test whether the proposed method of tracking the mood and factors is useful and fruitful, and whether the participants feel they have obtained new information and were presented with tools that helped them to reflect more upon their activities and their impact on their moods.

6.1 Usability test

The usability test will require seven participants to use the prototype for a week before giving feedback. Each participant will be female, as the data and factors have been designed with a female user in mind, as shown in Chapter 4.1.1: User scenario, and factors such as menstruation have been specifically included for this group.

6.1.1 setup

Table 10: User test setup

Item	Explanation
Participants	7
Diversity of participants	All women, each have different previous experiences and personal motivations in using tracking applications and journals.
Goals	● Test the relevance of the selected factors ● Test the usefulness of adding numerical value to the selected factors ● Test whether the prototype reached the following goals: ○ Helps the user reflect ○ User learns more/new information about themself ● Find flaws and possible improvements to the above mentioned points

Privacy and ethics	The study is complied with the General Data Protection Regulation (GDPR) and approved by the ethics committee EEMCS. Also, the participants have read the Information Brochure(See Appendix A) and signed the Informed Consent form(See Appendix B)
Collection of data	The questionnaire found in Appendix C will be sent by email three times daily for a period of seven days. The questionnaire found in Appendix D with journal-like prompts will be sent twice, on day three and day six. The schedule can be seen in Table 11.
Preparation of the data visualisation	The data that is collected in these seven days will be manually transferred into the Tableau software to create the visualisation, before it is shown to the participant.
Presentation	After answering questions about the user experience of the questionnaire, the user will be given a brief explanation of the graph and as much time as needed to view their data (5-10 minutes) before discussing this.
Feedback interview	The interview will take approximately 45-60 minutes and will discuss both the questionnaire and the results. The interview questions can be found in Chapter 6.2.1, and the full interview answers from each participant can be found in Appendix E.

Table 11: schedule for questionnaires to be sent to participants

Day	Questionnaire	Journal questionnaire
1	11:00, 15:00, 20:00	-
2	11:00, 15:00, 20:00	-
3	11:00, 15:00, 20:00	20:00
4	11:00, 15:00, 20:00	-

5	11:00, 15:00, 20:00	-
6	11:00, 15:00, 20:00	20:00
7	11:00, 15:00	-

6.1.2 Participants

Each participant is a female bachelor's student. The participants were found through an appeal with a short explanation spread through the researcher's network, resulting in participants from several different study backgrounds responding. After the information brochure in Appendix A was shared and thoroughly read an intake meeting took place, in which the participant was made fully aware of what is expected of them and what they can expect from the research. In this intake meeting, the participants each shared their motivation and previous self-tracking experience. The intake was concluded by making sure all questions were answered and the participant was fully ready to start the week of data collection and had signed the informed consent form found in Appendix B.

Table 12: participants

Participant	Age	Study year	Previous experience with tracking applications or journals	Motivation for previous tracking tools	Motivation to participate study
1	22	4	Myfitnesspal, Journal	To change habits, especially food related, and to write down when things are not great	"Discover what affects my mood, looking for new insights"
2	22	4	Daylio	What she has been doing, a moment of reflection to put things in perspective	"Very interested in what makes me happy"
3	19	2	Smartwatch	To find out when she is stressed	"Curiosity and I look forward to being busy with my mood and happiness"

4	16	1	Samsung health for step count and calories Pixels app	Health app was fun, and other app: to see if I can find patterns in my mood	"I want to find patterns in my mood so this is an interesting study for me"
5	20	2	Apple health Smart watch journal	Keep track of heart beat and step count, to move more when it's too low. Journal: for insight and to remember things	"I'm curious"
6	19	2	Food and drinks tracking Insight timer journal	To make sure she gets enough nutrients Insight timer: for meditation Journal: mindfulness, for memory and insight	"I am interested in mindfulness and stress management, and despite the fact that the experiment is a little bit of work, it might give me valuable insight."
7	20	3	Tried health apps, but dropped it soon	curiosity	"I was curious, I'd like to try a system like this. And I wouldn't mind learning about what makes me happy!"

6.2 Results

After the week of user tests, the visualisations were created for each participant as described in Chapter 5.2 and within two days an exit interview was conducted with each participant. Below, the themes and the main feedback is laid out. Each interview took 45-60 minutes and resulted in fruitful conversation that left the participant with a satisfying conclusion to their involvement in the project.

6.2.1 Interview summary

Table 13: Interview summary

Data Collection	
What was your overall	- 5/7 participants said it was a normal week, a good

impression of the week of data collection?	representation. - 1/7 participant said it was normal but there was not much to do - 1/7 participant said it was a normal week but with a lot of stress - 1/7 participant indicated that there was an event that impacted her, and it wasn't a good representation of a normal week.
How did you experience the questionnaire?	- Most participants said the questions were great overall, except one participant who immediately noted that she didn't see any connection between her mood and the factors. - 2/7 participants noted that the mood choices were specifically lacking an option for "tired" - 2/7 participants immediately noted that the timing of the last scheduled questionnaire of the day was simply too early, it should be filled in before bed - 2/7 participants initially noted that it gave them extra reflection or awareness of their day. - 2/7 participants indicated that they found the tags under some sliders lacking or wanted to personalize them somehow. - 1/7 participant noted an issue with the question that asked "what have you been doing in the last few hours?" because it was very similar to the productivity question - 1/7 participant said she felt strange filling in personal information online.
What was the usefulness of the asked factors?	- 4/7 participants specifically noted they found the chosen categories (social/physical/productive) useful - 2/7 said they thought social+physical were useful, but productivity was less useful for them. - 2/7 said that the questions could be more useful if they were time-specific: alcohol intake is not so useful at 11 AM but can be insightful at 11 PM. - 2/7 participants commented on the personalization of the questions: being able to add own standard tags and removing questions like coffee intake - 1/7 participant noted a different issue with the question that asked "what have you been doing in the last few hours?" because it only allowed for one answer, whereas you could be doing multiple things over the course of several hours.
Which questions were superfluous or lacking?	- 2/7 mentioned the lack of "tired" in the mood meter - 2/7 mentioned more issues with the question that asked "what have you been doing in the last few hours?"

	question: once again, you can't choose several options. Another issue was that a participant didn't know how to categorise "board membership work": not under work, but also not recreation. - 2/7 participants commented on the slight vagueness of the physical health and self care category: one participant said she wasn't sure what tags to add and one said maybe it should be split into two categories: physical health / self care - 1/7 participants said the social category was lacking a "colleagues" tag - 1/7 participant reiterated that she thought the productivity category was superfluous
What would you have added?	- 2/7 participants reiterated that they would add at least "tired" to the mood options - 2/7 said they would like a "colleagues" tag in the social category - 1/7 said they would like to see more sliders, for example for good/bad food or sleep - 1/7 said they would like more note sections, for example after "how do you feel?" a note question like "can you expand on that?"
What would you have removed?	- 4/7 participants made a comment on being able to personalize the questions by removing the questions that are always 0: like cigarettes or energy drink intake - 2/7 participants said the "what have you been doing in the past few hours?" could be dropped. - 1/7 participant said the note section could be dropped
Did the 'note' section add any value for you?	- 3/7 said yes, added context and added value - 2/7 said it was difficult to fill in, because it was unclear what it asked, or confronting to think about how little she did in a day. - 2/7 said no, it seemed like a repetition of the other questions.
Did you feel that the asked questions had an impact on your happiness?	- 5/7 said their mood would have been the same - 1/7 said their mood improved a little bit: good feelings were amplified and bad moods were slightly dampened - 1/7 said their mood was better.
Was the slider hard to use or interpret?	- 4/7 participants said they had no issues using the sliders, and that they were easy to use. - 1/7 said she had no issues, but was confused at the scale: "a little" was at 50%. - 1/7 said the social slider was easy to use, physical health

	and self care could use a little more information and productivity was easy to use but very confronting. - 1/7 said she lacked some context and explanation and had some trouble using the sliders.
Did the slider add value for you?	- 6/7 participants said the slider provided extra value and detail to the data - 1/7 participant said if there was more explanation and context it would add value.
When filling in the regular questionnaire, did you find time to stop and reflect? Did the questionnaire have any influence on your self-awareness and reflection?	- 7/7 participants said filling in the questionnaire made them more aware of their moods and created self-reflection - 2/7 participants said the reflection would be even stronger if the notification could be “snoozed” or chosen to be done before bed to ensure they have a moment to stop and think about it. - 2/7 participants said it was a direct cause for them to change their behaviour in the moment if they were feeling bad or if they hadn’t been doing much.
Was this level of reflection something you had expected?	- 4/7 participants said they had expected it - 2/7 participants said they had not expected it - 1/7 participant said they weren’t sure
Viewing the results	
What is your immediate impression of these results?	- 4/7 participants immediately started noticing possible correlations - 2/7 participants remembered things that happened by looking at the graph - 1/7 noticed that the data was slightly wrong
Can you name everything that can be seen on this graph?	- 7/7 had no trouble after a short explanation - 2/7 noted that it does take some time to go through and really understand
Can you find any correlations, or do they seem arbitrary?	- 4/7 found a correlation between productivity and mood - 3/7 found a strong correlation between social and mood - 2/7 found a correlation between step count and mood - 2/7 found a negative correlation between productivity and mood - 1/7 found a strong correlation between mood and physical health and self care - 2/7 didn’t find any strong correlations
What can you learn from this graph?	- 2/7 participants noted that they should meet friends more, especially if they feel stressed due to university work - 2/7 noted that the visual confirmation that their actions impact their mood is very valuable

	- 2/7 said that their choices have a stronger correlation to mood than they previously thought. - 2/7 said they had not learned much new information. - 1/7 said she'd take more breaks during studying to prevent intense stress.
Is that new information?	- 3/7 participants said no - 2/7 participants said it was completely new - 2/7 participant said it was a little bit new
Self-reflection questions	
When filling in the surveys, there were two moments of journal-like reflection. How did you experience these moments?	- 6/7 participants said that asking for 3 bad moments and 3 good moments in the span of a few days was too much, and that the question was too rigid. - 2/7 said that remembering good moments that had happened was nice, but bad moments was not necessary for them.
Did these questions add anything to your self-reflection?	- 3/7 said yes, it did help for self-reflection - 3/7 said no, it did not add anything - 1/7 said it added a little bit of self-reflection - 2/7 participants said they got enough moments of self reflection from the main questionnaire.
You filled in your 3 top moments and your 3 worst moments. Can you find these moments in your graph?	- 6/7 participants were able to find their main highs and lows in their graphs. - 1/7 participant didn't: she said her highs and lows were mainly fleeting moments.
General	
Would you consider using an app like this in the future?	- 2/7 participants said they would like to keep using an app like this as long as they could still learn new information from it. - 1/7 participant said yes, if things are not going too well, so that I can learn how to feel better - 1/7 participant would be interested in using a more journal once-a-week type system - 1/7 participant would mostly be interested in trying a Google Fit or fitbit like application - 1/7 said no.
What requirements would an application like this have to fulfill for you to	- 4/7 participants said they wanted to be able to change the times that the questionnaire needs to be filled in - 3/7 participants said they would like to have the ability to

use it?	personalize questions: not answer those that are not interesting and having preset tags for others - 3/7 participants said they would like to see a smarter system: automatically pointing out correlations and making suggestions such as “when you are social, your mood is better. Why not call a friend?” and plugging good moments from the reflection questionnaire into the main app to cheer up a user - 1/7 participant suggested having widgets that count alcohol/coffee/water intake throughout the day by one click - 1/7 reiterated that the mood choice should be improved
Would you be motivated to continue tracking your mood?	- 6/7 said they would be - 1/7 said she has learned enough from this week
Google fit	
Did you find relevance in tracking your body functions?	- 2/7 said it was hard to say, because it was a little more abstract - 2/7 said it was nice to get insight into their body, especially in the moment

6.3 Usertest Conclusion & Discussion

The goals for the usertesting were as follows:

- Test the relevance of the selected factors
- Test the usefulness of adding numerical value to the selected factors
- Test whether the prototype reached the following goals:
    - Helps the user reflect
    - User learns more/new information about themself
- Find flaws and possible improvements to the above mentioned points

From the results, we can conclude that the three main selected factors were relevant. That is, social, physical health and self care, and productivity. Participants expressed that the categories were appropriate and seemed to be connected to their well-being. Heart rate and step count had a slightly lower relevance, but from the interviews it is clear that tracking physical activity can have a big impact on mood. There is a possibility to transform heart rate and step count into a “sport” variable, which could have a much bigger impact.

Adding numerical data to the three categories had a tremendous impact. In essence, the prototype tracked almost the same factors as Daylio does, yet participant 002 remarked: “I have used Daylio for over a year and after only a week of this have I learned that specifically productivity has a big impact, for example.” (Appendix E). Adding this extra level of detail to the three categories was successful.

The two goals of the prototype, namely bring more reflection and self-knowledge to the user, were achieved. 7/7 Participants said filling in the questionnaire made them more aware of their moods and created self-reflection, and two changed their behaviour as a direct result of the self-awareness it brought on. More than half of the participants learned new information from their results after using the prototype for a week. This shows that the prototype achieved these goals.

Of course, there were also flaws and possible improvements. From the interviews, there is a clear list of possible revisions to the prototype. The main improvements to the questionnaire are:

- Revisit the circumplex model to see if there is a better or improved model to the Pick-a-mood model designed by Desmet et. al. (2012), as it seems to be lacking at least one mood: “tired”
- The question “what have you been doing in the past few hours?” should be altered or completely removed.
- The timing of at least the last questionnaire of the day should either be personalizable, snoozable, or before bed.
- The tags for each category should allow for personalization, a user should be able to add their own standard tags.

The first point of discussion is the user group of the proposed product. Female university students is a rather limited user group, and it is possible that there is a more suitable target audience. Also, 7 participants is a low amount, and more insights may have been produced with a larger participant group. This could have impacted the results of the study. In addition, the timespan of the study was only a week, and whilst most participants indicated that it was a good representation of a normal week for them, the data would have been more reliable if the study had been longer.

Besides this, the Google Fit data could have been more accurate if the participants wore a more comfortable watch, as four participants indicated that the watch was too big for them or simply too uncomfortable.

Chapter 7: Conclusion, Discussion & Recommendations

In the following chapter, the research question and sub questions will be answered and a conclusion of the graduation project will be drawn. Following this, there will be a discussion and finally recommendations for further research will be given.

7.1 Conclusion

The research question and sub-questions for this graduation project were:

2. How to design a tool that combines Quantified and Qualified Self concepts to aid the well-being of students?
    a. How can the concept of Qualified Self solve the critiques of the Quantified Self?
    b. What is the state of the art of Qualified Self tracking applications?
    c. How to define and track a user's well-being?
    d. What are the factors that contribute to one's well-being?

In order to answer the research question, the sub questions should be briefly summarized.
The critiques of the Quantified Self are focused on the distance between the user and the data. A user can feel overly connected to this objective, quantified data. This leads a user to become addicted to tracking their data, risking trusting the objective data points to a higher degree than what their body tells them. On the other hand, a user can feel too disconnected from their data, not understanding it or not finding it useful. In both of these cases, the concept of Qualified Self can help solve this. By providing context that the user can understand, in this case, adding a mood tracker, a user is brought back in close contact with their data whilst being asked specifically to self-reflect, preventing them from trusting the data more than their own feelings.
The state of the art of current mood tracking applications consists out of applications such as Daylio, Youper, and Sanvello. These applications mostly use a visual-analog scale to track mood, but some also add some more descriptive words, indicating the use of a circumplex model. In terms of factors that influence mood, the state-of-the-art applications all have a similar list of factors or tags that a user can add to their mood entry.
Research suggests that using a circumplex model is the most user-friendly way to track mood or well-being, and that the specific factors that influence one's well-being is personal and differs

strongly from person to person. However, testing with participants shows that these factors can be divided into three main categories that have a strong impact on one's mood: Social, physical health and self care, and productivity. So including these categories, and attaching a numerical value to each by means of a scale (0-100) is a successful design choice for a tool that aims to provide insight into a user's mood patterns. Adding more detail to this data is possible by still including tags for each category: Social (70) tags: friends, family. To increase the users self-reflection, journal-like prompts can be added to the design. However, this is strongly dependant on personal preference and motivation of the user.

Ultimately, what can be learned from this study is that there is much to improve and develop in the field of mood tracking applications. There is huge potential for an improved tool that can deliver results. There is no necessity to use a Quantified or Qualified self tool for an extended period of time, if the benefits and the knowledge obtained from using it are sufficient after only a short amount of time. A week was enough to see some cause and effect between mood and the categories for many of the participants. Whilst some said they would continue using an application like this, others indicated that they were satisfied with what they had learned and felt no need to keep tracking. This is totally fine. Additionally, it is important to note that all users are different, have different needs and wants and above all, they differ in what causes their moods to fluctuate. Finally, through the literature study and intake and exit interviews it has become clear how important personal motivations are for tracking in order to fully reap the benefits. It could be an interesting challenge to help increase or inspire motivation for users to track and learn about their well-being.

7.2 Discussion

The first point of discussion is that the factors and the categories chosen for the prototype originate from other state-of-the-art applications. This means that the product is heavily dependent on the choice of these applications for the research. Whilst the top applications were indeed chosen for comparison, this does not necessarily mean that they are completely reliable in their choice of factors that can impact well-being. For now, the design has succeeded in improving upon the state of the art, but it is unknown how much can still be improved using a more appropriate selection of factors.

In addition, some participants viewed their heart rate data as too abstract, which is a characteristic of one of the main critiques of the Quantified Self. This indicates that the visualisation for heart rate specifically did not successfully bridge the gap between Quantified

and Qualified self, and should be improved. As mentioned in the conclusion of Chapter 6, this problem might be solved by incorporating heart rate and step count into a “physical activity” factor, as this is much easier to understand and put into context for a user.
Furthermore, it is important to consider the suggestiveness of words. Some participants indicated disliking the productivity scale, and some even had a negative correlation between mood and productivity. This could be due to the suggestiveness of the word “productivity”. It implies that a user is required or expected to be productive, possibly inducing a level of stress or tension. This positive or negative perception of the way the factors have been worded could have a strong impact on the data. It is conceivable that participants would have had a different correlation result if “How productive have you been feeling in the last few hours?” had been replaced with a question such as “how busy have you been in the last few hours?”, perhaps implying a more neutral answer.

7.3 Recommendation for future work

For future research in mood tracking applications focused on bridging the gap between Quantified Self and Qualified Self, it is strongly recommended to find a good representation of objective self-tracking data, specifically heart rate and step count. A possible solution to this is to research the effectiveness of combining heart rate, step count, and other data into a value that indicates the level of physical activity, in order to add context and understanding to the objective data. However, this is not necessarily the only solution.
Additionally, further research is recommended in the effectiveness of tracking certain factors. Currently, this research was lacking as the state-of-the-art applications provided the factors used for the prototype. An exploration in the most appropriate list may lead to other categories, which could lead to additional information and self-knowledge for the user. This is strongly worth pursuing.
It is also recommended to further develop the visualisation for the prototype, as the current visualisation is time-based, whereas there are other possibilities that are potentially more effective in finding correlations.

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Appendix A: information brochure

Dear reader,

In this letter, I would like to inform you about the research you have agreed to participate in. The experiment will take place between 09/01/2020 and 16/01/2020. In the proposed research for my graduation project, entitled “From Quantified Self to Qualified Self: creating a happier user”, I will be testing a concept for a new self-monitoring tool, allowing users to become more reflective and more aware of what makes them happy. The aim is to discover which daily factors and activities have a strong impact on your moods and emotions, in order to give you a fuller self-image and the power to adapt your daily routine in a positive way.
To achieve this, you will be asked to wear a smartwatch for a period of 7 days, from waking until sleeping. This smartwatch is synchronised with an anonymous Google account that stores your tracked personal data. The tracked personal data consist of the measurements of the smartwatch. The measurements are executed over a time interval of 15 minutes, every 15 minutes the device tracks: Step counts; Calories burnt; Distance travelled; Locational data will be disabled. Average heartbeat; Speed and Type of physical activity. In order for the researcher to receive this data, you should be connected to the internet throughout the day.

You will be asked to fill in an online questionnaire three times a day. This questionnaire can be filled in using your smartphone and will ask you questions about your emotional state and recent activities. This has the goal of making you reflect on your mental state for a second. The data of this questionnaire will be stored on the same anonymous account as the data of the smartwatch.

The account will only be accessible by you and the researcher and will be removed once the project is over.

In addition, there will be a short entry interview that takes a maximum of half an hour and an exit interview that takes a maximum of one hour. In the entry interview we will discuss expectations and in the exit interview there will be a debriefing and a look at the data you have collected. The aim of the exit interview is to learn about your experience, feedback, and what you have learned from the experience and both entry and exit interviews will be recorded for review purposes. They will be anonymized and used only for this graduation project.

The total experiment lasts for 7 days, and the entry and exit interviews must be planned within 2 days of the start and finish of the experiment. Please note, that we, as part of the University of Twente, are obliged to comply with the General Data Protection Regulation. For this, we take measures with regard to the processing and inspection of personally identifiable data, such as your name, audio recording from the interviews, and the data of the smartwatch.

Yours sincerely,
Kristine Bardsen
Creative Technology graduate student
Tel:+31 (0)625383714 Email: k.t.bardsen@student.utwente.nl

Appendix B: informed consent

Informed Consent

‘I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the research as described in the aforementioned information brochure ‘Quantified Self to Qualified Self’. I will handle the smartwatch that I will wear during the experiment with great care, and see to it that it will be returned at the end of the experiment. My questions have been answered to my satisfaction. I agree with my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the experiment at any time. If my research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. My personal data will not be disclosed to third parties without my express permission.”

If I request further information about the research, now or in the future, I may contact Kristine Bardsen (telephone: +31625383714 email: k.t.bardsen@student.utwente.nl)

If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Electrical Engineering, Mathematics and Computer Science at the University of Twente, J.M. Strootman-Baas, Paviljoen 015, 7500 AE Enschede (NL),telephone: +31 (0)53 48 96 719; email: ethics-comm-ewi@utwente.nl
Signed in duplicate:

.....

Name subject Signature

‘I have provided explanatory notes about the research. I declare myself willing to answer to the best of my ability any questions which may still arise about the research.’

.....
Name researcher Signature

Appendix C: main questionnaire

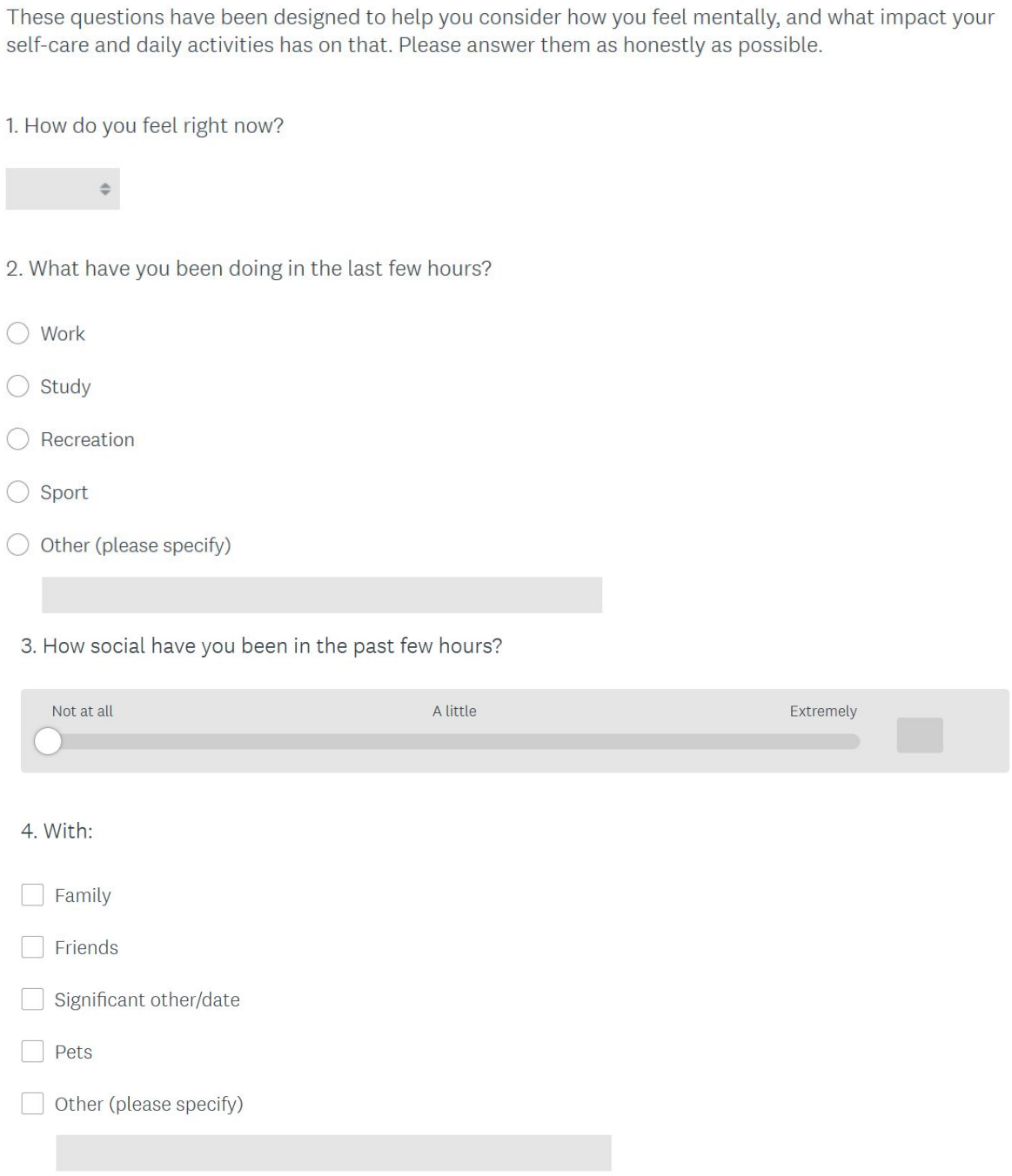

Figure 19: Main questionnaire

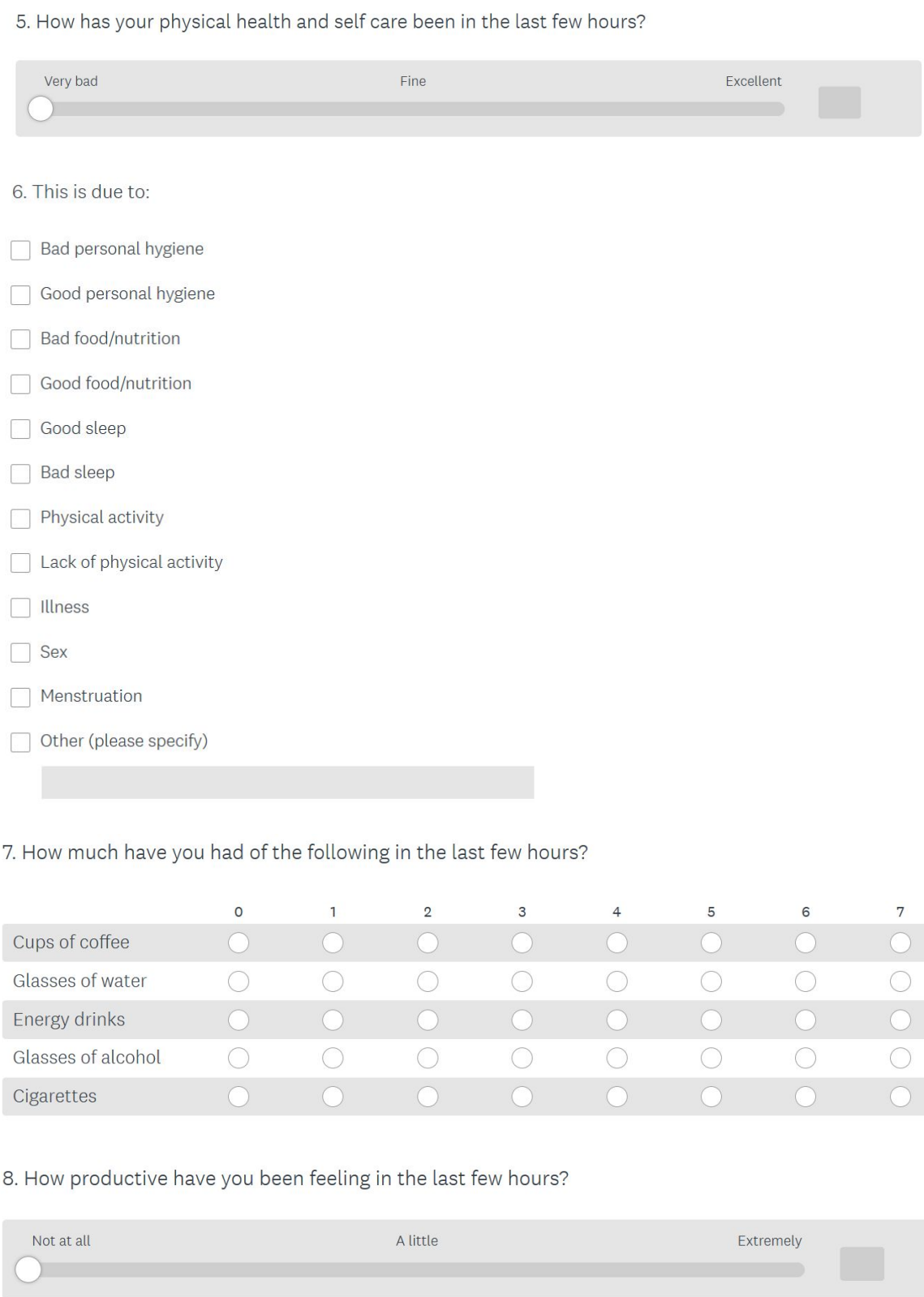

Figure 20: Main questionnaire

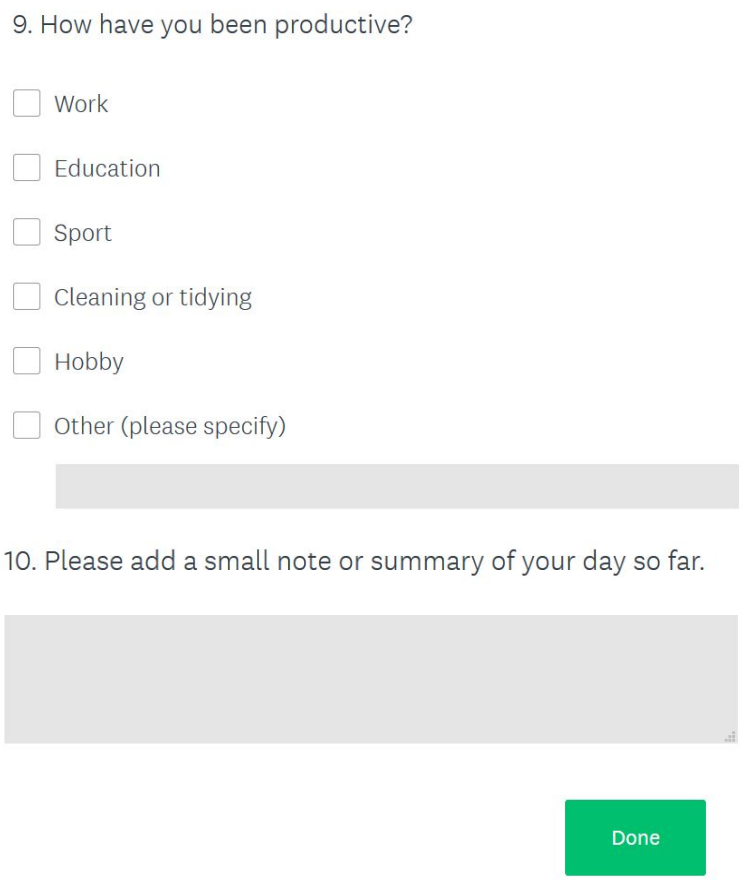

Figure 21: Main questionnaire

Appendix D: reflection questions

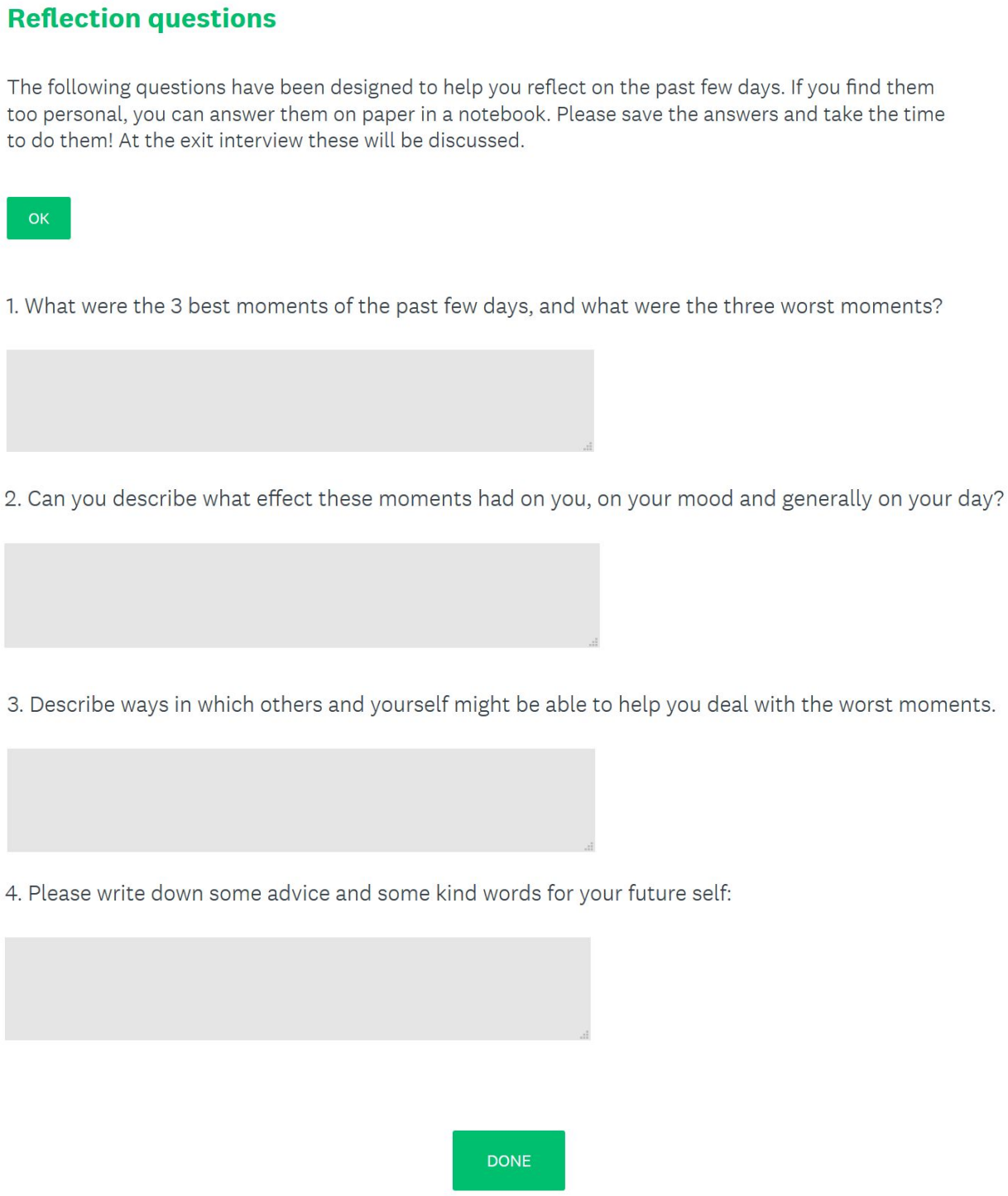

Figure 22: Journal-like reflection questionnaire

Appendix E: Individual participant results

Table 14: participant 1

	Participant 001
What was your overall impression of the week of data collection?	It was a normal week and a pretty good representation of my everyday life. Lots of appointments, but it was a good week.
How did you experience the questionnaire?	In general my experience was good, I liked the sliders. I did miss something in the moods that I could choose from, as they didn't always represent how I felt. I was tired a lot, but that wasn't an option. The fact that the last questionnaire was at 8 pm was a bit of a problem, as I start work at 8 so I can't fill it in before work and it's easy to forget it.
What was the usefulness of the asked factors?	As an example, I never drink coffee, so that was not very useful for me personally. Tracking alcohol would be useful, however since the last questionnaire is as early as 8 pm that usefulness is diminished because I usually only drink later than that. As a result, I wasn't sure when to fill that in. I really thought the categories of social and physical health were good and pretty useful.
Which questions were superfluous or lacking?	Besides having the option to choose "tired", the first question, I struggled with choosing an option sometimes. When I'm working as a board member, I'm not earning money and I do it for fun, but I wouldn't call it "recreation" and "work" seems wrong too. I often filled it in as "other". In the same theme, the social category missed an option like "colleagues", as they aren't really on the same level as friends but I do feel social with them.
What would you have added?	Nothing big, besides the things I have already mentioned. I was pretty happy with the questions.

What would you have removed?	Coffee and cigarettes, because they are not relevant for me.
Did the 'note' section add any value for you?	I liked it, and it does make it easy to read the results.
Did you feel that the asked questions had an impact on your happiness?	I have been very honest filling in the questionnaire, and I think the emotions I felt would have been the same with or without the questionnaire.
Was the slider hard to use or interpret?	I didn't have any issues using the slider, although I had my own interpretation of the social slider: I based it on how many people I saw every time. That may not be the best way to use it but that was how I saw it.
Did the slider add value for you?	Yes, a scale added a lot for me, because it has more information than just saying yes or no. maybe having 7 options (1-2-3-4-5-6-7) would have been fine too, but 3 choices would have not had enough detail for me.
When filling in the regular questionnaire, did you find time to stop and reflect? Did the questionnaire have any influence on your self-image?	I was a lot more aware of what I was feeling every time I filled in the questions, even if it was just for 5 minutes. Normally I'm pretty aware and concerned with my mood, but not as often as I was now.
Was this level of reflection something you had expected?	Yes and I was pretty happy with it. It is different when the reflection is recorded rather than just in my mind, so I liked that difference but overall the level of reflection was something I did expect.
Viewing the results	
What is your immediate impression of these results?	I immediately recognise the lower moment, because I was feeling bad. After looking at the rest of the results I can say I'm pretty content with these results. It's a good representation of a normal week and in general I feel pretty good. I don't feel bad that easily. Of course I have bad moods, but I don't really have trouble snapping out of those. So when I'm asked how I feel, 9/10 times its good! *as the participant was looking through the results, she kept repeating "oh yes, that was

	when /this/ happened”
Can you name everything that can be seen on this graph?	Yes. although the time scale could be a little more clear.
Can you find any correlations, or do they seem arbitrary?	The physical health and self care seem to strongly correlate with my mood. Sport and food have a big impact on my mood. Sometimes being productive also has an influence on my mood I see.
What can you learn from this graph?	My level of social time seems to fluctuate strongly, but it doesn’t seem to have a huge impact on me. Also the correlation between physical and mental is really clear. Also I seem to drink enough water :)
Is that new information?	Not specifically, although it is nice to see it so clearly.
Self-reflection questions with the graph	
When filling in the surveys, there were two moments of journal-like reflection. How did you experience these moments?	I liked thinking about my best moments, that helped me feeling really positive. I didn’t specifically enjoy thinking about my worst moments, that could have been left out for me. If the goal was to feel better, I don’t need to think about the bad moments. Thinking about how to feel better could be useful but sometimes you just can’t do that much about it. The advice for your future self was a cute addition but it wasn't clear what the advice should focus on. I don’t think it helped me much.
Did these questions add anything to your self-reflection?	Mostly helped feel positive by thinking about the good things that happened.
You filled in your 3 top moments and your 3 worst moments. Can you find these moments in your graph?	*she mentioned several moments and was able to find the moments in the graph too, also finding the high points in the mood results. One or two moments she wasn’t able to find.
General	

Would you consider using an app like this in the future?	Yes, especially a Google Fit type application. In fact, I'm going to start using this as I bought a new smartwatch (smaller than the one from the experiment)
What requirements would an application like this have to fulfill for you to use it?	Physical health can stay, but Social is not so interesting for me. My life is social enough for me to not have to worry about that. It's the same for productivity. It's going to happen either way. Since I have to put extra effort in to go to the gym or eat healthy, I would be much more interested in tracking that more. Also, it might help if the times are more personal - so if I could choose at what time to fill in the questionnaire. Also, being able to see results as they happen that would be a lot better. And the push notifications are not necessary for me.
Would you be motivated to continue tracking your mood?	I am a lot more interested in tracking my physical health, because that is what I have control over. I'm pretty aware of my mood either way, so I'm not sure if keeping track of it would add very much for me. Besides, since my physical health has a lot of impact on my happiness, I think I've learned enough from this one week of tracking.
Google fit	
Did you find relevance in tracking your body functions?	The results are not very obvious, probably because I wasn't wearing the watch properly. So it's hard to say. I'm very curious about the full potential of tracking all your body functions, especially because I know that my physical health has such an impact on my mental state. This specific watch was not great because it's too big and heavy, and not very comfortable.

Table 15: participant 2

	Participant 002
What was your overall impression of the week of data collection?	I enjoyed it. However sometimes the questionnaires weren't at the handiest

	moments. I'm not sure I could do this much longer than a week, because it was a lot.
How did you experience the questionnaire?	I tried to fill in the questionnaires at the moment they came in, however the last one would have been better if I'd done it right before bed, as there are still things that happen after 8 pm. Also, in the productivity category I sometimes struggled with the tags. I wasn't always being productive in the suggested things but I wasn't sure what to call it in the "other" tag. How specific am I meant to be? The tags are not very specific.
What was the usefulness of the asked factors?	I think it was the right choice in categories. I recognise that social, physical and productivity are quite impactful to mood.
Which questions were superfluous or lacking?	In the mood scale, I think I would have liked to see something like "tired", because when I was tired I wasn't sure what to pick. It's not the same as "relaxed" or "calm". I wasn't always sure what is a part of physical health and self care. I think sleeping is a part of that.
What would you have added?	More options for mood.
What would you have removed?	-
Did the 'note' section add any value for you?	Yes, I think in this case it does. It really adds some context, because you can see that you've been social but that can mean many things. Writing that you were at a birthday party adds a lot of information. Although I wouldn't spend a lot of time re-reading all the specific entries. It's not a diary to me. I want to see the overall trends.
Did you feel that the asked questions had an impact on your happiness?	I track my mood already of course but in a very different way (participant uses daylio). I think that tracking your mood once a day would maybe result in a happier, or maybe much less happy user depending on where you stand in the spectrum. I think if you only have one moment in the day to think about it it might amplify your mood. I myself am pretty steady in how good I feel but I don't know if

	tracking in the moment had any big impact on it.
Was the slider hard to use or interpret?	No! I thought it was handy and a good length. I liked that it was a spectrum.
Did the slider add value for you?	Yes I think it did add value because I think the way you feel does lie on a spectrum, and so gives a more complete picture of it.
When filling in the regular questionnaire, did you find time to stop and reflect? Did the questionnaire have any influence on your self-image?	Yes I did always take a moment, although sometimes I rushed through it a little bit. I think it would be a good option to be able to "snooze" the notification. Especially on the moments I felt a little worse, those were the moments I really took the time to reflect and think about why I didn't feel good.
Was this level of reflection something you had expected?	Yes, I think so.
Viewing the results	
What is your immediate impression of these results?	It is not that easy to interpret, I really need to scroll over it a couple times. But especially the bottom one (productivity) gives me a lot of information and I like that you can see the graphs correlations like this.
Can you name everything that can be seen on this graph?	Yes. It just takes a few minutes to get into it, and you really need to use your mouse.
Can you find any correlations, or do they seem arbitrary?	Especially in the beginning when the mood is fluctuating, there are some strong correlations between mood and productivity. In the rest of the week my mood is so steady that it's hard to really see anything, although after a second inspection the productivity and social are almost 0 during that period, so a steady week of relaxation.
What can you learn from this graph?	It's nice to have the visual confirmation that my mood is very steady. Especially when I am less busy and have less to do I'm still fine. Of course if I actually have a to-do list that I haven't completed it might have been a little different. Also, that shows that context is very

	important.
Is that new information?	It is slightly new. I know that I have a pretty steady mood, but really seeing how much influence productivity and social time have is completely new and I loved learning that.
Self-reflection questions with the graph	
When filling in the surveys, there were two moments of journal-like reflection. How did you experience these moments?	Sometimes it was hard thinking of 3 separate moments, although trying to think of 3 good things was nice, and they balanced out the worst moments. Since 3 was quite a lot maybe twice a week was too often to fill in this questionnaire. I didn't think question 4 really added anything for me.
Did these questions add anything to your self-reflection?	Yes, the first question put things into perspective for me, really thinking about the last few days.
You filled in your 3 top moments and your 3 worst moments. Can you find these moments in your graph?	That's a little hard to do because these moments are very small.
General	
Would you consider using an app like this in the future?	Yes. Although I would use it until I have learned all the information I can, after that I would stop.
What requirements would an application like this have to fulfill for you to use it?	If I compare this to daylio, I love that it has much richer data than daylio. I have used daylio for over a year and after only a week of this have I learned that specifically productivity has a big impact, for example. The questionnaire could be a little shorter, to decrease the "workload" every day, maybe by having more personal presets. Or, the slider is really the most important so keeping all the sliders and just having a note section.
Would you be motivated to continue tracking your mood?	As long as I can still learn new information.
Google fit	

Did you find relevance in tracking your body functions?	A little difficult to interpret. The watch doesn't always work but it's fun to see the step count for a party for example. The heartbeat information was slightly abstract to me. A way to improve this would be to combine heartbeat and step count into a "sport" result

Table 16: participant 3

	Participant 003
What was your overall impression of the week of data collection?	Pretty much as I had expected. I thought it was fine.
How did you experience the questionnaire?	Good, very clear.
What was the usefulness of the asked factors?	Mostly useful, sometimes I didn't see my option in the preset list of tags. Also, sometimes I had been doing several things and question 2 doesn't allow for multiple choices.
Which questions were superfluous or lacking?	The social category missed something like "project members" or "colleagues". Energy drinks and cigarettes were not relevant for me personally, but I do understand they would have an impact on mood so I wouldn't take them out or anything.
What would you have added?	Just "colleagues"
What would you have removed?	Question number 2 was a little difficult to answer occasionally, but nothing really.
Did the 'note' section add any value for you?	No, I really wasn't sure what to put there so I didn't really use it. It seemed just a repetition of the other questions.
Did you feel that the asked questions had an impact on your happiness?	No, I think it would have been the same.
Was the slider hard to use or interpret?	No, but I was confused that "a little" was at the 50% mark. That seems not right and it threw me off when using the slider.

Did the slider add value for you?	ja
When filling in the regular questionnaire, did you find time to stop and reflect? Did the questionnaire have any influence on your self-image?	Yes, I took the time to look back at what I had been doing and become aware of my activities. It reminded me to stop and start doing the important stuff.
Was this level of reflection something you had expected?	No, I actually didn't realise how little I'm aware of my day.
Viewing the results	
What is your immediate impression of these results?	Physical health and social seem to really impact my happiness, whereas productivity it seems to have a negative relation.
Can you name everything that can be seen on this graph?	Yes, no issue.
Can you find any correlations, or do they seem arbitrary?	Productivity with education had a strong negative correlation but other small productive moments didn't make much of a difference. Social has a strong correlation and physical health and productivity was pretty steady.
What can you learn from this graph?	I might need to be with friends more when I'm trying to be productive to prevent stress.
Is that new information?	A little bit. Especially when doing the questionnaire I realised I was very stressed in the last couple of days.
Self-reflection questions with the graph	
When filling in the surveys, there were two moments of journal-like reflection. How did you experience these moments?	Sometimes it was difficult to write down the worst moments, sometimes I didn't even have 3 bad moments.
Did these questions add anything to your self-reflection?	Mostly I had already mentioned it in the data. However, some great things happened in the evening so they are not in the data. Also being able to talk about things a little more specific was nice.
You filled in your 3 top moments and your 3 worst moments. Can you find these moments in your graph?	Yes, she can point to high points and low points in the graph that correlate with her top and worst moments. Only the good moment that happened after 8 did not appear.

General	
Would you consider using an app like this in the future?	Yes, as long as I can still get something out of it. I think after a few weeks I will have learned all I can learn.
What requirements would an application like this have to fulfill for you to use it?	The moods could have better choices. I chose neutral a lot because the others didn't fit properly. Also, sometimes when filling in the survey I had felt several different moods and I didn't know how to incorporate that into the questionnaire.
Would you be motivated to continue tracking your mood?	Yes. Sometimes I will have had a whole day and then at the end of it I will be like: "I feel tired. But what did I actually do today?" and now, I had that during the day and it helped me.
Google fit	
Did you find relevance in tracking your body functions?	The step count didn't add that much for me.

Table 17: participant 4

Data Collection	Participant 004
What was your overall impression of the week of data collection?	Fun experiment. I liked thinking about it every few hours. It wasn't a perfect representation of a normal week, so tracking for longer might help.
How did you experience the questionnaire?	The questions were fine for me. I liked the moment of reflection every day.
What was the usefulness of the asked factors?	I didn't always agree with the productive question; I mean I didn't think it had any added value for me, because it seems to me that mental health and motivation are not really correlated.
Which questions were superfluous or lacking?	I think question 8 and 9 were simply unnecessary.
What would you have added?	For "social" I would have liked to see

	“colleagues” and the option to choose “no one”
What would you have removed?	productivity.
Did the ‘note’ section add any value for you?	I thought it was difficult to fill in. Answering in words what you’ve been doing is takes some extra effort, but also requires some more reflection which I liked.
Did you feel that the asked questions had an impact on your happiness?	I think by reflecting and thinking about these things, my mood did improve. I thought about the nice things that happened and it helped.
Was the slider hard to use or interpret?	The slider was fine, it was easy to use.
Did the slider add value for you?	I think the slider does add more value, 1-10 would have been fine too.
When filling in the regular questionnaire, did you find time to stop and reflect? Did the questionnaire have any influence on your self-image?	The reflection and the positive results from filling in the questionnaire was mainly at the end of the day.
Was this level of reflection something you had expected?	No not really. It was more than I had expected, because it had a bigger impact on me than I thought it would have.
Viewing the results	
What is your immediate impression of these results?	Social has some moments where it perfectly aligns and some moments where it doesn’t seem to correlate at all. Physical health seems to correlate pretty accurately.
Can you name everything that can be seen on this graph?	Fine, clear enough.
Can you find any correlations, or do they seem arbitrary?	One moment is high on all graphs: I went dancing with friends. Dancing has a huge positive impact on me! Every time there is a high productivity peak in education the mood seems to be very low. But honestly I enjoy my study programme so I think that that is just circumstantial. Also in the beginning of the week something happened that just lingered and made me feel bad for several days.
What can you learn from this graph?	It’s good to reflect a few times a day, because

	that helps my general mood. But I don't think the graphs can really teach me many new things. I already knew that the more I sport the better I feel.
Is that new information?	no.
Self-reflection questions with the graph	
When filling in the surveys, there were two moments of journal-like reflection. How did you experience these moments?	I would prefer the good and bad moments in separate note blocks. I thought it was very difficult, because 3 is a lot. Maybe the question was posed too rigidly, something like "name good and bad things that happened"
Did these questions add anything to your self-reflection?	I don't think it added that much, because I already had a lot of reflection in the normal questionnaire.
You filled in your 3 top moments and your 3 worst moments. Can you find these moments in your graph?	The first few days my bad mood was pretty clearly visible in the graph, it drowned out the good moments a little bit, but one good moment is very very obvious in the graph.
General	
Would you consider using an app like this in the future?	Yes, it really does help me.
What requirements would an application like this have to fulfill for you to use it?	An app on my phone would be nice, also getting a push notification on the watch would help as a reminder. Also if the user could personalize the questions a lot more that would be cool.
Would you be motivated to continue tracking your mood?	Yes, absolutely.
Google fit	
Did you find relevance in tracking your body functions?	The watch was really too big for me, but otherwise it was fun to see your heart rate and cool to get a little insight in that. Especially in the moment.

Table 18: participant 5

	Participant 005
What was your overall impression of the week of data collection?	It was interesting and fun. I thought the questions were pretty easy to answer. At first I was confused why the last questionnaire of the day was as early as 8 pm. I do a lot in the evening, so it's just too early for me.
How did you experience the questionnaire?	The open questions were difficult for me to fill in, also because I knew someone would be able to read it. But also just filling it in on the computer felt weird. The moods didn't always have MY mood as an option.
What was the usefulness of the asked factors?	It was fine.
Which questions were superfluous or lacking?	Question 2 was too rigid, it should have given the option to choose several activities.
What would you have added?	Maybe I would have liked to see more sliders, like for personal hygiene, bad/good food, sleep, etc. because the binary was sometimes too rigid. Also, being able to add standard option if you keep answering the same thing.
What would you have removed?	The note section because I already use a diary. Also the option to remove questions that are not relevant.
Did the 'note' section add any value for you?	I didn't like the note section because I already use a diary, but I do recognize that it is nice to see the notes in the graph. I think I like the option, but maybe separate from the main questionnaire.
Did you feel that the asked questions had an impact on your happiness?	I think my moods would have been pretty much the same, but I was definitely more aware of my state of mind.
Was the slider hard to use or interpret?	Too vague. What do the numbers mean? It would have helped if there was an extra

	explanation.
Did the slider add value for you?	If more context was added, yes.
When filling in the regular questionnaire, did you find time to stop and reflect? Did the questionnaire have any influence on your self-image?	Yes. Sometimes these things were a little confronting. I think being able to fill in the last questionnaire at a later moment would have been better, because doing this at the very last moment of my day would have definitely been better for my self reflection.
Was this level of reflection something you had expected?	Yes, I think so.
Viewing the results	
What is your immediate impression of these results?	I would be interested in seeing data like this for longer than a week. My coffee intake seems to not be correct.
Can you name everything that can be seen on this graph?	participant had some issues
Can you find any correlations, or do they seem arbitrary?	When I was very productive, that influenced my mood in a positive way. I think when I was happier I was also more productive. Physical health and self care was also correlated with happiness.
What can you learn from this graph?	Not that much yet, I'd like to have seen this over a longer timespan. Also I wish the coffee intake was correct.
Is that new information?	-
Self-reflection questions with the graph	
When filling in the surveys, there were two moments of journal-like reflection. How did you experience these moments?	3 moments were just too much for me. I think I would have preferred a question like: can you name a good and bad thing that happened (every day)?
Did these questions add anything to your self-reflection?	I felt a little uncomfortable filling these questions on a computer, and the advice didn't do much for me. I did notice that it was hard for me to remember things which did make it harder for me to answer.
You filled in your 3 top moments and your 3	Yes. Participant was able to point out almost

worst moments. Can you find these moments in your graph?	all moments in the graph.
General	
Would you consider using an app like this in the future?	Not really. I discovered that I don't really like doing this on my phone.
What requirements would an application like this have to fulfill for you to use it?	If it was on my laptop I would like it more. The email was easy to use, I don't like having lots of apps. I would like more analysis: if the application could automatically point out correlations that would be much better, I don't want to do that myself. Having standard times is good but they should be able to be changed by the user. Having a simple widget that you just click every time you have a cup of coffee or water or alcohol would make that really easy and simple.
Would you be motivated to continue tracking your mood?	Not all the time, maybe like a week every month or something because the information is pretty cool but I can't do it longer than that, I get pretty bored of it.
Google fit	
Did you find relevance in tracking your body functions?	I think it's interesting to combine your mood with some completely objective data. However, I didn't like the watch because it was uncomfortable and big, and I had to charge it almost daily.

Table 19: participant 6

	Participant 006
What was your overall impression of the week of data collection?	Fine, I had a pretty stressed week though.

How did you experience the questionnaire?	I don't think there was any connection between your questions and my mood. And I noticed that I don't drink that much water.
What was the usefulness of the asked factors?	Some questions were not very useful at certain times. Maybe the "alcohol" question was not so relevant in the morning and other questions less relevant in the evening.
Which questions were superfluous or lacking?	The intake questions, like cigarettes, were just superfluous.
What would you have added?	An extra note after the "how do you feel" in which you expand on that.
What would you have removed?	I would have removed some questions that always have the same answers, like cigarettes.
Did the 'note' section add any value for you?	It was a little confronting, because I was stressed a lot and when I had to give a summary of my day I felt like I hadn't done that much.
Did you feel that the asked questions had an impact on your happiness?	The main thing it impacted were my actions, like when I answered the question and noticed I was stressed, that gave me a push to change my behaviour so that I could feel a little less stress.
Was the slider hard to use or interpret?	I thought the social slider was very easy to use. The physical health and self care was a little more difficult, it was more of a guess, but the tags helped give an indication. The productiveness was very confronting for me.
Did the slider add value for you?	Sure.
When filling in the regular questionnaire, did you find time to stop and reflect? Did the questionnaire have any influence on your self-image?	Yes. it forced me to stop and think about it. I was stressed a lot but filling in the questionnaire really confronted me with that fact. Being aware of that really made me change my behaviour a little.
Was this level of reflection something you had expected?	Not sure. I had expected much less realisation of my stress.

Viewing the results	
What is your immediate impression of these results?	I immediately see that social and mood are very very similar.
Can you name everything that can be seen on this graph?	Yes, no problem.
Can you find any correlations, or do they seem arbitrary?	Social and step count seem to correlate positively with mood. Those are strong correlations. I can see that productivity has a strong negative correlation with my mood, I'm really stressed. And I can see here (points to graph) that when I went to study (being productive) with friends I felt fine. Also, almost all of my high moods were in the evening.
What can you learn from this graph?	I need to see friends more! Exercise helps too. And I should maybe try to chill it on the stress and my study programme. Stress really comes when I am actively busy with my study. Maybe I should take more breaks.
Is that new information?	Yes, I would never have known that my social life has such an influence. I totally didn't expect this.
Self-reflection questions with the graph	
When filling in the surveys, there were two moments of journal-like reflection. How did you experience these moments?	I found this difficult. Especially since I hadn't done much it was hard to come up with three good moments. Although it was also nice, because I thought I'd had a bad week but when I couldn't come up with 3 bad moments that showed that the week hadn't been so bad after all. Although I did really struggle thinking about how to deal with the bad things. The questions could have been clearer or more narrow. If there are some tags that you can add, like stress, maybe the app could show you some previous answers regarding how to solve stress. I would have liked to see some of the good moments as reminders in later normal questionnaires.

	The 4th question wasn't so useful for me.
Did these questions add anything to your self-reflection?	Yes, I did like spending some more time thinking about it and after spending a few extra moments I could come up with some moments.
You filled in your 3 top moments and your 3 worst moments. Can you find these moments in your graph?	The good moments perfectly matched with the high points in the participants results.
General	
Would you consider using an app like this in the future?	No fitbit, I don't want another thing to stress about. But I would definitely consider using a more chilled once-a-week type app. I think it would add a lot, but every day is just more labour intensive.
What requirements would an application like this have to fulfill for you to use it?	More feedback from the journal-like questions in the main app. I use diaries a lot, so I'd like the app to be more similar to a diary. And having the option to fill it in whenever you don't feel great.
Would you be motivated to continue tracking your mood?	Yes, I think it would continue to be interesting, like in a different period of the year.
Google fit	
Did you find relevance in tracking your body functions?	Especially seeing my heartbeat in the moment was interesting and it definitely did motivate me to move a little more.

Table 20: participant 7

	Participant 007
What was your overall impression of the week of data collection?	It was fine. I had some trouble filling in the questionnaire on time, especially the one at 15.00, but overall I had a good week
How did you experience the questionnaire?	The "what have you been doing" and the productivity tags were pretty much the same

	thing.
What was the usefulness of the asked factors?	I think the main things were useful enough, and also the tags seemed useful to me.
Which questions were superfluous or lacking?	Physical health and self care are two different things, they could be split up into separate categories.
What would you have added?	Can't think of anything.
What would you have removed?	"What have you been doing?" is not necessary for me. It could be removed.
Did the 'note' section add any value for you?	Yes, just add a little extra context to you day that you can't add in the questions.
Did you feel that the asked questions had an impact on your happiness?	I was definitely more aware of my moods, because I was thinking about it more. A good mood is slightly amplified because I was aware of it, and a bad mood made me stop and think about why that was the case, so it was dampened a little. Overall the emotions would have been the same though.
Was the slider hard to use or interpret?	No it was pretty clear to me.
Did the slider add value for you?	Yes, it added some depth to the data.
When filling in the regular questionnaire, did you find time to stop and reflect? Did the questionnaire have any influence on your self-image?	Yes, I was a lot more aware of my moods and what was influencing it.
Was this level of reflection something you had expected?	Yes, I did expect something like this.
Viewing the results	
What is your immediate impression of these results?	It looks pretty cool. I didn't have that much to do. Did I drink too much alcohol there? I did drink enough water! The questionnaire actually helped me remember to drink more water. It's pretty nice to see that I was social and healthy.
Can you name everything that can be seen on this graph?	Yes, it looks good.

Can you find any correlations, or do they seem arbitrary?	High step count seems to correlate with a good mood. Productivity also has some positive correlation with a good mood, as well as being less social correlating with negative moods.
What can you learn from this graph?	Steps and physical activity has much more influence on me than I thought. Also seeing so clearly that you habits are so correlated with how you feel is a good reminder.
Is that new information?	Most things I know unconsciously, although the steps have more impact than I thought.
Self-reflection questions with the graph	
When filling in the surveys, there were two moments of journal-like reflection. How did you experience these moments?	I enjoyed thinking about it, but I thought it was hard to come up with the worst moments, because I didn't really have those this week. Maybe the question could be phrased differently like "what was nice this week?" "which moments influenced you this week?"
Did these questions add anything to your self-reflection?	I had enough self-reflection from the main survey. I didn't find it necessary to have another extra questionnaire.
You filled in your 3 top moments and your 3 worst moments. Can you find these moments in your graph?	Yes, the participant was able to find some of the moment in the graph.
General	
Would you consider using an app like this in the future?	Possibly. It depends on my situation, because if things are going well, I don't think I'd feel a need. If things aren't going well, then an app like this might be a good option, to see how to solve things.
What requirements would an application like this have to fulfill for you to use it?	If the app was smarter and learned from your data, that would be great: like if it has learned that a higher step count influences your mood in a positive way suggest moving more. Being able to choose your own time to fill in the questionnaire would be better. These times were not ideal. The Google Fit data is fine, but I wouldn't wear a watch.

Would you be motivated to continue tracking your mood?	Yes, when I'm not doing well. I'd want to know how to improve.
Google fit	
Did you find relevance in tracking your body functions?	I'm pretty sure my heart rate is constantly between 70 and 90. More than that it doesn't really interest me.