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## INTRODUCTION

Nowadays, sitting behind a desk for hours is occurring more and more often and is considered normal as well. Because of this amount of sitting, often in the wrong position, people's posture and health is effected in a negative way [1, 2, 3].

In this research, the effect of introducing a design artefact at work, incorporating the Pomodoro technique, on the health of office workers, is investigated. The Pomodoro technique is meant to improve one's productivity and create eustress. This is done by dividing tasks over intervals of 25 minutes, with breaks of 5 and 15 minutes in between [4, 5, 6]. It is suggested that the increased productivity provides a decrease in stress [7, 8, 9, 10]. On its turn, this ensures a longer sleep, more deep sleep and decreased insomnia [11, 12, 13]. Looking at this, it might suggest that the Pomodoro technique will positively influence sleep quality.

However, **'What is the Effect of the Pomodoro Technique on the Sleep Quality of Office Workers?'** is not investigated before. In this research, this theoretical relationship is examined, with the help of sensors, integrated in the Xiaomi Mi Band 3; a design artefact, with the Pomodoro technique implemented; questionnaires and an interview.

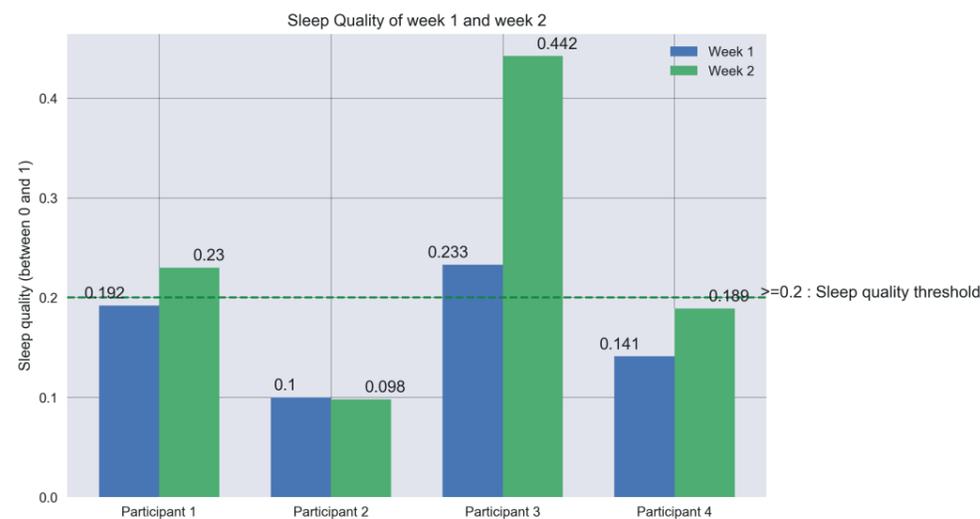


Figure 1, retrieved from: Kuipers, J., Pepping, J., Roelen, P. & Scholte, S. (2019). The Effect of the Pomodoro Technique on the Sleep Quality of Office Workers. Unpublished manuscript.

## DATA VISUALISATION & ANALYSIS

After the data is collected it will be analyzed. At first, the data from the Mi Band is obtained and processed. Only the data concerning sleep quality is extracted from the big data of the Mi Band. The test dates are selected and assigned to the specific data. The data is divided in 2 weeks at first and after that in 4 different types of sleep times: 'in Bed', 'Deep sleep', 'Light sleep' and 'Awake'. This, to be able to make comparisons between the weeks.

Using this data, 2 things can be examined. On the one hand the differences in sleep quality, measured as deep sleep divided by total sleep, which can be seen in figure 1. According to [14], 20 to 25% of the total sleep time should consist of deep sleep. On the other hand the comparison between the average amount of 'awake' and 'in bed' times can be examined.

Using the other data, retrieved from the daily questionnaires, a comparison can be made between perceived stress scores, which can be seen in figure 2. These stress scores can be generated by converting the answers of the questionnaire [15].

## PERSONAL DEVELOPMENT

In the making sense of sensors course I worked on setting up a research proposal, especially applying the FAIR principles and selected, converted and analyzed data (together with Jules Kuipers). Which was very educational to me in the area of planning and documentation. Moreover, it handled analyzing data in practice, which was one of my points of improvement in my PDP. Something I wanted to improve in project 3 but, due to planning and task division, I did not get that opportunity.

Because gathering and analyzing data is important to validate products in designing, I wanted to improve my basic data analytics skills to be able to find correlations and conclude from this, using tests and graphs. In this course I learned to select and aggregate data to select meaningful data on its turn.

Furthermore, I learned to select data from different diversely constructed datasets, representing different participants. I learned that you always have to check whether or not you have selected the right data, since you sometimes seem to have the right data, but time and dates might not be right when taking a closer look.

One of the most important things I learned this course, is that you have to document what you initially want to do and what you actually did. In our research for example, not all the participants generated data on the exact same dates. In theory, they might be able to wear the Mi Band every day, but in practice this was not the case. Instead of looking at it with hindsight, you should document the differences immediately to prevent making mistakes and forgetting things.

Additionally, I learned about making your research legal, ethical and FAIR. Holding on to tight regulations and formats give other researchers the possibility to use your research and prevents participants from getting harmed. Which is the most important condition for a performable research.

## METHOD

In order to be able to study the relationship described on the left, the following setup was established for each of the 4 participating office workers. After signing a consent form, in which clearly was described what the goal is of the study, as well as the consequences for the participants, the participants were asked to wear the Mi Band for two work-weeks. The first week was meant to set a 'zero' base. In the second week, participants used the design artefact providing the Pomodoro technique to create control data. At the end of every workday participants were asked to fill in a questionnaire, asking about their perceived level of stress. Additionally, at the end of the week an interview is conducted to gain more in-depth insights. Over these two work-weeks, the Mi Band is worn by the participant and has gathered data on sleep behaviour.

To make sure that the research is discreet and to satisfy the FAIR-principles, the data is clearly documented, this includes the process as well as the methodology and its application. Participants were asked to give consent to keep track of heart rate and sleep quality during a period of 2 weeks.

To make the research agree with the FAIR-principles, data is stored safely. This will be done in the Making Sense of Sensors canvas group, only containing members from the researching group.

After the research is done, the data is processed, concluded and the results are saved and stored, the data has to be removed. This is due to privacy reasons. The researchers are going to measure evening and nightly activity. Keeping those results stored probably will not comfort the participants, even though they gave consent.

We will only use the data that is needed to answer our research question, all other data will not be stored. To make sure that we do not delete precious data, we decide in advance what data we would certainly not going to use and what data might be interesting.

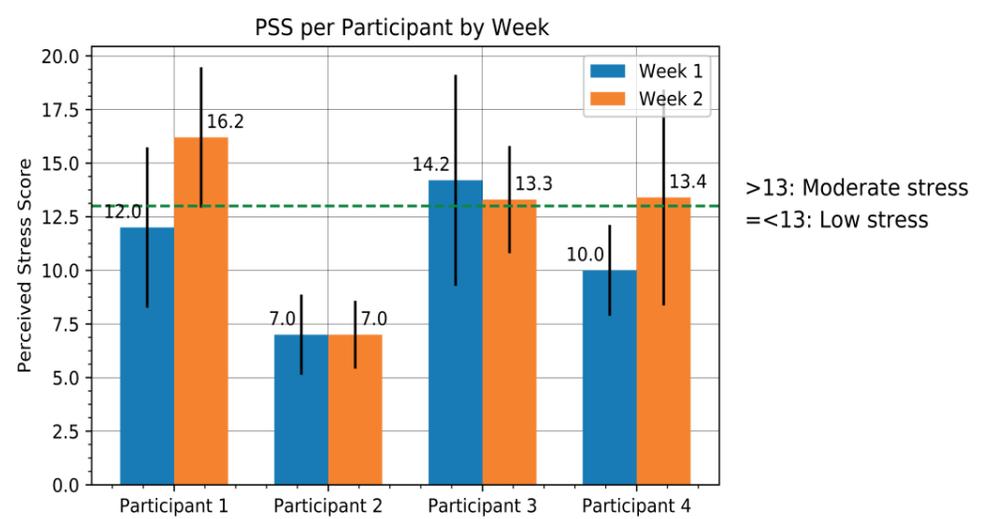


Figure 2, retrieved from: Kuipers, J., Pepping, J., Roelen, P. & Scholte, S. (2019). The Effect of the Pomodoro Technique on the Sleep Quality of Office Workers. Unpublished manuscript.

## DISCUSSION & CONCLUSION

With the help of the gathered data, the research question could be examined. As can be seen in figure 1, sleep quality for 3 out of 4 participants is, if not slightly, improved in week 2, compared to week 1. On the opposite site, perceived stress (as seen in figure 2) has not been changed or even increased for 3 out of 4 participants, included 2 of the participants that had better sleep quality. Furthermore, average time in bed increased for 3 out of 4 participants. Average awake time increased for only 1 participant. Those results combined suggest that participants' sleep quality improved in week 2 with respect to week 1, whilst perceiving more stress at the same time.

This is a contradicting result and an unexpected one as well, looking at the related work. This might be due to the fact that the research had a lot of uncontrolled variables. For example, the participants could have had a stressful week for one of the 2 weeks; the Pomodoro technique was in the interviews stated as 'not suitable' for the participants' lifestyle or way of working and thus might not work at all; the sample could have been not representative or too small; at last, the participants' data was not gathered on the exact same date, this might also influence the outcome.

Overall, there is not enough evidence to undoubtedly conclude that the Pomodoro technique indeed improves sleep quality. However, the data does either not reject the hypotheses.