



# Advisory report

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Reducing sedentary behaviour in an office environment  
by means of increasing awareness of current sedentary time

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**Student:**

Veroline Brouwer (346374)

International Facility Management, Hanze University of Applied Sciences

**Supervising lecturer and first assessor:**

Maris Boeringa

International Facility Management, Hanze University of Applied Sciences

**Second assessor:**

Ab Reitsma

International Facility Management, Hanze University of Applied Sciences

**Clients:**

Jan Gerard Hoendervanger and Justin Timmer

Innovation Workplace (IWP) Healthy Workplace (HWP) at Kenniscentrum NoorderRuimte

**External supervisor:**

Justin Timmer

Innovation Workplace (IWP) Healthy Workplace (HWP) at Kenniscentrum NoorderRuimte

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Student: Veroline (V.C.) Brouwer (346374)  
Class: IFM 4A1  
Academic year 4  
Institute: School of Facility Management, Hanze University of Applied Sciences  
Course code: IFVB18GRA – 2018 Graduation project  
Supervisors Maris Boeringa  
Ab Reitsma

Clients: Jan Gerard Hoendervanger and Justin Timmer  
Innovation Workplace Healthy Workplace at Kenniscentrum NoorderRuimte

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## Summary

The advisory report was written in response to the request of Innovation Workplace Healthy Workplace housed within the Hanze University of Applied Sciences. Lately, a lot of attention is drawn to the lack of physical movement in office environments and, as a result, anticipated increase of health problems. Sedentary time of office workers is high resulting in increased risks of getting health problems. It is assumed that most people are unaware of their actual time spent seated. This research was carried out to develop new knowledge about the role of awareness in reducing sedentary time and to research possible interventions for the Hanze University of Applied Sciences to promote healthy behaviour in the work environment. The main question of the research is: how could an increased awareness about personal sedentary behaviour for members of KCNR lead to a decrease in sedentary behaviour and what else is needed to reduce sedentary behaviour in the long run?

The theories studied are related to the three core concepts of this research; human behaviour at work, the importance of awareness in behaviour change, and steps of behaviour change. Both qualitative and quantitative data was gathered through desk research and an experiment. The experiment consisted of a measurement by a VitaBit health tracker, a personal diary for every participant and two surveys.

The experiment provided an insight into the current sedentary time of participants and showed a significant difference of 2.1 hours between estimated and measured sedentary time of participants at the start of the experiment. Most participants overestimated their sedentary time at work. 78% of participants state that the experiment made them more aware of their sedentary behaviour. Concluding from the results, personal feedback is most effective to increase awareness of current behaviour and allowing realistic goal-setting, and education is needed to teach the effects of sedentary behaviour. Both personal feedback and education are motivators for change. In addition to motivation for change, facilities and stimulation are needed. A lack of proper facilities withholds people to stand while working. People feel most stimulated through notifications that remind them to change and through social influence. Personal feedback can also help to stimulate people by showing their progress so far.

The recommendations for the HUAS are:

- Educating staff about risks and effects of sedentary behaviour and providing personal feedback based on current behaviour to eliminate under- and overestimating, allowing realistic goal-setting.
- Facilitating change by investing in sit-stand desks, refurbishing meeting facilities and creating walk routes on campus.
- Stimulating change through social support, tools notifying and cues reminding to change, personal feedback to show progress of change so far.

## Preface

This is the advisory report for Innovation Workplace Healthy Workplace and Hanze University of Applied Sciences. The request for the research on which the advice is based came from Innovation Workplace Healthy Workplace while the request to write an advisory report came from the institute of Facility Management to fulfil the graduation assignment. The research and writing of this report have been done between the end of February 2019 and end of May 2019.

I am grateful for the guidance and feedback provided by supervising lecturer and first assessor Maris Boeringa and supervising lecturer Irene van der Werff. I would like to say thanks to my clients Jan Gerard Hoendervanger and Justin Timmer for this great opportunity and unique research topic. I received a lot of freedom and trust during the assignment which allowed me to grow both professionally and personally. I felt independent doing research but had support of supervising client Justin Timmer whenever I needed it. Furthermore, the entire Healthy Workplace group, including supervisor Gea Posthumus and other junior researchers have been a great support these past few months. I would like to thank everyone at Kenniscentrum NoorderRuimte for creating a pleasant workplace. Special thanks to all the members of Kenniscentrum NoorderRuimte who were willing to participate in my experiment. Thank you for taking the time to participate and to enlighten me with your insights and experiences.

Fellow students Fije Wennink and Daisy Hesseling, thank you for giving me feedback on my report and helping me with any questions. Finally, I would like to thank second assessor Ab Reitsma, coach Trude Roelofsen and lecturer Johan Offringa for their advice whenever I had questions or struggles, and for preparing me for this graduation assignment in general over the past few years. You have been a great support for me, it is very much appreciated!

I hope you enjoy reading this report.

Veroline Brouwer

Groningen, May 29, 2019

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## Chapter 1: Introduction

This chapter introduces the research topic, problem statement, objective and stakeholders.

### 1.1 The reason for research

The request for research on which the advice is based came from Innovation Workplace Healthy Workplace while the request to write an advisory report came from the institute of Facility Management to fulfil the graduation assignment.

The aim of the client, Innovation Workplace Healthy Workplace (hereafter referred to as HWP), is to develop new knowledge, tools and interventions to promote healthy behaviour in the work environment. Healthy work environments are important to limit absenteeism and to increase performance and satisfaction of employees.

Lately, a lot of attention is drawn to the lack of physical movement in office environments and as a result the anticipated increase of health problems. Sitting is the new smoking and it is said that Dutch people are European champions in sitting (Hanzehogeschool Groningen, 2017a). The sedentary time of many office workers increases their risks of getting health problems. It is estimated that worldwide, physical inactivity is responsible for 7% of type 2 diabetes, 10% of breast cancer, 10% of colon cancer and for 9% of premature death (Lee, Shiroma, Lobelo, Puska, Blair, & Katzmarzyk, 2012). Dutch insurance company Zilveren Kruis (n.d.) states that on average, the Dutch are sitting 8.5 hours per day and the Ministerie van Sociale Zaken en Werkgelegenheid (2016) states that sitting at work plays a big role in sedentary behaviour of people. Higher educated people spent an average of 10,1 hours per day seated while lower educated people have an average sedentary time of 7,7 hours per day. According to Ministerie van Sociale Zaken en Werkgelegenheid (n.d.), long sedentary time at work is a new labour risk but since research about sedentary behaviour is still ongoing, international guidelines to limit sedentary behaviour at work have yet to be established.

Voskamp and Schilder (2005) state a boundary for sitting of maximum five hours a day in total with periods of standing or movement in between, or maximum two hours uninterrupted sitting per day. Standing can also be demanding and should be limited to maximum four hours a day with small interruptions or a maximum of one hour uninterrupted. From this literature, one can conclude that varying in positions while working is important. According to Contant (2009), people who perform computer work, should leave their workplace every hour for five minutes to move around.

The problem statement is:

*People are sitting too much at work which negatively affects their well-being.*

Increasing the level of physical activity at work is expected to decrease both physical and mental health problems among office workers. However, in order to change behaviour, it is first

necessary to create or increase awareness of current behaviour. It is assumed that most people are unaware of their actual time spent seated. To find out if that assumption is correct, the possible gap between perceived and actual sedentary time of members of Kenniscentrum NoorderRuimte (hereafter referred to as KCNR) was researched.

The objective of this research is to find out how awareness of sedentary behaviour at work can be increased, if increased awareness leads to intention to reduce sedentary time, and to find out what else is needed to reduce sedentary time at work in the long run. A detailed level of awareness and the long-term effect of awareness on sedentary behaviour will not be measured during this research.

An important note is that decreasing sedentary time, will not necessarily lead to reduced health complaints. As Contant (2009) mentions, a good workplace does not guarantee that someone will not experience any physical complaints. A change in body posture may also lead to (temporary) complaints. This research will not include guidelines for proper use of sit-stand desks and/or proper body posture. The focus of this research is not on correct behaviour or body posture but about creating awareness about current behaviour in order to stimulate behavioural change.

## 1.2 The stakeholders

HWP is housed within KCNR, a knowledge centre within the Hanze University of Applied Sciences (hereafter referred to as HUAS) where lecturers, (lecturer) researchers, students and professionals conduct practice-oriented research about the built environment. KCNR is situated in Groningen but cooperates with different organisations throughout the Netherlands. Kenniscentrum NoorderRuimte (n.d.-a) states that HWP is a collaboration between the HUAS Menzis, Engie, Planon, Health2Work and Measuremen.

The research is performed for HWP, but the final advice is focused on the HUAS as organisation. KCNR, and thus HWP are housed within the HUAS. Healthy ageing is a strategic theme of HUAS. According to Hanzehogeschool (2017a) healthy ageing is more than growing old pleasantly or about health in the sense of being ill, but about positive health, resilience, self-management and vitality. Stafbureau Human Resources of HUAS aims to create an optimal work environment, taking into account Healthy Ageing (Hanzehogeschool Groningen, n.d.-b). Currently the HUAS already has a lifestyle program, "Het Nieuwe Gezonde Werken 2.0" that offers individual coaching and sensortechnology to improve the health of staff (Hanzehogeschool Groningen, n.d.-c). The focus of this program is on a healthy lifestyle and vitality and aims to let people move more throughout the day. The program aims to increase (self)knowledge and training of healthy behaviour. The final advice helps the HUAS to realise a healthy and vital organisation.

## 1.3 Current and desired situation

In the current situation observations (A.2) showed that only few members of KCNR, the target group of this research, make use of a sit-stand desk in standing position and thus it is assumed



that they have limited physical movement at their workplace. Therefore, in the current situation, people have a higher risk to get health problems. Furthermore, it is assumed that members of KCNR are unaware of their time actually spent seated and thus do not feel the need to change this.

The desired outcome is that people at KCNR will be more aware of their sedentary time at work, leading to a desire to change sedentary behaviour. The results of the research will be generalised and a final advice will be provided for the entire HUAS. Therefore, in the desired situation, sedentary time of all HUAS staff will be reduced leading to increased well-being and productivity of staff, making HUAS a healthy and vital organisation.

## Chapter 2: Research questions

The main research question is as follows:

**How could an increased awareness about personal sedentary behaviour for members of KCNR lead to a decrease in sedentary behaviour and what else is needed to reduce sedentary behaviour in the long run?**

The sub-questions formed to answer the main question are:

1. How is awareness of health risk behaviour raised in general?
2. Is there a gap between the actual time spent seated and the perceived time spent seated by members of KCNR?
3. What do people at KCNR perceive as possible causes of the gap?
4. Will increased awareness about sedentary time stimulate members of KCNR to decrease the time spent seated and increase the time standing and moving?
5. Besides awareness, what else is needed to reduce sedentary behaviour at work?

Together the sub-questions help to answer the main question. The first four questions mostly help to answer the first part of the main question while the fifth sub-question is most important to answer the last part of the main question.

## Chapter 3: Theoretical framework

In this chapter one can find the core concepts of this research and the models and literature connected to them.

### 3.1 Core concepts

#### Core concept A: Human behaviour at work

Behaviour at work is largely formed by habits (Hoendervange & Timmer, 2019). Three routes are differentiated between a healthy work environment and healthy behaviour at work (Figure 3.1.1). Facilities are needed to create an opportunity, enabling employees to execute healthy behaviour. According to Hoendervanger and Timmer (2019), facilities can also be used to make unhealthy behaviour impossible. Think about not facilitating places to smoke. Stimulating employees is all about making behaviour options appealing according to Hoendervanger and Timmer (2019). Healthy behaviour should be easy and fun and can be influenced by nudging. A well-known example of making behaviour fun is the piano staircase which makes noise when stepping on the stairs. In the learning route people receive individual feedback or information about behaviour. Education leads to motivation and ability.

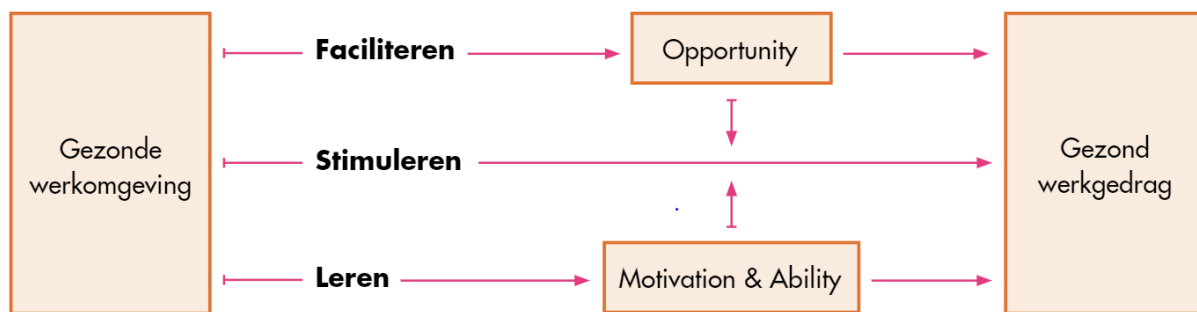


Figure 3.1.1. Three routes towards healthy work behaviour. Adapted from "Drie routes naar gezond werkgedrag" by J.G. Hoendervanger and J. Timmer, 2019, Smart WorkPlace, 77-81. Copyright 2019 Healthy Workplace.

#### Core concept B: The importance of awareness in behaviour change

Janse (2018) explains the importance of cognitive factors in the Social Learning Theory. Creating or increasing awareness about sedentary behaviour is part of creating knowledge and managing expectations. Based on knowledge of current behaviour and knowledge about risks of behaviour, people can alter expectations, change their attitude and eventually choose to change behaviour. According to Centre for Renewable Energy Sources and Saving [CRES] (2008), behaviour is formed by habits and intention, and influenced by facilitating conditions (Figure 3.1.2). Intention is formed by attitude, social factors and affect. Attitude can be formed by beliefs about outcomes and evaluation of outcomes. Both the beliefs and evaluation can only be accurate if one is aware of current behaviour, in other words, aware of the frequency of past behaviour, someone's habits. It seems to indicate that, in addition to being aware of the risk behaviour in general, awareness of the level of personal risk behaviour is also of importance. The level of risk behaviour that one is in may determine a person's attitude towards change and helps realistic goal-setting.

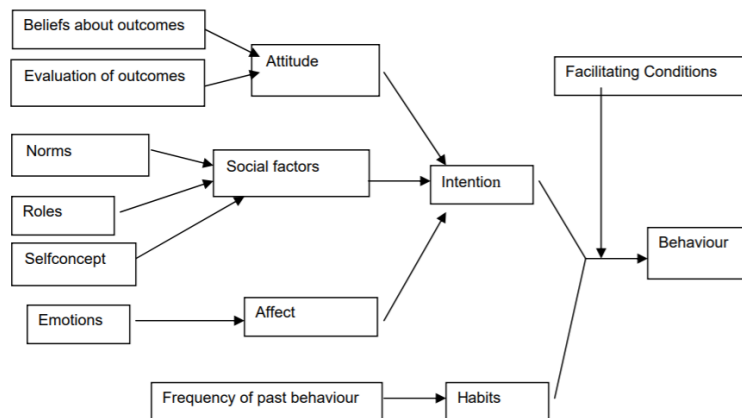


Figure 3.1.2. Triandis' Theory of Interpersonal Behaviour model. Reprinted from Triandis' Theory of Interpersonal Behaviour, from CRES, 2008, ([http://www.cres.gr/behave/pdf/Triandis\\_theory.pdf](http://www.cres.gr/behave/pdf/Triandis_theory.pdf)). Copyright 2008 by CRES.

Studies of Ronda, Van Assema, and Brug (2001) and Lechner, Bolman, and Van Dijke (2006) show that a majority of Dutch people who do not meet the recommended target for physical activity overestimate their level of physical activity. Similarly, a study of Van Sluijs, Griffin, and Van Poppel (2007) shows many inactive people rating themselves as active. Compared to "Realistic Inactives", "Overestimators" were less likely to intend to increase their physical activity level. The conclusion of the study states that "overestimators" less likely intended to change their physical activity, making awareness a potential barrier in physical activity promotion. It suggests physical activity promotion strategies to include interventions with a focus on increasing awareness.

With complex health risk behaviour like physical activity, people are often unaware of their risk behaviour and consequently do not the need to change. According to Lechner et al. (2006), increasing the accuracy of people's self-perceptions of physical activity is important. When people incorrectly think their health behaviour is sufficient, their cognitions are positive and they will not react to an intervention meant to change. This theory is supported by Van Sluijs et al, (2007) who state that lack of awareness also impacts on the predictive value of psychological models of behaviour change. Their study showed that a misconception of people's own fruit and vegetable consumption has decreased the predictive value of the Theory of Planned Behavior.

### Concept C: Steps of behaviour change

The Transtheoretical Model (hereafter also referred to as TTM) (Figure 3.1.3) shows the process of intentional behaviour change. People move through five stages when modifying behaviour: pre-contemplation, contemplation, preparation, action and maintenance. Awareness of personal risk behaviour is especially important to proceed from pre-contemplation to contemplating behaviour change. According to Prochaska, DiClemente, and Norcross (1992), in the pre-contemplation stage, people are often uninformed about consequences of their behaviour and therefore do not intend to change within the next six months. In the contemplation stage people intend to change in the next six months because they are more aware of their behaviour and the

pros and cons of changing behaviour. LaMorte (2018) states that in the preparation phase, people are ready to take action within 30 days and believe change leads to improvements. In the action phase someone is taking action for at least six months and in the maintenance stage the changed behaviour is remaining after those six months. Certain principles and processes of change are needed at each stage to reduce resistance, facilitate progress, and prevent relapse. Moved through all these stages one reaches termination, meaning that the behaviour has been changed and a person will not relapse (LaMorte, 2018).

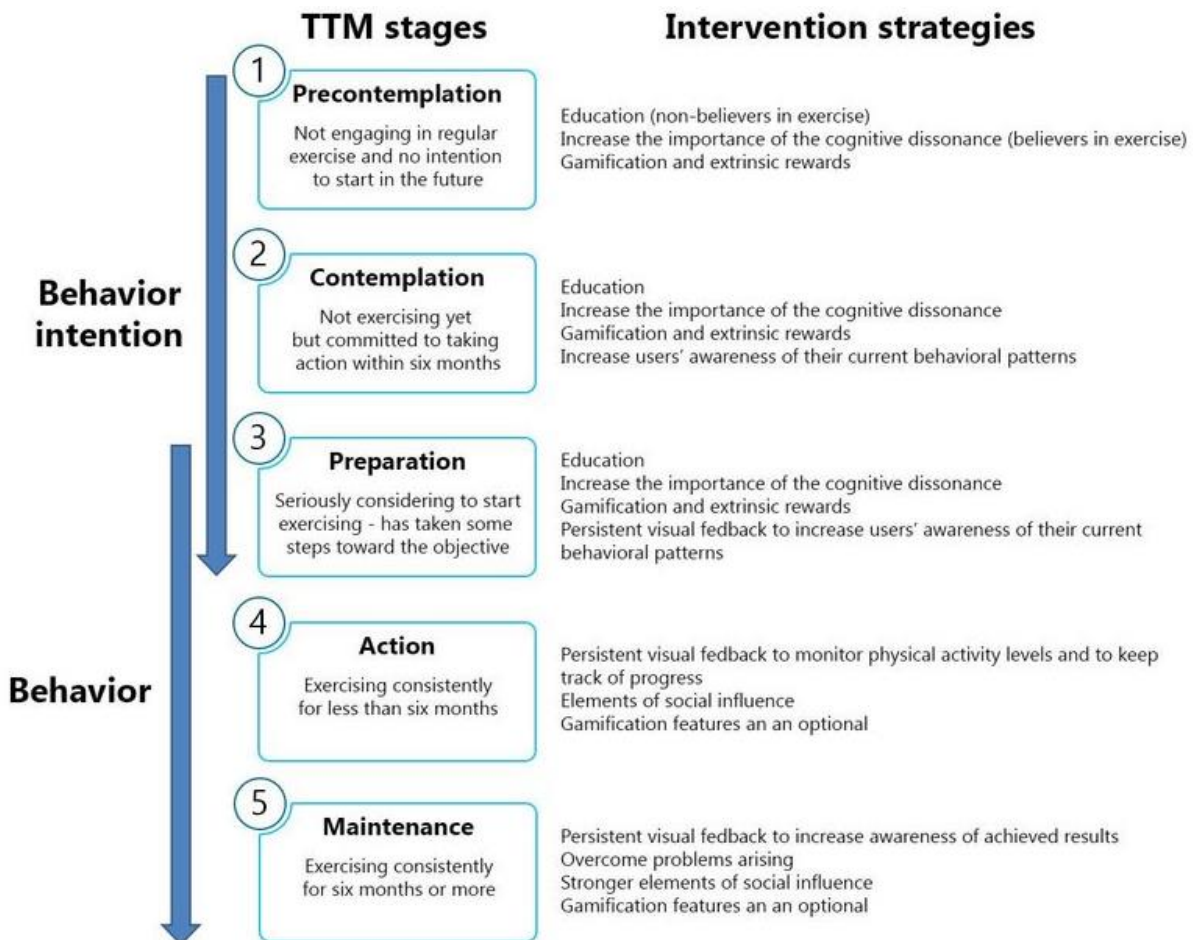


Figure 3.1.3. TTM stages and intervention strategies specific for increasing exercise. Reprinted from Transtheoretical model for designing technologies supporting an active lifestyle, M. Ferron, 2013, ([https://www.researchgate.net/publication/262402966\\_Transtheoretical\\_model\\_for\\_designing\\_technologies\\_supporting\\_an\\_active\\_lifestyle](https://www.researchgate.net/publication/262402966_Transtheoretical_model_for_designing_technologies_supporting_an_active_lifestyle)). Copyright 2013 by Ferron.

### 3.2 The relations between the core concepts

The relation between the core concepts is visualised in Figure 3.2. The first concept is about aspects of behaviour in general and aspects that influence human behaviour at work since that is the basis of this research. The second concept has a focus on awareness as an aspect of behaviour change, the main topic of the research. The last concept looks at the steps of behaviour change

which will help to learn what, in addition to awareness, is needed during the change process and to give a final advice.

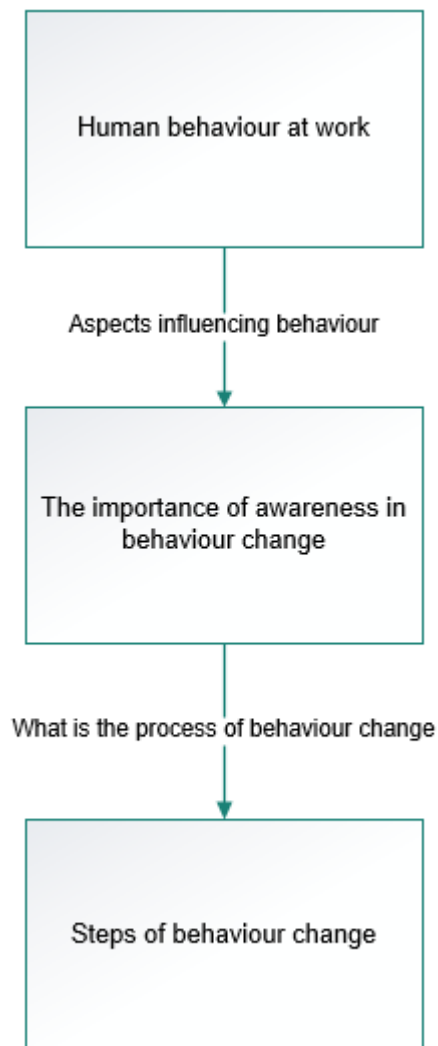


Figure 3.2. Self-made Figure.

### 3.3 Critical review

Literature has been reviewed about human behaviour at work, the importance of awareness of behaviour and the steps of behaviour change. There are many theories and models available on human behaviour and aspects of behaviour such as the Social Learning Theory that shows that personal, environmental and behavioural factors determine a person's behaviour. Personal factors are cognitive factors like knowledge, expectations and attitudes and play a crucial role in changing behaviour patterns according to Janse (2018). Similarly, Fu, Flood, Bosak, Morris, and O'Regan (2013) explain that the ability dimension in the AMO-model is defined by knowledge, skills and abilities. The AMO-model stands for abilities, motivation and opportunities, factors that all contribute to employee performance and behaviour. Since the goal of the advice is to change

behaviour at work in the long run, the decision has been made to work with the Healthy Workplace model describing the three routes to healthy work behaviour (Hoendervange & Timmer, 2019). The three routes include the aspects of the AMO-model but also describe other aspects playing a role between the work environment and employee behaviour.

Concerning the importance of awareness in behaviour change, the choice has been made to focus on the model of Triandis instead of the Social Learning Theory. The model is a bit dated but clearly shows that awareness can be related to the two main aspects leading to behaviour: intention and habits. Furthermore, it nicely displays what is needed for intended change. In addition, theories from literature research show the importance of awareness in behaviour change. Limitations in literature are that most published studies are about increasing physical activity in general and not necessarily focus on reducing sedentary behaviour. From the studies about awareness as part of increasing physical activity, the choice has been made to review Dutch studies since the target group of this research is also Dutch.

In order to come up with a strategic advice leading towards behaviour change, it is important to know what the stages of behaviour change are. There are many theories and model available on behaviour change. The decision was made to focus on the Transtheoretical Model because it provides a framework that is recommended to be used for effective physical activity interventions (Napolitano, et al., 2008). It has been successfully applied to a variety of problem behaviours.

## Chapter 4: Research methods

This chapter explains the research methods and target group used for this research.

### 4.1 Data collection methods

Both quantitative and qualitative data have been gathered to resulting in comprehensive results on the topic. Table 4.1 shows the research methods used per sub-question.

Table 4.1. Data collection methods.

Research question	Desk research	Experiment		
		VitaBit measurements	Diary	Survey
1. How is awareness of health risk behaviour raised in general?	X			X
2. Is there a gap between the actual time spent seated and the perceived time spent seated by members of KCNR?		X	X	X
3. What do people at KCNR perceive as possible causes of the gap?				X
4. Will increased awareness, as a result from the data gathered with the VitaBit, stimulate members of KCNR to decrease the time spent seated and increase the time standing and moving?		X	X	X
5. Besides awareness, what else is needed to reduce sedentary behaviour at work?	X			X

#### Literature/desk research

Several literature sources, such as published reports and theses, were reviewed about increasing awareness in general and about the steps of behaviour change. Relevant sources have been used to form the core concepts and to answer sub-questions.

#### Experiment

An experiment of three weeks with 25 participants was organised to examine the possible lack of awareness concerning sedentary behaviour of members of KCNR. VitaBit trackers were used to measure the difference between the perceived and actual time spent seated of participants.



### What is a VitaBit:

*According to VitaBit Software International B.V. (n.d.-b), a VitaBit tracks behaviour with help of a health sensor (Figure 4.1). A VitaBit tacker detects sitting, standing and walking behaviour. It is a small sensor that people carry in their pockets. Gathered results are displayed in an online portal.*

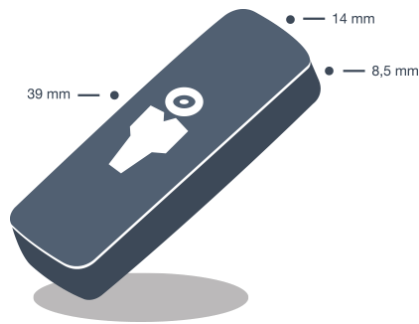


Figure 4.1. VitaBit. Reprinted from *product*, VitaBit, n.d., (<https://www.vitabit.software/nl-NL/index.html>). Copyright 2017 by VitaBit.

The goal was to find out if a VitaBit is an effective tool to contribute to awareness of sedentary time of members of KCNR. The experiment was divided in three phases. Each phase lasted one workweek. Some members did not work a full workweek and thus only took part in the experiment a few days out of the week. The three phases were:

1. People wore the VitaBit but did not receive the results about their time spent seated during work until the end of the first week.
2. People wore the VitaBit, they had seen the results from week one but did not receive the results of week two until the end of that week.
3. People wore the VitaBit and had access to the VitaBit app in which they could track their behaviour in real-time.

The difference between phase one and two was that in phase two, the participants had already seen the results of phase one. These insights could already have led to increased awareness and a change in behaviour.

During the experiment a survey-diary was kept by participants of the experiment to find out how much time they perceived to sit and standing each workday. The diary was in fact a small daily survey that people answered daily when wearing the VitaBit. The diary was kept for the first two weeks of the experiment since in the third week, people viewed their behaviour real-time and this would otherwise influence their estimated times and thus validity of the experiment. The data of the VitaBit and the diary were compared and analysed with help of SPSS to distinguish if changes were significant or not.

Surveys were used to research if awareness was increased and contributes to the intention to change sedentary behaviour of members of KCNR. Furthermore, participants were asked what

possible causes of the gap were and in which ways sedentary behaviour could be decreased. Results were analysed through cross tabulation (Survey Monkey, n.d.) meaning that categorical data was calculated to get relative frequency statistics of certain groups (e.g. OP, OBP and junior researchers). Filtering (Survey Monkey, n.d.) was also used to model data, meaning that the focus is narrowed to one particular subgroup while filtering out others (e.g. only looking at answers of people feeling not stimulated). So, instead of comparing subgroups to one another, here we're just looking at how one subgroup answered the question. Some questions were formed using ordinal variables based on the Likert-scale method and interval variables for example age categories, to allow cross tabulation and filtering.

#### 4.2 Research group

The target group of this research is people connected to KCNR. A diverse group including lecturers, lecturers, project coaches and (junior) researchers from different schools of the HUAS and administrative staff of KCNR. The diversity of the people connected to KCNR and the importance of innovation workplaces for the HUAS as described in their strategic plan makes KCNR seem like an excellent target group for an experiment. As one can imagine each institute may have different work habits. It is likely that lecturers in sport institute sometimes have different lecturing methods as business institutes. Even though it cannot be said that KCNR is completely generalisable for the entire HUAS, it represents staff with diverse functions and connected to diverse institutes. An extensive explanation of why KCNR was chosen as the target group for this research and why the results can be generalised for the HUAS can be found in Appendix 15.

#### 4.3 Operationalised variables

Table 4.3 shows the operationalisation of variables for this research.

Table 4.3. Operationalised variables.

Variable	Aspects and operationalisation of variable
Sedentary time	<p>Aspects:</p> <p>Estimated sedentary time kept in the diary</p> <p>Measured sedentary time measured with the VitaBit</p> <p>Operationalisation:</p> <p>First the difference between estimated and measured sedentary time is calculated. Then relative sedentary is calculated as the percentage of time spent seated during a work day.</p>
Awareness of sedentary time	<p>Aspects:</p> <p>Perception awareness of individuals, feeling conscious about sedentary behaviour during work time.</p> <p>Operationalisation:</p>

	Researched through a survey, focusing on the perception of participants. Relative sedentary time is also analysed to see if the gap between estimated and measured time decreased or not.
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#### 4.4 Guaranteeing quality of research

The results of valid research will help to answer the main question of the research. According to Saunders, Lewis and Thornhill (2012), validity is the extent to which data collection methods accurately measure what is intended to be measured. To make sure the survey was valid, it was provided in Dutch and English, the interpretation of the questions in the survey was tested by discussing them with the client and junior researchers working at KCNR. Results in Dutch were translated to English. To ensure valid results from the experiment, participants were given clear instructions and reminded of those instructions through E-mails (Appendices 8 to 12). The validity of a VitaBit has been tested, the outcomes are presented in A.18. Concerning the external validity of the research, the results of the research will be generalised for the HUAS and can be used by other organisations wanting to reduce sedentary behaviour of employees since the results were gathered in an office environment with people performing different functions at different workplaces.

According to Saunders et al. (2012), reliability is about yielding consistent findings. If repeated by other researchers, the same conclusions can be reached. Results are reliable when the possibility for coincidences has been minimised or better, excluded. If the research were to be repeated at another time, the results would be similar and stable. Several actions have been taken to ensure reliability. It was decided to have the experiment with 25 participants. To ensure high reliability of the experiment, more participants are needed. However, the VitaBits are delivered in sets of 25 pieces and looking realistically at the scope of the experiment, it does not seem achievable and of added-value to do an experiment with 50 participants. Although it is expected to influence behaviour more than awareness, the weather might be an external factor that can influence results and consistency of findings. However, if the results are repeated with the same duration (three weeks) in the same period of the year (spring), results are expected to be reliable. Repeating the experiment under different weather circumstances might influence reliability. It is likely that people walk more during a period of pleasant weather than during a cold and rainy period. Given the available time for this research is not possible to organise more than one experiment. To ensure reliability, a choice has been made to design an experiment of several weeks. The experiment exists of three phases of one week each. It is expected to deliver reliable results since within three weeks there can be different circumstances, but this should not affect the average of the results over three weeks.

Besides doing desk research, the researcher tested a VitaBit on validity and reliability. The results of this can be found in A.18.

## Chapter 5: Research results

This chapter outlines the research results per sub-questions.

### 5.1 Raising awareness of (health) risk behaviour in general

Mass media interventions are used to create awareness of all sorts of matters. A few examples of mass communication methods are radio and television commercials, posters, demonstrations, or even creating a national day related to the matter. According to Lechner et al. (2006), mass (media) interventions can be very effective but only if people feel addressed by the issue. As Lechner et al. (2006) state that if people incorrectly think their health behaviour is sufficient, their cognitions are positive and thus they will not react to mass (media) interventions. Social comparison is seen as one of the most important influences on self-judgements. Van Sluijs et al. (2007) concluded in their study, 61.4% of inactive participants rated themselves as active and that this lack of awareness has important implications. First, it acts as a barrier to behaviour change for people who do not feel the need to change and hence are unaffected by mass messages concerning physical activity. Second, it can result in inactive people being overlooked or neglected in health promotion efforts since these are commonly targeted at self-rated inactive populations.

Looking specifically at awareness of health risk behaviour, people need more personalised interventions. Weinstein's Precaution Adoption model describes three phases concerning awareness of risk behaviour. In phase one people need to have heard of the risk associated to the behaviour, in phase two people know the risk behaviour is prevalent, finally in phase three the person will be fully aware (Weinstein, 1988). However, being unrealistically optimistic about personal risk behaviour may prevent someone to transition from phase two to three. According to Weinstein (1988), personal feedback and normative feedback help to transition from phase two to three. Personal feedback is feedback on individual level and helps to eliminate people overestimating and underestimating their risk behaviour. Linde van den Brink, an environmental psychologist also emphasised the importance of personal feedback when trying to influence behaviour in the workplace. During a workshop (L. van den Brink, personal communication, May 9, 2019) it was explained that personal feedback is most effective when it is given when someone is executing the behaviour to be changed, for example a smartwatch vibrating after a long period of sitting to stimulate movement. Personal feedback can be given with the use of health apps, computer software, trackers and sensors. These solutions that track behaviour often have a reward program integrated. Some specific examples are Menzis' SamenGezond-app, WORK & MOVE software, FitBit watches, Polar watches, and VitaBit Software.

The results of the survey (Appendix 17) amongst the participants of the experiment show that participants prefer to receive feedback through a tool that tells them to move more (52%) over the VitaBit that precisely displays the time spent seated (9%). Other participants said both tools (22%), no preference between both options (4%) or no need to use a tool (13%). When asked specifically if participants recommend the use of a VitaBit to increase awareness of sedentary behaviour, 87% said yes. Furthermore, results show that receiving the insights in actual/measured sedentary time contributed most to awareness (Figure A.17.6). Both OP and OBP staff from the

HUAS prefer to receive the insight through a report with insights per day/week, junior researchers prefer to view results real-time in an app.

In a study conducted by Cole, Tully, and Cupples (2015), participants recorded data about sedentary behaviour with a phone application. Participants stated that recording costs time, but this was not a burden for everyone as it was counter-balanced by its perceived value in increasing awareness of sedentary behaviour (Cole, Tully, & Cupples, 2015). The results of the survey (A.17) also show that amongst the target group, keeping a journal contributed to awareness of sedentary behaviour.

The efficiency of interventions to promote physical activity among sedentary individuals targeting physical activity adoption and maintenance have been examined by Napolitano, et al. (2008). Participants received computer-generated expert system reports, stage-targeted booklets, and physical activity-related tip sheets. There were both telephone and print interventions. With telephone interventions the health educator also helped the participant to problem-solve barriers. Theory-based face-to-face, telephone, print, and internet interventions have all been shown to increase physical activity among sedentary adults (Napolitano, et al., 2008).

## 5.2 The awareness of sedentary behaviour of members of KCNR at the start of the experiment

Ronda et al. (2001) suggest that interventions aimed at increasing physical activity should be aimed at increasing awareness of personal activity levels. Before the experiment took place, the expectation was that there would be a gap between the perceived time spent seated and the measured time spent seated. The results of the experiment show that, in week one of the experiment, there is a gap of 2.1 hours between measured and perceived time spent seated. As one can see in Table 5.2.3, this is a significant difference, supporting the expectation of the researcher. The correlation is high, meaning that people who sit more also estimate a higher sedentary time. The statistics and correlations of the Paired Samples T-test are shown in Table 5.2.1 and 5.2.2.

Table 5.2.1. SPSS Paired Samples Statistics estimated versus measured sedentary time week one.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	1_Estimated time sitting	18,5435	23	9,22898	1,92438
	1_Measured time sitting	16,4348	23	8,54009	1,78073

Table 5.2.2. SPSS Paired Samples Correlations estimated versus measured sedentary time week one.

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	1_Estimated time sitting & 1_Measured time sitting	23	,890	,000

Table 5.2.3. SPSS Paired Samples Test estimated versus measured sedentary time week one.

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	1_Estimated time sitting - 1_Measured time sitting	2,10870	4,22575	,88113	,28134	3,93605	2,393	22	,026

### 5.3 Perceived possible causes of the gap

When asking participants what could be a possible reason of the gap between estimated and measured seating time, 33% could not think of a reason. The remaining answers included moving more in between than realised, for example to get coffee, and doubts about the reliability of the measurements. Although not officially recorded, some participants told the researcher that although they were conscious about their sedentary behaviour they found it hard to estimate exact times. Hence, some participants mentioned that they tried to think of how much they would stand or walk and deduct this from their total work time since trying to calculate how much people actually sat on a day was perceived as harder.

The reliability of measurements should be good when following the instructions, as explained in Appendix 18. To ensure reliability participants were asked how they wore the VitaBit. 65% of the participants usually wore it in the coin pocket of their pants or in the front pocket with a magnet, 17% with a sticker/magnet on their skirt/dress, 9% in the front pocket without the magnet and 9% differently. When asked if results of the VitaBit match reality, 13% said yes it completely matches reality, 65% said it mostly matches reality and 22% said no it did not match the reality. From this last group, one respondent said it was probably due to inaccurately keeping the journal while the remaining four respondents expressed that they have concerns about the reliability of the VitaBit. As further explained in Appendix 17, 43% of participants said they had unusual work-related activities influencing their sedentary behaviour during the experiment, 9% said there were unusual work-related activities but that it did not influence sedentary behaviour. From the 43%, 60% thought they had now spent more time seated while 40% thought they stood or walked more than normally.

### 5.4 The effects of sedentary behaviour insights on members of KCNR

The results of the survey show that fifteen of the participants (65%) were surprised by the insights in their sedentary behaviour. Again 65% said that expectations of sedentary behaviour were different from the results measured. When asking participants specifically if they feel more aware, 78% answered yes. In Figure 5.4.1 one can see the division of answers per function category. From OBP most participants (83%) said yes, followed by OP (78%) and junior researchers (75%).

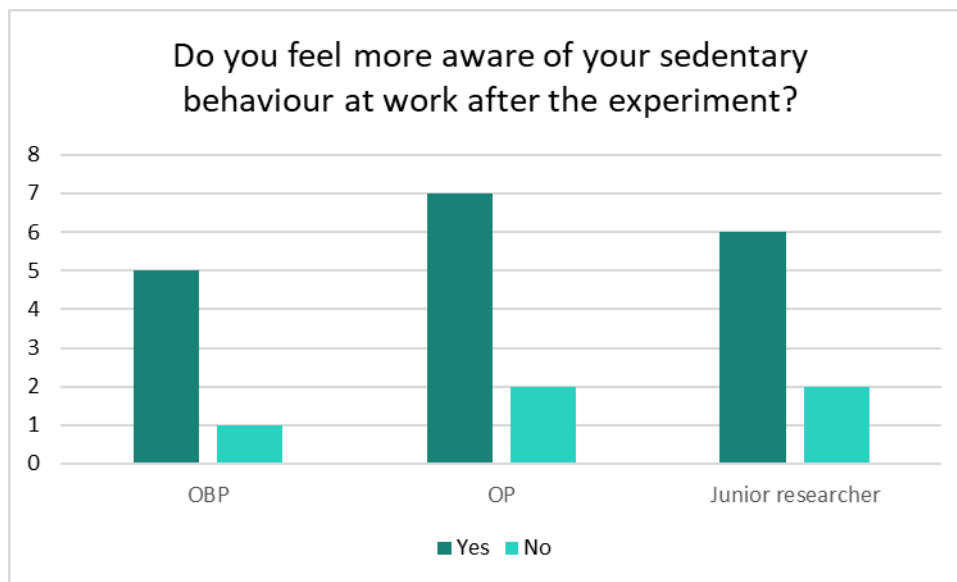


Figure 5.4.1. Increased awareness per function category.

When asking the 78% of participants that now feel more aware about their sedentary behaviour at work, to which extent they feel more aware, 28% answered a little more, 44% said more, and 28% said much more (Figure 5.4.2).

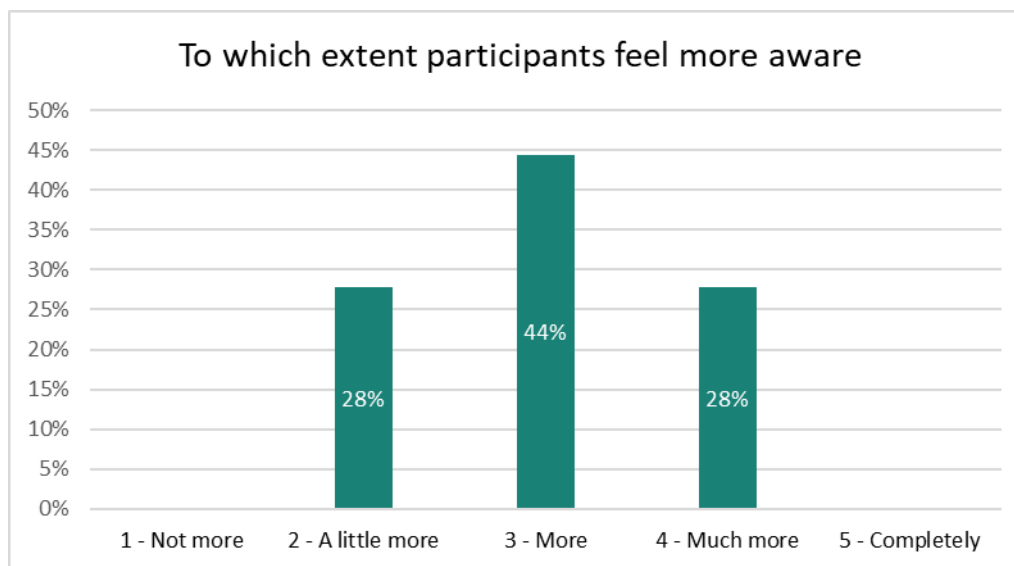


Figure 5.4.2. The extent of the increased awareness.

Just as in week one, the data shows a significant difference between the estimated and measured time seated in week two. Comparing the two weeks with each other, the difference increased from 2.1 hours in week one to 3.1 hours in week two (5.4.3). This difference is not significant (Table 5.4.4). The statistics and correlations of the Paired Samples T-test are shown in Table 5.4.1 and 5.4.2.

Table 5.4.1. SPSS Paired Samples Statistics estimated versus measured sedentary time week one and two.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	1_Estimated time sitting	18,5435	23	9,22898	1,92438
	1_Measured time sitting	16,4348	23	8,54009	1,78073
Pair 2	2_Estimated time sitting	19,4783	23	10,56928	2,20385
	2_Measured time sitting	16,3478	23	9,72250	2,02728

Table 5.4.2. SPSS Paired Samples Correlations estimated versus measured sedentary time week one and two.

		N	Correlation	Sig.
Pair 1	1_Estimated time sitting & 1_Measured time sitting	23	,890	,000
Pair 2	2_Estimated time sitting & 2_Measured time sitting	23	,961	,000

Table 5.4.3. SPSS Paired Samples Test estimated versus measured sedentary time week one and two.

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	1_Estimated time sitting - 1_Measured time sitting	2,10870	4,22575	,88113	,28134	3,93605	2,393	22	,026
Pair 2	2_Estimated time sitting - 2_Measured time sitting	3,13043	2,94347	,61376	1,85758	4,40329	5,100	22	,000

Table 5.4.4. SPSS Paired Samples Test difference week one to week two.

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Difference_week_1 - Difference_week_2	-1,02174	3,60706	,75212	-2,58155	,53807	-1,358	22	,188

The results of the experiment show that most people overestimate their sedentary time. The results show a very small reduction of relative sedentary time (Figure 5.4.3). Zooming in at the course of this reduction, it shows that the largest difference occurred between week one and two (a reduction of 3.5%) and it increases again in week three. A Paired Samples T-Test (Table 5.4.5, 5.4.6 and 5.4.7) shows that this reduction of sedentary time is not significant.



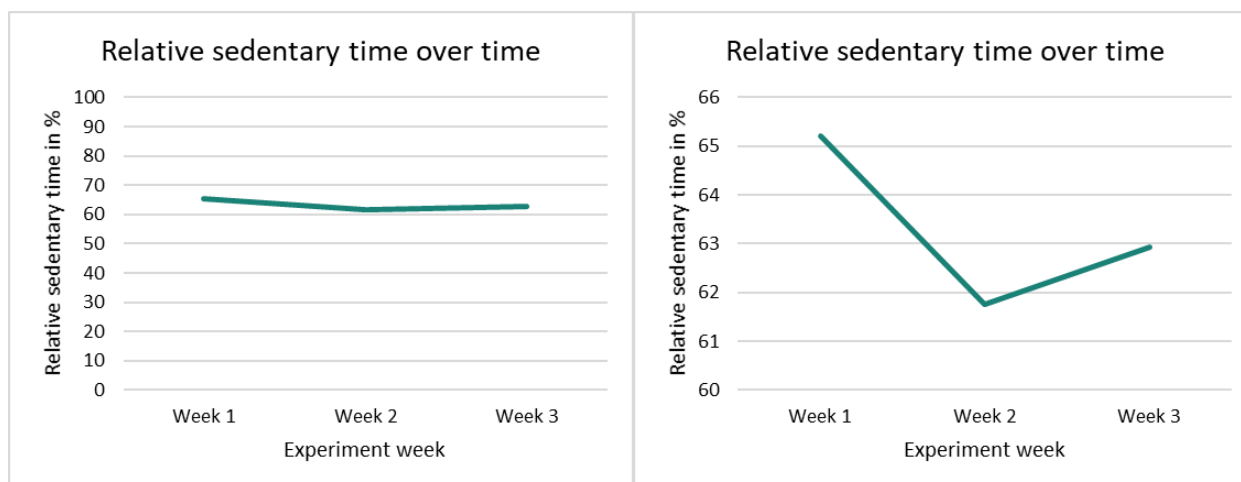


Figure 5.4.3. Relative sedentary time of participants over time and over time zoomed in.

Table 5.4.5. SPSS Paired Samples Statistics relative sedentary time in % week 1, 2 and 3.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Relative percent week 1	65,20182764	23	17,59090668	3,667957600
	Relative percent week 2	61,76240916	23	15,05797675	3,139805200
Pair 2	Relative percent week 1	64,30191071	22	17,45456089	3,721324886
	Relative percent week 3	62,93069733	22	18,53357929	3,951372380
Pair 3	Relative percent week 2	61,49061251	22	15,35447609	3,273585301
	Relative percent week 3	62,93069733	22	18,53357929	3,951372380

Table 5.4.6 – SPSS Paired Samples Correlations relative sedentary time in % week 1, 2 and 3.

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Relative percent week 1 & Relative percent week 2	23	,507	,013
Pair 2	Relative percent week 1 & Relative percent week 3	22	,634	,002
Pair 3	Relative percent week 2 & Relative percent week 3	22	,708	,000

Table 5.4.7. SPSS Paired Samples Test relative sedentary time in % week 1, 2 and 3.

Paired Samples Test									
		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower Upper				
Pair 1	Relative percent week 1 - Relative percent week 2	3,439418477	16,35177902	3,409581621	-3,63162102 10,51045797	1,009	22	,324	
Pair 2	Relative percent week 1 - Relative percent week 3	1,371213382	15,41605794	3,286714596	-5,46388380 8,206310559	,417	21	,681	
Pair 3	Relative percent week 2 - Relative percent week 3	-1,44008482	13,28324477	2,831997301	-7,32954562 4,449375975	-,509	21	,616	

All 23 participants were asked if insights from the experiment stimulated them to change their sedentary behaviour, 57% of the group said yes (Figure 5.4.4). Looking at the answers per function category, 83% of OBP said yes, 50% of junior researchers and 44% of OP. Reasons why OP did not feel stimulated were because sitting is the nature of (computer) work and because they sit less than expected.

Did the insights of the experiment  
stimulate to change sedentary behaviour?

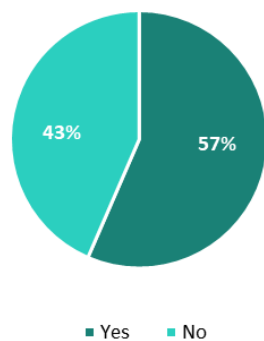


Figure 5.4.4. The effect of insights on anticipated behaviour change.

As one can read in Appendix 17, most people changed or want to change their sedentary behaviour by walking around more often, using a sit-stand desk more often and by having standing meetings. 65% of participants expect to stand more at work if they can use a sit-stand desk. Most participants felt stimulated to change their behaviour to minimise/reduce negative effects on health. When asked why people did not want to change their sedentary behaviour answers included that people sit less than expected and not being able to concentrate to do their work when standing. The participants who did not feel stimulated to change, as shown in Figure 5.4.4, were asked if they felt more stimulated to change their sedentary behaviour at work knowing that in addition to the results from the VitaBit, they sit additional time in their spare time. 70% said yes from which 40% wanted to change their sedentary behaviour outside work hours. When asking participants who did not feel stimulated to change if they felt stimulated knowing that prolonged sitting cannot be compensated by sports after work, 87% answered yes. They either felt more stimulated to stand working (22%), to move around more at work (22%) or both (43%). When asking how participants wanted to move around more at work, most people wanted to get a drink from the coffee machine or fridge more often (80%) and make a walk during lunch (73%). The complete results of the experiment can be found in Appendix 17.

### 5.5 Additional needs to reduce sedentary behaviour at work

As explained in the theoretical framework, facilities, stimulation and education are needed to achieve healthy behaviour (Hoendervange & Timmer, 2019). Connected to those needs are

abilities, motivation and opportunities, factors that contribute to employee performance and behaviour (Fu et al., 2013).

People need to learn more about health risk behaviour and effects of this to enhance ability and motivation. The results of the survey in Appendix 17 show that 87% of participants who at first did not feel stimulated to change, felt stimulated knowing that prolonged sitting cannot be compensated by being active after work. Voskamp and Schilder (2005) conclude that both standing and sitting are demanding and varying in positions while working is important. Similarly, Contant (2009), states that people who perform computer work, should leave their workplace every hour for five minutes. These are all aspects of that staff should be educated about.

Proper facilities are needed to give people the opportunity to reduce sedentary behaviour. As also expressed by Hoendervanger and Timmer (2019), the Triandis' Theory of Interpersonal Behaviour model shows that facilitating conditions influence people's behaviour (CRES, 2008). The survey shows that with 52%, the main thing withholding participants to stand working is not having a sit-stand desk. This supports that facilities influence behaviour.

Linde van den Brink (personal communication, May 9, 2019) emphasised the importance of personal feedback. This helps people to track or adjust their goals, keeping them realistic which supports self-liberation. Self-liberation is the commitment to change based on the belief that achievement is possible (LaMorte, 2018). Social influence and helping relationships are of great importance in behaviour change processes. According to LaMorte (2018) social influence helps to show support of others during change and helping relationships encourage the desired change. It is widely believed that team effort and support of colleagues is therefore important when changing behaviour. Slight peer pressure or competition can also help to stay motivated. This is all confirmed by the results of the survey. Besides motivation, personal feedback during a change process can service as stimulation to keep going (Ferron, 2013). As seen in Appendix 17, participants of the experiment feel stimulated through reminders (74%), team effort (35%), support of colleagues (30%), a competitive environment (26%) and rewards (17%). Of all participants 9% feel uncomfortable towards colleagues and this withholds them to stand while working, suggesting that social influence is high for them.

As explained in the theoretical framework, people move through five stages when modifying behaviour, these stages of change are distinguished as: pre-contemplation, contemplation, preparation, action and maintenance (Prochaska, DiClemente, & Norcross, 1992). Certain principles and processes of change are needed at each stage to reduce resistance, facilitate progress, and prevent relapse. Ferron (2013) created intervention strategies specific for increasing exercise which once in the contemplation stage included: education, increasing the importance of cognitive dissonance, gamification, extrinsic rewards, monitoring physical activity levels and keeping track of progress, persistent visual feedback, and social influence. LaMorte (2018) states that in total there are ten cognitive, affective and evaluative processes of change being: consciousness raising; dramatic relief; self-re-evaluation; environmental re-evaluation;

social liberation; self-liberation; helping relationships; counter-conditioning; reinforcement management; and stimulus control.

### 5.6 Summary of the research results

Providing personal (=individual) feedback is the most effective strategy to increase awareness about health risk behaviour. It raises awareness of the risk behaviour in general and makes people aware of their current level of risk behaviour, helping to eliminate people overestimating and underestimating current risk behaviour and realistic goal-setting.

The results of the experiment show a gap of 2.1 hours between the measured time and the perceived time spent seated in week one. In general participants overestimated their sedentary time. A possible reason of the gap is moving more in between than realised. Furthermore, estimating precise times of sitting and standing is difficult. 78% of respondents feel that the results of the VitaBit match reality.

Estimating sedentary time did not significantly improve or worsen between week one two. 78% of the participants feel more aware of their sedentary behaviour because of the experiment. 57% of participants felt stimulated to change their sedentary behaviour due to the insights of the experiment. OBP staff felt most stimulated from all function groups, OP least stimulated. People want to reduce/minimise health risks.

In addition to awareness of current sedentary behaviour, education about health risk behaviour and its effects is needed. Informing that prolonged sitting cannot be compensated by sports stimulates 87% of participants to change their sedentary behaviour at work. Habits and intention of behaviour can be influenced by facilities, therefore re-engineering the environment with proper facilities is needed to facilitate change. Personal feedback and social influences are important throughout every step of behaviour change.

## Chapter 6: Conclusions, discussion and recommendations

This chapter outlines the conclusions of the results per sub-questions, the discussion and recommendations for the client.

### 6.1 Conclusions

Based on the results, the following conclusions were drawn.

#### 6.1.1 Raising awareness of (health) risk behaviour in general

In short, providing personal feedback is effective to increase awareness of risk behaviour and to eliminate overestimating and underestimating by making people aware of their current level of risk behaviour. Providing personal feedback is most effective while someone is executing the behaviour to be changed. The use of a VitaBit is recommended but a tool sending notifications is preferred. Participants prefer to receive insights instead of actively keeping track of their behaviour. It can be concluded that keeping a diary contributes to awareness. Although it can be time-consuming, it has perceived value in increasing awareness.

#### 6.1.2 The awareness of sedentary behaviour of members of KCNR at the start of the experiment

In short, there is a gap of 2.1 hours between measured and perceived time spent seated. This is a significant difference.

#### 6.1.3 Perceived possible causes of the gap

Concluded from the results in chapter 5.3, people find it hard to estimate their total sedentary time. Besides the difficulty of estimating precisely, a possible reason for the gap could be that people move more in between tasks than they realise.

#### 6.1.4 The effects of sedentary behaviour insights on members of KCNR

From the results of the experiment in chapter 5.4 the researcher concludes that awareness of sedentary time and behaviour increased but that precisely estimating sedentary time is difficult. To sum up, estimations have not significantly worsened or improved due to insights, neither did sedentary time. OBP feel most aware after the experiment, followed by OP and junior researchers. The insights from the experiment stimulated OBP the most to change their sedentary behaviour. OP feel least stimulated to change their sedentary behaviour. Part of the OP say that sitting is necessary for computer work.

To conclude, confronting people with the fact that they spent additional time seated after work stimulates to change sedentary behaviour. From the fact that most participants felt stimulated to change their behaviour to minimise/reduce negative effects on health, it can be concluded that intrinsic motivation is greater than social influence. Participants want to reduce sedentary time

at work by walking around more often, using a sit-stand desk, having standing meetings, and have lunch walks.

#### 6.1.5 Additional needs to reduce sedentary behaviour at work

Altogether, the results of the literature and survey support that facilities, stimulation, and education are needed to reduce sedentary behaviour. Based on the results it can be concluded that education is needed to make change a good change. Furthermore, it is needed for intrinsic motivation. Proper facilities enable change. From the results the researcher concludes that providing personal feedback and reminders to change are important through all phases of behaviour change. It serves as stimulation and helps people to track or adjust their goals, keeping them realistic. Social influence and helping relationships are of great importance in behaviour change processes. It is widely believed that team effort and support of colleagues is therefore important when changing behaviour. Slight peer pressure, competition, gamification and extrinsic rewards can also help to stay motivated.

#### 6.1.6 Summary of the conclusion and answer to the main question

Personal feedback is most effective to increase awareness of risk behaviour and helps with realistic goal-setting. Insights of current behaviour increases awareness but tools sending notifications are effective to remind people to change. Recording behaviour, for example in a journal, costs time but positively affects awareness of behaviour.

Participants of the experiment estimated longer sedentary time than measured. Participants now feel more aware of their sedentary behaviour because of the insight provided and intend to change their sedentary behaviour. From the results it is concluded that estimating sedentary time is difficult, therefore a VitaBit showing the exact times is very useful and confronting.

People feel intrinsic motivation to reduce sedentary time, but social influence also plays an important role. Education about the effects of sedentary behaviour is needed to increase intrinsic motivation and to further stimulate change. Change can be facilitated by equipping the work environment with facilities that allow to stand while working. Change is an entire process and should be stimulated through regular personal feedback and social influence.

### 6.2 Discussion

A potential threat for the reliability of the research is the difficulty of measuring awareness. The results focussing on awareness are based on the perception of participants. The first week of the experiment was planned to serve as a baseline measurement, however it turned out that people already felt influenced by wearing the VitaBit and filling in the diary which could also have influenced sedentary behaviour. Although the researcher did look at a possible change in sedentary behaviour, it was not the main purpose of the research and thus it is not a big concern if those aspects actually influenced behaviour. A point of concern is that other, external,

influences may have affected people their awareness about their sedentary behaviour. An example is the recent activities of other organisations such as insurance company Zilveren Kruis who is currently nationally promoting sit-checks to make people aware of their sedentary behaviour and the news and other tv programs reporting about the health risks of sedentariness.

It cannot be said that KCNR is completely generalisable for the entire HUAS, but it represents staff with diverse functions and connected to diverse institutes. Therefore, KCNR seemed a logical target group for this research compared to performing it within one specific institute. The researcher tried to have a good division of the three participating functions (OP, OBP and junior researchers (students)) in the experiment.

When asking participants if they felt the results of the VitaBit match the reality 22% said no it did not match the reality. In case it is true that it did not match the reality, it affects the reliability of the results. Furthermore, some participants of the experiment did not wear the VitaBit correctly which could have affected both validity and reliability of results. Incorrect measurements, as some participants suggested, could also be arise when not keeping the diary correctly. For example, filling in the diary a few days later or broadly stating worktimes. For example, someone states their workday started at 09:00 but they actually arrived at 09:10 and were settled at their desk at 09:15. Still, they might calculate working from 09:00 and automatically calculate those 15 minutes as sedentary time. This is however a possibility, not proven or based on any facts. Another important concern to take into account was that the first question on the diary was not formulated correctly. It asked people to fill in their worked hours instead of beginning and end time needed to contract correct hours from the data. This was discovered before the start of the experiment and thus people were instructed about this orally and twice by written instructions. Unfortunately, some people still did not write it down correctly and told it to the researcher afterwards. This may have led to some differences between hours estimated and measured. This is one of the reasons why a two-hour difference between hours worked and hours measured was allowed as one will read in the next paragraph.

Data from one participant seemed unreliable since the measured time by the VitaBit was only half of the hours worked registered in the diary. It is unknown if there was a defect in the VitaBit tracker or if the participants did not follow the instructions correctly. The data of this participant has not been analysed. Since small deviations in measured time versus total time worked are expected, the decision was made to allow a maximum difference of two hours between hours worked and hours measured. Results of days where the gap was larger was deleted due to inaccuracy and unreliability. Looking at how big some of the differences were between estimated and measured sedentary time of some participants (as explained in A.17), it is questionable how reliable the results of those days were. There might be errors in the data due to unreliable measurements but since the experiment was held over three weeks, one day of bad results should not affect the average of results when comparing it in SPSS.

43% of respondents said there were unusual activities that influenced their sedentary behaviour during the experiment. From this 43%, 60% thought they spent more time seated than normally



due to the unusual activities while 40% thought they stood or walked more than normally. This is quite unfortunate since it affects the validity of the experiment. Although it still measures the sedentary behaviour during work time, it might not reflect normal work conditions. However, to which extent the unusual activities influenced the participant has not been measured. People might have answered yes when in fact they have only visited a congress for one day. Given the fact that the experiment had a duration of three weeks, this one day should not affect the total outcome.

The results show a very small reduction of sedentary time. The largest difference occurred between week one and two (a reduction of 3,5%) and it increases again in week three. The reduction is not significant. Further research is suggested to find out if the intervention simply had no effect or that the group of participants was too small for a good comparison. Further research with a larger group of participants and an extended timeframe are advised to further research the effects of such an intervention on the long run. Furthermore, effects on awareness and sedentary behaviour on the long-term could be researched in a follow-up study. It is recommended to do additional research about the effects of facilities on behaviour. Is behaviour different when working at home instead of at the office? Do employees with sit-stand desks on average sit less than employees who don't? Lastly, a more in-depth study about the relation between motivation to change and current behaviour is suggested. Are people who perform only computer work less motivated to change than people with varying tasks such as lecturers?

### 6.3 Recommendations

The researcher has the following recommendations for the HUAS to increase awareness about personal sedentary behaviour of employees and to reduce their sedentary behaviour in the long run. The advice is divided into the three aspects of the model of Hoendervanger and Timmer (2019) as shown in the theoretical framework. Starting with the education aspect which is according to the researcher the most important, followed by facilities and stimulation which are equally important (Figure 6.3.1).



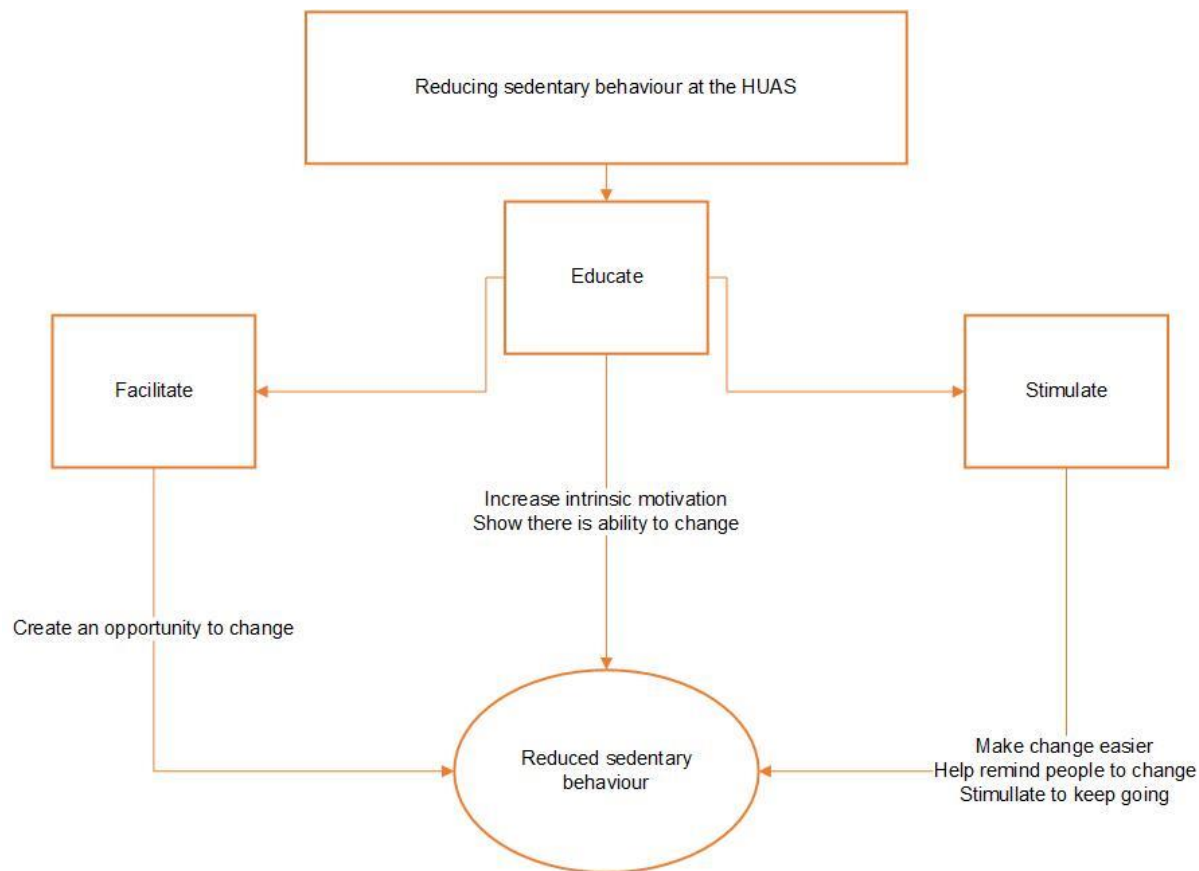


Figure 6.3.1. Self-made Figure about aspects needed to reduce sedentary behaviour at HUAS

## Education

The purpose of this research was to see how awareness contributes to reduction of sedentary time on the long run. After all, the researcher is convinced that awareness plays the most important role when aiming for healthier behaviour in the long run. To have lasting behaviour change and reach the termination phase of the steps of behaviour change, people first need intrinsic motivation. They should not want to change for the organisation or for their team, but for themselves. Personal feedback about sedentary behaviour of individuals can increase awareness and serve as a motivator for change. Furthermore, it helps people to track and adjust their goals, keeping them realistic and supporting self-liberation. Self-liberation is the commitment to change based on the belief that achievement is possible (LaMorte, 2018). Therefore, the use of a VitaBit is strongly recommended, providing actual and confronting insights in current sedentary behaviour and to eliminate over- and underestimating. In addition, a diary could be used so people consciously have to think about their own behaviour. Education about correct behaviour in terms of sitting and standing, and the risks and effects of sedentariness on health is needed to increase intrinsic motivation. This education needs to be actively promoted and given, and not just informing staff through an E-mail. This way people might feel more stimulated to join the education and it may be more effective because small groups make it more personal. Staff should also learn that, if proper facilities are provided, there is no relationship between sedentary behaviour and specific tasks such as computer work.

**Facilitation**

Facilitating standing and walking is needed to create an opportunity to reduce sedentary time. The most obvious way to facilitate standing at work is through a sit-stand desk. In addition, the researcher recommends to refurbish some of the meeting facilities so people can choose to book rooms allowing standing meetings. These rooms can be facilitated with high tables and objects that people can lean on. Examples of facilities used to lean on are poles in the ground or objects similar to a ballet barre and objects to lean on as seen in bus stops. Furthermore, staff shows interest in walking during their lunch break, therefore it is strongly recommended to create more walk routes on campus. Redesigning some areas on campus in green areas will make walks more pleasant. HUAS has recently removed many trash bins in buildings and replaced them by recycling bins who are more centrally located. Because the bins are (often) located further from classrooms and workplaces, it creates the opportunity to walk every time people have trash. This is a great example of making unhealthy behaviour more difficult and pushing people towards healthy behaviour. Similarly, in case HUAS needs to redesign parking spaces, they should consider placing them further from the buildings with exceptions of parking spaces for the disabled. HUAS can install software on the sit-stand desks which can set the desks in a higher position in the evening as an example of not facilitating sitting. Optimally HUAS can even refurbish a number of classrooms to allow standing lectures. Instead of only looking at reducing sedentary time for staff, HUAS should consider to facilitate standing for all people working at HUAS, also including students.

**Stimulation**

Besides educating, the use of VitaBits is recommended because confronting people with actual insights also works stimulating since they can see the change that has been made so far. After creating awareness of sedentary behaviour, other tools such as smart watches or smart chairs should be used in the action stage to send notifications and help remind people to change their position more frequently. The researcher is of opinion that the preference for tools sending notifications comes from the ease of use. When working concentrated, intended change may easily be forgotten and people are likely to continue with habit behaviour, making the notifications very effective. The notifications can help to remind people to move every hour for five minutes as recommended by Contant (2009). Compared to the VitaBit, some other tools are also easier in use since using a VitaBit requires consciously wearing it every day. A watch, for example, is easier in use because once in place, people can leave it on for several days. Instead of investing in a smartwatch or smart chair HUAS can consider installing software on sit-stand desks sending reminders to the user to change position and automatically adjusting the height of the desk if allowed by the user. As expressed in the discussion, further research is suggested before choosing to invest in a certain tool. Which tool is most effective may be personal. It is recommended to after a while, during the change process, allow people to use a VitaBit again giving people insight in their change and allowing them adjust their goals if necessary.

Re-engineering of the environment is needed to stimulate people daily for example by placing cues and nudges to support and encourage the behaviour change and removing those that

encourage the unwanted behaviour. Examples are stimulating quotes and images about movement. Social influence should be stimulated by the HUAS. Creating peer groups or participating group, who together start a process of change can serve as helping relationships and show support and encouragement during the process of change. Creating peer groups might result in slight peer pressure, giving it a competitive edge. However, making a change process too competitive can have reversed outcomes and should therefore be carefully considered. When people for example do not meet targets or are underperforming compared to team members, they may feel demotivated and give up. Making change fun by a competition or gamification is not recommended because the researcher believes that this is not effective on the long run. Games are fun when they are new but people are likely to get bored after a while. A reward system during the change process can be implemented and is expected to be very stimulating in the action stage where people start with their behaviour change. Reinforcement management helps in the change process by rewarding positive behaviour and reducing rewards for negative behaviour. Finally, the main motivation to change should be from within, and can be increased by education. Once intrinsic motivation exists, people should be stimulated to continue.

### The main advices per aspect

The most important advices per aspect to reduce sedentary behaviour of staff of HUAS is visualised in Figure 6.3.2.

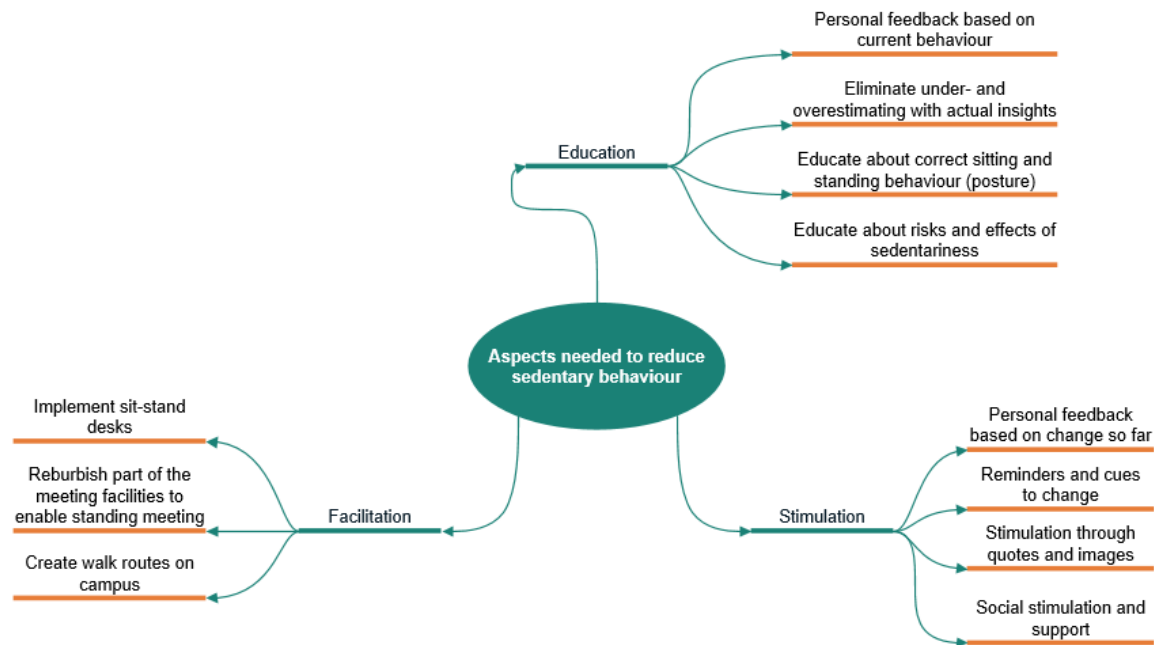


Figure 6.3.2. Self-made Figure about the main advice for HUAS per aspect

### The change plan:

It is advised to influence and improve healthy behaviour per institute. Although facilities need to be implemented on the entire campus, tools that will be used temporarily such as the VitaBit can then be distributed per team, reducing costs. When focusing on behavioural change per team, it is easier to provide quality education and individual feedback. Furthermore, support groups can

be formed within the teams/institutes. The three aspects of change are needed at different moments during a change process. Which aspect is needed at which stage of change is visualised in Figure 6.3.3. One can see that there is always a subprocess needed before one can move from one stage to another. Facilitation is only needed once, to move from the preparation phase to the action phase. Education is also suggested at the end so people can ask questions and receive personal feedback in the action phase, moving towards the maintenance phase. Stimulation is consciously not suggested in the beginning since, as explained earlier, the first step towards successful behaviour change should come from intrinsic motivation which can only be reached by means of education.

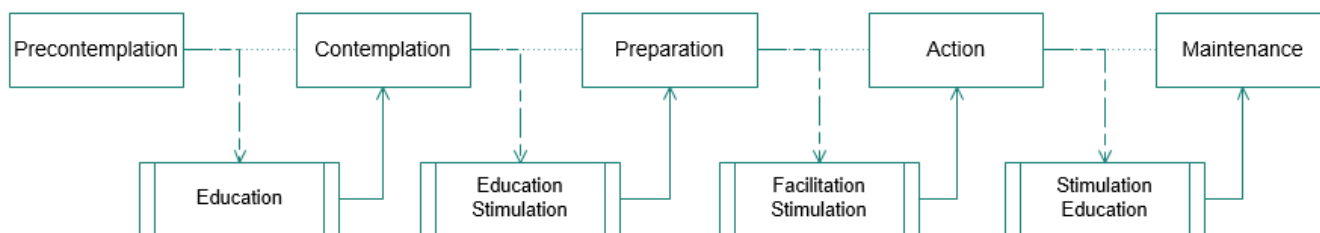


Figure 6.3.3. Self-made Figure about aspects needed per change stage.

The financial and legal factors to take into consideration, and the impact on internal processes are explained in Appendix 21.

### The outcome:

Reviewing literature available on the effects of sedentary behaviour and the outcome of the experiment, the researcher is of opinion that this advice will help HUAS to reduce sedentary time of staff. It will help HUAS to create a healthy work environment, which is important to limit absenteeism and to increase well-being, performance and satisfaction of employees. The results of this research and recommendations of the researcher are a great addition to “Het Nieuwe Gezonde Werken 2.0”, the lifestyle program of HUAS designed to improve health and vitality of staff.

On the short-term, the researcher advises HUAS to do additional research on the topic, as explained in the discussion. Since changing behaviour is an entire process, there will not be any lasting results on short-term when following the advice of the researcher. However, following the advice and implementing changes will support HUAS its view on healthy ageing and vitality. Also, within the next two years, HUAS is advised to further develop a change plan to reduce sedentary behaviour and to emphasise increasing health of staff in their organisation strategy.

On medium-term, from two to five years from now, HUAS should have a change plan finished including a complete approved investment plan and time plan. HUAS should in those three years focus on the precontemplation, contemplation and preparation stages of reducing sedentary behaviour.

Once a good basis for change has been made by going through the precontemplation, contemplation and preparation stages, most of the staff will be motivated, stimulated and

facilitated for change. It is then time for action and maintenance. On the long-term, following the advice is expected to lead to reduced sedentary time and thus healthier behaviour at work and healthier staff. Behaviour change is an entire process, but once staff is used to the change they are expected to work more efficiently.

## Chapter 7: Reflection

The reflection is structured with help of the reflection model of Gibbs.

### Description:

I performed this research to satisfy my client and graduate from my education program. The research had a duration of approximately 3.5 months. I had one supervisor from HWP and two supporting lecturers who attended the COL meetings organised by school. The research was performed within KCNR at the HUAS.

### Feelings:

I feel that the assignment allowed me to develop my professionalism. Early in the process I lost my insecurities and took control of the assignment and all responsibilities that came with it. Although my internal supervisor has always been helpful, I felt very independent working on the assignment. In the beginning I felt that the COL meetings were not very helpful, but I later realised that the time and place was organised for us, but we had to show our own initiative to give the meetings meaning. Looking back, I feel like I used the help of other students much better in the end. I think that people who worked with me during the process saw both personal and professional growth in me.

### Evaluation and analysis:

The research was a good experience. I learned to be proactive. I planned and executed an entire experiment from beginning to end which improved my time management skills and my abilities to adjust to unexpected situations. My client requested me to do an experiment with a VitaBit but gave me full control over what I wanted to do and how I wanted to do it. Since I wanted to do research about awareness of sedentary behaviour I decided to make a diary as part of the experiment. The quality of the questions in the diary could have been better but by making mistakes, I learned to be more careful during the set-up of the final survey. Some unforeseen circumstances appeared during the start of the experiment but were dealt with by continuing to work at night and informing stakeholders where necessary. Examples of unforeseen circumstances were late delivery of the VitaBits and different set-up requirement than expected. Fortunately, I planned well ahead and started quite early with my experiment, resulting in flexibility to deal with unforeseen circumstances. Things that could have been done better are starting earlier with desk research and making the theoretical framework and working together with students in the COL group.

### Conclusion:

Overall, I am very satisfied with the process and results. With future research projects, I should sooner create a good theoretical framework and work together with peers from the beginning. I learned much about being a researcher but also about creating healthy workplaces and behaviour, both important for a Facility Manager. This research again showed me that my passion as a Facility Manager is in housing and workplace related aspects of FM.

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Any Figures and Tables without references are self-made.

## Appendices


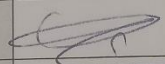
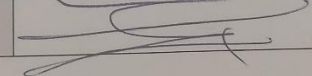
This chapter shows all the appendices related to this advisory report.

### A.1 – Assessment of presentation for client

A. Assessment form for the presentation of the Advisory Report to the client

<b>Attendance:</b>	The presentation will always be attended by the company supervisor and, if possible, by other relevant individuals within the client's organisation.
<b>Duration of the presentation:</b>	30 minutes
<b>Structure of the presentation:</b>	The student will discuss a suitable format for the presentation with the company supervisor. The usual format is a presentation of around 20 minutes, followed by an exchange of ideas and an opportunity for questions and comments.
<b>Assessment:</b>	The company supervisor will record their observations and findings.
<b>Appendix to the advisory report:</b>	The student will append the assessment to the advisory report.

<b>Standard 8</b>  <b>Hanzehogeschool Groningen</b> University of Applied Sciences	<b>Graduation project – presentation of the advisory report to the client</b>
<b>Name of student:</b>	Veroline Brouwer
<b>Date:</b>	23-5-2019
<b>Company supervisor:</b>	Jan Gerard Hoender-vanger
<b>Title of the advisory report:</b>	Reducing sedentary behaviour
<b>Date of presentation:</b>	23-5-2019
<b>Content of the research</b>	<b>Observations and findings</b>
The student provides information on the objective and question.	Okay, but broader context (IWP) might have been elaborated more.
The student provides information on the approach to the research.	Rather limited
The student summarises the key research data.	Well done; clear.
The student summarises the key conclusions and recommendations.	Very well done! broad range of good recommendations.
<b>Conduct and performance</b>	<b>Observations and findings</b>
The student makes the presentation interactive, provides an opportunity for questions and can participate in the discussions at junior professional level.	Very well done; professional!! A lot of good interaction
The student takes charge of the meeting.	She did.
<b>Student's signature:</b>	
<b>Company supervisor's signature:</b>	

## A.2 Definitions

### Awareness

Awareness is described as “knowledge and understanding of a particular activity, subject, etc. (Cambridge Business English Dictionary, n.d.-a). For the purpose of this research, raising awareness equals making people more conscious. It is reached by sharing insights and thus knowledge about the actual sedentary behaviour of people. It is making people aware of the difference between the actual and the perceived time spent seated during regular work hours.

### Computer work

According to Contant (2009), one speaks of computer work when people work for a minimum of two hours per day on a computer or one hour uninterrupted. When this time is reached, the Dutch law speaks of computer work.

### Members of KCNR

Members of KCNR include all people who are registered to work for/with KCNR. This includes part-time and fulltime employees and partners. Most members of KCNR have one of the following functions: administrative staff, knowledge workers, teachers and junior researchers. Not all members work at the location of KCNR, some teachers rarely work at KCNR but are part of a lectorate and thus automatically a member of KCNR.

### Moving/movement

The term moving is used when someone is active, in motion. Moving is the movement of the body. According to Cambridge Business English Dictionary (n.d.-b), movement is a change of position.

### Nudges

According to Linde van den Brink (personal communication, May 9, 2019), a nudge is a change in the environment that may influence someone's decision while someone is unconscious of it. It pushes people in the direction of correct behaviour.

### Personal feedback

Individual feedback based on personal level such as someone's behaviour or goals.

### Seating time

Seating time refers to the time spent by people in a sitting position. It is the time people spent on sedentary behaviour. This time can be mentioned per hour, per day, per week, and per year.

**Sedentary behaviour and sitting behaviour**

According to Travis (2017) there is confusion about the terminology of sedentary behaviour. The main confusion exists in the difference between sitting and inactivity. Sedentary Behavior Research Network [SBRN] (n.d.) states that sedentary behaviour is any waking behaviour with an energy expenditure of less than 1.5 metabolic equivalents (METs), this can be in a sitting, reclining or lying posture.

Since the target group of this research is monitored at work, sedentary behaviour in the researched is assumed to be sitting behaviour. According to Sedentary Behavior Research Network [SBRN] (n.d.), sitting is a position in which one's weight is supported by one's buttocks instead of someone's feet and in which someone's back is upright. With active sitting the energy expenditure is over 1.5 METs, with passive sitting it is less than 1.5 METs. Using a cycle desk is an example of active sitting.

Therefore, for the purpose of this research, sedentary behaviour and sitting behaviour are used as one term. Sedentary and sitting behaviour are characterised as inactive behaviour where someone's weight is supported by one's buttocks by a chair.

**Self-liberation**

The commitment to change based on the belief that achievement is possible LaMorte (2018).

**Sit-stand desk**

A sit-stand desk is a height adjustable workplace. According to Contant (2009), a height adjustable desk can be adjusted to a height of 120 cm. This height of 120 cm allows people to stand while working and have vary their body posture in order to prevent pain complaints. Other terms that are often used for height adjustable desks are sit stand desk, standing desk, and stand up desk.

**Standing**

Sedentary Behavior Research Network [SBRN] (n.d.) defines standing as a position where people are in an upright position while supported by their feet. For this research, the term standing is used to describe passive behaviour with no obvious movement.

**VitaBit**

VitaBit Software International B.V. (n.d.-b), explains that their main goal is to detect and give an insight in sitting

behaviour. The VitaBit tracker can distinct sitting from standing and also detects physical movement. The sensors are worn in pockets of trousers. When not wearing trousers or trousers with pockets, one can wear the VitaBit with the help of stickers places on skin or clothes. According to Berninger, Ten Hoor, and Plasqui (2018), laboratory findings show that VitaBit is eligible for the monitoring of sedentary behaviour.

### VitaBit portal

VitaBit developed a coaching portal in which real-time data gathered by the health sensor is shown. According to VitaBit Software International B.V. (n.d.-b) the coaching portal can help to gain insights, set goals and compare results and ultimately improve vitality. Users can receive notifications to stimulate them to stand up. The portal can be used individually but also in groups.

### A.3 Observation of sedentary behaviour

In order to get acquainted with the organisation and the topic sedentary behaviour, observations have been performed at KCNR for a duration of three days. The observations took place at February 26, 27, and 28. The timeframes for the observations are hourly, meaning one time per hour the workplaces were observed. This should not be confused with observations with a duration of a full hour. Only people physically present at their desk during the observations were observed. The aim of the observations was to find out if people at KCNR current use the workplaces in a standing or sitting position. All the regular workplaces were observed in the quiet and whisper area. Some of these workplaces are height adjustable workplaces, others are not. However, at any observed time there were still height adjustable desks available so people always had the option of choosing this desk over a regular desk.

Please note that these observations do not give a clear insight in sedentary behaviour. The observations were snapshots in time, held hourly to see if people were using their desk in a sitting or standing position. The sedentary time of people will be recorded during the experiment with help of the VitaBit. Still, these observations may give an insight in sedentary behaviour. As one can conclude from the explanation provided, short periods of movement were not recorded and thus the researcher cannot conclude if the behaviour of people was healthy or not. Members of KCNR did not know that their use of the workplaces was being observed in order to prevent this awareness from influencing their behaviour.

The workplaces were divided into the three different working areas at KCNR. The areas are divided into silent area, a whisper area and a collaboration area. Within the collaboration area there are no real office desks or height adjustable workplaces so the only place where people are likely to stand is the high central table at which people can stand while working or consulting. In practice, this high table is mainly used to consult and not to work individually. In addition there is a cycle desk in the whisper area, the use of this special desk was also observed. During the observations, no one was seen using the cycle desk.

The observation matrix displayed below was used during the observation, the observed data has already been entered in this matrix.

Table A.3. Observation matrix including findings.

Date	Day	Time	Quiet area				Whisper Area				Consulting table			Cycle desk
			Available	Desks in	Sitting	Standin	Available des	n use whis	Sitting	Standi	Consu	Number of user	Positic	In use
26-2-2019	Tuesday	09:30 - 10:30	10	0	0	0	12	1	1	0	Yes	5	Standing	No
26-2-2019		10:30 - 11:30	10	3	2	1	12	1	0	1	No	-	-	No
26-2-2019		11:30 - 12:30	10	1	1	0	12	1	0	1	Yes	3	Standing	No
26-2-2019		13:30 - 14:30	10	3	3	0	12	2	2	0	No	-	-	No
26-2-2019		14:30 - 15:30	10	3	3	0	12	5	5	0	Yes	3	Standing	No
26-2-2019		15:30 - 16:30	10	2	2	0	12	5	4	1	No	-	-	No
26-2-2019		16:30 - 17:30	10	1	1	0	12	1	1	0	No	-	-	No
27-2-2019	Wednesday	09:30 - 10:30	10	2	2	0	12	3	3	0	No	-	-	No
27-2-2019		10:30 - 11:30	10	2	1	1	12	3	3	0	No	-	-	No
27-2-2019		11:30 - 12:30	10	3	3	0	12	2	1	1	No	-	-	No
27-2-2019		13:30 - 14:30	10	2	2	0	12	2	2	0	No	-	-	No
27-2-2019		14:30 - 15:30	10	2	2	0	12	3	3	0	No	-	-	No
27-2-2019		15:30 - 16:30	10	1	1	0	12	3	2	1	No	-	-	No
27-2-2019		16:30 - 17:30	10	1	1	0	12	2	1	1	No	-	-	No
28-2-2019	Thursday	09:30 - 10:30	10	3	2	1	12	3	3	0	No	-	-	No
28-2-2019		10:30 - 11:30	10	1	1	0	12	3	3	0	Yes	2	Standing	No
28-2-2019		11:30 - 12:30	10	1	1	0	12	6	6	0	Yes	2	Standing	No
28-2-2019		13:30 - 14:30	10	3	3	0	12	3	3	0	No	-	-	No
28-2-2019		14:30 - 15:30	10	3	2	1	12	1	1	0	No	-	-	No
28-2-2019		15:30 - 16:30	10	4	4	0	12	5	4	1	No	-	-	No
28-2-2019		16:30 - 17:30	10	3	3	0	12	4	3	1	No	-	-	No

On the next page charts are displayed that have been created based on the data gathered with the observations.

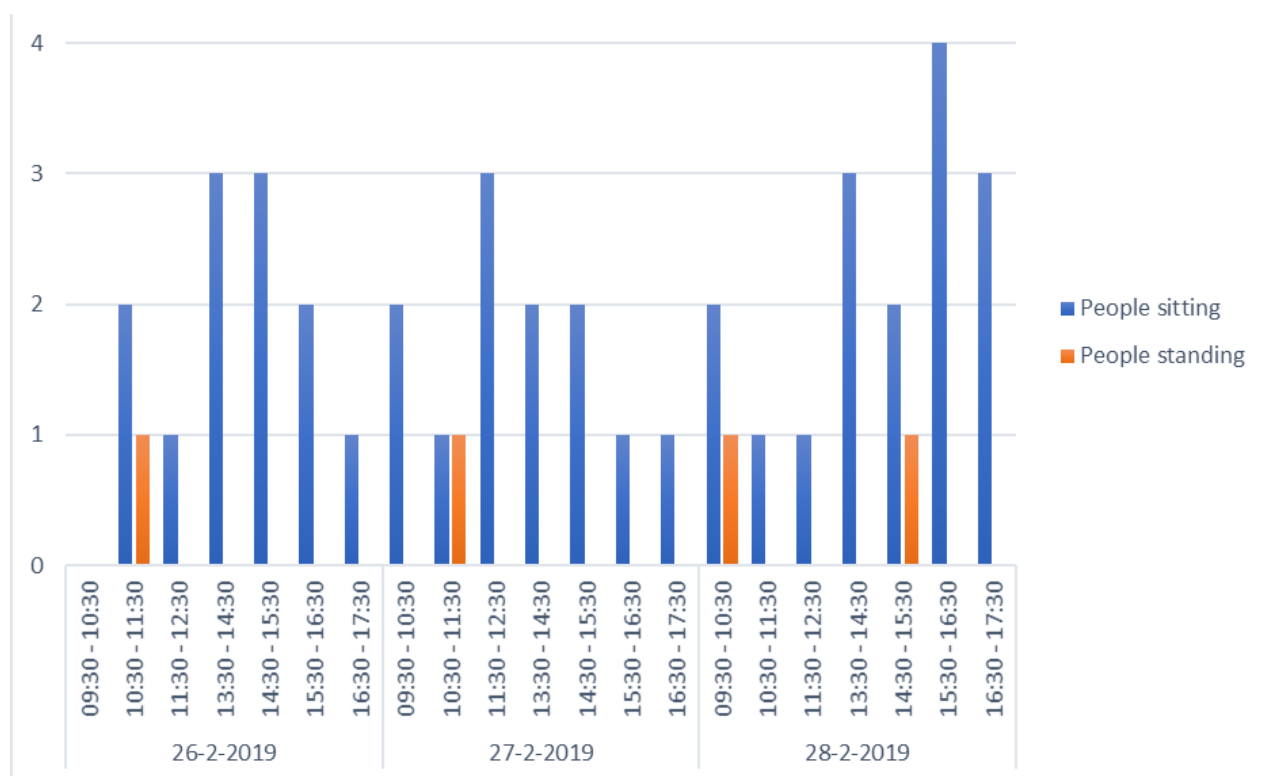


Figure A.3.1. People standing/sitting in quiet area per day and timeframe.

Figure A.3.1 shows the number of people sitting and standing in the quiet area per day and timeframe for the total of three days in which the observations took place. As one can see, there was never more than one person at a time standing in this area during the observations. Although



an official conclusion cannot be made, it seems that when working in the quiet area, a standing position is preferred in the morning.

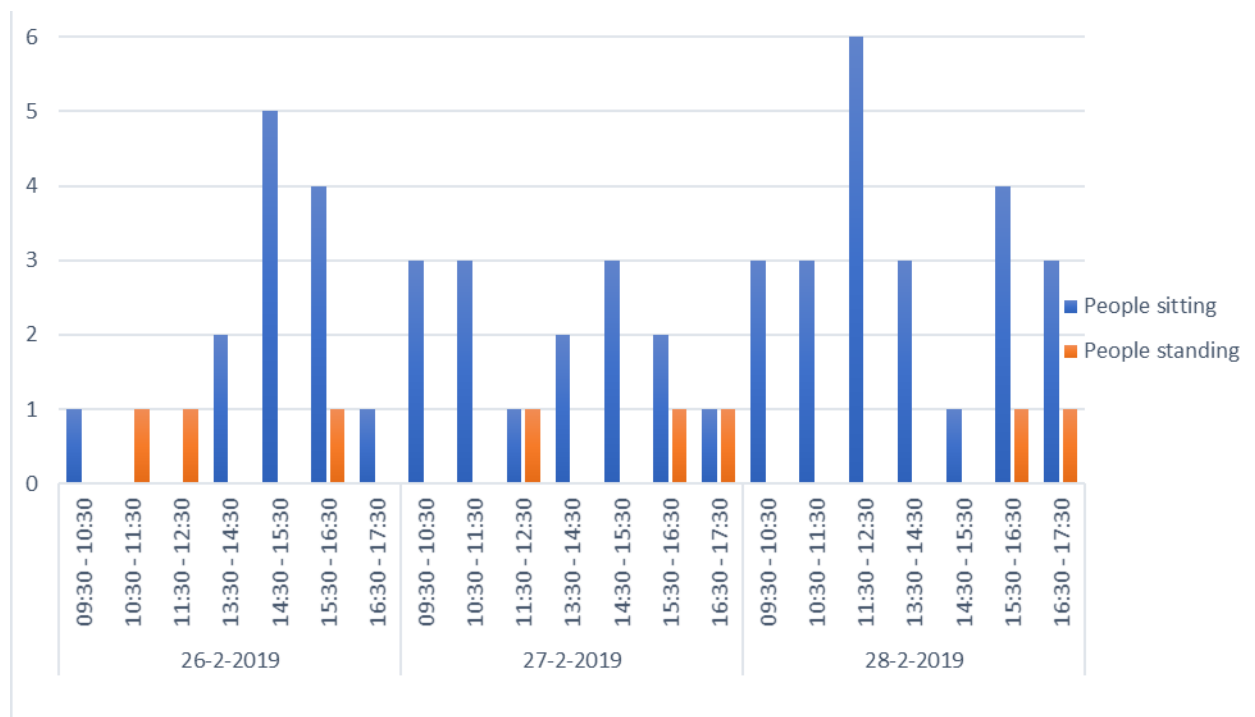


Figure A.3.2. People standing/sitting in whisper area per day and timeframe.

Figure A.3.2 shows the number of people sitting and standing in the whisper area per day and timeframe for the total of three days in which the observations took place. Also in this area, there was never more than one person standing during a timeframe observed in this area. Although an official conclusion cannot be made, it seems that in this area, people prefer standing later in the morning and in the late afternoon.

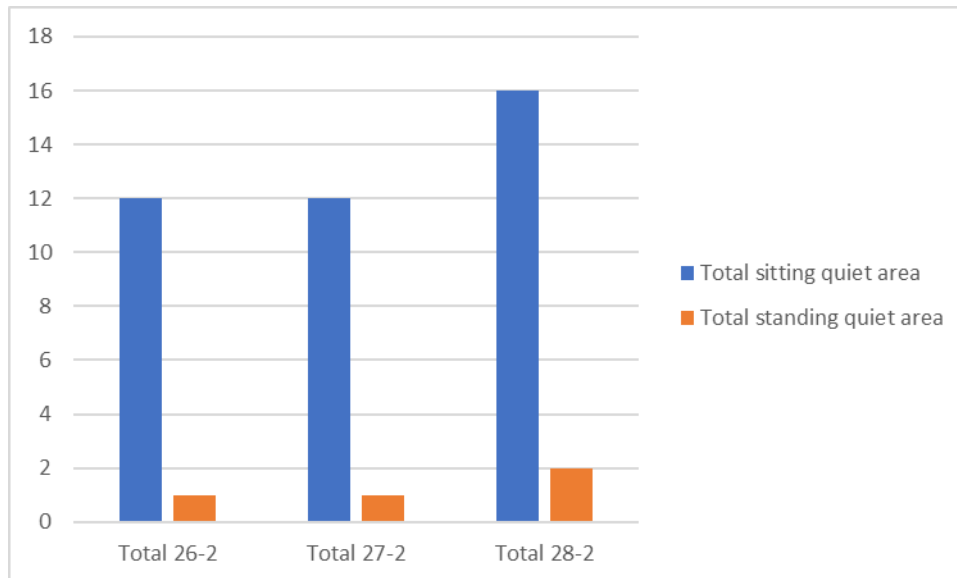


Figure A.3.3. Total people standing/sitting in quiet area per day.

Figure A.3.3 shows the total number of times people were observed sitting and standing in the quiet area per day. Although one can also read this from Figure A.3.1, this chart will show more clearly that during the observations, most people were observed sitting.

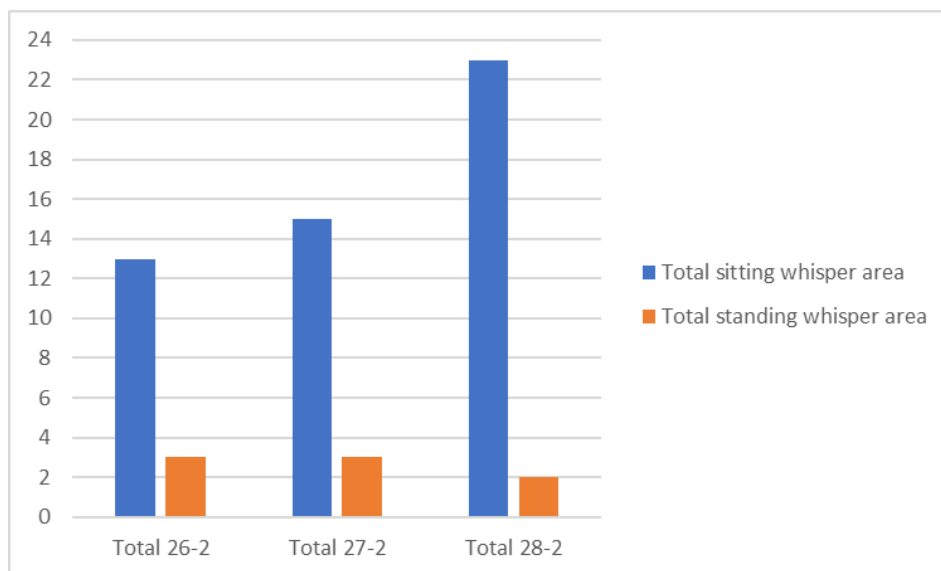


Figure A.3.4. Total people standing/sitting in whisper area per day.

Figure A.3.4 shows the total number of times people were observed sitting and standing in the whisper area per day. Although one can also read this from Figure A.3.2, this chart will show more clearly that during the observations, most people were observed sitting.

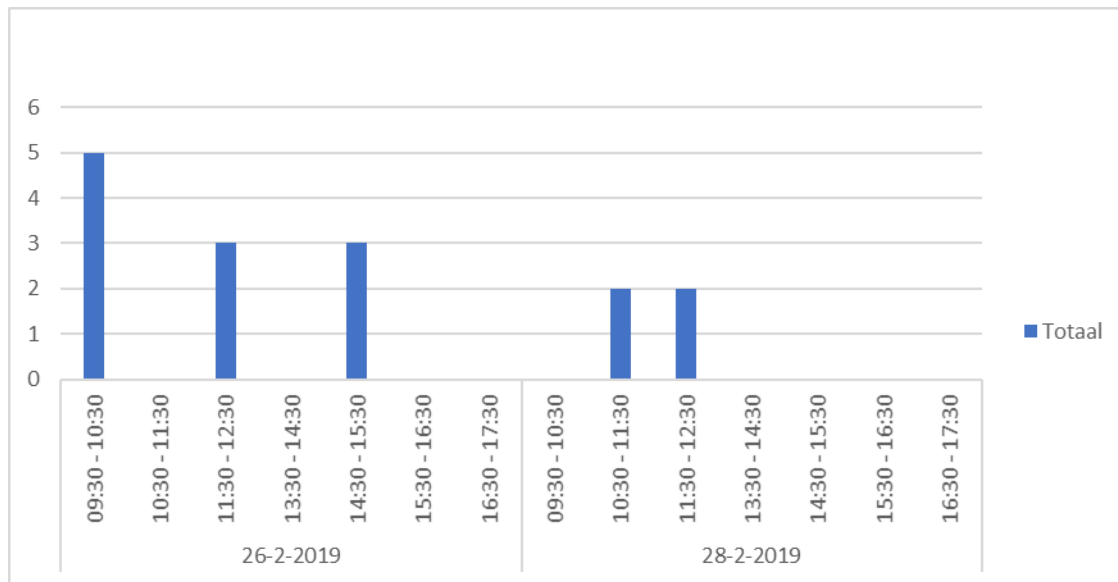


Figure A.3.5. Total number of users at consulting table.

Figure A.3.5 shows the total number of users observed during a timeframe at the consulting table in the open collaboration space of KCNR. During February 2, no one was observed using the consulting table and therefore this date is missing in the chart.

#### A.4 Research planning

The weekly planning as set out by the school of facility management will be followed to a certain extend. This planning states what should be done in which week. Partially based on this, a personal planning for this research has been made. The personal planning is visualised and can be found below in Figure A.4.

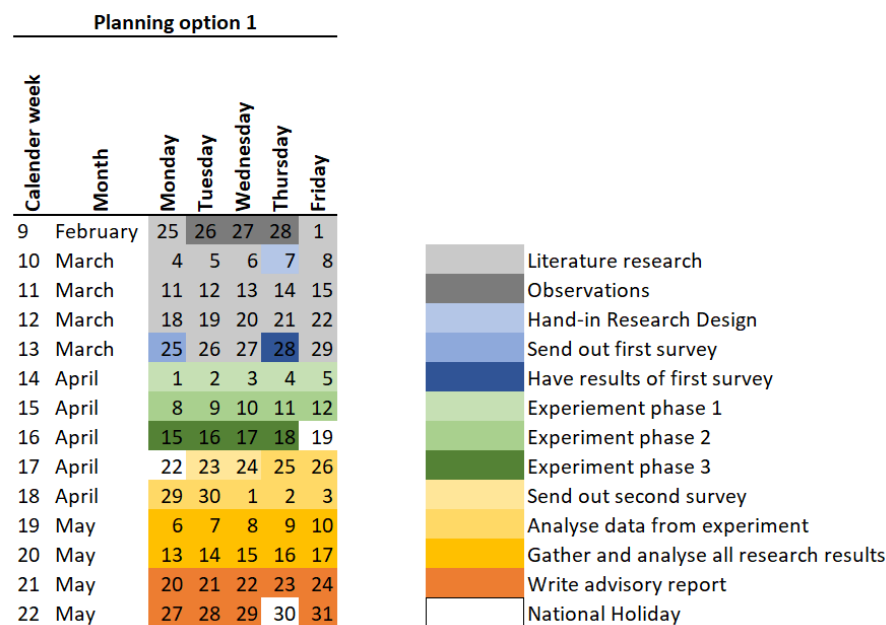


Figure A.4. Research planning.

The planning provided by the School of Facility Management starts at calendar week 6, however, as this research takes place at KCNR, the researcher was required to follow their program which started with an introduction week in week 7, followed by a break in week 8, and two more introduction days in week 9. Only after that introduction period, the researcher could start with her research and an action plan. Figure A.4 is a colourful visualisation of the planning but not very detailed, therefore, more details are provided in Table A.4.

Table A.4. Detailed research planning

Calendar week	Activities
9	<ul style="list-style-type: none"> <li>Finishing the introduction program at KCNR.</li> <li>Meeting with the client to learn more about the aims of the research.</li> <li>Start with exploratory observations.</li> </ul>
10	<ul style="list-style-type: none"> <li>Work on research plan and theoretical exploration of the subject.</li> <li>SIFM group meeting 2: discussion of action plan/literature.</li> <li>Hand-in research plan <b>Thursday March 7<sup>th</sup> 2019, 23:59 o'clock.</b></li> </ul>
11	<ul style="list-style-type: none"> <li>Literature research</li> <li>Planning experiment and gathering participants</li> </ul>
12	<ul style="list-style-type: none"> <li>Literature research</li> <li>Planning experiment and gathering participants</li> <li>Have a company visit with supervising lecturer</li> </ul>

13	<ul style="list-style-type: none"> <li>• Group meeting 3: feedback on research plan from supervising lecturer</li> <li>• Prepare participants for the experiment</li> <li>• Send out first survey to participants of experiment</li> <li>• Hand out VitaBits and diary to participants of experiment</li> </ul>
14	<ul style="list-style-type: none"> <li>• Start the experiment <b>Monday April 1<sup>st</sup></b></li> <li>• Change research plan as needed, based on feedback of supervising lecturer</li> <li>• Send out results of first week of the experiment to participants</li> <li>• Submit changed research plan: deadline <b>Friday April 5<sup>th</sup> 23:59 o'clock</b></li> </ul>
15	<ul style="list-style-type: none"> <li>• Start week 2 of the experiment</li> <li>• Analyse information received with first survey</li> <li>• Analyse data of first week of the experiment</li> <li>• Prepare for week 3 of the experiment</li> </ul>
16	<ul style="list-style-type: none"> <li>• Start week 3 of the experiment</li> <li>• Group meeting 4: data collection and organisational analysis</li> <li>• Supervising lecturer gives feedback on the research plan</li> <li>• Analyse data of second week of the experiment</li> <li>• Analyse results of the diary</li> </ul>
17	<ul style="list-style-type: none"> <li>• Make changes to the research according to feedback from supervising lecturer</li> <li>• Analyse results from the experiment</li> <li>• Send out second survey</li> </ul>
18	<ul style="list-style-type: none"> <li>– Analyse results from experiment</li> <li>– Do additional desk research based on results from experiment</li> </ul>
19	<ul style="list-style-type: none"> <li>– Group meeting 5: theme – describing results</li> <li>– Analyse research results</li> <li>– Do additional desk research about legal and financial implications</li> </ul>
20	<ul style="list-style-type: none"> <li>– Analyse research results</li> </ul>
21	<ul style="list-style-type: none"> <li>– Group meeting 6: theme – conclusions and recommendations, final presentation and defence</li> <li>– Write advisory report</li> </ul>
22	<ul style="list-style-type: none"> <li>– Write advisory report</li> </ul>
23	<ul style="list-style-type: none"> <li>– Submit advisory report in OnStage <b>by 9:00 am June 3<sup>rd</sup> 2019</b></li> </ul>
24	<ul style="list-style-type: none"> <li>– Wait for results of advisory report and prepare for final preparation</li> </ul>
25	<ul style="list-style-type: none"> <li>– Final presentation and defence/final mark</li> </ul>
26	<ul style="list-style-type: none"> <li>– Final presentation and defence/final mark</li> </ul>

### A.5 Recruitment email

The following email has been sent out to all people connected to KCNR, including lecturers, researchers, junior researchers and supporting staff. The purpose of this email was to introduce the experiment concerning awareness of sedentary behaviour and to recruit people willing to participate in the experiment. The email is in Dutch, as are all the other emails related to the experiment since the people connected to KCNR are/speak Dutch.

#### Onderwerp: Uw kans om gezonder te werken!

Beste collega,

Mijn naam is Veroline Brouwer en ik ben op zoek naar deelnemers voor mijn experiment als onderdeel van mijn afstudeeronderzoek.

#### ***Wilt u gezonder werken? Dit is uw kans!***

Wij Nederlanders zijn namelijk Europees kampioen zitten. Recente cijfers laten zien dat de gemiddelde Nederlander per dag gemiddeld 8,5 uur zit. Zitten wordt gezien als het nieuwe roken. Vanuit de wetenschap komt steeds meer inzicht dat langdurig zitten schadelijk is voor de gezondheid, ook al voldoet men aan de beweegnorm van vijf keer per week minimaal een half uur matig intensieve lichaamsbeweging.

Het schijnt dat veel mensen zich niet bewust zijn van hun zitgedrag. Voor mijn afstudeeropdracht, die zich richt op bewustwording van zitgedrag, wil ik graag een experiment uitvoeren om te kijken wat het verschil is tussen de vermoede zittijd en de actuele zittijd per dag voor werknemers bij bNR. Wat levert u dit op? Inzicht in uw werkelijke zitgedrag! Dit inzicht kan u stimuleren om uw zitgedrag te veranderen.

Voor het experiment wordt verwacht dat deelnemers drie weken lang elke werkdag een sensor in hun broekzak dragen. Geen zorgen, er is ook een oplossing om de sensor te dragen indien u geen broekzakken heeft. Daarnaast zal zowel voor als na het experiment een korte vragenlijst worden verstuurd. Het experiment staat gepland om te beginnen op 25 maart.

Bent u geïnteresseerd om deel te nemen aan mijn experiment? Stuur me dan een mailtje! Aanmelden als deelnemer kan tot en met **12 maart**.

Vriendelijke groet,

Veroline Brouwer  
Afstudeerder binnen IWP Healthy Workplace, NoorderRuimte  
E-mail: [v.c.brouwer@st.hanze.nl](mailto:v.c.brouwer@st.hanze.nl)

## A.6 Introduction email

The following email, sent to participants of the experiment gave additional information about the experiment, including instructions. Furthermore a link to the introduction survey was placed within the email. The email was sent with Enalyzer, the survey program.

### Onderwerp: Introductie experiment bewustwording zitgedrag

Beste deelnemer,

Allereerst bedankt voor uw deelname aan dit experiment.

Ik wil u vragen om bijgevoegde korte survey in te vullen. Bij het overhandigen van de VitaBit zal ik een dagboekje uitdelen waarin tijdens werkdagen een paar vragen kunnen worden bijgehouden. Dit kost u hooguit 2 minuten per werkdag. Na het eind van zowel de eerste als tweede week ontvangt u inzichten in uw zichtgedrag. In de derde week krijgt u een dagelijks inzicht in uw zitgedrag. Alle data van dit onderzoek wordt geanonimiseerd. Naast de onderzoeker krijgt niemand inzicht in uw persoonlijke resultaten. U krijgt enkel inzicht in uw persoonlijke resultaten.

Graag deel ik donderdag 28 maart de VitaBits uit. Bent u aanstaande donderdag op de Hanzehogeschool zodat ik de VitaBit bij u af kan leveren? Zo ja, waar en op welk moment zou ik de VitaBit kunnen langsbrengen? Indien u donderdag niet aanwezig bent op de Hanzehogeschool hoor ik graag van u wanneer u wel aanwezig bent.

Belangrijke instructies voor het experiment:

- Draag uw VitaBit tussen uw riem en knie. Het muntzakje bij uw broekzak wordt aangeraden omdat de sensor hierin weinig kan bewegen. Wanneer u geen, of erg ruime broekzakken heeft kun u ook de bijgeleverde magneet gebruiken om de sensor te dragen en op zijn plek te houden.
- Wanneer u 's ochtends de sensor in uw broekzak stopt, loop dan eerst 30 seconden zodat de sensor kan kalibreren.
- Beweeg de sensor niet wanneer u deze eenmaal in uw broekzak heeft geplaatst
- Leg uw sensor 's avonds op een vast plek neer, bijvoorbeeld naast uw laptop, tandenborstel of sleutels zodat u deze de volgende ochtend niet vergeet. U kunt ook een reminder in uw mobiel instellen zodat u uw sensor niet vergeet.
- Wellicht ten overvloede: Vergeet niet uw sensor uit uw broekzak te halen voordat u uw kleding wast!

[Ik wil u vragen om deze korte survey in te vullen.](#)

Bij het overhandigen van de VitaBit zal ik een dagboekje uitdelen waarin tijdens werkdagen een paar vragen kunnen worden bijgehouden. Dit kost u hooguit 2 minuten per werkdag. Na het eind van zowel de eerste als tweede week ontvangt u inzichten in uw zichtgedrag. In de derde week krijgt u een dagelijks inzicht in uw zitgedrag. Alle data van dit onderzoek wordt geanonimiseerd. Naast de onderzoeker krijgt niemand inzicht in uw persoonlijke resultaten. U krijgt enkel inzicht in uw persoonlijke resultaten.

Graag deel ik donderdag 28 maart de VitaBits uit. Bent u aanstaande donderdag op de Hanzehogeschool

29-05-2019

Reducing sedentary behaviour in an office environment  
by means of increasing awareness of current sedentary time

---

zodat ik de VitaBit bij u af kan leveren? Zo ja, waar en op welk moment zou ik de VitaBit kunnen langsbrengen? Indien u donderdag niet aanwezig bent op de Hanzehogeschool hoor ik graag van u wanneer u wel aanwezig bent.

Mocht u nog vragen hebben na aanleiding van bovenstaande informatie dan beantwoord ik deze graag.

Vriendelijke groet,

Veroline Brouwer



### A.7 Consent form

The following form was handed out together with the VitaBit trackers as a statement of consent. The form introduces the experiment and its purpose, instructions for the participants and what is expected from them, the facts that participating is voluntary and that participants are allowed to stop their participation at any given time without providing a reason. Furthermore it states that an insurance is not provided since risks are not increased by participating in this experiment.

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## Healthy Workplace

### Bewustwording van zitgedrag

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Samen werken aan de gezonde werkplek van de toekomst!

**Informatiebrochure en toestemmingsverklaring voor deelnemers**

Hanzehogeschool Groningen  
Maart 2019

Beste medewerker van de Hanzehogeschool,

De gezondheidsrisico's van kenniswerk worden steeds breder onderkend. Een hoge mentale belasting in combinatie met te veel zitten, te weinig bewegen en te weinig ontspannen, kan (op termijn) leiden tot onderpresteren, medische klachten en uitval door ziekte. Betreft het vele zitten: wij Nederlanders zijn Europees kampioen zitten. Recente cijfers laten zien dat de gemiddelde Nederlander per dag gemiddeld 8,5 uur zit. Zitten wordt gezien als het nieuwe roken. Vanuit de wetenschap komt steeds meer inzicht dat langdurig zitten schadelijk is voor de gezondheid, ook al voldoet men aan de beweegnorm van vijf keer per week minimaal een half uur matig intensieve lichaamsbeweging.

### **De achterliggende gedachte achter dit experiment**

De verwachting is dat veel mensen zich niet bewust zijn van hun zitgedrag. Het experiment moet duidelijk maken of er daadwerkelijk een verschil is tussen verwachte en actuele zittijd. Het experiment moet bijdragen aan de bewustwording van zitgedrag.

### **Wat levert deelname voor u op?**

Een inzicht in uw werkelijke zitgedrag. Na deelname van het experiment ontvangt u individueel informatie over uw zitgedrag tijdens werktijd. Dit inzicht kan invloed hebben op uw motivatie en leiden tot verandering van gezondheidsgedrag.

### **Wat verwachten we van jou?**

Voor dit experiment is het belangrijk dat u gedurende drie weken elke werkdag de VitaBit sensor bij u draagt. U kunt elke werkdag meedoen aan dit experiment, ongeacht uw werklocatie. Dus ook wanneer u vanuit een andere werkplek werkt als Kenniscentrum NoorderRuimte, of als u vanuit huis werkt, kunt u de sensor dragen. Het wordt aangeraden deze in het muntzakje van uw broek te dragen. Mocht u deze niet hebben dan kan het ook in uw broekzak of middels een kledingsticker. Mocht u de sensor in uw broekzak dragen, bevestig deze dan met een magneetje zodat de sensor niet vrij beweegt in de broekzak. De VitaBit sensor ontvangt u van de onderzoeker. Deelname is vrijwillig en terugtrekken is op elk moment mogelijk zonder dat opgaaf van reden vereist is.

Gedurende het onderzoek worden de volgende aspecten verwacht bij deelname:

- Dat u elke werkdag tijdens werkdagen de VitaBit sensor bij u draagt.
- Dat u de bijbehorende VitaBit app installeert.
- Dat u de gegevens van de sensor aan het eind van uw laatste werkdag tijdens week 1 en 2 synchroniseert in de VitaBit app. Dit doet u door de app te openen, Bluetooth aan te zetten en in nabijheid van de sensor de pagina van de app naar beneden sleept.
- Dat u zowel voor als na het experiment een survey invult. Deze survey wordt u per mail toegestuurd.
- Dat u tijdens het experiment, de eerste twee weken een dagboekje invult. Deze ontvangt u samen met de VitaBit.
-

**Wat gebeurt er met uw data?**

Voor de data die uit de VitaBit komt ga je akkoord met de voorwaarden van VitaBit. Deze voorwaarden vallen buiten onze verantwoordelijkheden. De data wordt anoniem verwerkt door de onderzoeker van de IWP Healthy Workplace. De anonieme data kan worden gebruikt voor wetenschappelijk onderzoek of voor blogs op de Healthy Workplace website.

**Vrijwillige deelname**

U beslist zelf om mee te doen aan het project. Deelname is vrijwillig. U kunt op elk moment uw deelname stoppen, ook tijdens het project en zonder opgave van reden.

**Verzekering**

Voor het onderzoek is geen extra proefpersonenverzekering afgesloten omdat het onderzoek geen extra risico's met zich meebrengt.

**Ondertekening toestemmingsverklaring**

Als u besluit mee te werken aan dit onderzoek vragen wij u het bijgevoegd formulier te ondertekenen. Door ondertekening van deze zogenoemde toestemmingsverklaring, geeft u aan voldoende geïnformeerd te zijn om een beslissing te nemen, aan het project te willen deelnemen en in te stemmen met deelname aan het onderzoek. Eén van de projectleiders zal het formulier ook ondertekenen en daarmee bevestigen dat de projectleiders je voldoende geïnformeerd hebben over dit project en het onderzoek, en dat de projectleiders bereid zijn om verdere vragen met betrekking tot het project en het onderzoek te beantwoorden.

**Nadere informatie**

Mocht u na het lezen van deze brochure, voor of tijdens het experiment nog nadere informatie willen ontvangen dan kunt u contact opnemen met de projectleiders van het onderzoek. Contactgegevens vindt u onderaan deze brief.

Wij hopen u voldoende te hebben geïnformeerd en hopen dat u bereid bent om aan dit project en onderzoek deel te nemen.

Veroline Brouwer, Hanzehogeschool Groningen  
Junior onderzoeker IWP Healthy Workplace  
Tel: 0646482818  
Email: v.c.brouwer@st.hanze.nl

Justin Timmer, Hanzehogeschool Groningen  
Onderzoeker/Projectleider IWP  
Tel:  
Email: j.l.timmer@pl.hanze.nl

Healthy  
Workplace  
0505952294

**Toestemmingsverklaring**

*IWP Healthy Workplace – VitaBit experiment “bewustwording zitgedrag”.*

Ik heb de email met informatie voor de deelnemers gelezen en heb de mogelijkheid gehad om aanvullende vragen stellen. Mijn vragen zijn voldoende beantwoord.

Ik had genoeg tijd om te beslissen of ik meedoe. Ik weet dat meedoen helemaal vrijwillig is. Ik weet dat ik op ieder moment kan beslissen om toch niet mee te doen. Daarvoor hoef ik geen reden te geven.

Ik weet dat de data verkregen tijdens dit experiment anoniem verwerkt wordt door de onderzoeker van de IWP Healthy Workplace. Ik geef toestemming dat de data verkregen met de VitaBit, een inzicht in mijn zitgedrag, gebruikt worden voor het doel (het meten van zitgedrag en de bewustwording van zitgedrag) van dit onderzoek. Ik geef toestemming om gegevens nog maximaal 5 jaar na afloop van dit onderzoek te bewaren voor nadere analyse.

Ik ben mij er van bewust dat ik een VitaBit sensor leen van de onderzoeker. Ik ga hier voorzichtig mee om en lever deze na afloop van het onderzoek in bij de onderzoeker. Ik lever de VitaBit uiterlijk 25 april in bij de onderzoeker.

Ik vind het goed om aan dit project en onderzoek mee te doen.

Naam deelnemer:

Datum : \_\_ / \_\_ / \_\_

Handtekening:

-----

Ik verklaar hierbij dat ik deze deelnemer volledig heb geïnformeerd over het genoemde project en onderzoek.

Als er tijdens het project en onderzoek informatie bekend wordt die de toestemming van de deelnemer zou kunnen beïnvloeden, dan breng ik hem/haar daarvan tijdig op de hoogte.

Naam onderzoeker (of diens vertegenwoordiger):

Datum: \_\_ / \_\_ / \_\_

Handtekening:

### A.8 Additional experiment instructions and diary

The following instructions were handed out to participants as additional instructions for the experiment together with the consent form and the diary. The VitaBit app was installed and logged into together with the participants but instructions were given just in case something happened and the participant would be logged out. Together with these instructions each participant received an individual username and password to log into the app.

#### **Verdere instructies experiment bewustwording van zitgedrag:**

- Installeer de VitaBit app
- Log in met uw inloggegevens
- Aan het eind van uw laatste werkdag in zowel week 1 als week 2 kunt u uw gegevens in de app synchroniseren (door het scherm naar beneden te slepen). Voor het belang van dit onderzoek is het belangrijk dat u verder geen gebruik maakt van de app en niet uw dagelijkse performance bekijkt.
- De eerste drie vragen van het dagboekje zijn open vragen. Ik verzoek u om de tijden zo nauwkeurig mogelijk in te vullen. U mag uw pauzes mee tellen als werktijd. U mag dit indelen in uren en kwartieren (bijvoorbeeld: 8,75 uur gewerkt, 6,5 uur zitten, 2,25 uur staan).
- De laatste drie vragen zijn meerkeuze vragen.
- Indien u op-/aanmerkingen of bijzonderheden heeft over uw werkdag, u bent bijvoorbeeld veel onderweg geweest met de auto. Dan wordt u verzocht om dit als opmerking te noteren onder de laatste vraag van die betreffende dag.

A diary was developed in which the participants of the experiment could fill in their workdays, work times and additional information about their work day. The Figure below shows the front page of the diary.



The image shows the front page of an experiment diary. At the top, the title "EXPERIMENT DAGBOEK" is centered in a rounded rectangle. Below the title, a paragraph explains that the diary is a daily questionnaire as part of the experiment, used for awareness of sitting behavior, and that it should be filled out on weekdays. A line is provided for the participant to write their name. At the bottom, there is a logo for "Healthy WORKPLACE" featuring three stylized figures.

EXPERIMENT DAGBOEK

Dit dagboek is een dagelijkse vragenlijst als onderdeel van uw deelname aan het experiment "bewustwording van zitgedrag". Invullen van dit dagboek is alleen nodig op werkdagen waarop u de VitaBit heeft gedragen.

Dit dagboek is van:

Healthy  
WORKPLACE

Figure A.8.1. Front page of experiment diary.

Figure A.8.2 shows the inside of the diary. Each diary contained five of these pages, a total of ten days to fill in. The decision for ten days was made since, during the third week of the experiment participants were allowed to look at their sedentary behaviour in the app and therefore asking for an estimated sitting and standing time would not make sense.

Additional instructions were given to fill in the start and end time of the work day (at the first question in the diary) so the working times could be contracted from the data. Since the data was gathered for three weeks and the diary had ten days to fill in, participants were later asked to state their workdays in the third week on the back of the journal, only the date, start and end time of each workday.

<u>Alle vragen gaan over uw werkdag:</u>		Datum:
Hoeveel uur heeft u vandaag gewerkt?		
Hoeveel uur denkt u dat u vandaag heeft gezeten?		
Hoeveel uur denkt u dat u vandaag heeft gestaan?		
Welk type werkplek had u vandaag?	<input type="radio"/> Zit/sta bureau	<input type="radio"/> Geen zit/sta bureau
Welke activiteit(en) heeft u vandaag voornamelijk op uw werk uitgevoerd?	<input type="radio"/> Computer werk	<input type="radio"/> Overleg <input type="radio"/> (Video)bellen
Indien u overleg heeft gehad, hoe was dit overleg?	<input type="radio"/> Zittend	<input type="radio"/> Staand

<u>Alle vragen gaan over uw werkdag:</u>		Datum:
Hoeveel uur heeft u vandaag gewerkt?		
Hoeveel uur denkt u dat u vandaag heeft gezeten?		
Hoeveel uur denkt u dat u vandaag heeft gestaan?		
Welk type werkplek had u vandaag?	<input type="radio"/> Zit/sta bureau	<input type="radio"/> Geen zit/sta bureau
Welke activiteit(en) heeft u vandaag voornamelijk op uw werk uitgevoerd?	<input type="radio"/> Computer werk	<input type="radio"/> Overleg <input type="radio"/> (Video)bellen
Indien u overleg heeft gehad, hoe was dit overleg?	<input type="radio"/> Zittend	<input type="radio"/> Staand

Figure A.8.2. Page of experiment diary.

## A.9 Start email

This email was sent to participants at the first day of the experiment. Oral instructions were given to each individual participant during the distribution of the VitaBits and diaries. The most important instructions were repeated in this message as a reminder.

Beste deelnemer,

Indien u vandaag werkt, is vandaag uw eerste dag van het experiment *bewustwording van zitgedrag*! Ik wil u graag nog een keer wijzen op de volgende punten:

### Installatie:

- Zorg dat u de VitaBit app heeft geïnstalleerd op uw mobiel en dat deze is gekoppeld aan uw account en VitaBit sensor.
- Wilt u vandaag nog controleren of u de juiste versie van de app heeft? Klik in de app op "device", bij firmware zou 011f moeten staan.
- Gebruik de app verder niet, enkel aan het eind van uw laatste werkdag van week 1 en 2 om eenmalig de data te synchroniseren. Sleep hiervoor het scherm in de app naar beneden maar bekijk de dagelijkse performance niet.

### Dragen:

- Draag de VitaBit sensor in het muntzakje van uw broekzak of bevestig deze in uw broekzak middels het bijgeleverde magneetje, dit voorkomt beweging in de broekzak.
- Leg de sensor op een plek waar u hem 's ochtends niet vergeet te dragen.
- Draag de sensor zodra u begint met werken. Indien u voor uw werk moet reizen kunt u de sensor ook tijdens de reistijd dragen, noteer dan in het dagboekje dat u moest reizen als.
- **Vergeet de sensor niet uit uw broek te halen voor u uw kleding in de wasmachine doet!**

### Dagboekje:

- De eerste drie vragen van het dagboekje zijn open vragen.
  - Vraag 1: graag de start en eindtijd van de werkdag opschrijven (bijvoorbeeld 09:00-18:00). Dagelijkse reistijd van uw huis naar uw werkplek telt niet meer, reistijd die u maakt voor uw werk (bijvoorbeeld overleg op locatie) telt wel mee als werktijd.
  - Vraag 2+3: Vul het zo nauwkeurig mogelijk in. Pauzes tellen mee. Invullen per uren en kwartieren (bijvoorbeeld: 6,75 uur zitten, 2,25 uur staan).
- Op-/aanmerkingen of bijzonderheden over uw werkdag (u bent bijvoorbeeld veel onderweg geweest met de auto), kunt u als opmerking onder de laatste vraag van die betreffende dag opschrijven.

Mocht u nog vragen hebben of ervaart u problemen met de sensor, dan kunt u mij bereiken via:  
Tel: 0646482818 E-mail: v.c.brouwer@st.hanze.nl

Vriendelijke groet,

Veroline Brouwer  
Student international facility management  
Afstudeerder binnen IWP Healthy Workplace, NoorderRuimte



### A.10 Results week 1 email

This email was sent after analysing the data of the first week of the experiment. The data gathered on each workday between 09:00 – 17:00 was analysed since actual workdays and times were still unknown at this stage since the diaries were still with the participants. Where possible, the email was sent at the beginning of the first day of week two (April 8).

Beste deelnemer,

De eerste week van het experiment is voorbij. De eerste data set toont het volgende aan met betrekking tot uw zitgedrag tijdens reguliere werktijden:

Datum	Uren gezeten
1 april	-
2 april	-
3 april	-
4 april	-
5 april	-

Het aantal zituren is afgerond op halve uren. Aangezien de werktijden en -dagen nog niet uit het dagboekje gehaald kunnen worden, gaan bovenstaande resultaten op de zittijd gemeten tussen 09:00 – 17:00 en zal wellicht niet uw complete werkdag weerspiegelen.

Om de meest betrouwbare data te krijgen is het belangrijk dat de sensor elke ochtend kan kalibreren. Dit doet de sensor automatisch wanneer u een minuut loopt direct na het plaatsen van de sensor in uw broekzak.

Succes tijdens de 2e week!

Vriendelijke groet,

Veroline Brouwer  
Student international facility management  
Afstudeerder binnen IWP Healthy Workplace, NoorderRuimte

### A.11 Instructions week 3 email

This email was sent at April 12, the end of week two of the experiment. Instructions were provided for the third week of the experiment, in which participants were asked to look into the VitaBit app every workday and note their workdays and times at the back of the journal or to share these with the researcher at a later stage.

Beste deelnemer,

Vandaag is het einde van de 2<sup>e</sup> week van het experiment bewustwording van zitgedrag. Vergeet u niet de app te synchroniseren? Let alstublieft bij de synchronisatie op dat de app bij "last update" zowel bij "server" als "tracker" de datum van vandaag aangeeft.

Tijdens de derde (tevens laatste) week van het experiment hoeft u alleen uw dagelijkse werktijden bij te houden en deze achteraf met mij delen (dit mag per mail of op de achterkant van het dagboekje bijvoorbeeld).

Daarnaast verzoek ik u om tijdens de laatste week, elke werkdag minstens 1 keer in de app te kijken naar uw resultaten van die dag. Op welk moment u hiernaar kijkt mag u zelf weten. U mag ook vaker dan 1 keer per dag kijken maar dit is geen verplichting.

Succes tijdens de laatste week!

Vriendelijke groet,

Veroline Brouwer  
Student international facility management  
Afstudeerder binnen IWP Healthy Workplace, NoorderRuimte

### A.12 Results week 2 email

This email was sent after analysing the data of the second week of the experiment. The data gathered on each workday between 09:00 – 17:00 was analysed since actual workdays and times were still unknown at this stage since the diaries were still with the participants. Where possible, the email was sent at the beginning of the first day of week two (April 15).

Beste deelnemer,

Vandaag begint de laatste week van het experiment bewustwording van zitgedrag.

De data van week twee toont het volgende aan met betrekking tot uw zitgedrag tijdens reguliere werktijden (09:00-17:00):

Datum	Uren gezeten
8 april	-
9 april	-
10 april	-
11 april	-
12 april	-

Vanaf nu hoeft u uw dagboekje niet meer bij te houden. Wel wil ik u vragen nog uw dagelijkse werktijden bij te houden zodat u mij deze achteraf kan laten weten (dit mag per mail, of op de achterkant van het dagboekje).

Daarnaast verzoek ik u om deze week elke werkdag minstens 1 keer in de app te kijken naar uw resultaten van die dag. Op welk moment u hier naar kijkt mag u zelf weten. U mag ook vaker dan 1 keer per dag kijken maar dit is geen verplichting.

Succes tijdens de laatste week!

Vriendelijke groet,

Veroline Brouwer  
Student international facility management  
Afstudeerder binnen IWP Healthy Workplace, NoorderRuimte

### A.13 End of experiment email

This email was sent at the end of the experiment, on April 18. Participants were asked to carefully synchronise all their data with the VitaBit app and to make an appointment to pick up the VitaBit tracker. Furthermore the participants were informed that their data based on the workdays written down in the diary would be analysed and shared with them and that one final survey would follow after sharing these results.

Beste deelnemer,

In verband met met Goede Vrijdag is vandaag de laatste dag van het experiment bewustwording van zitgedrag. Bent u al net zo benieuwd naar de resultaten als ik?

Ik verzoek u om aan het eind van vandaag nogmaals goed uw gegevens te synchroniseren in de VitaBit app. Soms moet u uw scherm meerdere malen naar beneden slepen om de data goed te synchroniseren. Wanneer u uw scherm naar beneden sleept ziet u staan "last update - server" en "last update tracker". De datum achter zowel server als tracker moet op 04-18 staan.

Graag wil ik een afspraak met u maken om volgende week dinsdag of woensdag uw VitaBit + doosje en uw dagboekje op te halen. Kunt u mij laten weten of u volgende week dinsdag of woensdag op de Hanzehogeschool aanwezig bent en wat voor u een geschikt moment is om de VitaBit en het dagboekje op te halen?

Op basis van het dagboekje volgt een nieuwe analyse van uw zitgedrag tijdens uw werktijden. Deze ontvangt u eind volgende week of in het begin van de meivakantie. Na ontvangst van het rapport zult u nog 1 enquête ontvangen, ik verzoek u om deze voor 8 mei in te vullen.

Vriendelijke groet,

Veroline Brouwer  
Student international facility management  
Afstudeerder binnen IWP Healthy Workplace, NoorderRuimte

#### A.14 Experiment results email

This email was sent at the end of the experiment, after analysing data of each individual's working days and times. An overview was provided with the hours worked on a specific workday, estimated time spent seated and standing as filled in in the diary, and actual time spent seated, standing and walking as measured by the VitaBit.

Beste deelnemer,

De data van uw VitaBit is geanalyseerd en toont het volgende m.b.t. uw werkdagen:

Datum	Uren gewerkt	Geschatte zittijd	Gemeten zittijd	Geschatte sta-tijd	Gemeten sta-tijd	Gemeten looptijd
Week 1						
1 april	-	-	-	-	-	-
2 april	-	-	-	-	-	-
3 april	-	-	-	-	-	-
4 april	-	-	-	-	-	-
5 april	-	-	-	-	-	-
Week 2						
8 april	-	-	-	-	-	-
9 april	-	-	-	-	-	-
10 april	-	-	-	-	-	-
11 april	-	-	-	-	-	-
12 april	-	-	-	-	-	-
Week 3						
15 april	-	N.V.T.	-	N.V.T.	-	-
16 april	-		-		-	-
17 april	-		-		-	-
18 april	-		-		-	-

De bovenstaande tijden zijn in uren en afgerond op kwartieren. Wanneer er een dag niet is gewerkt is dit ingevuld met "-". Wanneer data niet is gemeten is er een "X" ingevuld. In enkele gevallen is er niet de hele werkdag data gemeten, hierdoor kan er een verschil zijn tussen de totale gewerkte tijd en de totale gemeten tijd.

Ik ben benieuwd wat u van de resultaten vindt en of het dragen van de VitaBit en deze resultaten invloed hebben gehad op de bewustwording van uw zitgedrag. Er zal nog een laatste enquête worden verstuurd om hier een inzicht in te krijgen. Ik verzoek u vriendelijk om deze uiterlijk 8 mei in te vullen.

Nogmaals bedankt voor het deelnemen aan het experiment.

Vriendelijke groet,

Veroline Brouwer  
Student international facility management  
Afstudeerder binnen IWP Healthy Workplace, NoorderRuimte

### A.15 Generalisability of Kenniscentrum NoorderRuimte

The experiment about awareness of sedentary behaviour was held at Kenniscentrum NoorderRuimte, the Research Centre for Built Environment at the Hanze University of Applied Sciences. Kenniscentrum NoorderRuimte (KCNR) is one of the three knowledge centres of the Hanze University of Applied Sciences (HUAS) and has a diverse group of people connected to it. Hanzehogeschool Groningen (n.d.-a) states that it is a place where lecturers, (lecturer) researchers, students and professionals from the field work together on research.

According to the Management Assistant of Kenniscentrum NoorderRuimte, Saskia Wiepkema, there are approximately 80 lecturers, knowledge workers and permanent staff connected to KCNR at this moment and 60 students/junior researchers. Many lecturers and knowledge workers connected to KCNR only work part-time for KCNR because they are project coach, researcher, or member of a lectorate.

The following six lectorates are connected to KCNR (Hanzehogeschool Groningen, n.d.-d):

- Aardbevestigingsbestendig en kansrijk Groningen
- Facility Management
- Leefomgeving in Transitie
- Ruimtelijke Transformaties - Energie
- Ruimtelijke Transformaties – Water
- Vastgoed

The HUAS annual report (Hanzehogeschool Groningen, 2017b) states that there are 18 schools of which the following five schools are connected to KCNR:

- Academie voor Architectuur, Bouwkunde & Civiele Techniek
- Academie voor Beeldende Kunst, Vormgeving en Popcultuur Minerva
- Instituut voor Bedrijfskunde
- Instituut voor Engineering
- Instituut voor Facility Management

These six schools together host 29 education programs.

The HUAS annual report (Hanzehogeschool Groningen, 2017b) states that at the end of 2017, there were 3,323 employees employed by HUAS. Of all the jobs, 79% were permanent jobs. Of all the employees, 43% are male and 57% are female (Hanzehogeschool Groningen, 2017b). The division of the participants in the experiment is 39% male and 61% female. According to a privately shared document provided by the HR department of the HUAS (Hanzehogeschool 2019), at the moment of writing, there are 3382 employees. The HUAS has put all functions of employees below two main functions being lecturing staff (OP, currently 1984 people) and supporting staff (OBP, currently 1398 people). The information shared and the information of the participants in the experiment is outlined table A.15, outlined below. Under the Hanze Figures one will see the total number of employees within that age category, followed by the percentage of employees within that same category and lastly the percentage of the total employees. Under the

experiment group one will see the total number of participants within that age category, followed by the percentage within that group and lastly the percentage of these people in the total participant group.

Table A.15. Age categories per function.

	OP						OBP					
	HUAS figures			Experiment group			HUAS figures			Experiment group		
<b>18-29</b>	103	5%	<b>3%</b>	0	0%	<b>0%</b>	223	16%	<b>7%</b>	2	33%	<b>9%</b>
<b>30-39</b>	433	22%	<b>13%</b>	0	0%	<b>0%</b>	203	15%	<b>6%</b>	1	17%	<b>4%</b>
<b>40-49</b>	527	27%	<b>16%</b>	4	44%	<b>17%</b>	379	27%	<b>11%</b>	1	17%	<b>4%</b>
<b>50+</b>	921	46%	<b>27%</b>	5	56%	<b>22%</b>	593	42%	<b>18%</b>	2	33%	<b>9%</b>
<b>Total</b>	1984	100%	<b>59%</b>	9	100%	<b>39%</b>	1398	100%	<b>41%</b>	6	100%	<b>26%</b>

Comparing the total percentages per function group, there are some differences between the HUAS Figures and the experiment group. This is partly due to the fact that participating in the experiment include lecturing staff, supporting staff and junior researchers. Junior researchers are students doing research for KCNR. Some part-time others fulltime. According to the HUAS annual report (2017), there are 29,087 students attending HUAS. Since the annual report is from 2017, the numbers may be slightly different. Healthy ageing is of great importance to the HUAS, but who says this should be limited to staff? It is healthy ageing as an organisation, a community. Therefore the junior researchers took part in the experiment this allows the researcher to give an advice to the HUAS concerning sedentary behaviour of all people working within the HUAS.

The strategic plan of the Hanzehogeschool Groningen (2016) mentions that in 2015, there were 220 lecturer researchers. The strategic plan of the HUAS states that the society asks to turn knowledge from fundamental research into innovation in professional practice. According to the strategic plan of the Hanzehogeschool Groningen (2016), they want to achieve this by creating a learning community in the form of a innovation workplace. In 2020, every students has to at least participate once in a innovation workplace during their study. Furthermore, in 2020, every school has to be involved in an initiative to connect education, research and professional practice. The strategic plan of the Hanzehogeschool Groningen (2016) also states the importance of working with lecturer researchers to achieve their plans since the lecturer researchers connect research with professional practice. From this one can state that good innovation workplaces and knowledge centres are important to the HUAS and thus creating a good, pleasant and healthy workplace there is important to keep people satisfied and healthy.

To conclude, knowing the importance of the innovation workplaces, KCNR is a good target group to do an experiment with. Looking at the people connected to KCNR, it is a diverse group with staff connected to different schools and departments within the HUAS. It is not unlikely that there are different working habits per school and thus the results of the experiment will be more generalisable if the experiment is held at KCNR, a place with lecturers from different and diverse schools. This will make the result more generalisable for the entire HUAS instead of having an experiment at one specific school. Participants of the experiment are both OP and OBP. Comparing the division of gender of staff and participants, it is very similar. The age groups are

not completely corresponding but can still provide good information to give an advise to HUAS. Overall one can conclude that the participants of the experiment is a diverse group and can represent HUAS staff, allowing the researcher to generalise the results of the experiment for the entire group. However, it is not 100% generalisable and this is partly due to the small group of participants in the experiment.



## A.16 Data of the experiment

The following data was gathered with the experiment. The text in black is the data measured and retrieved from the VitaBit, the text in blue is retrieved from the diary of participants and the text in grey is the calculated difference between total measured time and total hours worked in order to removed data with a difference of more than two hours due to inaccuracy. The complete raw dataset can be delivered upon request.

Table A.16. Data gathered with the VitaBit.

Participant/date	Hours worked	Estimated time sitting	Measured time sitting	Estimated time standing	Measured time standing	Measured time walking	Total measured time	Hours worked	Difference time measured and hours worked
<b>BNR1</b>									
Week 1	20	18.25	15.5	1.75	2.5	2	20	20	0
2-4	7	6	5.75	1	0.5	0.75	7	7	0
3-4	6	5.75	5.25	0.25	0.25	0.5	6	6	0
4-4	7	6.5	4.5	0.5	1.75	0.75	7	7	0
Week 2	18	13.5	8.5	4.5	6.25	2.75	17.5	18	0.5
10-4	6	5.5	3.25	0.5	2	0.75	6	6	0
12-4	12	8	5.25	4	4.25	2	11.5	12	0.5
Week 3	17.25		12		2	2.5	16.5	17.25	0.75
16-4	7.25	N.A.	5	N.A.	0.5	1.5	7	7.25	0.25
17-4	10	N.A.	7	N.A.	1.5	1	9.5	10	0.5
<b>BNR23</b>									
Week 1	10	8.75	3.75	0.5	4.5	0.75	9	10	1
3-4	8.75	7.5	3.5	0.5	4.5	0.75	8.75	8.75	0
4-4	1.25	1.25	0.25	0	0	0	0.25	1.25	1
Week 2	23.5	20	15	2.5	5.25	2.25	22.5	23.5	1
9-4	7	6.5	4.5	0	1.75	0.5	6.75	7	0.25
10-4	8.5	7.5	5.75	0.5	1.75	0.75	8.25	8.5	0.25
11-4	8	6	4.75	2	1.75	1	7.5	8	0.5
Week 3	15		9.25		4.5	1.25	15	15	0
17-4	11.75	N.A.	7	N.A.	3.5	1.25	11.75	11.75	0

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	18-4	3.25	N.A.	2.25	N.A.	1	0	3.25	3.25	0
BNR2										
Week 1		21	14	17.5	7	2	1.25	20.75	21	0.25
	2-4	6	4	4	2	1.5	0.5	6	6	0
	3-4	8	5	7	3	0.25	0.5	7.75	8	0.25
	4-4	7	5	6.5	2	0.25	0.25	7	7	0
Week 2		14	10	10.75	4	1.5	1.5	13.75	14	0.25
	8-4	6	4	4.75	2	0.5	0.75	6	6	0
	9-4	8	6	6	2	1	0.75	7.75	8	0.25
Week 3		22		16		3.25	1.75	21	22	1
	15-4	8	N.A.	4.75	N.A.	1.5	0.75	7	8	1
	16-4	8	N.A.	6.5	N.A.	0.5	1	8	8	0
	17-4	6	N.A.	4.75	N.A.	1.25	0	6	6	0
BNR21										
Week 1		27.25	20.25	11.75	7	11.25	3.25	26.25	27.25	1
	2-4	5	4	2	1	2.5	0.5	5	5	0
	3-4	7.25	4.25	1.5	3	5	0.75	7.25	7.25	0
	4-4	7.5	5.5	4.5	2	1.5	1.5	7.5	7.5	0
	5-4	7.5	6.5	3.75	1	2.25	0.5	6.5	7.5	1
Week 2		28	23.75	19.5	4.5	6.25	2.25	28	28	0
	8-4	5.5	4.5	2.5	1	1.75	0.75	5	5.5	0.5
	9-4	7.5	6.5	5.25	1	2	0.75	8	7.5	-0.5
	10-4	2	1.75	2	0	0	0	2	2	0
	11-4	9	7.5	6.75	1.5	1.75	0.5	9	9	0
	12-4	4	3.5	3	1	0.75	0.25	4	4	0
Week 3		14.5		9.5		3	1.75	14.25	14.5	0.25
	15-4	7	N.A.	5	N.A.	1	0.75	6.75	7	0.25
	17-4	4.5	N.A.	2.75	N.A.	1.25	0.5	4.5	4.5	0
	18-4	3	N.A.	1.75	N.A.	0.75	0.5	3	3	0
BNR19										
Week 1		34	28.5	26.75	5.5	4.5	2.5	33.75	34	0.25
	2-4	8	6	5.75	2	2	1	8.75	8	-0.75
	3-4	10	9	8.25	1	0.75	0.5	9.5	10	0.5
	4-4	9	7.5	6.25	1.5	1.5	1	8.75	9	0.25
	5-4	7	6	6.5	1	0.25	0	6.75	7	0.25
Week 2		45	31.5	27.25	13.5	14.5	3	44.75	45	0.25
	8-4	8	6.5	6	1.5	2	0.5	8.5	8	-0.5
	9-4	10	7	5.25	3	2.75	0.75	8.75	10	1.25
	10-4	9	5	5.75	4	2.5	0.5	8.75	9	0.25
	11-4	8	6	5.75	2	2	0.75	8.5	8	-0.5
	12-4	10	7	4.5	3	5.25	0.5	10.25	10	-0.25
Week 3		38		29.75		4.5	2.5	36.75	38	1.25
	15-4	10.5	N.A.	7.75	N.A.	1.75	0.75	10.25	10.5	0.25

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	16-4	8	N.A.	6.75	N.A.	0.5	0.5	7.75	8	0.25
	17-4	11	N.A.	8.75	N.A.	1.5	0.75	11	11	0
	18-4	8.5	N.A.	6.5	N.A.	0.75	0.5	7.75	8.5	0.75
BNR15										
Week 1		37.75	29.5	23.25	1	10.75	2.5	36.5	37.75	1.25
	1-4	8.5	7	5.5	0.5	0.75	0.75	7	8.5	1.5
	2-4	7.25	5	5.5	0.5	1	0.75	7.25	7.25	0
	3-4	9.5	9	3.5	0	6	0.25	9.75	9.5	-0.25
	4-4	10	8.5	7.75	0	1.5	0.75	10	10	0
	5-4	2.5	?	1	0	1.5	0	2.5	2.5	0
Week 2		40.75	33	26.25	0	10.75	4.5	41.5	40.75	-0.75
	8-4	9.25	8	1.25	0	6	0.25	7.5	9.25	1.75
	9-4	8.5	7	5.25	0	1.75	1.25	8.25	8.5	0.25
	10-4	7.25	6.5	7.5	0	0.75	1	9.25	7.25	-2
	11-4	6.5	5.5	5.75	0	0.25	0.5	6.5	6.5	0
	12-4	9.25	6	6.5	0	2	1.5	10	9.25	-0.75
Week 3		34		14.75		17	2	33.75	34	0.25
	15-4	8.5	N.A.	2.5	N.A.	5.75	0.25	8.5	8.5	0
	16-4	9	N.A.	6	N.A.	2.25	0.75	9	9	0
	17-4	8.25	N.A.	2.5	N.A.	5.25	0.25	8	8.25	0.25
	18-4	8.25	N.A.	3.75	N.A.	3.75	0.75	8.25	8.25	0
BNR11										
Week 1		46	33.5	26.5	6	10.75	6.25	43.5	46	2.5
	1-4	9	7.5	6.75	0.5	1.5	0.75	9	9	0
	2-4	9.5	8	7.5	0.5	1	1.25	9.75	9.5	-0.25
	3-4	9	7	5.25	0.5	1	1	7.25	9	1.75
	4-4	8.5	6	3	1.5	4	1.25	8.25	8.5	0.25
	5-4	10	5	4	3	3.25	2	9.25	10	0.75
Week 2		50.5	36	26.5	6	15.25	6.5	48.25	50.5	2.25
	8-4	8.25	6	5.25	1	2	1	8.25	8.25	0
	9-4	8.25	4	3.25	2	3	2	8.25	8.25	0
	10-4	11.5	8	6.25	1	3	1.5	10.75	11.5	0.75
	11-4	11	9	6.75	1	2	0.75	9.5	11	1.5
	12-4	11.5	9	5	1	5.25	1.25	11.5	11.5	0
Week 3		19.5		13.25		2.25	2.25	17.75	19.5	1.75
	15-4	8.75	N.A.	6.75	N.A.	1.25	0.75	8.75	8.75	0
	16-4	4.5	N.A.	3.25	N.A.	0.75	0.5	4.5	4.5	0
	18-4	6.25	N.A.	3.25	N.A.	0.25	1	4.5	6.25	1.75
BNR3										
Week 1		33.25	23.75	23.75	7	6.5	3	33.25	33.25	0
	1-4	8.5	6	5.5	2.5	2.25	0.75	8.5	8.5	0
	2-4	8.5	7	7	0	0.5	1	8.5	8.5	0
	3-4	7.75	6.75	5.75	0.5	1.25	0.75	7.75	7.75	0

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	4-4	8.5	4		5.5	4	2.5	0.5	8.5	8.5	0
Week 2		16.25	12		12.5	4	2.75	1.25	16.5	16.25	-0.25
	8-4	8.5	5		5.5	3	2.25	1	8.75	8.5	-0.25
	9-4	7.75	7		7	1	0.5	0.25	7.75	7.75	0
Week 3		33.25			23.5		7.25	2.5	33.25	33.25	0
	15-4	8.25	N.A.		5.25	N.A.	2.5	0.5	8.25	8.25	0
	16-4	8.25	N.A.		6.75	N.A.	1.25	0.25	8.25	8.25	0
	17-4	8.25	N.A.		6.5	N.A.	1	0.75	8.25	8.25	0
	18-4	8.5	N.A.		5	N.A.	2.5	1	8.5	8.5	0
BNR18											
Week 1		12.25	7		8.25	3	1.5	2.75	12.5	12.25	-0.25
	1-4	4.25	2		3	2	0.5	0.5	4	4.25	0.25
	2-4	6	3		3.75	1	0.5	2	6.25	6	-0.25
	3-4	1	1		0.5	0	0.5	0.25	1.25	1	-0.25
	4-4	1	1		1	0	0	0	1	1	0
Week 2		19.75	15		10.5	4.75	6.75	2.75	20	19.75	-0.25
	8-4	2	1.5		1.75	0.5	0.25	0	2	2	0
	9-4	6.25	5		2.75	1.25	3	0.5	6.25	6.25	0
	10-4	7.25	5		4.5	2.25	1	1.75	7.25	7.25	0
	11-4	4.25	3.5		1.5	0.75	2.5	0.5	4.5	4.25	-0.25
Week 3		8			5		1.5	1.5	8	8	0
	16-4	4	N.A.		2.5	N.A.	0.5	1	4	4	0
	18-4	4	N.A.		2.5	N.A.	1	0.5	4	4	0
BNR4											
Week 1		31	26.75		18.75	3.25	9.5	2.5	30.75	31	0.25
	1-4	8.5	8		5	0.25	3	0.5	8.5	8.5	0
	2-4	7	6		3	0.25	3.5	0.5	7	7	0
	4-4	7.5	6.75		4.5	0.75	1.75	1	7.25	7.5	0.25
	5-4	8	6		6.25	2	1.25	0.5	8	8	0
Week 2		28	22.5		19.5	5.5	5	3	27.5	28	0.5
	8-4	8	6		5.25	2	2	0.5	7.75	8	0.25
	9-4	4.5	4		2.5	0.5	1	0.5	4	4.5	0.5
	10-4	8	7.5		7.25	0.5	0.5	0.5	8.25	8	-0.25
	11-4	7.5	5		4.5	2.5	1.5	1.5	7.5	7.5	0
Week 3		27.5			21.25		2.75	3.5	27.5	27.5	0
	15-4	8	N.A.		6.25	N.A.	0.75	0.5	7.5	8	0.5
	16-4	9	N.A.		6.75	N.A.	1	1.5	9.25	9	-0.25
	17-4	5.5	N.A.		4.25	N.A.	0.75	0.75	5.75	5.5	-0.25
	18-4	5	N.A.		4	N.A.	0.25	0.75	5	5	0
BNR9											
Week 1		33	23.5		20.5	5	5.75	4.75	31	33	2
	1-4	8	6		4.75	0.5	0.5	1.25	6.5	8	1.5
	2-4	8.5	6.5		5.75	1	1.5	1.25	8.5	8.5	0

	3-4	8.5	6	5.25	2	2	0.75	8	8.5	0.5
	4-4	8	5	4.75	1.5	1.75	1.5	8	8	0
Week 2		38.5	30.5	27.75	3	5.5	5	38.25	38.5	0.25
	8-4	8	5.5	6.5	0.5	0.75	0.75	8	8	0
	9-4	7	6	4.75	0.25	1	0.75	6.5	7	0.5
	10-4	8	7.5	6.5	0.25	0.75	1	8.25	8	-0.25
	11-4	8.5	6.5	6.25	1	1.5	0.75	8.5	8.5	0
	12-4	7	5	3.75	1	1.5	1.75	7	7	0
Week 3		17.5		14		2	1.25	17.25	17.5	0.25
	17-4	8.75	N.A.	6.75	N.A.	1	0.75	8.5	8.75	0.25
	18-4	8.75	N.A.	7.25	N.A.	1	0.5	8.75	8.75	0
BNR16										
Week 1		25.75	21.5	17.5	3	3.25	1.25	22	25.75	3.75
	2-4	8.25	6.5	5	1	1	0.5	6.5	8.25	1.75
	3-4	7.5	6	7	1	0.5	0	7.5	7.5	0
	4-4	10	9	5.5	1	1.75	0.75	8	10	2
Week 2		54.5	38	39.25	11	12.75	2.75	54.75	54.5	-0.25
	8-4	10.5	7	9.75	2	0.5	0.5	10.75	10.5	-0.25
	9-4	11.5	7.5	10.75	2.5	0.5	0.25	11.5	11.5	0
	10-4	11.5	7.5	9.75	2	0.5	0.5	10.75	11.5	0.75
	11-4	11.5	8.5	3.75	2.5	6.75	1	11.5	11.5	0
	12-4	9.5	7.5	5.25	2	4.5	0.5	10.25	9.5	-0.75
Week 3		26.5		16.25		7.5	2	25.75	26.5	0.75
	15-4	8.5	N.A.	5.5	N.A.	2.25	1	8.75	8.5	-0.25
	17-4	9	N.A.	7.25	N.A.	1.25	0.5	9	9	0
	18-4	9	N.A.	3.5	N.A.	4	0.5	8	9	1
BNR6										
Week 1		29.25	25.5	23.25	2	3.5	2.75	29.5	29.25	-0.25
	1-4	8	6.5	6.25	0.5	0.75	1.25	8.25	8	-0.25
	2-4	8.25	7	6.75	0.5	0.75	1	8.5	8.25	-0.25
	3-4	8.5	7.75	6.75	0.75	1.5	0.5	8.75	8.5	-0.25
	5-4	4.5	4.25	3.5	0.25	0.5	0	4	4.5	0.5
Week 2		44	33.5	26	10.5	10.75	7.75	44.5	44	-0.5
	8-4	8	6	5	2	1.75	1.25	8	8	0
	9-4	8	7	6.25	1	0.75	1	8	8	0
	10-4	8	7	5.75	1	1.5	1	8.25	8	-0.25
	11-4	11	8	5.75	3	3.5	1.75	11	11	0
	12-4	9	5.5	3.25	3.5	3.25	2.75	9.25	9	-0.25
Week 3		40.25		25		7.75	7.25	40	40.25	0.25
	15-4	9	N.A.	4.75	N.A.	1.25	2.5	8.5	9	0.5
	16-4	8.75	N.A.	6	N.A.	1.5	1.25	8.75	8.75	0
	17-4	10.5	N.A.	7.25	N.A.	1.25	2.25	10.75	10.5	-0.25
	18-4	12	N.A.	7	N.A.	3.75	1.25	12	12	0

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BNR12										
Week 1		4	1	1.75	0	1.25	1	4	4	0
	4-4	4	1	1.75	0	1.25	1	4	4	0
Week 2		5.5	5.5	4	0	1.25	1	6.25	5.5	-0.75
	8-4	2	2	1	0	0.75	0.25	2	2	0
	9-4	3.5	3.5	3	0	0.5	0.75	4.25	3.5	-0.75
Week 3		25.5		17		4.5	2	23.5	25.5	2
	15-4	4.5	N.A.	2.75	N.A.	0.25	0.25	3.25	4.5	1.25
	16-4	3.75	N.A.	2.5	N.A.	0.75	0.5	3.75	3.75	0
	17-4	11	N.A.	7.75	N.A.	1.75	0.75	10.25	11	0.75
	18-4	6.25	N.A.	4	N.A.	1.75	0.5	6.25	6.25	0
BNR8										
Week 1		14.5	8	4.75	6	5.75	3	13.5	14.5	1
	3-4	7.5	5	2.75	3	2.25	1.5	6.5	7.5	1
	4-4	7	3	2	3	3.5	1.5	7	7	0
Week 2		7	5	1.75	1	3.75	0.5	6	7	1
	8-4	5	4	1.25	1	2.5	0.25	4	5	1
	10-4	2	1	0.5	0	1.25	0.25	2	2	0
Week 3		18		7		10	0.75	17.75	18	0.25
	15-4	8	N.A.	3.75	N.A.	4	0.5	8.25	8	-0.25
	16-4	10	N.A.	3.25	N.A.	6.25	0.5	10	10	0
BNR13										
Week 1		25.5	9.5	15	15.5	7	3	25	25.5	0.5
	2-4	9.5	2	7.5	7	1.25	1	9.75	9.5	-0.25
	4-4	8	4	3.25	4	2.75	1.5	7.5	8	0.5
	5-4	8	3.5	4.25	4.5	3	0.5	7.75	8	0.25
Week 2		22	11.5	10.25	10	8.5	2.5	21.25	22	0.75
	8-4	8	4	2	4	4.5	0.75	7.25	8	0.75
	9-4	6	5	1.75	1	3	1.25	6	6	0
	11-4	8	2.5	6.5	5	1	0.5	8	8	0
Week 3		18.5		6.25		8	1.5	15.75	18.5	2.75
	16-4	9	N.A.	1.75	N.A.	5.25	1	8	9	1
	18-4	9.5	N.A.	4.5	N.A.	2.75	0.5	7.75	9.5	1.75
BNR22										
Week 1		37.25	30.5	29.5	6.5	4.75	3	37.25	37.25	0
	2-4	8	8.5	5	1.5	2	0.75	7.75	8	0.25
	3-4	9.75	5	8.25	0.5	1	1	10.25	9.75	-0.5
	4-4	12.5	12	10.5	2.5	1	0.75	12.25	12.5	0.25
	5-4	7	5	5.75	2	0.75	0.5	7	7	0
Week 2		22.5	19	13.5	3	5	3.5	22	22.5	0.5
	8-4	10	8	7.25	2	1	1.5	9.75	10	0.25
	9-4	12.5	11	6.25	1	4	2	12.25	12.5	0.25
Week 3		35		25.5		5.75	4.25	35.5	35	-0.5

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	16-4	9	N.A.	7.5	N.A.	0.75	0.75	9	9	0
	17-4	9	N.A.	5.75	N.A.	2	1	8.75	9	0.25
	18-4	12	N.A.	8.75	N.A.	2.5	1.5	12.75	12	-0.75
	19-4	5	N.A.	3.5	N.A.	0.5	1	5	5	0
BNR5										
Week 1		27.25	24	23	3.25	3	1.5	27.5	27.25	-0.25
	1-4	7	6.25	5.25	0.75	1.5	0.5	7.25	7	-0.25
	2-4	6	5.5	5.5	0.5	0.25	0.25	6	6	0
	3-4	7.25	6.25	6.5	1	0.25	0.5	7.25	7.25	0
	4-4	7	6	5.75	1	1	0.25	7	7	0
Week 2		13	12.5	10.25	3	0.75	0.75	11.75	13	1.25
	8-4	6	5.5	5.5	1.5	0.25	0.25	6	6	0
	9-4	3.5	4	3	0.5	0.25	0.25	3.5	3.5	0
	11-4	3.5	3	1.75	1	0.25	0.25	2.25	3.5	1.25
Week 3		11		9.5		1	0.5	11	11	0
	15-4	6	N.A.	5	N.A.	0.75	0.25	6	6	0
	18-4	5	N.A.	4.5	N.A.	0.25	0.25	5	5	0
BNR24										
Week 1		5	4.25	4.25	0.75	0.5	0.25	5	5	0
	2-4	5	4.25	4.25	0.75	0.5	0.25	5	5	0
Week 2		15.5	12.75	10.5	2.75	2	1.25	13.75	15.5	1.75
	9-4	4.5	4	3	0.5	1	0.75	4.75	4.5	-0.25
	10-4	5	4	2.5	1	0.5	0.25	3.25	5	1.75
	11-4	6	4.75	5	1.25	0.5	0.25	5.75	6	0.25
BNR10										
Week 1		17.5	15.5	15.25	2.25	1.25	0.75	17.25	17.5	0.25
	3-4	7.25	7	6.5	0.75	0.5	0.25	7.25	7.25	0
	4-4	8	7	7	1.5	0.5	0.5	8	8	0
	5-4	2.25	1.5	1.75	0	0.25	0	2	2.25	0.25
Week 2		19.5	13.5	15	6.5	4.25	0.25	19.5	19.5	0
	8-4	6.5	6	6.5	0.5	0	0	6.5	6.5	0
	9-4	5.5	3	3.75	3	1.75	0	5.5	5.5	0
	10-4	7.5	4.5	4.75	3	2.5	0.25	7.5	7.5	0
Week 3		17.5		14		2.25	1.25	17.5	17.5	0
	15-4	2	N.A.	2	N.A.	0	0	2	2	0
	16-4	6.5	N.A.	4.75	N.A.	1.25	0.5	6.5	6.5	0
	17-4	3	N.A.	1.75	N.A.	0.75	0.5	3	3	0
	18-4	6	N.A.	5.5	N.A.	0.25	0.25	6	6	0
BNR7										
Week 1		32	22	24.75	10	3.5	2.5	30.75	32	1.25
	1-4	8	6	4.25	2	1.5	0.75	6.5	8	1.5
	2-4	8	6	6.75	2	0.75	0.75	8.25	8	-0.25
	3-4	8	5	7.25	3	0.5	0.25	8	8	0

	4-4	8	5	6.5	3	0.75	0.75	8	8	0
Week 2		40	29	28.25	11	6.25	4.25	38.75	40	1.25
	8-4	8	6	5.75	2	0.75	0.5	7	8	1
	9-4	8	6	5	2	2	1.25	8.25	8	-0.25
	10-4	8	4	6.75	4	0.5	0.75	8	8	0
	11-4	8	7	6.5	1	0.5	1	8	8	0
	12-4	8	6	4.25	2	2.5	0.75	7.5	8	0.5
Week 3		8		7		1.5	1	9.5	8	-1.5
	16-4	8	N.A.	6	N.A.	1.25	0.75	8	8	0
BNR14										
Week 1		26	16	7	6	17	1.75	25.75	26	0.25
	2-4	8.5	7	5.75	0.5	2.25	0.25	8.25	8.5	0.25
	3-4	8.5	5	1	1.5	7	0.5	8.5	8.5	0
	4-4	9	4	0.25	4	7.75	1	9	9	0
Week 2		26	17	10.5	5	13.25	1.75	25.5	26	0.5
	8-4	8.75	5	0.5	1	7.25	0.75	8.5	8.75	0.25
	10-4	8.25	6	2.25	2	5	0.75	8	8.25	0.25
	11-4	9	6	7.5	2	1	0.5	9	9	0
Week 3		25.5		1.75		20.25	2	24	25.5	1.5
	15-4	8.5	N.A.	0.5	N.A.	6.5	0.5	7.5	8.5	1
	16-4	8	N.A.	0.25	N.A.	6.25	1.25	7.75	8	0.25
	17-4	9	N.A.	1	N.A.	7.5	0.25	8.75	9	0.25
BNR25										
Week 1		12.25	9	7	3.5	3	1.75	11.75	12.25	0.5
	2-4	3.5	2	1.75	1.5	0.75	0.75	3.25	3.5	0.25
	4-4	4	3	2.75	1	0.75	0.25	3.75	4	0.25
	5-4	4.75	4	2.5	1	1.5	0.75	4.75	4.75	0
Week 2		5.5	3	2	1.5	1.25	1.25	4.5	5.5	1
	8-4	5.5	3	2	1.5	1.25	1.25	4.5	5.5	1
Week 3		5		2.5		1.5	0.75	4.75	5	0.25
	15-4	5	N.A.	2.5	N.A.	1.5	0.75	4.75	5	0.25



### A.17 Results of the survey and experiment

This appendix shows the total results from the experiment, including the surveys sent out before and after the experiment period. The experiment was held with 25 participants who are all connected to KCNR. Unfortunately one participant lost the VitaBit tracker early in the experiment and thus an insufficient amount of data was gathered to be analysed. Data from one participant seemed unreliable since the measured time by the VitaBit was only half of the hours worked registered in the diary. It is unknown if there was a defect in the VitaBit tracker or if the participants did not follow the instructions correctly. Therefore, the results were gathered and analysed for the remaining 23 participants.

#### Results of the introduction survey

The introduction survey was used to gather basic information about the participants to see if they were a good fit to participate in the experiment. Of the remaining 23 participants, 9 (39%) were male and 14 (61%) were female. Since people connected to KCNR have very different functions, participants were divided into three categories being:

Category 1: Junior collaborator, student researcher.

Category 2: Lecturers, including lecturer researchers and lecturer coaches (= OP).

Category 3: Any other functions not fulfilled by a student or lecturer. Including full-time researchers, project leaders communication and administrative staff (= OBP).

The group of participants existed for 35% of category 1, 39% of category 2, and 26% of category 3. Meaning category 1 had eight people, category 2 had nine people, and category 3 existed of six people. From the participants in category 2, 56% (5 participants) said they do not teach classical in this school period but only coach students and/or have administrative tasks. The remaining 44% (4 participants) said they have an average of 1 to 6 classical lecture hours this school period.

Before the experiment with the VitaBit sensor started, participants were asked how much time they expect to spent seated during a workday. The results are outlined in Figure A.17.1.

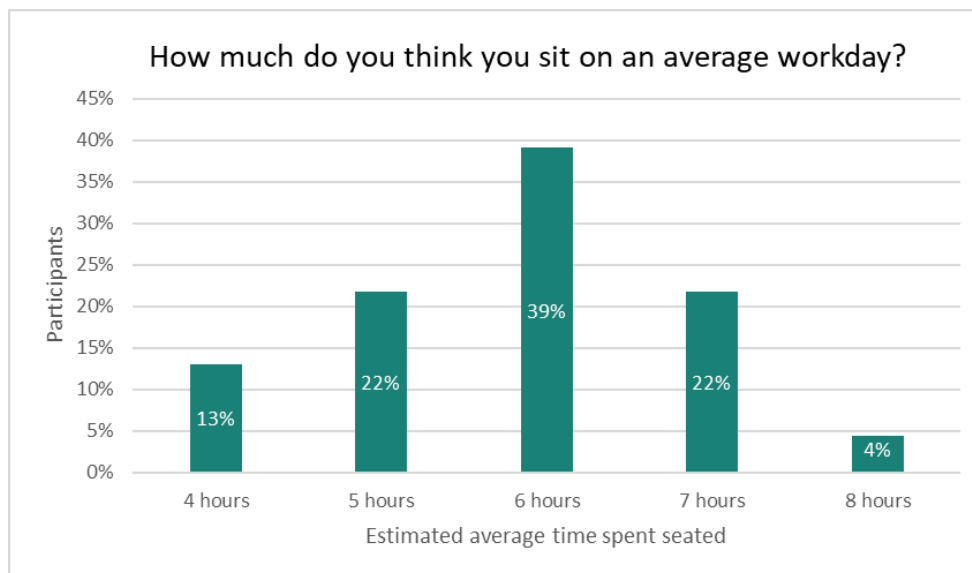


Figure A.17.1. Estimated sedentary time.

When asked if participants have a preferred time to stand while working, if they have a possibility to work standing, two people (9%) prefer to stand in the morning, 4 people (17%) prefer to stand in the afternoon, and 74% have no preference or are not able to stand at their workplace.

Participants were also asked if they use any tool (e.g. a smartwatch, smart chair, app or software) that reminds them to move or stand up regularly. The outcome shows that 78% of respondents use no tool to remind them to move or stand up regularly. The other 22% answered that they use tackers or smartwatches from Apple, FitBit and Polar.

### The VitaBit measurement results

The VitaBit trackers resulted in a lot of data. The data was selected on workdays and hours of participants, which each participant kept in their journal. The data gathered outside of worktimes was deleted. Calculations were performed to display all the relevant data in an understandable overview. The data was then checked for accidental errors which could be missing information in the journal such as the estimated hours spent seated by the participant or an inaccurate measurement from the VitaBit in which less time was measured then the hours worked according to the participant. Since there can always be a small deviation in measured time versus total time worked, the decision was made to allow a difference of two hours. When the gap between hours worked and hours measured was larger than two hours, data was deleted due to inaccuracy and unreliability. A gap of two hours is still quite large especially for workdays with a duration of less than eight hours. However, as one can see in the data set (Appendix 16), in the remaining data it did not occur often that there was a large gap between time measured and hours worked.

The remaining data has been put in an overview and participants received information about their sedentary behaviour. Participants received email 1 (Appendix 10) after the first week of the experiment, email 2 after the second week of the experiment (Appendix 12), and email 3 at the end of the experiment (Appendix 14). Furthermore they received the following information

(Appendix 5, 6, 7, 8, 9, 11 and 13). All information and emails were written in Dutch since the target group is Dutch.

In order to analyse the results, a Paired Samples T-Test has been used in SPSS. The Paired Samples T-Test is used to distinguish if there is a difference between the start of the experiment and the end of the experiment. In other words, did the intervention with the VitaBit have an effect on the awareness of people or on their sedentary behaviour? The first week of measurements can be seen as a baseline measurement as it shows the results of people without them having any insights in their actual time spent seated. However, people may already be more conscious about their sedentary behaviour because of wearing the VitaBit, therefore the baseline measurement is not completely valid. During the second week of measurements participants were informed about the results of their first week. In other words, this intervention shared the factual sedentary time of participants and could affect their awareness and influence their sedentary behaviour during the second week.

Before the experiment took place the expectation was that there would be a gap between the perceived and thus estimated time spent seated and the measured time spent seated. The Paired Samples T-Test should thus clarify whether or not this gap is existing and if the gap decreased after the intervention. The data (Table A.17.1, A.17.2 and A.17.3) shows that there is a significant difference between estimated sedentary time and measured sedentary time in both week one and week two. The correlation is high, as expected meaning that participants who sit more, also estimate their sedentary time higher.

Table A.17.1. SPSS Paired Samples Statistics estimated versus measured sedentary time week one and two.

#### Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	1_Estimated time sitting	18,5435	23	9,22898	1,92438
	1_Measured time sitting	16,4348	23	8,54009	1,78073
Pair 2	2_Estimated time sitting	19,4783	23	10,56928	2,20385
	2_Measured time sitting	16,3478	23	9,72250	2,02728

Table A.17.2. SPSS Paired Samples Correlations estimated versus measured sedentary time week one and two.

#### Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	1_Estimated time sitting & 1_Measured time sitting	23	,890	,000
Pair 2	2_Estimated time sitting & 2_Measured time sitting	23	,961	,000

Table A.17.3. SPSS Paired Samples Test estimated versus measured sedentary time week one and two.

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	1_Estimated time sitting - 1_Measured time sitting	2,10870	4,22575	,88113	,28134	3,93605	2,393	22	,026
Pair 2	2_Estimated time sitting - 2_Measured time sitting	3,13043	2,94347	,61376	1,85758	4,40329	5,100	22	,000

Even though there is a significant difference, the results are different than expected. The gap between expectation and reality is a positive gap instead of an expected negative gap. People think they sit more than they actually do at work. On average in week one, people estimate to sit 2.1 hours more at work than they actually do. Due to this gap, it is assumed that people are not aware of their sedentary behavior at work. Notable and unexpected, is that in week two the gap between estimated and measured time seated is even bigger than in week one, on average 3.1 hours. It can however still be the case that people are more aware of their sedentary time and behavior but find it different to estimate and calculate this precisely. The end survey results, discussed further down should clarify this.

Looking at the data, in week one, five participants estimated their sedentary lower than measured by the VitaBit. Their estimations improved in week two. However, looking at how big some of the difference are between estimated and measured sedentary time it is questionable how reliable the results of those participants are. As explained in Appendix 18 the VitaBits are recommended to measure sedentary behaviour but further testing is recommended. There might be errors in the data due to unreliable measurements. For example when looking at the data set (Appendix 16) one can see that occasionally the data seems off. An example is the measurement of April 10 from participant BNR14. The participant estimated that he/she sat six hours and stood two hours. The data shows that the person sat two hours and fifteen minutes, and stood five hours. It seems highly unlikely that someone has such a large gap between estimated and time measured.

A Paired Samples T-Test has been used to see if there is a change in sedentary behaviour. The expectation was that people would reduce their sedentary time when confronting them with their actual sedentary time, also resulting in increased awareness. When looking at the relative sedentary time of participants, the results show a very small reduction of sedentary time. Figure A.17.2 shows this reduction. Zooming in at the course of this reduction, it shows that the largest difference occurred between week one and two (a reduction of 3.5%) and it increases again in week three.

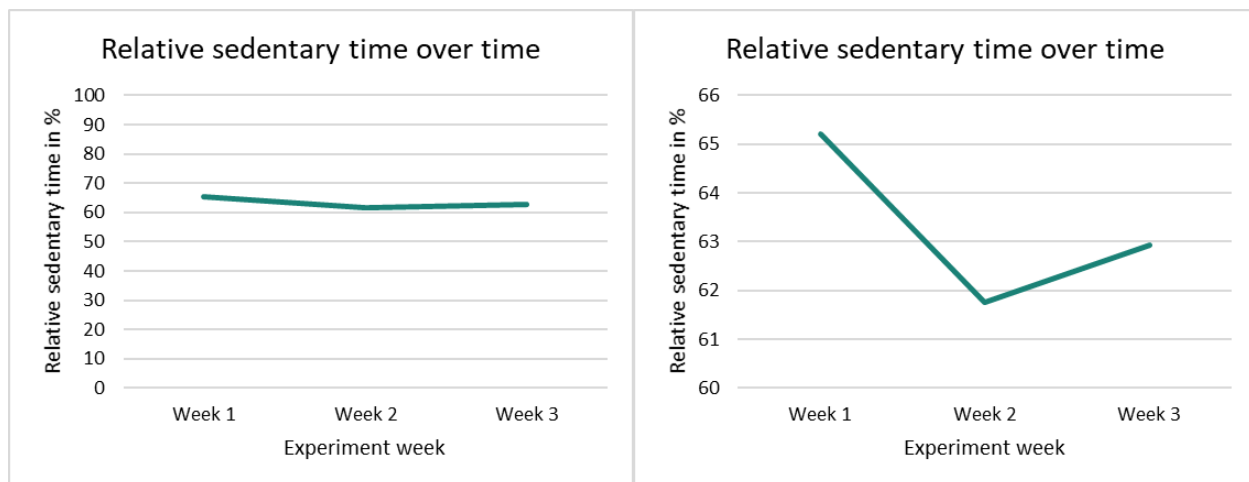


Figure A.17.2. Relative sedentary time of participants over time and over time zoomed in.

However, as one can see in the Paired Samples T-Test below (Table A.17.4, A.17.5 and A.17.6), the reduction of sedentary time is, as expected, not significant. Hence, the reduction of sedentary time is not demonstrably. It can be the case that the difference is indeed not significant because the intervention simply had no effect. It can also be a coincidence because there is no clear differentiation. Another possible reason why the results are not seen as significant can be that the group of participants was too small for a good comparison. Further research with a larger group of participants or an extended timeframe are advised to further research the effects of such an intervention over time.

Table A.17.4. SPSS Paired Samples Statistics relative sedentary time in % week 1, 2 and 3.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Relative percent week 1	65,20182764	23	17,59090668	3,667957600
	Relative percent week 2	61,76240916	23	15,05797675	3,139805200
Pair 2	Relative percent week 1	64,30191071	22	17,45456089	3,721324886
	Relative percent week 3	62,93069733	22	18,53357929	3,951372380
Pair 3	Relative percent week 2	61,49061251	22	15,35447609	3,273585301
	Relative percent week 3	62,93069733	22	18,53357929	3,951372380

Table A.17.5. SPSS Paired Samples Correlations relative sedentary time in % week 1, 2 and 3.

Paired Samples Correlations		N	Correlation	Sig.
Pair 1	Relative percent week 1 & Relative percent week 2	23	,507	,013
Pair 2	Relative percent week 1 & Relative percent week 3	22	,634	,002
Pair 3	Relative percent week 2 & Relative percent week 3	22	,708	,000

Table A.17.6. SPSS Paired Samples Test relative sedentary time in % week 1, 2 and 3.

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Relative percent week 1 - Relative percent week 2	3,439418477	16,35177902	3,409581621	-3,63162102	10,51045797	1,009	22	,324
Pair 2	Relative percent week 1 - Relative percent week 3	1,371213382	15,41605794	3,286714596	-5,46388380	8,206310559	,417	21	,681
Pair 3	Relative percent week 2 - Relative percent week 3	-1,44008482	13,28324477	2,831997301	-7,32954562	4,449375975	-,509	21	,616

In the test below (Table A.17.7, A.17.8 and A.18.9) the difference between estimated and measured seating time from week one is tested against week two. The results are not significant meaning that there is no change between week one and two. The estimations have not improved nor have they worsened.

Table A.17.7. SPSS Paired Samples Statistics difference week 1 and 2

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Difference_week_1	2,1087	23	4,22575	,88113
	Difference_week_2	3,1304	23	2,94347	,61376

Table A.17.8. SPSS Paired Samples Correlations difference week 1 and 2.

Paired Samples Correlations		N	Correlation	Sig.
Pair 1	Difference_week_1 & Difference_week_2	23	,543	,007

Table A.17.9. SPSS Paired Samples Test difference week 1 and 2.

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Difference_week_1 - Difference_week_2	-1,02174	3,60706	,75212	-2,58155	,53807	-1,358	22	,188

## Results final survey

After participants received an overview of their sedentary time of the past three weeks, they were asked to fill in a final survey. Of all participants, 65% said they were surprised by the insights gathered by the VitaBit. From the participants who were surprised by the results, 27% said that they sit more at work than they expected, 60% said they sit less than they expected. This corresponds with the data showing that people estimate higher sedentary time than measured. Two participants (13%) answered other. One explained that he/she is sitting a lot on average, the other stated that there were large variations in behaviour between the days and that sometimes the difference between estimated and measured time was large.

When asked if the expectation of sedentary behaviour was similar to behaviour measured by the VitaBit, 35% said yes. From the remaining 65% of participants, 67% expected to sit more and 33% said that they expected to sit less. When asking about a possible reason for the difference in expectation and measured seating time, 33% could not think of a reason. The other participants answered moving more in between than they realised (for example when getting coffee); doubts if the measurements were correct and reliable, sometimes due to their own behaviour (e.g. wearing/attaching the VitaBit to different types of trousers with different pocket sizes, filling in the diary a few days later); working more at home (without the facilities to stand while working) than expected; and being more aware of sedentary behaviour due to the experiment.

It is assumed that most people feel more aware of their sedentary behaviour due to the 65% of participants answering that they were surprised by the results of the experiment and again 65% of answers stating that the expectation of sedentary behaviour was different from the measured results. When asking participants if they feel more aware of sedentary behaviour during work after participating in the experiment, this assumption is confirmed by 78% (18) respondents saying yes. In Figure A.17.3 one can see the division of answers per function category. Awareness increased most for the OBP group with 83% of OBP saying they feel more aware. Followed by OP (78%) and junior researchers (75%) saying their awareness has increased.

The remaining 22% of respondents answered that they did not feel more aware because: they were already aware (4%); felt increased awareness while wearing the VitaBit but this faded after the experiment (4%); it does not affect awareness because the nature of computer work requires sitting (4%); the experiment did not influence awareness during work (9%).

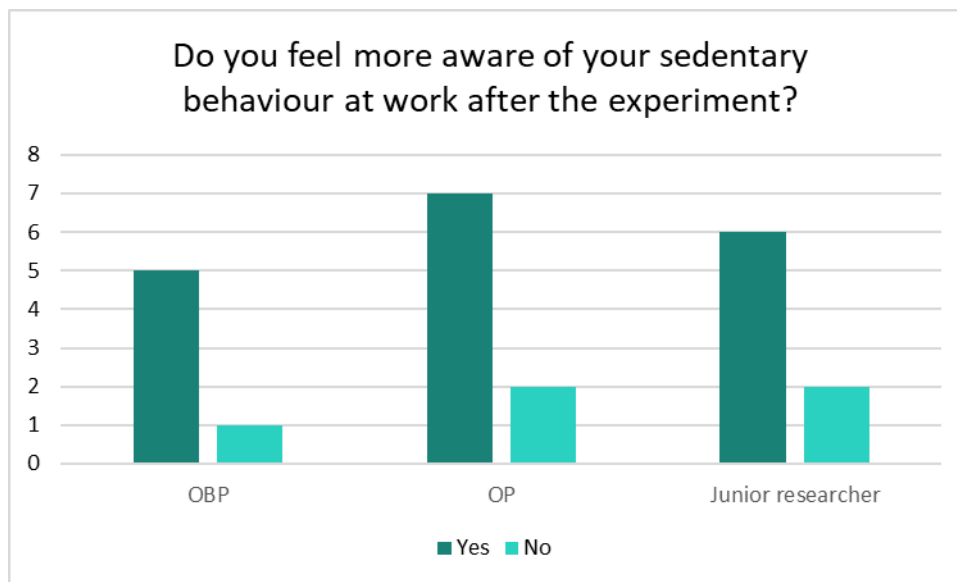


Figure A.17.3. Increased awareness per function category.

When asking the 78% of participants that feel more aware, to which extent they feel more aware about their sedentary behaviour at work after the experiment, 28% answered a little more, 44% said more, and 28% said much more.

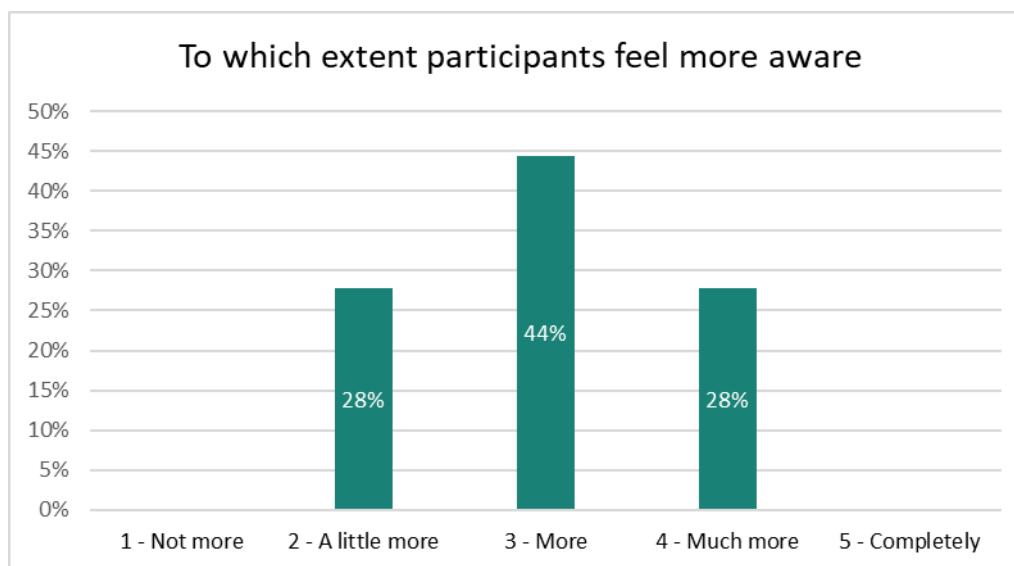


Figure A.17.4. The extent of the increased awareness.



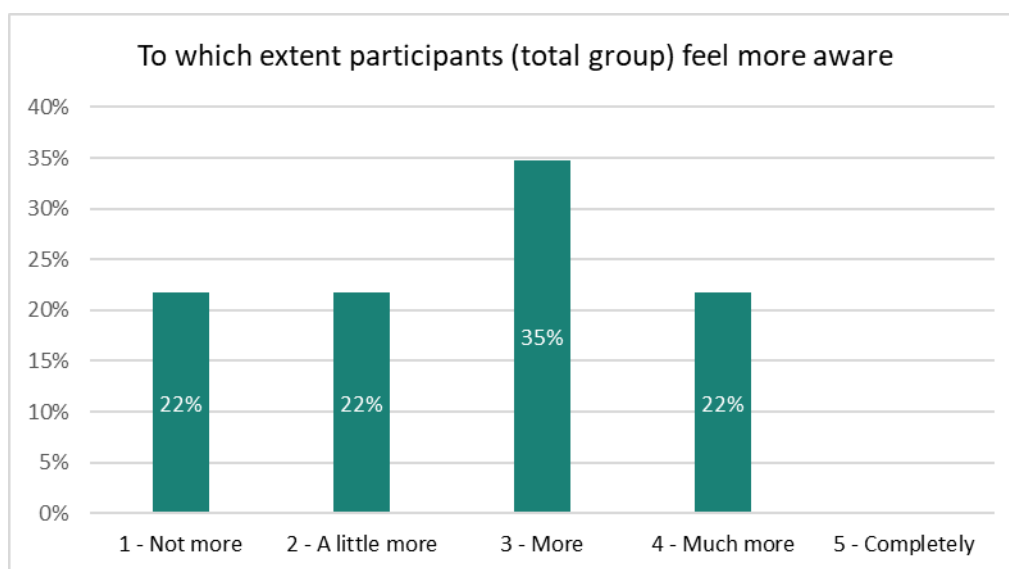


Figure A.17.5. Feeling of awareness for all participants.

Figure A.17.6 shows to which extent certain aspects of the experiment contributed to the awareness. This was only asked to the 78% of participants who felt that their awareness increased by the experiment. This shows that keeping the journal and wearing the VitaBit, even without receiving the insights, already contributes to awareness which suggests that in the baseline week (week one) people may already have been influenced and therefore showed different behaviour.

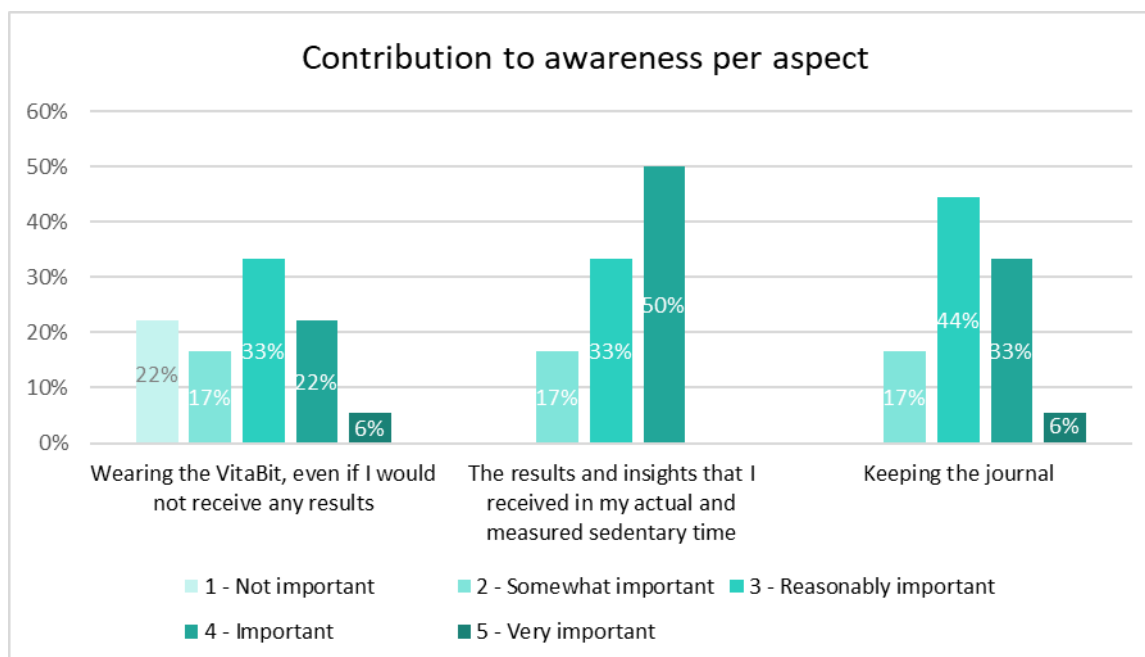


Figure A.17.6. Contribution to awareness per aspect.

The experiment was divided into three phases where in phase one and two people received reports on a weekly basis with insights per day and in phases three people could view their activity

in the VitaBit app. When asking the 78% of participants that feel more aware of their sedentary behaviour which phase contributed most to their awareness, most answered phase one, as displayed in Figure A.17.7. When looking at the preference per function category it is notable that with 71% OP prefer to receive a report with insights per day/week. For OBP there is a small preference for the report (60%) instead of the app (40%). Junior researchers (67%) prefer to use the app.

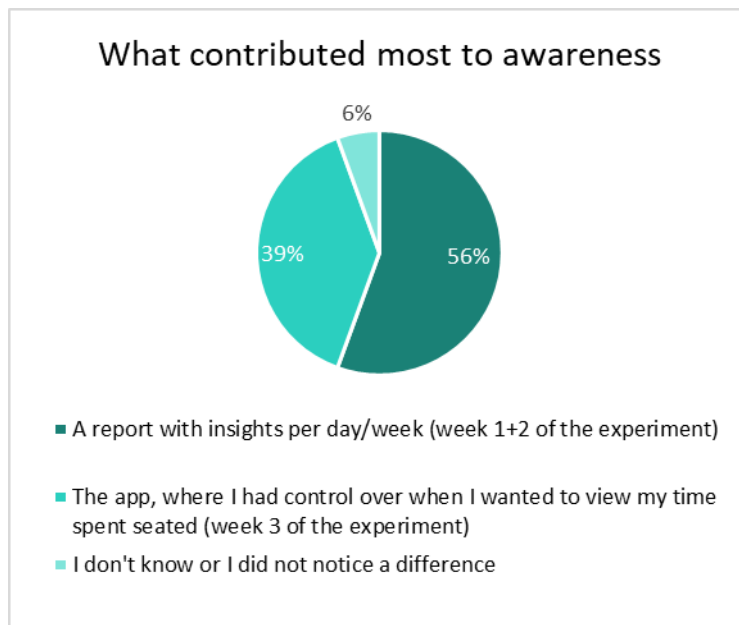


Figure A.17.7. Which phase contributes most to increasing awareness.

When asked what the effect of the increased awareness was on the 18 respondents, none answered that they move more every hour. People were allowed to give several answers and as one can read in Figure A.17.8, most people (50%) answered they stand up more often or walk somewhere during working hours. 28% of the participants who feel more aware say the increased awareness has no effect on their behaviour.

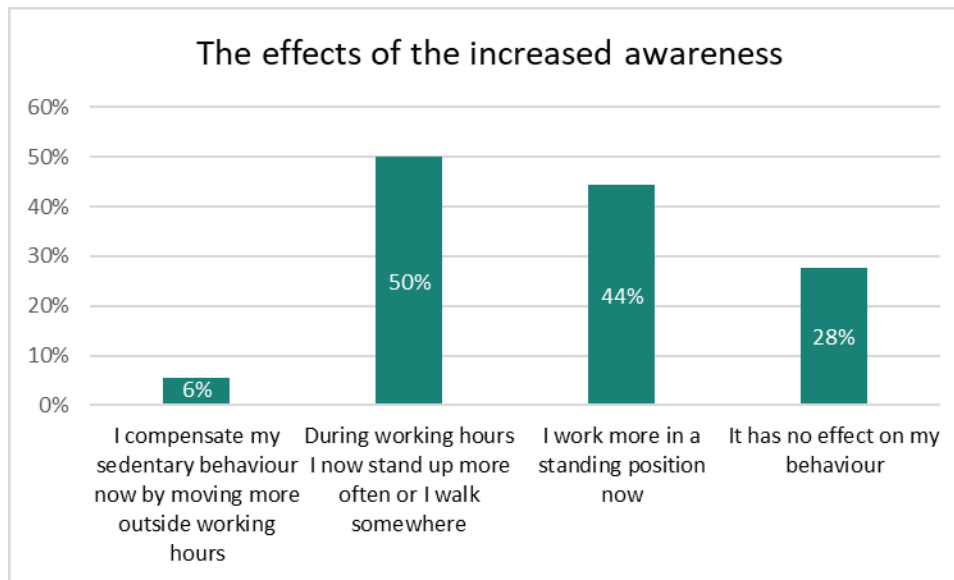


Figure A.17.8. The effects of increased awareness on the participants.

The entire group of 23 participants was asked if the insights from the experiment stimulated them to change their sedentary behaviour. A little more than half of the group (57%) said yes, the remaining said no as displayed in Figure A.17.9. Looking at the answers per function category, OBP feel most stimulated with 83% saying yes. Junior researchers are divided with 50% saying yes and 50% saying no. OP feel least stimulated with 44% saying yes.

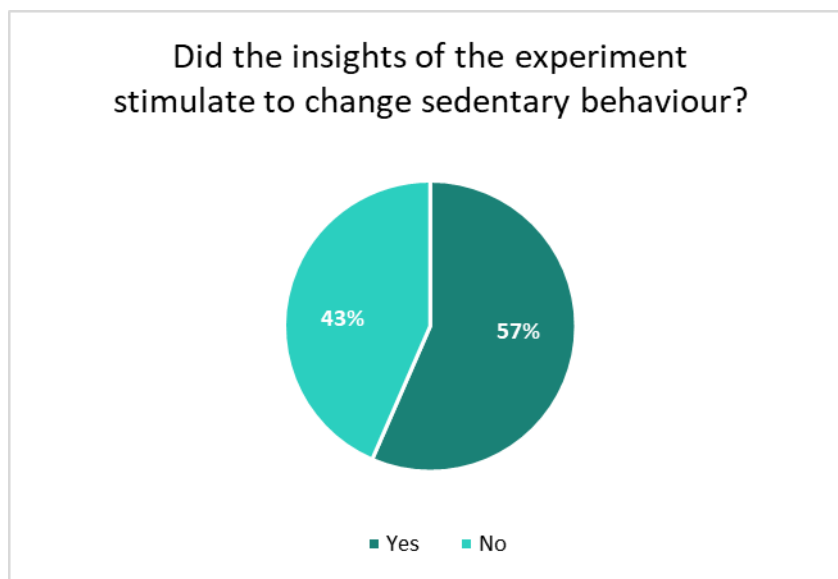


Figure A.17.9. The effect of insights on anticipated behaviour change.

When asked how those 57% of participants changed or want to change their sedentary behaviour answers included: standing up more in between tasks (2x); have more standing meetings (4x); walking around more often (6x); using a sit-stand desk more often (if possible) (5x). When asking why people felt stimulated to change their behaviour the answers included: because sitting is bad

and to minimise/reduce negative effects on my health (12x); it helps me to concentrate throughout the day when I move more (1x). The people that did not want to change their sedentary behaviour gave the following reasons for this: because I sit less than I expected (3x), because I can better concentrate when I sit (1x); due to the nature of computer work I cannot stand during work (2x); I don't feel the need to change my sedentary behaviour (2x); I am already trying to sit less (2x).

When asking all the participants if the experiment changed their sedentary behaviour outside working hours, 74% said no. Most of the remaining 26% explained that they also try to sit less and move more in the evening. When asking if participants expect to stand more at work if they could use a sit-stand desk, 65% said yes, 13% said no, 9% said they don't know and 13% said it was not applicable since their workplace(s) already facilitates this. When asking what could motivate people to stand up during work, most people answered reminders to stand up during work. People were allowed to give more than one answer. The remaining answers are displayed below in Figure A.17.10. Answers given under the option "other" included more attractive workplaces to stand, adjusting the position of a sit-stand desk more easily, increasing the acceptance of standing/walking meetings at the HUAS, and nothing because people are not willing to stand while working under any condition.

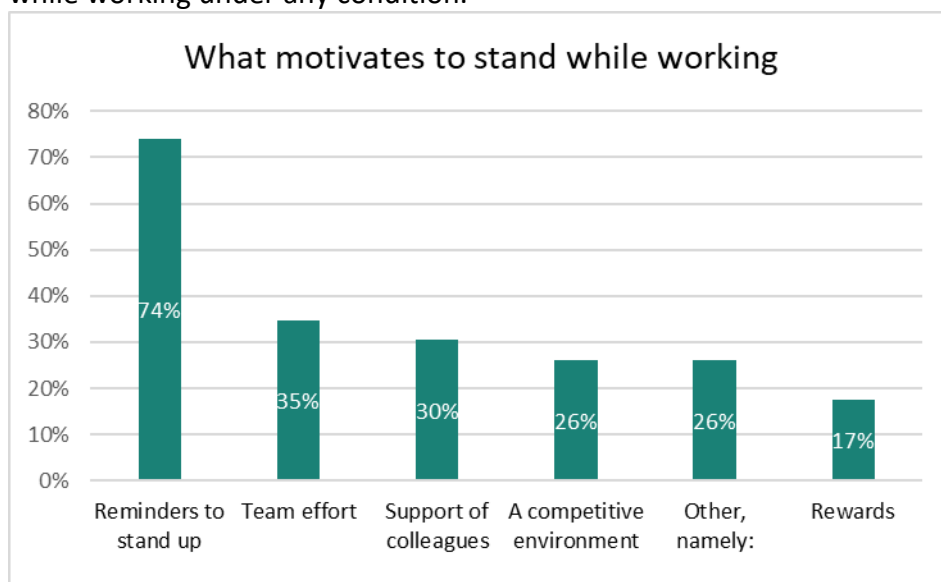


Figure A.17.10. Motivators to work standing.

What withholds participants the most (more than one answers allowed) to stand up while working is not having a sit-stand desk, followed by not being able to perform their work while standing. The remaining answers are displayed in Figure A.17.11. Under the open answer for other reasons people answered that not all workplaces have sit-stand desks (1x), that sitting is a moment of rest after standing in front of a class (1x) and not wanting to change the position of a desk up and down (1x).

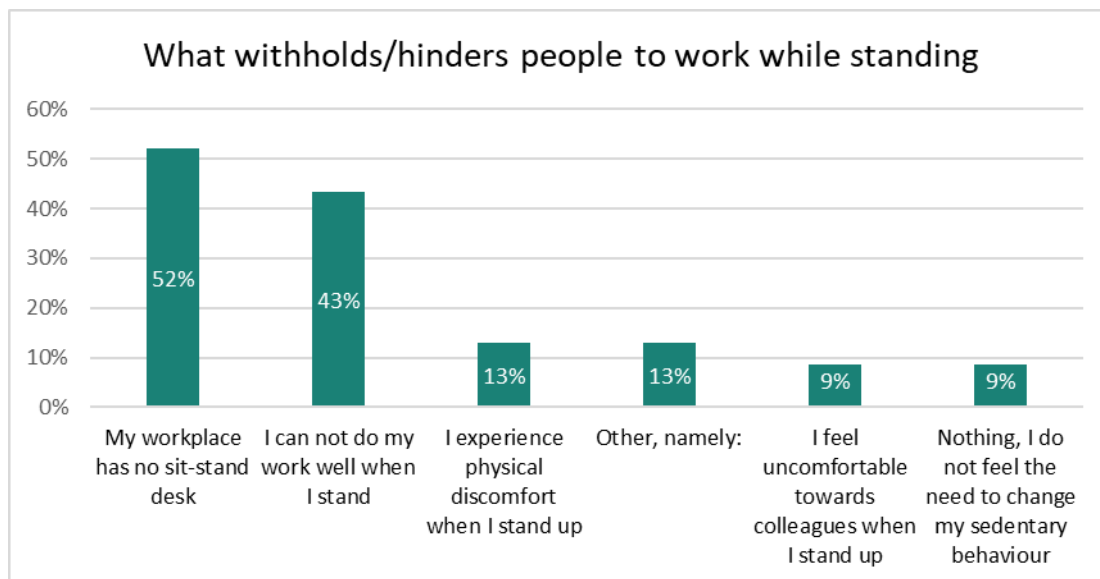


Figure A.17.11. What withholds/hinders people to stand up while working.

Participants were asked what type of tool seems most effective to them when trying to reduce their sedentary behaviour. Their answers are displayed in Figure A.17.12. Most people prefer a tool that reminds them to change their behaviour over a tool that precisely displays their behaviour without reminding them to change it. When looking at the answers per function category, every function has the preference for a tool that tells people to move more. Only OBP is divided with 50% answering they prefer a tool telling them to move more and 50% saying both a tool that says to move more and a VitaBit that precisely displays sedentary time. Notable is that 25% of the junior researchers state that they do not feel the need to use a tool.

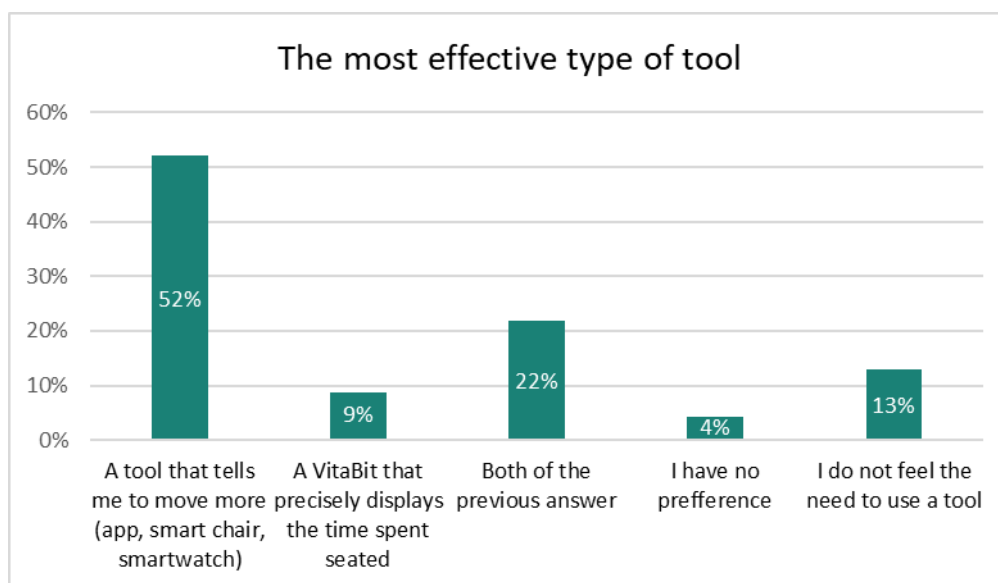


Figure A.17.12. Effective tools.

To ensure reliability of the results people were asked how they usually wore the VitaBit, 65% of the participants did it the best and safest way by wearing it in the coin pocket of their pants or in the front pocket with a magnet. Furthermore 9% said they usually wore it in the front pocket without the magnet, 17% usually wore it with a skirt/dress and a clothing sticker or magnet, and 9% did it differently from which one person answered wearing it in the back pocket of pants. The more stable the VitaBit is in place, the less accidental errors in data and thus more reliable results. When asking the participants if they felt the results of the VitaBit matches the reality, 13% said yes it completely matches the reality, 65% said it mostly matches the reality and 22% said no it did not match the reality. From this last group, the 22% who said the results did not match reality, one respondent said it was probably due to inaccurately keeping the journal and wearing the VitaBit while the remaining four respondents expressed that they do not trust the VitaBit. When asking the participants if they would recommend the use of a VitaBit to make people more aware of their sedentary behaviour, 87% said yes versus 13% saying no.

To find out if the experiment was held under circumstances that would reflect normal habits and behaviour during work time, the question was asked whether there were unusual work related activities that influenced sedentary behaviour during the experiment period. Examples could be visiting a congress or handing out surveys on the street. 48% of all the participants said no, 9% said there were unusual activities but that they did not influence sedentary behaviour, and 43% said yes. From this 43%, 60% thought they spent more time seated than normally due to the unusual activities while 40% thought they stood or walked more than normally. This is quite unfortunate since it affects the validity of the results measured by the VitaBit. Although it still measures the sedentary behaviour during work time, it might not reflect normal work conditions. However, to which extend the unusual activities influenced the participant has not been measured. People might have answered yes when in fact they have only visited a congress for one day. Given the fact that the experiment had a duration of three weeks, this one day should not affect the total outcome.

Participants were asked if they think they sit more or less than the average Dutch, who sit 8,5 hours per day. They were asked to take into account that the results of the VitaBit only shows sedentary time during work and that most people spent additional time seated outside work hours for example when watching tv, eating breakfast and dinner, and while driving a car. The answers are shown in Figure A.17.13.

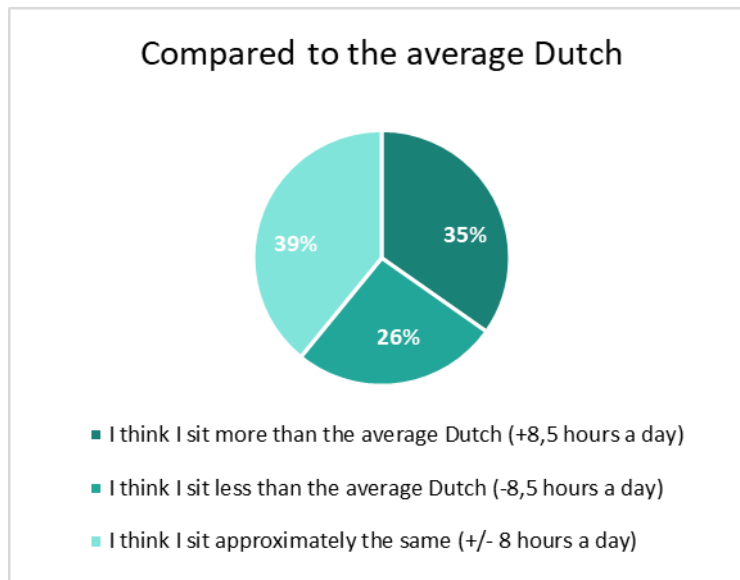


Figure A.17.13. Seating time compared to the average Dutch.

Participants that earlier said that the insights from the experiment did not stimulate them to change behaviour were asked if they feel more stimulated to change their sedentary behaviour taking into account that, in addition to the results of the VitaBit, people spent additional time seated outside work hours. From this group of ten people, 30% said yes, 40% answered no, not my sedentary behaviour at work but my sedentary behaviour outside work, and the remaining 30% said no. Furthermore, all participants were asked if they feel more stimulated to change their sedentary behaviour at work knowing that prolonged sitting cannot be compensated by working out after work. Only 13% of participants said no, the remaining 87% said yes to feeling more stimulated to stand while working (22%), to move around while working (22%), and to both stand up and move around to working (43%). Those participants saying that they wanted to move more during work were asked how they wanted to do this, multiple answers were allowed and the outcome is getting something to drink from the fridge or coffee machine more often (80%), make a walk during lunch (73%), regularly stretch at the workplace (13%), not choosing the copying machine closest to the workplace (7%), and open answers were walking outside during meetings/phone calls (7%) and I don't know (7%).

### A.18 Reliability and validity of the experiment and the VitaBit trackers

In order to have a valid experiment, the survey was tested among some people at KCNR. Some of these people also participated in the experiment, others did not. With their help the questions were formulated in a clear and understandable way. The end survey, focusing on the experience and perceived awareness of the participants, contained many relatively easy yes/no questions followed by probing questions to find good and useful answers. Some questions were aiming for the same result but asked in a different way to ensure both validity and reliability when comparing the answers. An example is:

*Question 1: Were you surprised by the insights gathered by the VitaBit?*

*Question 2: Was your expectation of your sedentary behaviour similar to the sedentary behaviour measured by the VitaBit?*

Although not impossible, it would be strange if someone would answer no to both questions. One would assume that if there is a difference between expected and measured sedentary behaviour, they would be surprised by the outcome.

The VitaBit was tested and compared to direct observation and to a current best-practice device on a minute-by-minute basis (Berninger, Ten Hoor, & Plasqui, 2018). According to Berninger et al. (2018), the VitaBit yielded specificity and negative predictive rates of above 91.2% and sensitivity and precision ranged from 74.6% to 85.7% during the laboratory test for sitting and standing. "In the free-living condition, the device revealed performance of over 72.6% for sitting with the ActiGraph as criterion" (Berninger, Ten Hoor, & Plasqui, 2018). These results showed sensitivity and precision for standing and walking between 48.2% to 68.7%, and the specificity and NPR exceeded 83.9%. According to Berninger et al. (2018), VitaBit is eligible for sedentary behaviour monitoring but results are not transferrable to daily life activities and therefore a direct observation study in a free-living setting is recommended.

The researcher herself tested the VitaBit for several days before and after the experiment where she measured her sedentary time with her phone and compared this to the results of the VitaBit. She did not measure the time standing and walking but only the time spent seated and compared this to the time spent seated according to the VitaBit. The results were as follows:

Table A.18 – Test measures with the VitaBit.

Date	Total time test measure	Accuracy
18-03-2019	8 hours	Completely accurate
19-03-2019	8 hours	Completely accurate
25-03-2019	7 hours	Completely accurate
26-03-2019	8.5 hours	Completely accurate
27-03-2019	6 hours	Completely accurate
02-04-2019	7 hours	Fairly accurate*
04-04-2019	8 hours	Completely accurate
11-04-2019	7 hours	Completely accurate
16-04-2019	7.5 hours	Not accurate at all**



18-04-2019	6.5 hours	Completely accurate
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\* A small difference but not more than one hour

\*\* All sedentary time was measured as standing time

As one can see, the results were accurate for eight out of ten days. One day there were small deviations and one day the data was completely wrong. It is unknown why the sedentary time was not measured correctly on April 16. As soon as it was noticed that the measurement did not go correctly, the researcher walked around trying to calibrate the tracker but somehow this did not work. The tracker was worn in the same way as all the other days.

The same was found in the results, for some people they estimated 1 hour standing and the VitaBit measured 5 hours, for example with BNR 11 in the dataset. It is highly unlikely that someone has such a large gap between expectation and measured time. In case the difference is too large everyday one can assume that the data is still reliable but not valid, most likely due to an error in the VitaBit. In this case it seems unlikely because these large gaps only occur every now and then, not regularly. Possible reasons could be the behaviour of the participants, e.g. not wearing the VitaBit correctly or not keeping the journal properly.

In order for the VitaBit to work properly, the following conditions are important:

- Wearing the VitaBit properly: in the front pocket of trousers, preferably the coin pocket, or with a special clothing sticker between the waist and the knee. If needed, the tracker can be kept in place with the magnet, for example in large pockets to minimise movement in the pocket.
- When starting to wear the VitaBit one must first walk approximately 100 steps so the tracker can calibrate.

In case participants followed the instructions carefully, meeting the above conditions, the experiment should result in valid data, measuring the sitting, standing and walking time. When they filled in the diary correctly, the accurate working hours could be contracted from the data and the difference between perceived and measured time could be calculated.

In order to further research validity and reliability the participants were asked how they usually wore the VitaBit. 65% of the participants did it the best and safest way by wearing it in the coin pocket of their pants or in the front pocket with a magnet. Furthermore 9% said they usually wore it in the front pocket without the magnet, 17% usually wore it with a skirt/dress and a clothing sticker or magnet, and 9% did it differently from which one person answered wearing it in the back pocket of pants. This suggests that, with a few exceptions, most people wore the VitaBit properly, ensuring reliability and validity of the data. However, when asking participants if they felt the results of the VitaBit match the reality, 13% said yes it completely matches the reality, 65% said it mostly matches the reality and 22% said no it did not match the reality. From this last group, the 22% who said the results did not match reality, one respondent said it was probably due to inaccurately keeping the journal and wearing the VitaBit while the remaining four respondents expressed that they do not trust the VitaBit. In case it is true that it did not match

the reality, it might slightly affect the reliability of the results but the reliability is still assumed to be high with 78% of participants confirming this.

Looking at the test measures and the findings of Berninger et al. (2018), the VitaBit gathers reliable data. Due to clear instructions for participants, the possibility for coincidences was minimised and thus it is assumed that if the experiment were to be repeated, the results would be similar and thus the results of the experiment are reliable.

### A.19 Survey questions first survey

This appendix shows the survey that was sent at the beginning of the experiment. All questions were mandatory unless instructed otherwise. Only one answer was allowed for every question. The complete survey including the raw data can be delivered upon request.

**Uw geslacht**

- ☐ Man
- ☐ Vrouw

**Uw leeftijd**

- ☐ 20 - 30
- ☐ 30 - 40
- ☐ 40 - 50
- ☐ 50+

**Wat is/zijn uw functie(s)?**

-Open answer

**Indien u docent bent, welke situatie is momenteel op u van toepassing**

- ☐ Ik ben geen docent
- ☐ Ik geef deze onderwijsperiode geen klassikaal les alleen coaching/begeleiding of ben bezig met administratieve taken
- ☐ Ik geef deze onderwijsperiode gemiddeld 1 tot 6 uur klassikaal les per week
- ☐ Ik geef deze onderwijsperiode gemiddeld 7 tot 12 uur klassikaal les per week
- ☐ Ik geef deze onderwijsperiode gemiddeld 13 tot 18 uur klassikaal les per week
- ☐ Ik geef deze onderwijsperiode gemiddeld 19 tot 24 uur klassikaal les per week
- ☐ Ik geef deze onderwijsperiode gemiddeld meer dan 24 uur klassikaal les per week

**Welke dagen per week werkt u? (onafhankelijk welke locatie en voor welke organisatie, dus niet specifiek werkdagen voor Kenniscentrum NoorderRuimte)**

- ☐ Maandag
- ☐ Dinsdag
- ☐ Woensdag
- ☐ Donderdag
- ☐ Vrijdag

**Maakt u gebruik van een tool (smartwatch, software, app, slimme stoel) die u vertelt dat u regelmatig moet gaan staan of bewegen?**

- ☐ Nee
- ☐ Ja, namelijk...

**Hoeveel denkt u dat u gemiddeld zit tijdens uw werkdag?**

- ☐ 3 uur of minder

- 4 uur
- uur
- uur
- uur
- uur

**Indien u kunt staan op uw werkplek, heeft u een voorkeursmoment om te staan?**

- Nee, ik heb geen voorkeur
- Ja, in de ochtend
- Ja, in de middag

**Indien u nog opmerkingen heeft kun u deze hier noteren**

-Optional

## A.20 Survey questions first survey

This appendix shows the survey that was sent at the end of the experiment. The survey was created in both Dutch and English, participants could choose their preferred language. All questions were mandatory unless instructed otherwise. Only one answer was allowed for the questions where answers are marked with black squares. Answers marked with white circles were multiple choice. The complete survey including the raw data can be delivered upon request.

### **Were you surprised by the insights gathered by the VitaBit?**

- Yes
- No

### **What surprised you the most?**

- I sit more at work than I expected
- I sit less at work than I expected
- Other, namely:

### **Was your expectation of your sedentary behaviour similar to the sedentary behaviour measured by the VitaBit?**

- Yes
- No

### **Did you expect to spend more or less time seated?**

- More
- Less

### **What is a possible reason for the difference in your expected versus real seating time?**

- I don't know
- I think/expect:

### **Do you feel more aware of your sedentary behaviour during work after the experiment?**

- Yes
- No

The answers to this question led to two different groups, group A and B. Based on their answer they were asked only follow-up questions related to their group.

#### **A. Why do you not feel more aware about your sedentary behaviour during work?**

#### **B. To which extent do you feel more aware about your sedentary behaviour at work?**

I feel .... aware:

- 1 - Not more
- 2 - A little more
- 3 - More

- 4 - Much more
- 5 - Completely

**B. How important were the following aspects in contributing to your awareness?**

1. Wearing the VitaBit, even if I would not receive any results
2. The results and insights that I received in my actual and measured sedentary time
3. Keeping the journal

Options per aspect:

- 1 - Not important
- 2 - Somewhat important
- 3 - Reasonably important
- 4 - Important
- 5 - Very important

**B. What contributed most to your awareness?**

- A report with insights per day/week (week 1+2 of the experiment)
- The app, where I had control over when I wanted to view my time spent seated (week 3 of the experiment)
- I don't know or I did not notice a difference

**B. What effect(s) has the awareness on your behaviour?**

- I now move more every hour
- I compensate my sedentary behaviour now by moving more outside working hours
- During working hours I now stand up more often or I walk somewhere
- I work more in a standing position now
- It has no effect on my behaviour
- Other, namely:

**In the last week of the experiment you were asked to view your results in the app. Did you do this?**

- Yes, every day, once a day
- Yes, every day, twice a day
- Yes, every day, more than twice a day
- Yes, but not every workday
- No

**Did the insights of the experiment stimulate you to change your sedentary behaviour?**

- Yes
- No

The answers to this question again led to two different routes. Based on the answer respondents were asked only follow-up questions related to their group.

**A. How do you change your sedentary behaviour or how do you want to change this?**

**A. Why do you feel stimulated to change your sedentary behaviour?**

**B. Why do you not feel stimulated to change your sedentary behaviour?**

**Did the experiment change your sedentary behaviour outside working hours?**

- No
- Yes, explain:

**Would you feel more motivated to stand while working if your workplace facilitates this?**

- Yes
- No
- I don't know
- Not applicable, my workplace already facilitates standing

**What can motivate you to stand while working?**

- Reminders to stand up
- Team effort
- Support of colleagues
- A competitive environment
- Other, namely:

**What withholds or hinders you to work more in a standing position?**

- My workplace has no sit-stand desk
- I can not do my work well when I stand
- I experience physical discomfort when I stand up
- I feel uncomfortable towards colleagues when I stand up
- Nothing, I do not feel the need to change my sedentary behaviour
- Other, namely:

**Do you expect to stand more at work if you always have the choice to work behind a sit-stand desk?**

- Yes
- No
- I don't know
- Does not apply, my workplace(s) already has/have a sit-stand desk

**In case you can use a tool to reduce your sedentary behaviour, which one seems most effective?**

- A tool that tells me to move more (app, smart chair, smartwatch)
- A VitaBit that precisely displays the time spent seated
- Both of the previous answer
- I have no preference
- I do not feel the need to use a tool

**How did you usually wear the VitaBit?**

- In the coin pocket of my pants
- In my front pocket without the magnet
- In my front pocket with the magnet
- At my thigh with a skirt/dress and clothing sticker or magnet
- Other, namely:

**Do you think that the sedentary time measured by the VitaBit matches the reality?**

- Yes, the results seem to completely match the reality
- Yes, the results seem to mostly match the reality
- No, explain:

**Would you recommend the use of a VitaBit to make people more aware of their sedentary behaviour?**

- Yes
- No

**Were there during the experiment unusual work related activities (e.g. visiting a congress or handing out surveys on the street) that influenced your sedentary behaviour?**

- Yes, there were unusual work related activities that influenced my sedentary behaviour
- Yes, there were unusual work related activities but they did not influence my sedentary behaviour
- No

**A. How did the unusual activity influence your sedentary behaviour?**

- I think that I spent more time seated than normally
- I think that I stood or walked more than normally
- I don't know

"Recent numbers show that on average the Dutch sit 8,5 hours per day. The results of this experiment shared with you are only about working hours. In spare time people often spent additional time seated, think about driving a car, eating breakfast and dinner, watching TV.

Knowing this, do you think you sit more or less than the average Dutch?"



- I think I sit more than the average Dutch (+8,5 hours a day)
- I think I sit less than the average Dutch (-8,5 hours a day)
- I think I sit approximately the same (+/- 8 hours a day)

**"Recent numbers show that on average the Dutch sit 8,5 hours per day. The results of this experiment shared with you are only about working hours. In spare time people often spent additional time seated, think about driving a car, eating breakfast and dinner, watching TV.**

**Knowing this, do you feel more stimulated to change your sedentary behaviour at work?"**

*Only asked to people who earlier stated they did not feel stimulated to change*

- Yes
- No, not my sedentary behaviour at work but my sedentary behaviour outside work
- No, I do not want to change my sedentary behaviour

**"Research shows that prolonged sitting can not be compensated by working out after work.**

**Knowing this, do you feel more stimulated to change your behaviour during work?"**

- Yes, I feel more stimulated to stand while working
- Yes, I feel more stimulated to move around while working
- Yes, I feel more stimulated to stand up more and move around more while working
- No, both not

People who answered that they wanted to move more were asked the following:

**A. In which way would you like to move more during working hours?**

- I will take something to drink from the fridge or coffee machine more often
- I want to make a walk during lunch
- I will regularly stretch at my workplace
- I do not choose the closest copying machine but walk a little further
- Other, namely:

**Space for comments**

### A.21 Considerations and impact of the advice

There are financial to take into consideration when implementing the advice. HUAS is a non-profit organisation but any additional revenue and costs savings resulting from the advice can be invested in expansion and improvement projects of HUAS. During the meeting of Kenniskring Optimalisatie van Huisvesting on May 24, 2019, Bonder presented a business case about investing in a healthy building. According to Bonder (personal communication, May 24, 2019), a healthy building increases productivity, and reduces sick leave and as a result reduced recruitment costs. Bonder (personal communication, May 24, 2019) explained that it may even lead to opportunities for collective health insurance premiums and showed figures from Cap Gemini and CFPB showing that a 1% productivity increase can lead to €950 additional revenue per person, per year. Simultaneously, 1% reduction of sick leave will save €400 per person, per year according to Bonder (personal communication, May 24, 2019). Facilitating standing, and less facilitation of sitting is part of creating a healthy building. However, reducing sedentary behaviour is only part of increasing health of employees. Therefore it cannot be said that in the best case scenario, HUAS will have a benefit of €1,350 per person per year when implementing the advice.

When refurbishing, there are many options available in different price categories. The total price of refurbishment depends on the total number of desks that need to be replaced. The researcher has no insight in the total number of desks owned by the HUAS and how many of those are already sit-stand desks. The same applies to meeting tables. The total price will not only depend on the number of objects to be replaced but also on the quality of the products.

Besides refurbishment, the researcher suggests to use VitaBits. VitaBit offers their product and services for €99,95 per user (VitaBit Software International B.V., n.d.-a). This includes the VitaBit, a vitality report of the user, one year of access to the VitaBit app and Portal, and one year of E-coaching by professionals. The total investment depends on the number of VitaBits ordered. When used as suggested, in teams, HUAS has to purchase less VitaBits than when trying to stimulate all staff members to change at the same time. Again, buying in bulk may result in a discount. The same applies to investing in other tools such as smartwatches and smart chairs.

The researcher suggests to create walk routes on and around the campus. This can be done in the current environment which will not lead to any costs but it is strongly recommended to improve walking areas around campus. Perhaps by planting more flowers and trees. The researcher is aware that the facilities department of the HUAS has a big plan to redevelop the campus but is not aware if these plans already include creating walk paths. If not included, the facilities department is advised to take this into consideration when allocating the budget of the plan.

Legal factors to take into consideration are concerns and legislation concerning privacy when using tools that give an insight in behaviour and activity of staff. HUAS can decide to give the tools to people without tracking any information themselves and without asking that the tools will be returned. HUAS can also create legally correct consent forms expressing all information gathered by tools will be carefully processed and protected and stating no personal data will be published. Furthermore HUAS should state that participating in the change process is voluntary and that



HUAS is under no circumstance liable for any health complaints arising, for example from a change in posture.

The advice is not expected to impact the internal processes drastically. The only expectation is that staff will ultimately be more productive which can improve efficiency of some internal processes.

## A.22 Safe Assign

The Safeassign test shows an 8% overall match.

Review Submission History: Advisory report

### Advisory report

Reducing sedentary behaviour in an office environment  
by means of increasing awareness of current sedentary time

29-5-2019

Student:  
Veroline Brouwer (346374)  
International Facility Management, Hanze University of Applied Sciences

Supervising lecturer and first assessor:  
Maris Boeringa  
International Facility Management, Hanze University of Applied Sciences

Second assessor:  
Ab Reitsma  
International Facility Management, Hanze University of Applied Sciences



**Assignment Details** ▾

**GRADE**  
LAST GRADED ATTEMPT /10

**ATTEMPT**  
5/29/19 4:11 PM /10

SafeAssign ▾ 8% overall match

Submission

 [Advisory Report Veroline Brouwer 29052019.docx](#) 

OK Start New

Figure A.22. Screenshot of SafeAssign