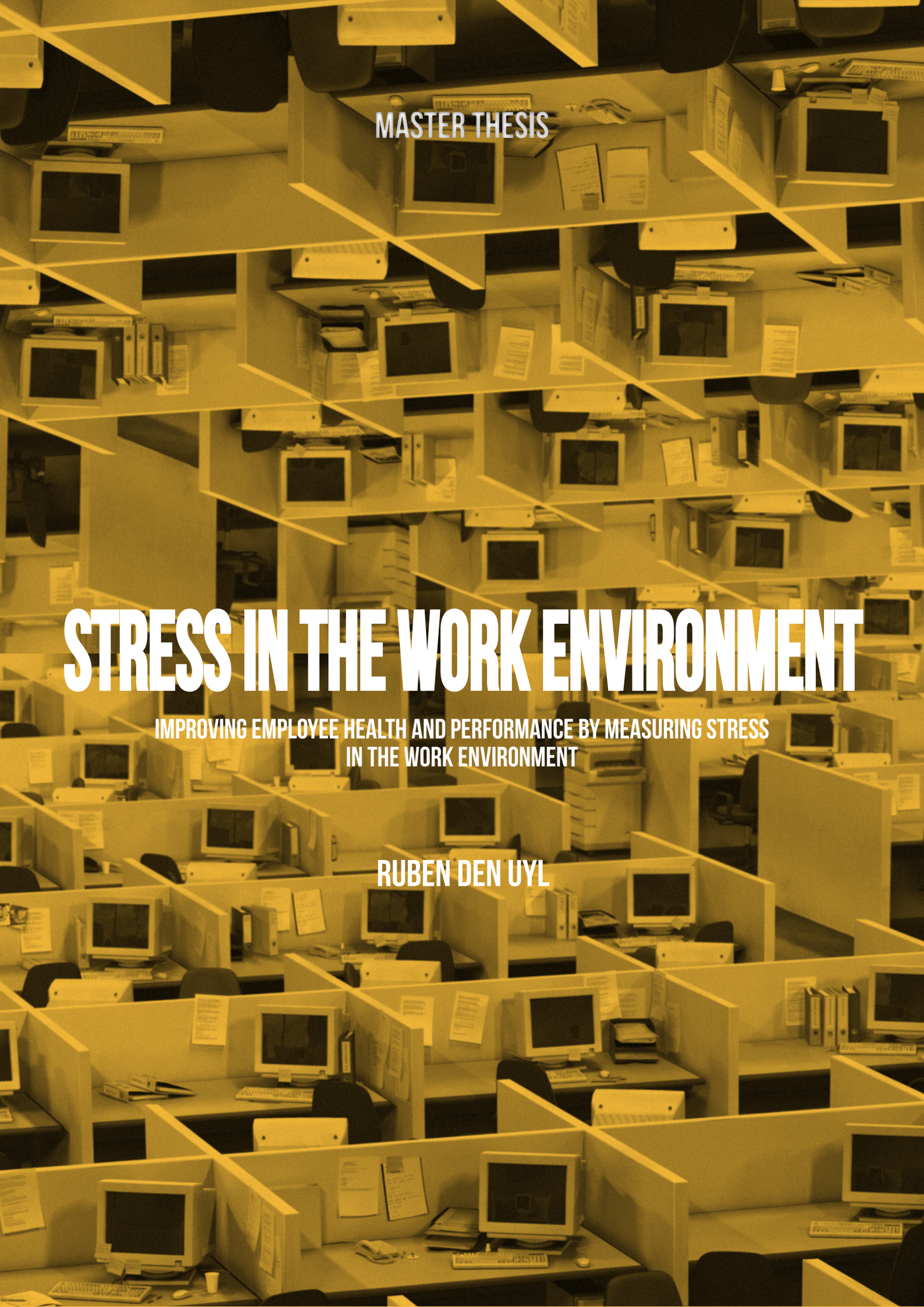


MASTER THESIS

STRESS IN THE WORK ENVIRONMENT

IMPROVING EMPLOYEE HEALTH AND PERFORMANCE BY MEASURING STRESS IN THE WORK ENVIRONMENT

RUBEN DEN UYL

COLOPHON

TITLE

Stress in the Work Environment:
Improving employee health and performance by measuring stress in the workenvironment

VERSION

Master thesis P5 report
5 April, 2019

FACULTY

Management in the Built Environment (MBE)
Faculty of Architecture and the Built Environment (A+BE)
Julianalaan 134, 2628 BL, Delft, The Netherlands

Delft University of Technology (TU Delft)
Mekelweg 5, 2628 CD, Delft, The Netherlands

STUDENT

R.G. (Ruben) den Uyl
4218574
R.G.denuyl@student.tudelft.nl
rgdenuyl@gmail.com

FIRST MENTOR

Ir. M.H. (Monique) Arkesteijn
Management in the Built Environment
Real Estate Management
M.H.Arkesteijn@tudelft.nl

SECOND MENTOR

Ir. R.P. (Rein) de Graaf
Management in the Built Environment (A+BE)
Real Estate Management
R.P.deGraaf@tudelft.nl

BOARD OF EXAMINERS DELEGATE

Dr. A. (Arie) Romein
OTB | Research in the Built Environment (A+BE)
A.Romein@tudelft.nl

INTERNSHIP MENTOR

Ir. M.J. (Marjon) van Bree MBA RT
Partner | Director Corporate Real Estate Solutions
Colliers International Occupier Services
M.vanBree@colliers.com

ABSTRACT

Problem statement: Stress in the work environment is a growing problem, pushed forward by changing societal standards associated with meritocracy and the omnipresence of technology and communication devices. Individuals and organizations are simultaneously becoming more aware and active in this domain of healthy workplaces. To make an actual improvement within the work environment to reduce stress, a stronger knowledge base is required than is currently present. In this research, the relation between the workplace and stress is further investigated. The main research question is: "How can insights in the relation between workplace and activity on employee stress be used to develop a real estate decision-making model?"

Research method: By conduction an operational-empirical research, the research questions are investigated. The operations research develops a model that can be used by real estate managers in the process of forming accommodation strategies. The empirical research is needed to form the required input for the operational model. This input is the quantified correlations between stress and the work environment. To obtain the input, a method is developed based on structured observations, using a smart wearable device to get a bio-metric for stress through sensor data.

Goals and objectives: The goal of the research is to help employees reduce their stress within the work environment. To scope the goal, the research will focus on the knowledge base on the correlation between stress and the workplace. The objectives of the research are to provide a tool in the form of an operational model for Real Estate Managers to help reduce stress, by getting a better understanding of the relation between workplace and stress.

Key findings and conclusion: The developed method of using a smart ring in combination with a structured observation design resulted in a feasible method for doing stress measurments in the work environment. The outcomes of the stress measurements can be operationalized into a real estate decision-making model, but the usability of the model output is still to be reaserched. Current findings mainly support existing findings from literature, with a main focus on the importance of privacy and control as a factor in the forming of stress. Due to the non-random nature of employee workplace choices, it is not possible to expect findings on all possible workplace characteristics. Future research with an increased sample size or based on intervention testing with the developed method could improve the creation of insights in the relation of stress in the work environment.

Keywords: *Corporate Real Estate Management, stress, work stress, burnout, health, workplace, work environment, smart tools*

PREFACE

Before you lies the master thesis 'Stress in the Work Environment: Improving employee health and performance by measuring stress in the work environment", that symbolises the end of my educational period as a student. The thesis is written to fulfil the graduation requirements of the master track Management in the Built Environment of the Faculty of Architecture and the Built Environment at the Delft University of Technology (TU Delft). The thesis describes the research process conducted that started with the ambition to contribute to the domain of Workplace & Health. The basis of the thesis is an experiment of structured observations that measure stress levels among employees in the work environment. I was engaged in researching and writing the thesis from February 2018 to April 2019, with a fulltime commitment from September 2018 on.

The research purpose and design were formed during the first period of the project, combining my interests in technology with the research ambitions of the chair of Real Estate Management in Workplace & Health. Together with my mentors from both the University and my internship company Colliers International Occupier Services, this purpose and design were finalised into the current format.

The final form of my thesis supports my vision on the built environment that has been formed over the last six and a half year during my period as a student. I have always had a strong user centred perspective, while not always consciously, that made me see real estate as a means to an end. The built environment should have the goal of supporting and enabling its user to get the best out of him or herself. The current socioeconomic situation in this country and many others are starting to put more pressure on the workforce in terms of both physical and mental demands. The work environment should respond to this, and relevant knowledge is required to fulfil the promise that the work environment has towards its users: offer support and not be a contributor to the problem.

I have profoundly enjoyed the process of this master thesis, finding a feeling of fulfilment in the act of doing research that I did not know was there. I have many persons to thank for this, starting at the beginning: Monique Arkesteijn, my first mentor, and Rein de Graaf, my second mentor. Through their guiding I have stayed on track, spending most of my time doing productive things, instead of dwelling through the endless space of research design and methodologies.

From my internship company, I want to thank both Marjon van Bree, my internship mentor, for her practical advice on the workings of real estate management needed for my operational model. I would also like to thank Harold Coenders for his insights into workplace characteristics, giving me the tools to analyse the work environment. I also want to thank Thom Schreurs, my fellow graduate intern, for countless little talks, brainstorms, advice, and coffees.

At a more personal level, I want to thank my family and girlfriend for support, genuine interest and practical help with my thesis.
And lastly, I want to thank and offer my apologises to everyone that had to listen to me talk endlessly about my graduation research. It's all over now.

I hope you enjoy your reading.

Ruben den Uyl

Rotterdam, April 5, 2019

EXECUTIVE SUMMARY

Introduction

Stress in the work environment has taken a prominent place in the public agenda. Newspaper articles on the rise of burnouts and dangers of stress can be found everywhere. TNO (2017) put forward some disturbing numbers: 17% of employees experiences burnout complaints, with an 2% increase in the last three years and sick leave due to mental complaints (one third of all sick leave) costs employers over €1.8 billion per year. However, the problem of stress of a long standing problem with an extensive research field in occupation psychology but the problem still exists. The work environment is an important domain for the creation of stress, with 33% of an adults total waking hours spend in this environment (Veitch, 2011). A new method for stress research could develop a new perspective for the issue of stress in the work environment with the potential of actually changing these environments for the better.

"17% OF ALL EMPLOYEES EXPERIENCE BURNOUT COMPLAINTS"

Healthy employees are productive employees (Allen, Hubbard, & Sullivan, 2005; Burton, Conti, Chen, Schultz, & Edington, 1999) and the physical part of health in the work environment receives a lot of attention, especially over the last few years, with emerging terms as 'Active Design' and 'Healthy Offices'. Research in the mental part of health in the work environment is still somewhat under developed. Employee satisfaction is a popular study theme, since it is relatively easy to conduct, but stress research stays somewhat behind. While occupational psychologist do research organisational aspects of the work environment, such as relations with supervisors, the physical aspect of the work environment in relation to stress could be further developed.

Research that has been conducted in this field, has mainly focussed on the spatial layout of the office, particularly on the openness or closedness of spaces. From this research, negative results are often found for open plan offices, with disturbances, lack of control, and lack of privacy as main causes of stress. (Davis, Leach, & Clegg, 2011; De Croon, Sluiter, Kuijer, & Frings-Dresen, 2005; Mylonas & Carstairs, 2008)

In terms of stress measurement methods, all previously conducted research used self administered questionnaires as research tool, measuring perceived stress. While this does say something about the work environment, it is not hard objective data that can be calculated with, due to the ordinal nature of self-rated variables. Besides that, self-rated stress is only asked once every so often, whether this is once a day or once in three months. This makes the self-rated stress not a suitable measurement for doing in depth research in the work environment, since differences between real-time events are required to be observed in order to analyse them. Physiological features, in the form of bio-markers, provide the solution for this. This bio-markers can be measured real-time through wearable devices that have made great technological advancements over the past few years (Alberdi, Aztiria, & Basarab, 2016).

At the same time, real estate managers are missing the tools to sensitize the problem of stress in the work environment. While they do hear and acknowledge to problem of stress, they do not have valid predefined solution of which they know they will work, often also because solution do not work for everyone, due to the personal nature of stress. This hampers the development of stress less work environments.

Research aim and questions

This thesis aims to broaden the knowledge base of the relationship between workplace and stress by performing quantitative research with objective data and aims to investigate the feasibility of creating a tool through operational-empirical research that can help decision-makers and users use the generated knowledge to decrease stress in the work environment.

Based on the problem statement and the research aim, the main research question of this research is:

"How can insights in the relationship between workplace and activity on employee stress be used to develop a real estate decision-making model?"

Five research question were drawn up to find an answer to the main research question. The sub-questions of this research are as follows:

1. What is the relation between workplace types and activities on employee stress?
2. How can employee stress be measured?
3. What workplace characteristics are of influence on employee stress?
4. What are the input and output variables for a decision-making model that can reduce employee stress?
5. How can real estate managers use the decision-making model?

Research design and methods

This study has taken an Operational-Empirical approach divided into structured observations and quantitative analysis (Empirical), and the development of an operational model (Operational). The structured observations are performed at the company Colliers International Netherlands at two locations, the Rotterdam office and the Amsterdam office. The structured observations consists out of a 5 day observation period per participant, that wore a smart ring that real-time measures stress through electrodermal activity and kept a logbook, logging their workplace and activity on a 15-minute interval. Participants were allowed to fill in their logbook at the end of the day but were encouraged to do so throughout the day. The observation validity with a Kappa score of 0,49 for workplace and activity was determined fair.

Theoretical framework

Person

The person is central in this study, since the study aims to reduce stress in the long term for these persons. Every employee is different, however some grouping is necessary to operationalise the results. How people deal with every-day life events, is determined by their personal characteristics: coping styles, hardiness, locus of control, individual knowledge and skill & ability (Edwards, Caplan, & Van Harrison, 1998) together forming the personal resources of an employee. These characteristics are hard to determine, since extensive psychological assessments are required. These personal resources are used to perform activities related to their job. These tasks have job demands. When the job demands exceed the personal resources, negative outcomes will form for the employee.

In order to map these job demands, activities are studied in this research. The Center for People and Building propose a list of 9 activities. From these activities Beijer, Brunia,

De Bruyne, Gosselink, and Pullen (2011) of the CFPB have developed six activity profiles, dividing employees according to the spread of activities they generally perform during the week.

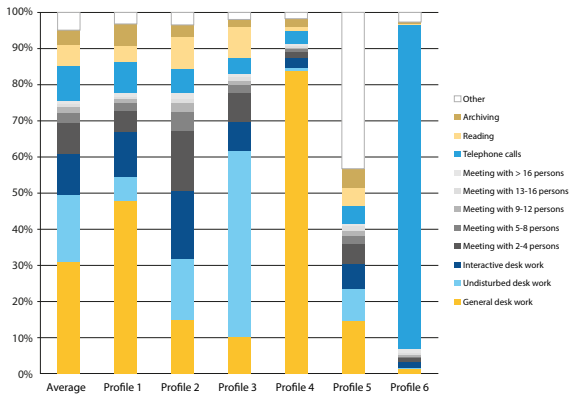


Figure i. Activity profiles from CFPB

Work environment

Vos, Van Meel, and Dijcks (1999) define the office as 'the place where office work is performed'. For this research, workplaces are a part of the work environment. This work environment contains both physical characteristics, and social and mental constructs of the place and space where someone works, that can have an impact on a person. By dividing a workplace in characteristics, it becomes possible to determine which characteristic contributes to the correlation between stress and the work environment. 21 characteristics have been defined, divided over the categories privacy, facilities, allocation and use agreements.

Health

The World Health Organization (n.d.) divide health intro three aspects: physical, social and mental. Stress is an issue in the mental domain, but also causing physical problems, such as cardiovascular illnesses. Stress is a physical response to a negative outcome of the threat-safety assessment, caused by a stressor, releasing the hormones adrenaline and cortisol in the body and activating the sympathetic nervous system, making it ready for action.. Due to negativity bias people may review all potential dangers as threats, triggering the stress response in situations that appear harmless, such as social interactions, or faced with deadlines. (Thayer, Åhs, Fredrikson, Sollers III, & Wager, 2012)

"STRESS IS A PHYSICAL RESPONSE TO A THREAT-SAFETY ASSESSMENT"

There are multiple ways to reduce employee stress, in different stages (preventive, reducing impact and reactive). While it is best to prevent stress from forming, it is sometimes not possible to exclude stressors from daily life. Thus actions must be taken to reduce the stress.

In the theoretical model, health is represented only by the concept of stress, since this is the researched concept in this study. Stress impacts performance; however, performance is a stressor on its own and should, therefore, be included in the theoretical model as a sperate concept. Stressors are external factors that result in stress and form the binding factor between the external world an the internal mental health of a person.

Smart tools

The definition of smart tools used in this research is:

A service or product which collects real-time information to improve a current activity or process, while supporting decision making on the future activities or processes.

In this context, the required information are the stress level, current workplace and current activity. While automated stress measurements are possible, the automation of the workplace and activity tracking is not in a plug and play stage yet and therefore fell outside of the scope of this research. Since these measurements where not yet real-time available, in combination with the lack of knowledge for decision making, the objective of improving current activity of the smart tool can not be achieved yet. Proposition have been made in the report on how it could be achieved.

To do real-time stress measurements, the bio-marker electrodermal activity (EDA) is used. EDA measures the skins resistance, which is influenced by the activation of sweat glands, whom are linked to the sympathetic nervous system and activated during the stress response.

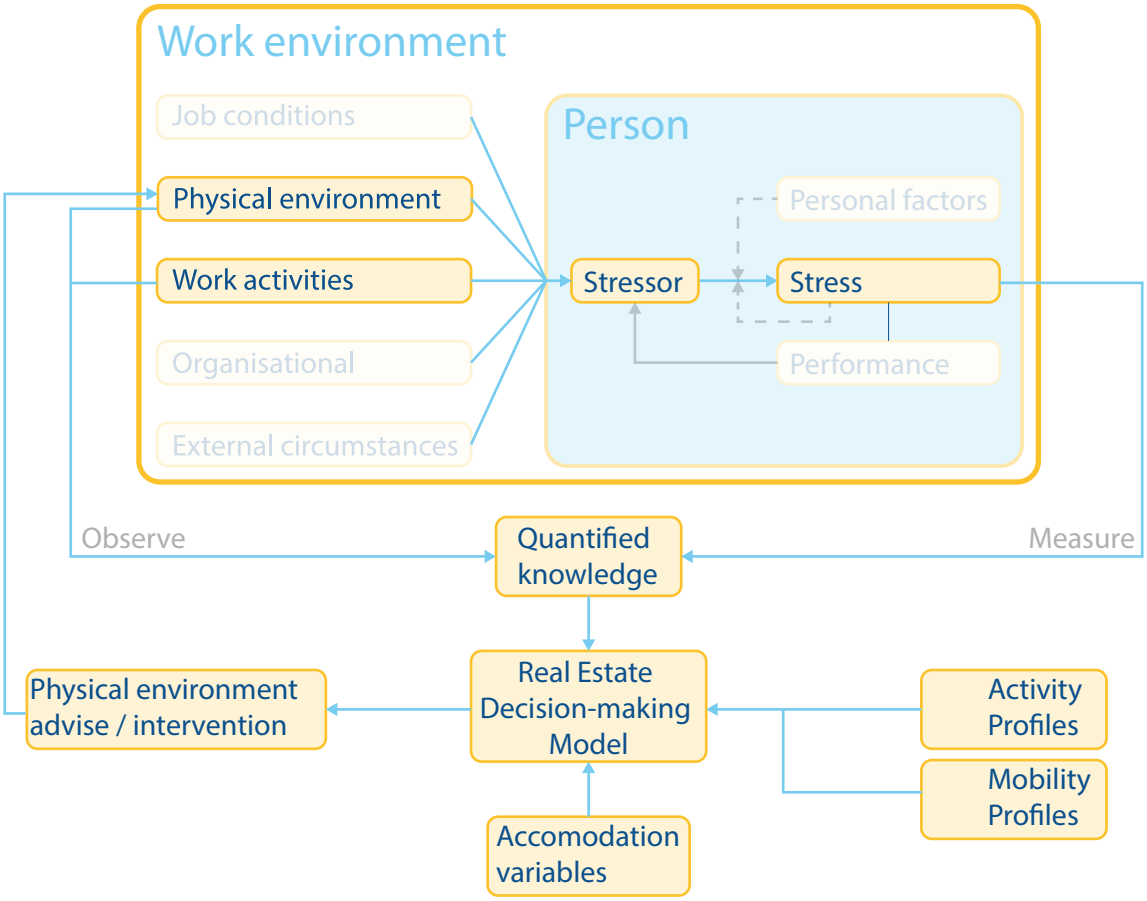


Figure ii. Conceptual model

Variable type	Variable	Can be divided into
Dependent variable	Stress	*Perceived*
		Actual
Independent variables	Personal characteristics	*Age*
		Gender
		Activity profile
		Mobility profile
	Workplace	*Privacy*
		Facility
		Use
		User agreements
	Activity	*Type*
Confounding variables	Activity	*Workload*
		Skill utilization
		Skill variation
	Personal factors	*Coping styles*
		Hardiness
		Locus of control
		Individual knowledge
		Skill & ability
	Organizational	*Level of autonomy*
		Social support
		Relation supervisor
		Role ambiguity
		Feedback
	Job conditions	*Security*
		Salary
		Task significance
	External	*Life events*
		Work-home conflict
		Social

Table i. Overview of variables associated with stress in the work environment in the literature (own ill.)

A smart ring from the company Moodmetric has been selected to perform the measurements with, due to their product being scientifically validated and the ability to extract data easily from the device through a cloud based data storage.

The secondary objective of the smart tool is to support decision making for future processes. This is done by creating an operational model that, based on the acquired data from the structured observations, can propose an program of requirements for a work environment, by minimising the stress by choosing a variety of workplaces that best support the diversity of employees in the company.

Theoretical model

To investigate the relations that are drawn in the theoretical model on the person, work environment and health, variables need to be defined. The variables are a translation of the relevant concepts to elements that, potentially, could be measured. Variables are divided into three groups, dependent variables, independent variables, and confounding variables.

The dependent variable is the concept that is investigated and changes due to changing values of independent variables. In the case of this research, this is stress. Stress can be divided into two types, perceived stress, and actual stress. Perceived stress refers to how a person experiences stress and other feelings that the person associates with stress but are not necessary stress. Actual stress is a measured form of the physiological reaction in the body, in the form of a bio-metric.

The independent variables are concepts that form the context of the measurement. They are expected to influence the dependent variable. Independent variables can be manipulated to take certain values. In the case of this research, the independent variables are personal characteristics, workplace, and activity.

Each person differs from another and thus reacts differently to varying circumstances. Personal characteristics are therefore of potential influence. While gender and age are respectively linear and dichotomous, divisions of time spend on certain activities, and switching behaviours are not. To create generalised findings, it is necessary to form profiles. Thus the Activity Profile and Mobility Profile are used.

Different work activities have different demands. Since activities are the main concept of activity based working environment, the work environment that will be investigated during the structured observations, these activities are an important variable to be investigated. For the activities, the adapted list of activities from the CfPB is used.

In Chapter 4 workplaces are discussed, and from it, four basic characteristics were defined, privacy, facilities, use and use agreements. These basic characteristics after that were divided into 21 sub characteristics, that will be used as variables for workplace.

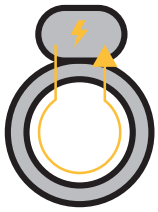
The above-mentioned independent variables are not the only variables that are of potential influence on stress. From the literature review in the previous chapters, five more big groups of aspects could be divided: activity (with the focus on the demands on the employee) (sub chapter 5.3), personal factors (chapter 3), organizational factors (sub chapter 5.1), job conditions (section 5.1.2) and external circumstances (section 5.1.2). The subdivisions of these variables are shown in the overview table.

"STRESSORS ARE FORMED WHEN PERSONAL RESOURCES DO NOT MATCH THE JOB DEMANDS"

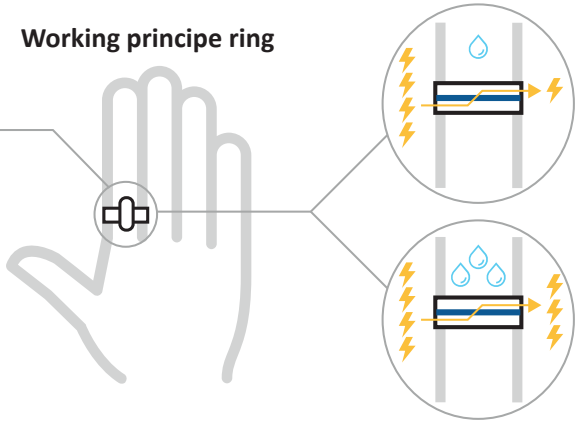
These variables are named confounding variables, meaning that there is a potential influence on the dependent variable. However, they are not taken into account during the research. If one critically looks at these variables, it can be noted that important variables are listed among the confounding variables, that presumably have the potential to cause a lot of stress.

However, as mentioned during the scoping of this research, with the current dependent and independent variables, the research does not investigate the cause of the stress. It merely determines in what variable combinations stress occurs in higher or lower levels.

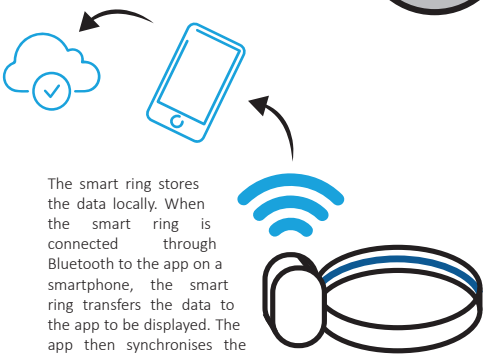
STRESS MEASUREMENT



Working principe ring



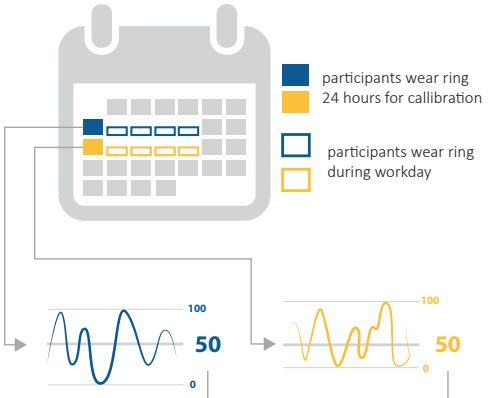
Data transfer and storage



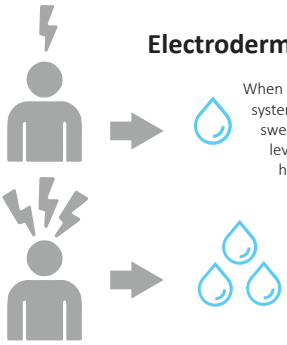
The smart ring stores the data locally. When the smart ring is connected through Bluetooth to the app on a smartphone, the smart ring transfers the data to the app to be displayed. The app then synchronises the data to the cloud storage, where it can be accessed by the user and researcher.

The band of the smart ring consist out of three parts: two conductive stainless steel bands, with a non-conductive plastic band in between. The smart ring sends out a very small but stable pulse of electricity through one of the stainless steel bands of the ring. The smart ring contains a sensor that measures the level of electicity returning from the other stainless steel band. In order for the electricity to reach the other band, it has to travel through the skin. The resistance of the skin determines how much electricity will pass. The amount of sweat on the skin can decrease the skins resistance, allowing more electricity to pass and to be measured.

Observation schedule

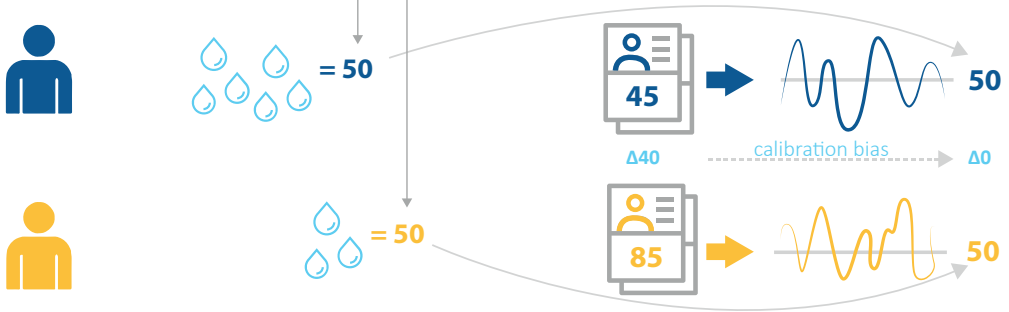


Electrodermal activity as biomarker



When stressed, the sympathetic nervous system is activated that triggers sweatglands to produce sweat. The higher level of stress is present in the body, the higher the production of sweat will be, increasing the electrodermal activity. The changes in the electrodermal activity of the skin can be rapidely measured and can change a lot in the course of minutes, making it an ideal biomarker to measure changes in the stress level of a person throughout time.

*"Your **50** is not my **50**."*



Participants

Every participant is different is many ways, but two aspects are of influence on the observations: the degree of sweatiness of hands and the current actual stress in general

Personal sweatiness

During the first day the employee's relative sweatiness is measured to callibrate a personal coefficient. All measurements are adjusted through this coefficient.

Relative stress measure

When the actual stress level of a participant would be determined (by e.g., psychological and physiological testing), this could result in a difference, as in th example above, of Δ40, however the callibration removes this difference, resulting in a distorted difference of Δ0.

Figure iii. Infographic on the stress measurement during the structured observations

Results empirical research

The sample size of the structured observations was n=36 (19 male, 17 female). Age distribution was representative, with <25(n=2), 25-34(n=18), 35-44(n=11), 45-54(n=4), 55-65(n=1). There were no participants with the age of 65+. Below the representation of the profiles is given.

	Mean	Stdv	Variance	n
Female	47,34	13,85	191,76	17
Male	55,56	18,15	329,52	19

Table ii. Descriptive statistics of variable Gender (own ill.)

	Mean	Stdv	Variance	n
<25	n/a	n/a	n/a	2
25-34	49,42	17,57	308,80	18
35-44	55,43	17,94	321,84	11
45-54	44,96	5,48	29,99	4
55-65	n/a	n/a	n/a	1

Table iii. Descriptive statistics of variable Age (own ill.)

A total of over 3000 databites (complete data of a 15 minute interval observation for one participant) were gathered and analysed. Analysis of Variance and T-test comparisons of means are performed to analyse the data.

As can be seen in the next tables, the perceived stress and stress score appear to be linear correlated, however due to the calibration bias, no hard conclusion can be drawn from this.

"OVER 3000 DATABITS WERE GATHERED DURING THE OBSERVATIONS."

For the same comparison with the stress score minus mean, no definitive findings is done, however it appear that perceived stress and measured stress are correlated.

Measured stress appear to be correlated to perceived productivity, where a low stress levels in a high productivity, supporting the statement that healthy employees are productive employees. Interestingly enough, the comparison between perceived stress and perceived productivity tells a different story, where productivity appears to be correlated to stress. This raises the objection of common method bias for the self-rated stress variable, since this is logged at the end of the workday, thus having an increased change of strain and stress. This makes the self-rated stress variable biased to appear higher than the average throughout the day might have been.

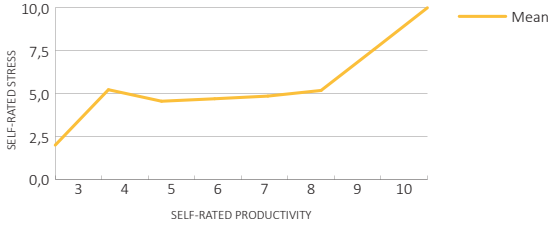
On the next page, the overview of the findings derived from literature compared to the findings from the research are presented.

During the evaluation of the results in a focus group, it was proposed that the main concepts related to stress in the work environment, derived from the findings and from experience, are privacy, control, and job demands. When the desired level of privacy and/or control is not reached, this decrease personal and job resources, thus making it harder to satisfy the job demands. When job demands are not met, stressors are formed.

Measured stress versus perceived stress

Measured stress versus perceived productivity

Perceived stress versus perceived productivity



Findings from literature	Hypothesis	Findings from research	Conclusion
Biomarkers for stress should be investigated as a potential measuring method	Using a smart ring that measures electrodermal activity, reliable stress measurements can be done	Literature suggests that electrodermal activity is a reliable biomarker for stress and that the used smart ring outputs reliable results in comparison to medical equipment. The actual validity of the obtained measurements in terms of being a precise representation of someone's actual stress level is unknown since it is not verified during the research. However, it is reasonable to assume that the measurements are credible when displaying the measurements and regarding them in the context of the before mentioned scientific evidence.	Findings suggest that electrodermal activity obtained through a smart ring is a suitable measuring method for stress research; however, further study in the relationship between the measurement and the actual stress level of a person can help to sensitize the measurements
A measuring method that adapts itself to individual physiology should be considered	By using the calibration function of the smart ring, the output will result in comparable stress values	The calibration function of the smart ring resulted in adjusted measurements that could be compared with other participants. However, due to its adaptive nature, calibration bias causes the outputted measurements to be stripped of a reference point, dismissing the potential of obtaining someone's actual stress level, making the method not suitable for doing research into comparing persons or groups on the basis of their average measurements, but only to how) much' the measurements change under certain circumstances	Adaptivity to an individuals physiology is possible and recommended, in order to make measurements comparable. A new method, however, must be introduced to remove calibration bias and to make it possible to compare persons and groups
A (quasi) real-time measuring method is needed to capture the changing nature of task and space	By using a combined method of obtaining biometric data and self-observing through a logbook, significant findings can be done relating to the nature of the combination of workplace and activity to stress	Significant findings have been done, using the combined method during the structured observations; however, the accuracy of the observations are regarded fair, as measured with Cohens Kappa. The method used in this research works with an interval of 15 minutes, which was assumed to be the smallest interval possible for the current method. This interval is not supported by testing, and no other methods have been researched.	In contrary to existing methods, the combined method used allows specifying certain workplaces and activities from each other, resulting in more precise results. The method of obtaining biometric data through a smart ring has been found to be very precise and appropriate. The accuracy of the logged observations, however, can still be reviewed as limited, where automatization of the observations is proposed as a solution.
Physiological measurements instead of perceptual and self-report measurements should be investigated in terms of usability for workplace research	There are differences between physiological stress measurements and perceptual self-reported stress measurements in relation to workplace research	Self-rated stress and Stress Score appear to be correlated; however, due to the calibration bias, this finding cannot be regarded as definitive. It does point it that direction. Self-rated stress and Stress Score Minus Mean do not result in a significant correlation. Self-rated stress data is gathered only once every day, making it by definition less accurate than the physiological measurements, that are recorded every second and used per 15 minutes.	No definitive conclusion can be drawn on the differences between physiological measurements and self-reported measurements; however, findings strongly point to the direction that they should not be regarded the same. Further research in the relation of actual and perceived stress is needed, together with additional research on the actual stress in relation to the Stress Score

Table iv. Comparison of literature findings and research findings on method

Findings from literature	Hypothesis	Findings from research	Conclusion
Employees in open plan offices are more likely to experience stress Open plan offices reduce privacy Open plan offices increase job demands	V1: open 5-10 and open 10+ are more stressful V2: open and open with 1 wall are more stressful	V1 open 5-10 is not significantly more stressful V1 open 10+ is significantly more stressful V2 open with 1 wall is not significantly more stressful V2 open is significantly more stressful	There are inconsistent findings that indicate a correlation between the size of room and stress, suggesting an increase in size results in an increase of stress There are inconsistent findings that indicate a correlation between the openness of room and stress, suggesting an increase in openness results in an increase in stress
Workplaces with increased possibility for distraction, have higher job demands Physical enclosure is an important factor for the perception of privacy Privacy is important in the perception of the work environment Privacy and control are important factors in the work environment in relation to satisfaction and stress	V3: 1 or 2 and 2+ are more stressful	V3 Audio privacy on average results in no significant findings V4 Visual division on average result in no significant results	Findings do not support the statements from literature
Visual division in combination with crowding is associated with job demands	V1 & V4 are correlated; High crowding with a low level of visual division is more stressful Low crowding with a high level of visual division is less stressful	V1 cellular 1 person combined with V4 wall results in less stress V1 cellular 5-10 combined with V4 non, results in less stress V1 open 5-10 combined with V4 non results in more stress V1 open 10+ combined with V4 non results in more stress	There are inconsistent findings on the combination between visual divisions and size of room. However, it appears there might be a correlation where crowding in combination with low levels of visual division results in more stress
Desk-sharing increase job demands	V13: flex use is more stressful	V13 Flex use is not significantly more stressful	Findings do not support the statement from literature

Table vi. Comparison of literature findings and research findings on workplace characteristics

Model	Hypothesis	Findings from research	Conclusion
Person-Environment Fit: Employees performing activities that are a core part of their job activities can handle higher job demands	AP: AP2 performing PMT or UPM is less stressful AP3 performing UDW is less stressful AP4 performing GDW is less stressful	AP2 has no significantly lower stress for activities PMT and UPM AP3 has no significantly lower stress for the activity UDW AP4 has no significantly lower stress for the activity GDW	Employees of specific activity profiles are not less stressed performing more common activities for their activity profiles
JD-R model: Facilities that support certain activities are job resources	V5: availability of power sockets reduces stress in general V6: availability extra monitor reduces stress for UDW, GDW and IDW V7: desk chairs reduce stress for UDW, GDW and IDW, other chairs increase stress for UDW, GDW and IDW V8: Individual desks reduces UDW, GDW and IDW Individual desks increase stress for PMT and UPM V9: Presentation hardware reduces stress for PMT and UPM V10: Spacious desks reduce stress for GDW and IDW V11: No storage increases stress for GDW	V5 Power sockets is not significantly less stressful V6 Extra monitor in combination with UDW, GDW or IDW is not significantly less stressful V7 Desk chairs in combination with UDW results in less stress. Desk chairs in combination with GDW or IDW is not significantly less stressful. Other chairs types in combination with UDW, GDW or IDW are not significantly more stressful V8 individual desk in combination with UDW results in less stress. Individual desks in combination with GDW or IDW are not significantly less stressful V9 Presentation hardware in combination with PMT or UPM are not significantly less stressful V10 spacious desks in combination with GDW or IDW are not significantly less stressful V11 Storage in combination with GDW is not significantly less stressful	There is very limited evidence that facilities that support certain activities as job resources, result in less stress

Table v. Comparison of literature findings and research findings on activities

Operations research

In order to make use of the quantified findings, represented in the quantified knowledge base (see also Appendix VII), assumption are made in terms of the data:

- All data is comparable, due to identical gathering and calculation method
- All variables have linear relations to stress
- Confounding factors impact the results evenly

These three assumptions could be further investigated in future research.

In order to create an program of requirements based on workplaces, these workplaces first had to be formed. This was done through a calculation method, creating four variants four each work mode of focus, collaborate, meet and social. Each variant has a different amount of different workplaces in them, ranging from one to four, creating a total of 16 variant (4 work modes X 4 variants). Each variant is calculated to have workplace characteristics in them that result the lowest potential stress score, by combining different activities profiles together. Doing this, results in a more differentiated workplace portfolio that accommodates more employees in their reduction of stress.

The operational model itself is based on linear programming (LP). This model aims to yield the best possible solution for a work environment with minimized stress levels, by providing a program of requirements on a workplace level. This program of requirements consists of a list of different workplace types and their amount.

The current model can translate the gathered knowledge into a concrete program of requirements, based on the given constraints. This program of requirements can be used as a starting point or reference point for further designing and analysis.

The model takes into account four different work modes. This could be increased to a diversification of the required workplace types, making the model more complex. The model is in a way parametric that it is easily adjustable and variables can be added without harming the core structure of the model.

The current model is not yet capable of dealing with the uncertainties and inaccuracies of the quantified knowledge base. This is something that needs to be assumed to be correct. Therefore, the outcome of the model should not be considered to be an absolute truth, but rather serve as an assisting tool in developing finalised programs of requirements, providing a new perspective of optimizing on stress in the work environment.

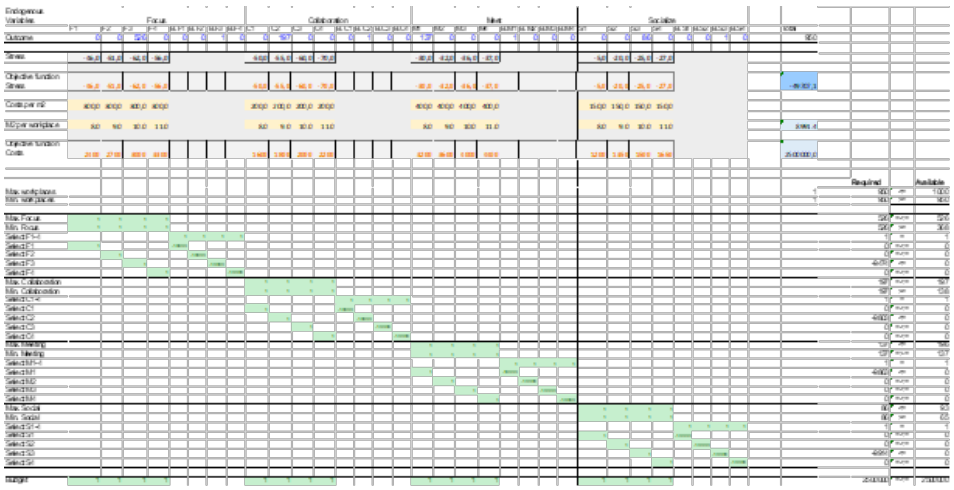


Figure iv. Snapshot of the operational model (own ill.)

Conclusion

To conclude, a comprehensive answer will be given to the main research question:

"How can insights in the relation between workplace and activity on employee stress be used to develop a real estate decision-making model?"

In order to develop a real estate decision-making model, profound insights into the correlation between the work environment and stress are needed. To improve a situation, first it is necessary to know what the situation actually is and how possible interventions will influence that situation.

By performing structured observations to determine stress levels in a variety of workplace and activity combinations, quantified knowledge can be generated that can be used to evaluate possible interventions beforehand.

Combining the quantified knowledge and practical information and processes together in a real estate decision-making model, a new perspective is created that can help real estate managers make future decision in reducing stress in the work environment.

Discussion

The current method is not yet perfect, but it is an improvement to previous self-rated methods. Automatisation of the workplace and activity logging could greatly improve the accuracy and remove observation bias, however, common method bias is still a problem.

Causality in the results is an issue, limiting the potential insight generated from them. The findings can be strengthend with qualitative feedback.

The impact of counfounding factors is unknown in terms of quantified numbers and should be further investigated.

The measurements from the ring provide an excellent new perspective by creating hard objective data. It is, however, unfortunate that no method has been found during this research to counter the effect of calibration bias that removes the reference of an absolute stress level of the partcipants. This has resulted in the inability to compare groups with one another. For this research that was not a large problem, however, for future research this must be resolved.

The operation model is as good as the data from the empirical research. In order to make substantiated statements on this, intervention testing must be done according to the outcomes of the model to validate the findings.

Recommendations

It is recommended to continue this research, however, some changes could be made. A smaller list of workplace characteristics could be used to focus on specific insights.The focus could be specified by the use of the concept privacy, control and job demands.

Within this research it was not possible to add sound and occupancy rate to the measurements, but this would be highly recommended for future research.

Intervention testing based on the current findings and models is recommended in pilot versions, by using the current method, to investigate differences and improving the quality of the model. This could be done on a large scale, but also done on an individual scale, by determining personal preferences and values.

TABLE OF CONTENTS

PART III

PART IV

PART V

GLOSSARY

This list defines the use of specific terms, abbreviations and acronyms in the report.

List of definitions

Ability: proficiencies acquired through training and experience.

Activity: groups of actions that describe actions with (partially) the same characteristics, that an employee performs during the workday. Activity types are undisturbed desk work (UDW), general desk work (GDW), interactive desk work (IDW), planned meeting (PMT), unplanned meeting (UPM), calling (CL), socialize (SCL) and other (OTH).

Activity Based Working: the concept of having a variety of workplaces available to support a wide range of activities, that can be shared by multiple employees.

Activity type: *see Activity.*

Built environment: the human-made surroundings that provide the setting for human activity. In this thesis, the built environment refers to the spaces and places that people perform work, with a main focus on the office.

Burnout: the medical condition that describes emotional exhaustion due to excessive work demands and can be seen as a syndrome of three characteristics: 1) Emotional exhaustion, 2) Depersonalisation and 3) Decreased personal ability.

Calibration bias: the process that creates the difference between the average of measured values and its true value, due to an unknown reference point.

Common method bias: the influencing factor of a measurement that is caused by the measuring method and equipment instead of the actual studied variable.

Center for People and Buildings: Dutch knowledge institute focused on the relation between human, work and work environment.

Confounding variable: a variable that is possibly of influence on the dependent variable, but is not considered as an independent variable, due to lack of knowledge of the variable or scope limitations. *See also: Independent variable and Dependent variable.*

Corporate Real Estate Management: the discipline that manages and operationalises the accommodation strategy for a company or organization. Also known as REM.

Coping styles: the manner a person deals with different situations.

Data Management Plan: a document that describes how data will be generated or used within a given project, how they will be collected, managed, stored and made available during the study, and how they will be shared upon completion of the research project.

Desk sharing: the term for an office use agreement within an organization, which involves multiple employees using a single physical workplace during different time periods.

Dependant variable: a variable that is being studied and is influenced by the independent variables. Dependant variables are the outcome or output whose variation is being studied. *See also: Independent variable.*

Electrocardiography: a measurement that records the electrical activity of the heart. From this information, the heart rate and heart rate variability can be deducted. *See also: heart rate variability.*

Electrodermal Activity: a measurement that uses the electrical conductance of the skin. This is a biomarker for stress.

Employee: a knowledge worker that performs its work in an office.

Facility Management: the discipline that manages and operationalises the supportive processes and activities of an organization, in order to facilitate the core business processes.

Fulltime equivalent: indicating the workload of a fulltime employed person. This can differ per company and is usually 36-40 hours per week. In relation to accommodation strategies, the FTE is used to indicate how much workplaces there are in a flexible office concept. With a FTE of 0,7 there are 70 workplaces for every 100 fulltime employees.

General Data Protection Regulation: European law that protects citizens privacy rights.

Hardiness: the ability to endure difficult situations.

Health: state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

Heart Rate Variability: the difference in time between individual heartbeats. This is a biomarker for stress.

Hot desking: see Desk Sharing.

Human Research Ethics Committee: the responsible committee of the Delft University of Technology that checks researches with human participants according to the ethical standard of the university.

Independent variable: a variable that represents an input or cause that potentially has influence on the variation of the dependent variable. Independent variables can be manipulated, assigned or observed in order to test for effect on the dependent variable. *See also: Dependent variable.*

Individual knowledge: information someone believes to be true and is stored in memory, related to a certain topic.

Job Demand-Resources model: psychological model that describes the workings of work activities on the human condition.

Linear programming: a method to achieve the best outcome in a mathematical model whose requirements are represented by linear relationships in the form of constraints, resulting in a feasible solution space.

Locus of Control: the cognitive placement of responsibility of a situation, either within a person or outside of one.

Mental health: a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community.

Mobility type: one of four types that describe the internal movement of an employee within an office. Respectively from low mobility to high mobility: The Camper, The timid Traveller, The Explorer and The True Transient.

New Ways of Working: an initiative to increase flexibility and employee satisfaction within organizations. Often associated with the increase of flexible office concepts with increased use of desk sharing.

Observation: a unit of data that is gathered by means of noting down a real-life event or

measurement.

Office: a workplace where people process information as a part of their job.

Population: the total group of persons or objects that the study aims to generate knowledge. From the population, the sample is drafted. *See also: Sample.*

Photoplethysmogram: a measurement to register the hearth rate by an optical sensor. Could potentially register heart rate variability. *See also: Heart Rate Variability.*

Qualitative research: a research strategy that focusses on the description of a problem and the creation of new knowledge, with an emphasis on the way's individuals interpret their social world.

Quantified Metrics: forms of data that is quantifiable numerical information representing a real-world occurrence. They are the objective result of measurements.

Quantitative research: a research strategy that focusses on the collection and analysis of quantified data to generalize existing knowledge to objective reality.

Real Estate: property in the form of land and the buildings on it. Mainly used to describe the collection of buildings in one's ownership.

Sample: a representation of the research population that is used for a study. *See also: Population.*

Skill: *see Ability.*

Stress: a physiological reaction that follows from the fight-or-flight response.

Stress level: a measurement that describes stress on a scale. The scale is subject to different implications.

Stressor: a mental event that is caused by threat-or-safety assessments, based on an internal or external stimulus.

Smart tool: a service or product which collects real-time information to improve a current activity or process, while supporting decision making on future activities or processes.

User: a person that uses a specific service or product. In the context of this research, also an employee.

World Health Organization: a global suborganization of the United Nations, to study aspects of health and healthcare and to coordinate activities to improve the health of the world population.

Workplace: a location with certain characteristics that enable a person to perform an activity.

Workplace type: a group of workplaces that have similar characteristics.

Work environment: the collection of employees, workplaces and organizational aspects where employees perform their work.

List of abbreviations

ABW: Activity Based Working

AVG: Algemene Verordening Gegevensberscherming, *see General Data Protection Regulation.*

CFPB: Center for People and Buildings

CL: calling, *see Activity.*

CREM: Corporate Real Estate Management

DMP: Data Management Plan

DV: Dependent Variable

ECG: Electrocardiography

EDA: Electrodermal Activity

FAIR: Findability, Accessibility, Interoperability, and Reusability.

FM: Facility Management

FTE: Fulltime Equivalent

GDPR: General Data Protection Regulation.

GDW: General Desk Work, *see Activity.*

HRV: Heart Rate Variability

HREC: Human Research Ethics Committee

IdV: Independent Variable

IDW: Interactive Desk Work; *see Activity.*

JD-R model: Job Demands-Resources model

LP: Linear Programming

NWoW: New Ways of Working

Obs: Observation

OT: Other, *see Activity.*

PMT: Planned Meeting, *see Activity.*

PPG: Photoplethysmogram

UDW: Undisturbed Desk Work, *see Activity.*

UPM: Unplanned Meeting, *see Activity.*

RE: Real Estate

SCL: Socialize, *see Activity.*

WHO: World Health Organization

PART I

RESEARCH INTRODUCTION & DESIGN

In the first part of this thesis, an introduction to the research is given. In Chapter 1 a global introduction on the topic is given and the research question are presented. In Chapter 2 the research design and methods are discussed.

1. INTRODUCTION

Open a newspaper or turn on the TV, and the chances are substantial that the topic presented is about stress. Only last year, dozens of new books about stress were published. Where this increase in attention to stress comes from is debatable. Numerous self-help retreats and mindfulness professionals seem to pop up like mushrooms on an autumn day. But the question that rises, is: Do people have more stress then before or is there just increased attention to it? At the same, society is changing rapidly, as people are integrating new ways of communicating in their lives and balancing their need and desire for the merits of technology with the continuous demands of societal conventions. There are no more excuses to not be aware, to not respond, to not be available. Ask people how they are doing, and the chances are high that they will answer with "busy," as it is an achievement.

Whether there is more attention to stress or there actually is more stress then there used to be, there is no denying that stress is a problem. A problem that needs to be dealt with. However, stress has always been present in people's lives, and people have always been trying to deal with it. Thus, it might be time to try a different approach.

This study takes a built environment perspective to investigate the problem of stress, contrary to an organizational psychological perspective, that many types of research have taken. Studies have revealed that people spend 90% of their time indoors, and full-time employed people spend 33% of their total waking hours at their workplace (Veitch, 2011). This is a substantial part of one's life and can arguably have the greatest impact on the stress level of a person's life. Therefore, this study researches stress in the physical part of the work environment. Multiple factors are of influence on the stress of a person, as will be further described later in this chapter. To scope the research and maximise the creation of specific knowledge, the study focuses on the physical work environment and its relationship with stress. It does acknowledge the influence of factors such as organization and external life events on the stress level of a person but will not investigate them further in this research.

1.1 RELEVANCE

1.1.1 Societal

In the Netherlands absence because of sick leave costs employers about €13 billion in personnel costs every year (TNO, 2017). Of the total sick leave, 34,7% is due to mental illness, mainly caused by stress and burn-outs complaints. Of the total workforce, 5% is at home due to burnout complaints. 17% of all employees are experiencing burnout complaints. This is a growing problem, with an increase of more than 2% in burnouts complaints in the last three years (CBS & TNO, 2017). TNO (2017) estimates the costs of absence related to stress €1.8 billion per year. That is the equivalent of more than 40.000 fulltime employees.

The reasons for stress among employees vary and are hard to substantiate, mostly because often they are a combination of different factors. Complaints about the work environment, however, are among the reasons. Therefore, they must be addressed. While it is maybe hard to grasp that the physical environment itself might cause stress, the work environment is the location where a lot of stress is created. It can either function as a buffer that caused stress or aggravate it (Bakker, Demerouti, & Euwema, 2005). However, which aspects of the work environment influences employee stress levels in what factor is unknown and improved knowledge could contribute to stress reduction.

At the same time, pressure on the work environment is high. With the rise of New Ways of Working (NWoW) alongside a desire for a structural decrease in office square meters during the recession, new office concepts were introduced that enabled flexibility, collaboration, and productivity, while reducing the required amount of space. Desk sharing, hot-desking, open plan offices, teleworking, active design, activity-based design are some of the concepts that are widely adopted nowadays in corporate offices all over the world. Some of the ideas are not new but increased exponentially in use over the last decade. But, in contrary to the concepts it was designed for, researchers shows that quality of communication drops (Mylonas & Carstairs, 2008), satisfaction with the office drops (Kim & De Dear, 2013), and productivity is decreased significantly (Davis, Leach, & Clegg, 2011) and employees are sick more often (Bodin Danielsson, Chungkham, Wulff, & Westerlund, 2014). To prevent future workplaces from becoming a dysfunctional environment, it is important to know what works, what does not work and especially why.

1.1.2 Scientific

Literature concludes that healthy employees are more productivity (Allen, Hubbard, & Sullivan, 2005; Burton, Conti, Chen, Schultz, & Edington, 1999), but at the same time indicate that there is no strong consensus as of how and in what degree (De Croon, Sluiter, Kuijer, & Frings-Dresen, 2005; Veitch, 2011). While physical health and ergonomisc are popular study themes, with emerging terms as 'Active Design' and 'Healthy Offices' that stimulate employees to adopt healthy behaviour that stimulates the physical well-being of a person, in the mental health field, there still exists a gap in knowledge. Multiple studies have researched aspects of the relation of mental health, stress and burnout to the work environment with a perspective on either physical, organizational or both (Bakker & Demerouti, 2007; De Croon, Sluiter, Kuijer, & Frings-Dresen, 2005; Iacovides, Fountoulakis, Kaprinis, & Kaprinis, 2003; Regehr, Glancy, & Pitts, 2013; Sohail & Rehman, 2015; Su, Murdock, & Rounds, 2015; Veitch, 2011; Warr, 1994), however these studies usually present vague and generalised conclusions on a high scale level and do not acknowledge the fact that person can differ greatly from each other when it comes to mental health.

A gap of knowledge on the relation of the workplace and mental health is described (De Croon et al., 2005; Veitch, 2011), in which more in depth knowledge into the physical aspects of the work environment could provide a strong fundament for further research

.

Current studies on stress use often the same method of conducting big surveys. The variable stress is these cases becomes a subjective self-rated score, obtained at a random time in that person's life and can only tell something about how the person perceives the work environment. To obtain more specified and detailed information, objective measurements are required to quantify and measure differences between variables (Sohail & Rehman, 2015).

With the knowledge on the physical work environment, directions for further research can be indicated. It could also serve as a knowledge base for intervention testing and (smart) tool development.

An overview of the main literature is given in Table 1, where the findings of four literature types of research on the topics stress measurements, workplace & performance, and workplace & health are shown. The conclusions of these findings are used as a starting point and reference point for this research.

Author	Author Subject	Finding	Conclusion
Alberdi, Aztiria, and Basarab (2016)	*Stress measurements*	Stress-measuring methods based on hormonal techniques and subjective questionnaires are not suitable for real-time monitoring and require people to get out of their routine activities.	**Biomarkers for stress should be investigated as a potential measuring method**
	Stress measurements	Physiological features are associated with stress levels, however, differ in individuals, thus making it difficult to develop a detection system.	**A measuring method that adapts itself to individual physiology should be considered**
Davis et al. (2011)	*Stress measurements*	The nature of tasks and the space that workers utilize to fulfill them vary over time and between individuals. Capturing such interactions and experiences, require techniques more sophisticated than cross-sectional surveys or questionnaires administered months apart	**A (quasi) real-time measuring method is needed to capture the changing nature of task and space**
	Stress measurements	Research concerning the evaluation and effects of open-plan offices within field settings has been dominated by perceptual and self-report measurements, with the inherent dangers of common method bias. Using physiological measurements as indicator for stress measurements would enable more direct integration of findings with related literature and would provide another source of 'hard' data for designers and other stakeholders.	**Physiological measurements instead of perceptual and self-report measurements should be investigated in terms of usability for workplace research**
	Workplace & performance	Open plan offices have greater opportunity for cognitive overload or over-stimulation to occur and contributing to stress, which results in an increased occurrence of negative outcomes (e.g., withdrawal from the workplace, reduced environmental satisfaction or decremented task performance)	**Employees in open plan offices are more likely to experience stress (1)**
	Workplace & performance	Distraction in the work environment increases cognitive effort, adding to the present job demands, increasing the possibility of exceeding the capacity of information processing of an individual	**Workplaces with increased possibility for distraction, have higher job demands**
	Workplace & performance	High-density offices with relatively few visual divisions are associated with increased distraction, lower levels of concentration and lower levels of motivation	**Lack of visual division in combination with crowding is associated with higher job demands**
	Workplace & performance	Lack of psychological privacy may result in decreasing open-behaviours, such as confidential discussion and work-related feedback	**Privacy is associated with performing potential beneficial behaviour related to organisational aspects**

Table 1. Literature Overview

De Croon et al. (2005)	*Workplace & performance*	There is strong evidence that working in open workplaces reduces the office worker's psychological privacy	**Open plan offices reduce privacy**
	Workplace & performance	There is limited evidence that working in open workplaces intensifies cognitive workload	**Open plan offices might increase job demands**
	Workplace & performance	There is limited evidence that a close distance between workplaces intensifies the office worker's cognitive workload and reduces his/her psychological privacy	**Crowding might increases job demands and decreases privacy**
	Workplace & health	There is inconsistent evidence that close distance between workstations has an effect on job satisfaction and for an effect of workplace openness and the distance between workstations on stress caused by crowding	**Employees in open plan offices are more likely to experience stress (2)**
	Workplace & health	There is inconsistent evidence for an effect of workplace openness and distance between work stations on performance and health.	**Employees in open plan offices are more likely to experience stress (3)**
	Workplace & performance	Inconsistent evidence is found that desk-sharing intensifies cognitive workload	**Desk-sharing increase job demands**
Mylonas and Carstairs (2008)	*Workplace & health*	Disturbances in the work environment impact job satisfaction, workers' stress levels and affect task performance	**Employees in open plan offices are more likely to experience stress (4)**
	Workplace & health	Enclosure is correlated with privacy, which in the office is, to some extent, dependent upon the physical enclosure	**Physical enclosure is an important factor for the perception of privacy**
	Workplace & health	Architectural privacy seems to be correlated with overall job satisfaction	**Privacy is important in the perception of the work environment**
	Workplace & health	Workplace density should generally be avoided as it results in opinions of overcrowding, increased noise disturbance, difficulties with temperature control, decrements in task performance and reductions in job autonomy	**Workplace density results in crowding stress, reducing control, performance and autonomy**
	Workplace & health	Workers in an open plan office environment reported lower satisfaction due to inadequate control over the environment. This lower satisfaction occurs through a lack of auditory privacy, personal privacy, and confidentiality of communications. Workers also appear less satisfied with their workstations and jobs when faced with intrusions from others. These intrusions are stressors because they hamper control and decrease predictability of events	**Privacy and control are important factors in the work environment in relation to satisfaction and stress**

Table 1. Literature Overview

1.1.3 Sectoral

In the definition of corporate real estate management (CREM) of Dewulf, Krumm, and De Jonge (2000) focusses on obtaining a maximum added value for an organization by aligning real estate to the core business needs. In organizations that have their core business in the services sector and thus employ knowledge workers, the typical office users, core business needs are supported when employees are supported in doing their jobs. Performance measurement in this area has shifted over the years from financial to added value based (Riratanaphong, 2014). This perspective change has turned to focus on maximizing turnover productivity to a wider scale. Especially in a job climate where there is a war for talent, added values such as corporate image, corporate culture, and increasing innovations have come to be more important.

In these present days, many companies struggle with the problems that stress cause in their organization and aim to improve their work environment on that bases. How this is done, however, is often not based on scientific evidence and is often done by trial and error, due to a lack of tools in this area. Using scientific knowledge could greatly improve decision-making processes that aim to improve the work environment.

The CREM discipline is shifting, just as many other disciplines, into a more data-driven domain. Due to the availability and affordability of things such as sensor technology, decision-making processes are now often supported or even automated based on (real-time) data. This development can improve the argumentation of decision-making and at the same time offer new insights that were not possible to obtain before (Buckman, Mayfield, & Beck, 2014; Valks, Arkesteijn, Den Heijer, & Vande Putte, 2016). Adoption of these emerging technologies into the built environment is slow but promising. There is a wide field of available technologies that can be tested and used, but specific explorative research is needed before they will become commonly used in the sector.

1.2 PROBLEM STATEMENT AND RESEARCH AIM

Based on the previously described situation and gaps of knowledge, the following problem statement is formulated:

Stress in the work environment is a long-standing problem for which there is no conclusive solution yet. Current research methods have their limitations when it comes to detailedness, comparability, and preciseness. More specific insights are needed that take into account differences of peoples to reduce stress in the work environment. Designers, Real Estate Managers, and users lack tools to help them to make decisions that can reduce stress in the work environment.

This problem statement leads to the following research aim:

This thesis aims to broaden the knowledge base of the relationship between workplace and stress by performing quantitative research with objective data and aims to investigate the feasibility of creating a tool through operational-empirical research that can help decision-makers and users use the generated knowledge to decrease stress in the work environment.

In the aim besides the designers and Real Estate Managers, also the user is mentioned. Since the user, or the employee in the context of the work environment, is the one that experiences the stress, this is a core stakeholder and should have a key role in reducing stress. However, because of the lack of knowledge in the field of stress measurement and insights into the work environment, no tool for the user can be developed within the scope of this research, since the knowledge development in the relationship between stress and the work environment is needed first.

1.3 RESEARCH QUESTIONS

Based on the problem statement and the research aim, the main research question of this research is:

"How can insights in the relationship between workplace and activity on employee stress be used to develop a real estate decision-making model?"

Five research question were drawn up to find an answer to the main research question. The sub-questions of this research are as follows:

1. What is the relationship between workplace types and activities on employee stress?
2. How can employee stress be measured?
3. What workplace characteristics are of influence on employee stress?
4. What are the input and output variables for a decision-making model that can reduce employee stress?
5. How can real estate managers use the decision-making model?

1.4 CONCEPTUAL MODEL

In its simplified form, the concepts that are derived from the research questions can be grouped in Employee Stress, the Work Environment and the Real Estate Decision-making Model and are displayed in the simplified conceptual model (Figure 1). Between the concept groups, actions are visible that represent steps in the research design.

This process starts by measuring the Work Environment (that consists of Work Activities and the Physical Environment of the workplace) and its impact on Employee Stress. These measurements are then analyzed and interpreted to understand the relationships between activities, work environment, and stress. Based on these insights a Real Estate Decision-Making Model can provide input for an improved future situation of the Work Environment. The last step, the design and change step, is outside of the scope of this research but will be discussed in the recommendations. As can be seen, the process can and should be iterative, to obtain more information and adapt to changing circumstances, both physical as societal.

The simplified conceptual model, however, does not provide an in-depth view of the actual relevant concepts. Therefore, in Figure 2 the adjusted theoretical model is shown, scoped for this research. This model is introduced and elaborated on in the second part of this thesis, the Theoretical Framework. The model shows how the concepts are related to each other. The model can be divided into two parts: The Work Environment where the Employee (or Person) goes about his/her day at work and the Knowledge part where the information from this work environment is gathered, analyzed, decided on and adjusted.

This research, as earlier introduced, focused on the relationship between both physical environment and work activities on an employee's stress. Elements within these work activities and physical environments can act as stress triggers, the so-called stressors, resulting in a stress reaction of the employee. By measuring this stress and observing what types of elements within the physical environment are present and what types of activities are performed, quantified knowledge can be generated. This quantified knowledge will serve as the base information on which the Real Estate Decision-making Model is designed that aims to give an accommodation advise for the physical environment that reduces stress as much as possible while dealing with the given input and constraints.

This accommodation advise could be realised and applied to the physical environment, tested, measured again and evaluated in an iterative cycle.

1.5 READERS GUIDE

This research has operational-empirical research design, consisting out of qualitative research based on structured observations and an operational part, in which an operational model is designed and built. The report is divided into five parts:

Part I Research Introduction & Design:
Contains the Introduction and Research Design & Methods chapters. It elaborates on how the research is structured and gives an overview of the process.

Part II Theoretical Framework:
In this part the Theoretical Framework is developed, based on the literature review that has been performed.

Part III Empirical Research:
Describes the process of the structured observations and the findings of the quantitative analysis.

Part IV Operational Research:
Contains a chapter on the model design process and a findings chapter on the decision-making model.

Part V Results:
Contains a chapter with the combined results, and a conclusions and recommendations chapter, that conclude the research.

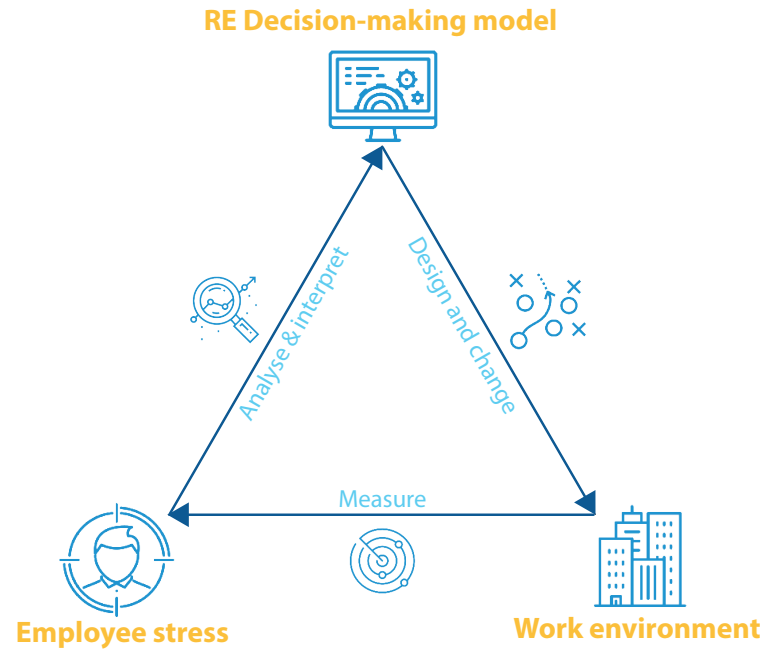


Figure 1. Simplified conceptual model (own ill.)

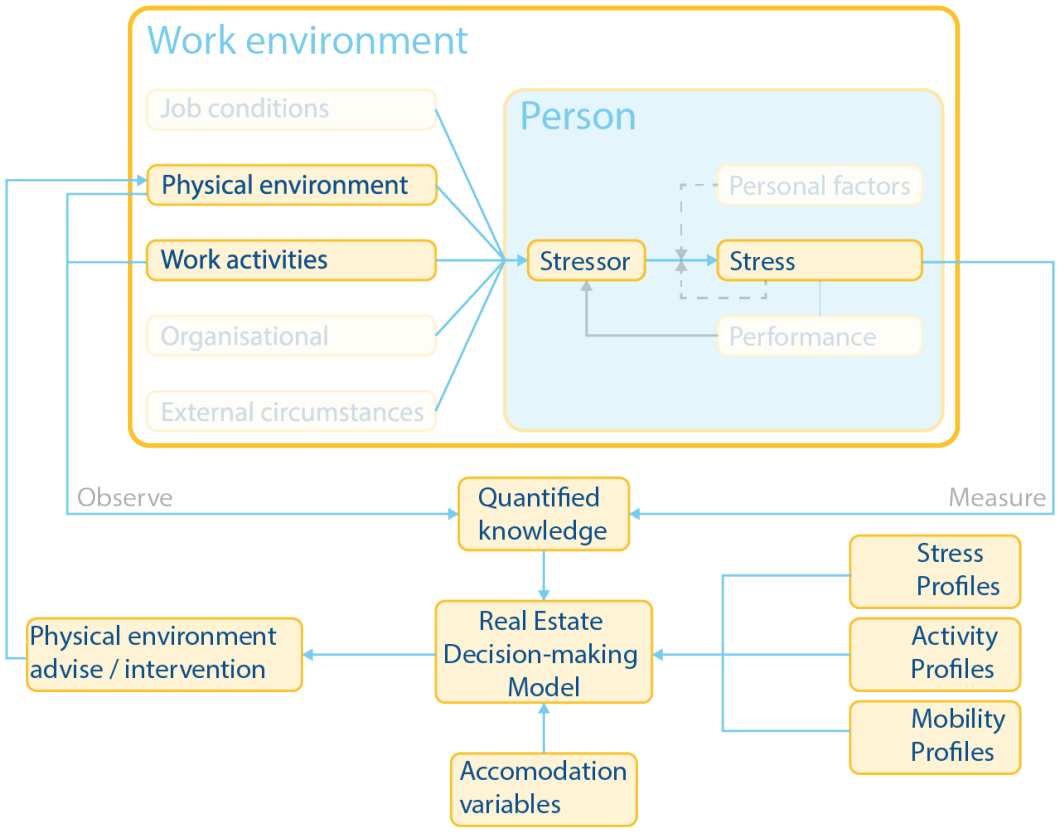


Figure 2. Adjusted theoretical model (own ill.)

2. RESEARCH DESIGN & METHODS

This chapter describes the research design of this thesis and the research methodologies used to answer the research questions. Subchapter 2.1 introduces the research design, subchapter 2.2 introduces the research methodologies, and subchapter 2.3 describes what research instruments are used and how.

2.1 RESEARCH DESIGN

As stated in the introduction, this study aims to reduce employee stress in the work environment by exploring the relation between the workplace and stress more in depth. For this study a physical approach has been chosen when it comes to the work environment, to remain firmly grounded in the domain of real estate management and not go too much into organizational and psychological structures. It, therefore, limits itself to insights that are directly attached to the relation between workplace and stress.

A research design serves the purpose of providing structure and guiding the research (Bryman, 2016). It can also determine what perspective is applied to the research, because different research designs can lead to different ways of data generation. This research will use an ***Operational-Empirical research design***. This mixed method approach uses two different research design, that of ***operations research*** and ***empirical research***.

The main research question of this research is:

"How can insights in the relationship between workplace and activity on employee stress be used to develop a real estate decision-making model?

The sub questions of this research are:

1. What is the relationship between workplace types and activities on employee stress?
2. How can employee stress be measured?
3. What workplace characteristics are of influence on employee stress?
4. What are input and output variables for a decision-making model that can reduce employee stress?
5. How can real estate managers use the decision-making model?

Operations research is used, because to answer the research question, an artefact needs to be created or the existing situation needs to be changed (Barendse, Binnekamp, De Graaf, Van Gunsteren, & Van Loon, 2012). This artefact will be the decision-making model and is created during a design process as introduced by Dym and Little (2004), who propose a generic design process to be used of operations research.

Empirical research is used to obtain the values that are needed to use the decision-making model. As described in the introduction of this thesis, a gap of knowledge exists when it comes to the relation between workplace and stress. To gather these values, quantifiable data is needed in order for the data to serve as input values for the decision-making model. Empirical research is also needed during the iterative process of the operational model design process. This process requires evaluations and feedback in order to improve the preciseness and usability of the model.

2.1.1 Operations research

Design process

Dym and Little (2004) propose a generic design process that can be used for operations research (Figure 3). This research design will be based on this generic model.

Below in Figure 4, the proposed research

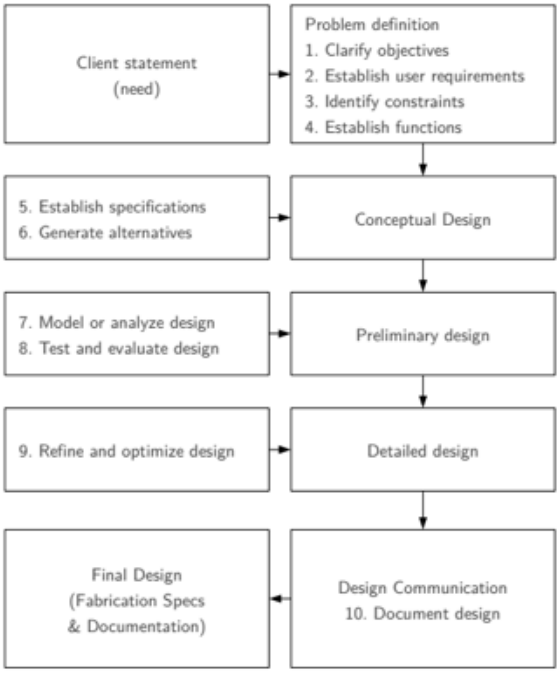


Figure 3. Operations design process (Source: Dym and Little, 2004)

design is presented. The stage and task are largely corresponding with the generic design process as described by Dym and Little (2004), but changes have been made. In the generic design process, ten steps have been identified, that are connected by different design stages. These design stages are created by iterative processes. In the version of Dym and Little (2004) three iterative cycles can be identified:

1. Conceptual design to preliminary design
2. Preliminary design to detailed design
3. Detailed design to final design

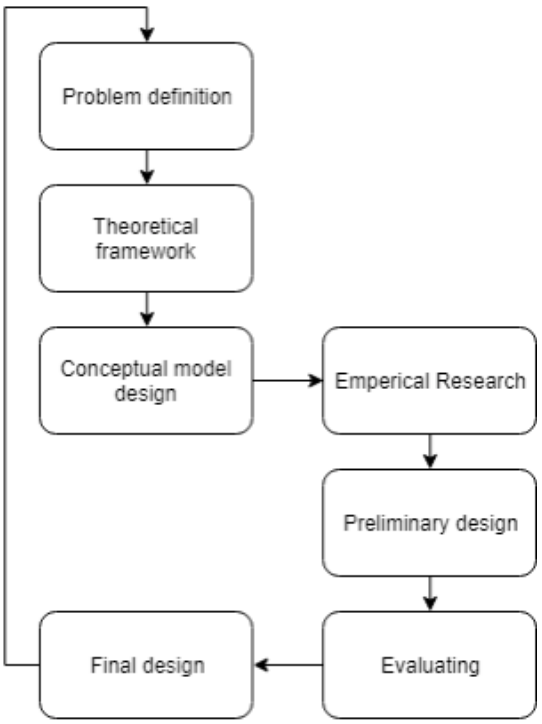


Figure 4. Operations design process (Source: Dym and Little, 2004)

These cycles are supported by actions as testing, refining and evaluating. Rule of thumb is that the more cycles one does, the closer the model comes to the perfect model. However, how perfect the model can become, is constrained by the quality of the ***client statement*** and ***the problem definition***. Besides that, operations research has a practical perspective, meaning that it focusses on the process of the model and not on the input values. Operations research assumes that all the information given is correct and that the model will connect that information through a mathematical model.

Because of unknown input values, and knowledge on the interaction of the variables is limited, empirical research is needed. This is why Operational-Empirical design is used. Instead of using a ***client statement***, the research uses a theoretical framework as the foundation of the model and its variables and is based on the problem definition.

After this foundation, a conceptual model is designed, that connects the derived variables into the mathematical model. The input variables are now known, but the input values are not. Because this data is what makes the model work, empirical research is needed to find these values. This is done by quotative research, as described in the next section. Based on the found values from the empirical research, the preliminary model design is made.

The next iteration in the process is evaluation of the preliminary design. This evaluation is done with empirical research as well, also described in the next section. With the outcomes of this evaluation, the preliminary model design is improved into the final design.

This final design might still have limitations regarding the usability of the model. The identification of those limitations can lead to a renewed problem definition, creating a cyclical process to improve the operational model.

Boundaries of operations design

Since operations research results into a mathematical model, the output of the model depends on both the input variables and input values. It is very hard to grasp all factors of influence in a model, since some factors are not known or hard to quantify. Since operations research can be a cyclical process, every time new factors can be added to improve the quality of the model. However, due to scope limitations, such as time in this thesis, the amount of cycles that can be completed is often very low. For this thesis, only one cycle will be completed.

The conclusions and limitations that follow out of this thesis will be presented as possible starting points for further research.

2.1.2 Empirical research

Empirical research within operations research is not done very often, because it is time consuming and expensive (Flynn, Sakakibara, Schroeder, Bates, & Flynn, 1990). However, it can greatly improve the quality of the model, since more attention to the real-life situation is given. Nowadays, the gathering of empirical information has become much easier, with the introduction of digital information systems. Smart buildings that are using this technology to improve their enterprise and efficiency are an example of how operational models benefit from the input of empirical information (Buckman et al., 2014).

As stated in the previous section, on three occasions in the research design, empirical research is required: to formulate the theoretical framework, during the quantification of the input variables and the evaluation process.

Formulating the theoretical framework and evaluating the model design are done with empirical methods and are described in the next subchapter. The empirical research to quantify the input variables, however, is a research on its own. This research therefore has its own research design.

Cohort study design

The quantification of the input variables will be done by means of a cohort study design. It aims to create conclusions on the relation between stress, workplace types and activity types (these variables are further described in the theoretical framework, chapters 3 to 7). The cohort study design is based on multiple observation that are related to potential independent variables. How much independent variables and observations there are, depends on the present study. An example of a cohort study with one variable can be seen inFigure 5. ***T*** stands for the time of the observation, or sometimes timeframe, since not all observations will be done exactly at the same time.

Because the observations are linked to the independent variables that are present at ***T***, it is possible to create a connection to the measurement from the observation and the independent variable. This is not without ambiguity of casual influence since other (non-identified) variables can be of influence (Bryman, 2016).

In this study, ***T*** as time is not necessarily interesting. The focus lays on the similarity of independent variables at observation in relation to the measurement of this observation. The independent variables are the workplace and the activity, while the dependent variable is the stress level. Since multiple subjects will be measured at the same time, at time T it is to be expected that multiple combinations of independent variables (workplace and activity) are present. This changes the perspective of the cohort study. Normally a cohort study looks at a certain dependent variable state and tries to find what independent variable that has been observed in the past could have caused that. This study looks for combinations of independent variables (workplace and activity) at $T_1 - T_n$, and analyses if there is a significant relation to an increase or decrease of the dependent variable (stress).

For analysis, the cohort study divides paired independent variables to each other, in order to group the observations, as can be seen in Figure 6.

Boundaries of the cohort study design

In the cohort study design, observations will be done on the bases of different variables, with stress as the dependent variable. As will be stated later in the theoretical framework, stress has a wide variety of causes called stressors that are present in someone's life. It is impossible to map all those different stressors, for multiple reasons. Among those reasons:

- Not all stressors are known
- Every person reacts differently to stressors

The goal of this study is to gain insight into stress in the work environment. Stress that is present in the work environment is not necessarily caused by the work environment. External stressors such as work/life balance or being late due to traffic could cause stress. This study, therefore, does not search for the causes of the stress, but merely tries to find relations between the work environment and stress. This is done by using three basic elements of doing one's job: personal characteristics, workplace, and activity.

While the confounding variables are important for understanding where stress comes from, they will not be investigated in this thesis. This thesis only investigates the manifestation of stress in the work environment for different combinations for personal characteristics, workplace, and activity.

T_1	...	T_n
Obs_1		Obs_1
Obs_2		Obs_2
Obs_3		Obs_3
...		...
Obs_i		Obs_i

Figure 6. Cohort study design (Bryman, 2012)

IdV_a+IdV_1			IdV_b+IdV_1			IdV_a+IdV_2			IdV_b+IdV_2		
T_1	...	T_n	T_1	...	T_n	T_1	...	T_n	T_1	...	T_n
Obs_1		Obs_1	Obs_1		Obs_1	Obs_1		Obs_1	Obs_1		Obs_1
Obs_2		Obs_2	Obs_2		Obs_2	Obs_2		Obs_2	Obs_2		Obs_2
Obs_3		Obs_3	Obs_3		Obs_3	Obs_3		Obs_3	Obs_3		Obs_3
...		...	...		...	...		...	...		...
Obs_i		Obs_i	Obs_i		Obs_i	Obs_i		Obs_i	Obs_i		Obs_i

Figure 5. Cohort study design based on independent variables (Source: own ill. Based on Bryman (2016))

2.2 RESEARCH METHODS

2.2.1 Operations research

Barendse et al. (2012) describe multiple definitions for operations research. One of them is '*a discipline that deals with the application of advanced analytical methods to help make better decisions.*' Since one of the objectives of this research is to help employees to make a decision that will improve their mental health, operations research fit that description.

Ackoff and Sasieni (1968) describe how in operations research a general (symbolic) formula is used for notation of the structure of a decision-making problem.

$$U = f(X_i, Y_j)$$

- U represents the utility or value of the performance of the system
- X_i represents the controllable variables
- Y_j represents the uncontrollable variables that affect U.
- f is the relationship between U and X_i and Y_j (Barendse et al., 2012).

Van Loon (1998) later splits the X_i variables into two groups, decision variables D_i, and result variables R_k. In his notation he also changed Y_j into F_j, for a fixed variable, and looks like the following:

$$U = f(D_i, R_k, F_j)$$

That means that D_i can be seen as 'decisions' or 'choices' in the context of the problem and R_k the results of those choices. The variables within D_i can be influenced outside of the model, by choices of people for instance, while R_k only exists inside of the model, because of the decisions made. F_j is the 'environment' or the 'constraints' of the problem, to which the decision maker has no control.

Because within this formula the values for the decision variables D_i are negotiable, a feasible solution space can be found (Barendse et al., 2012). The concept of operations research is that an engineer designs a solution for the problem that produces the highest value of U, by selecting the optimal set of D_i, given F_j, R_k and f. To do so, an operations research project is conducted. An operations research project consists of five stages (Ackoff & Sasieni, 1968):

1. Formulating the problem.
2. Constructing the model.
3. Deriving a solution.
4. Testing the model and evaluating the solution.
5. Implementing and maintaining the solution.

Example:

An example of a problem that can be solved through an operations research, would be the purchase of a house. A buyer has a constraint for budget (F_{j1}) and must deal with market conditions (F_{j2}). His decision can be based on price, size, and distance to work (D_i). Depending on what the buyer thinks is most important, the buyer could, for instance, choose for a small home near work or a large home far away. The buyer could also choose to buy a smaller house and use the budget that is left to spend on home improvements (R_k).

2.2.2 Structured observations

The research method that will be used in the cohort study is called ***structured observations***. It uses systematic observations of individuals' behaviour in terms of categories systematically. The method is originally a social research method and has been adapted from the method as described by Bryman (2016). This research method is needed to collect direct information from the participants without the interference of a post-observational survey. No observer besides the participant is used in this study. This deviates largely from the method that Bryman (2016) describes, since he describes an external observer, although the outcome should be the same in terms of data sets, only with different observant bias. Using sensor data in terms of social research is rather new and not done often (Müller, 2017). Therefore it is logical that no clear methodology on this exists. Sensor data is far more common in technical research and sometimes medical science, thus during the analysis of the data, lessons from those fields can be used to increase the validity of the data.

Bryman (2016) describes the process of doing structured observation in the context of behavioural observations as: *dividing behaviour into categories that have to be observed visually by an observer and coded by that same observer*. This study takes a different approach when it comes to the actual observation. As described in the introduction section of the research design, data on three variables are being gathered: ***stress***, ***workplace***, and ***activity***. For a more in-depth description of the measurements that will be conducted, see subchapter 2.3.

Two central requirements to a structured observation are the ***observation schedule***, containing an observation strategy, and the coding scheme.

Observation schedule

An observation schedule is a description of who, what, when and how should be observed. The more defined this schedule is, the higher the quality of the observations can be achieved. This is important to achieve high consensus among observers about the coding. For a more in-depth description of the observation schedule, see subchapter 2.3.

Observation strategy

The observation strategy determines when an observation is done. Four different ways can be identified (Bryman, 2016):

Record method	Concept	Relation to time
Incidents	Record all incidents of categorised behaviour	Not time bound
Short periods	Record the observed categories based on time samples	Continuous recording separated by interval
Long periods	Record all observed category and their durations during a specified period.	Continuous recording
Time sampling	Record the present category of behaviour at a specific point in time, based on intervals.	Interval based

Table 2. Recording methods (own ill. based on Bryman, 2016)

In this study, the aim is to observe and record the ***average behaviour*** with ***15-minute intervals***, for ***long periods.*** That would result in a mix of the long period and time sampling methods because continuous recording is done, but only one record per variable per 15-minute interval is stored. That introduces a problem since long period observations and time sampling observations are in a way the opposing methods.

The long periods strategy has the upper hand since it uses continuous observations. However, to analyse, intervals will be used, to make the data quantifiable. It is, therefore, necessary to determine *at the end of the 15-minute interval* what the most common behaviour is. This most common behaviour is determined by means of counting the time spend performing a certain behaviour. For a

more in-depth description of the observation strategy used in this study, see subchapter 2.3.

Coding scheme

The coding scheme is an overview of all the categories used to describe possible behaviour. These categories are usually given a code in the form of a number, letter or combination of the two, to quickly and easily record the behaviour during the observation. For the coding scheme that is used in this study, see subchapter 2.3. Using a coding scheme invokes common method bias. Common method bias is the factor of variance within a measurement that can be related to the method instead of the actual thing that is measured. In this case, the observed activity is partially steered through the description of the those activities and communication to the participants, where unclarity or carelessness might result in a different observation than the actual situation.

2.2.3 Sampling

Population

The ideal population would be all knowledge workers working in offices worldwide. However, due to sample size restrictions, it would be too bold to make that statement. Therefore, it will be limited to the representation of the expected sample. This representation contains knowledge workers of one organization (Colliers International Netherlands B.V.), n=330.

Sample size

The sample size is limited to the available time and measurement devices and has a maximum of n=60, based on ten available measurement devices for a period of 6 weeks, and each measurement takes one work week (5 days). The actual sample size is lower, n=36, due to calendar constraints of possible participants, a limited number of specific ring sizes and a number of dropouts during the experiments, or due to failing equipment (not connecting phones, battery off for too long and one malfunctioning ring).

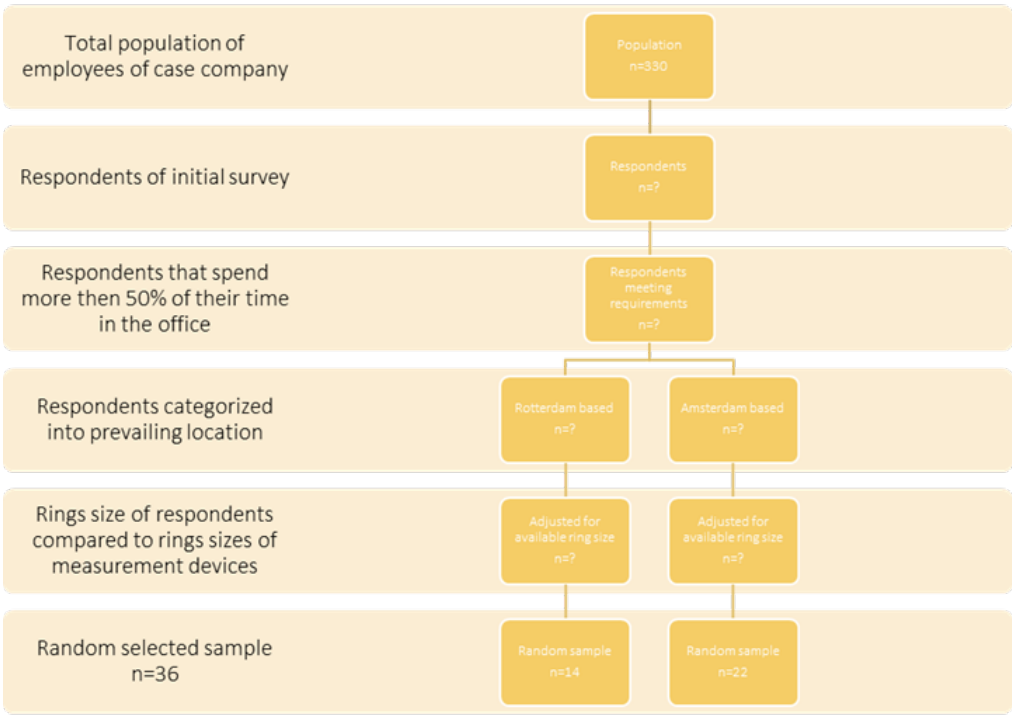


Figure 7. Overview of the sample selection process (own ill.)

Sample selection

As sample selection method, non-probability sampling is used in the form of convenience sampling, making use of the sample of Colliers International Netherlands B.V.. Due to this, the population of knowledge workers is not representative anymore.

This population will be reached using an email and post on the intranet hub and receive an invitation to participate in the experiment. To do so, they need to fill in a survey, to see if they meet the requirements to participate. The sample will need to meet the following requirements:

- Ring size (available measurement devices)
- Time spent at the office (>50%) the expected testing week
- Based in one of two offices: Rotterdam or Amsterdam (more than 75% of the time spent in the office needs to be at that location).

Sample bias

Some sample bias is present, mainly due to the requirement of having to be at least 50% of the time in the office. Some employees are less than 50% of the time in the office because they often work at locations of their customers. It could be argued that these persons have certain characteristics that match their job description of being highly mobile, that may be of influence how they perceive stress. By leaving them out, it could impact the results. On the other hand, they are not the primary group in the office for which the work environment is designed.

At the same time, only people that answer the invitation to participate in the experiment, are eligible actually to participate. There might be a bias among people that do answer and people that do not, for instance how busy people are, or if people are afraid of the insight in their stress because they feel of themselves that they are high.

2.2.4 Statistical methods

To conclude from the observations, a statistical analysis is performed to check for correlations between different variables. The variables that are defined within the study are listed in Table 4 and are further introduced in Part II, the Theoretical Framework.

The confounding variables are not considered within the statistical analyses since they are not measured. The other variables are operationalised to the set that can be seen in Table 5.

To select appropriate statistical tests, it is important to know what data measurement scales the data is measured and represented in. There are five types of data scales:

Type	Description
Ratio	Variables where the distances between the categories are identical across the range and have an absolute 0 point
Interval	Variables where the distances between the categories are identical across the range. Can range from minus infinite to plus infinite
Ordinal	Variables whose categories can be rank ordered but the distances between the categories are not equal across the range
Nominal	Variables whose categories cannot be rank ordered
Dichotomous	Variables containing data that have only two categories

Table 3. Data measurements scales, based on Bryman (2016)

While most variables are easily assigned a data measurement scale, a few raise discussion. Variables that could be assigned different measurement scales are the self-rated variables and the different profiles.

The self-rated variables are scored on a scale of 1 to 10, which sounds very much like a ratio scale, with defined steps that are equal. However, because it is self-rated, it is a subjective scale. This means that it is not possible to verify that a 3 for one person is the same 3 for another, or that a difference between a 3 and a 5 is the same as a difference between an 8 and a 10. Because of this, the self-rated variables are defined as ordinal scales.

The profile variables raise a different issue, between being ordinal or nominal scales. One could argue that the profiles range on a scale, activity perhaps on a scale from high concentration to low concentration, stress from easily stressed to hardly stressed and mobility form high mobility to low mobility. However, only the mobility profile is assigned based on criteria that match a high-low scale, while activity and stress are more based on patterns of specific elements. It is therefore chosen to define mobility profile as an ordinal scale while defining stress and activity profiles as nominal.

Age normally has a ratio scale, since it goes from an absolute 0 point upwards. However, due to privacy reasons, it was necessary to use an ordinal scale using decades as options, since the data was otherwise traceable to a single participant.

The complete list of variables and their data measurement scale can be seen in Table 6.

Variable type	Variable	Can be divided into
Dependent variable	Stress	*Perceived*
		Actual
Independent variables	Personal characteristics	*Age*
		Gender
		Activity profile
		Mobility profile
	Workplace	*Privacy*
		Facility
		Use
		User agreements
	Activity	*Type*
Confounding variables	Activity	*Workload*
		Skill utilization
		Skill variation
	Personal factors	*Coping styles*
		Hardiness
		Locus of control
		Individual knowledge
		Skill & ability
	Organizational	*Level of autonomy*
		Social support
		Relation supervisor
		Role ambiguity
		Feedback
	Job conditions	*Security*
		Salary
		Task significance
	External	*Life events*
		Work-home conflict
		Social

Table 4. Overview of variables associated with stress in the work environment in the literature (own ill.)

Variable type	Variable	Operational data
Dependent variables	Stress	*Stress score from measuring device*
		Self-rated stress (logged)
		Self-rated productivity (logged)
Independent variables	Personal characteristics	*Age (surveyed)*
		Gender (surveyed)
		*Activity profile**
		*Mobility profile**
	Workplace	*Workplace characteristics**, based on logged workplace*
	Activity	*Activity typed(logged)*
	Time	*Timestamp of data*

Table 5. Overview of measured variables during the structured observations (own ill.)

**Profiles are based on gathered data and are not a self-rated variable.*

***Workplace characteristics contain a list of characteristics, mentioned in the section Workplace of the Theoretical Framework*

Variable type	Variable	Operational data	Data measurement scale
Dependent variable(s)	Stress	*Stress score from measuring device*	*Interval*
		Self-rated stress (logged)	*Ordinal*
		Self-rated productivity (logged)	*Ordinal*
Independent variable(s)	Personal characteristics	*Age (surveyed)*	*Ordinal*
		Gender (surveyed)	*Dichotomous*
		*Activity profile**	*Nominal*
		*Mobility profile**	*Ordinal*
	Workplace	*Workplace characteristics**, based on logged workplaces*	*Nominal*
	Activity	*Activity types (logged)*	*Nominal*
	Time	*Timestamp of data*	*Interval*

Table 6. Data measurement scales of the selected variables (own ill.)

2.2.5 Analysis of observations

To obtain knowledge from the gathered data, two types of analyses are conducted:

- ***Descriptive statistics***, to discuss the gathered data in terms of usability, validity and general insight. For this, analyses of the mean, standard deviation, and the distribution will be performed.
- ***Analysis of variance*** (ANOVA) to test whether an independent variable is of influence on the dependent variable stress.

2.2.5.1 Descriptive statistics

Sensitising the stress score

Due to the measurement method with the smart ring (further introduced in section 6.1.4 of the Theoretical Framework), some discussion is needed to interpret the measurement. The smart ring returns a value that is corrected by a coefficient that is specific for each participant. The coefficient aims to make sure that the daily average stress score of the person during the calibration period is 50. This calibrated stress score of 50 from then on serves as a reference point. Some important notes need to be placed in this method:

- ***Calibration bias:***

The smart ring can only measure absolute values for EDA, not absolute values for stress. This means that if a person is very stressed in general during the observation period, the ring cannot register this, since it will index the EDA measurement with the personal coefficient, resulting in an approximate average stress score of 50 of the total observation period.

- ***Deviation analysis:***

Because no absolute stress values can be measured, the stress scores that are measured during the observation period can only be interpreted in terms of deviation from each other.

- ***Observation period:***

Since the coefficient is based on measurements throughout the day, and the observations are only done during the workday (08:00-18:00), the measurements for one day of a participant with a mean of 55 could only indicate that the participant is more stressed at the office than at home. Conclusions based on the mean of the stress score should therefore be very carefully formulated.

In other to make the stress scores comparable, the scores need to be adjusted. For this purpose, two derivative stress values are used, the Stress Delta (SD) and the Stress Score Minus Mean (SSMM). The SD is calculated by comparing the stress score of the current observation with the stress score from the previous observation (of the same participant) and taking the difference (delta). This way the possible result of the impact of the independent variables on the dependent variable is isolated. The purpose of the SSMM is making overall score more comparable by taking the stress score of the current observation and subtracting the mean of that participant. Therefore, the mean of all SSMM should be zero, countering the effect of people with different means, resulting in scores that are based on deviations rather than absolute values. Doing this removes the calibration bias. Calibration bias in this context is a problem, because the absolute stress level of a person is not known. Person A could have an absolute stress level of 9 out of 10, while Person B could have a 4 out of 10. Because the calibration coefficient brings the stress score back to an average of 50, this difference is lost. An overview of the relation between SS, SD and SSMM is given below.

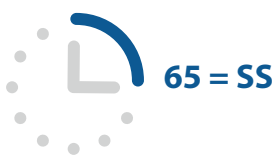
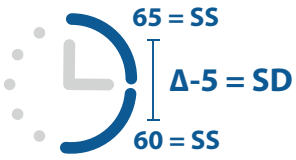
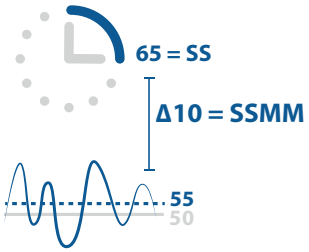
Measure	**Stress Score (SS)**	**Stress Delta (SD)**	**Stress Scoe Minus Mean (SSMM)**
Formula	$= EDA * \alpha_x$	$= SS(obs_{xn}) - SS(obs_{xn-1})$	$= SS(obs_{xn}) - \mu_x$
Description	Measured EDA value adjusted with the personal coefficient.	Current Stress Score measurement subtracted by the Stress Score of the previous measurement (15 minutes before).	Current Stress Score subtracted by the personal mean of the participant.
Interpretation	Shows current stress level.	Shows vector deviation between previous and current stress level, where a positive value equals a increasing stress level and a negative value a decreasing stress level.	Shows the current stress score in relation to the personal mean, where a positive value equals a higher than average stress level and a negative value a lower than average stress level.
Visual representation			

Table 7. Calculation methods of the stress variables (own ill.)

Where:

- ***EDA*** is the measured electrodermal activity value
- ***α*** is the personally calibrated coefficient
- ***x*** the participant
- ***obs*** the observation
- ***n*** the number of the current observation
- ***μ*** the mean

2.2.5.2 Statistics

The aim of the data analysis is to determine if some combinations of variables yield significantly different stress levels than other. This will be done in two steps, first, on a variable level, analysis of variance will be conducted. If this yields a significant result, a Student's t-test is performed to see which values of those variables are significant.

Analysis of Variance

An ***analysis of variance*** (ANOVA) is performed to determine if two or more groups have the same mean in a sample. It compares the means of different groups in combination with the variance (the squared standard deviation) within the groups and among the groups. The statistical change is calculated of the probability that two groups are the same. An ANOVA results into two values, the ***F-value***, and the p-value. (Bryman, 2016)

The F-value is calculated with the following formula:

$$F = \frac{variance\ between\ groups}{variance\ within\ groups}$$

If the F-value is greater than one, it becomes more likely that the sample groups are not the same. This can easily be demonstrated with two groups that contain the length of kindergarten children, group A, and group B. The contain the following values:

Group A = [110, 105, 115, 105, 110]
Group B = [115, 120, 130, 125, 120]

The group means are:

(110 + 105 + 115 + 105 + 110) / 5
= 545 / 5
= 109 for Group A

(115 + 120 + 130 + 125 + 120) / 5
= 610 / 5
= 122 for Group B

The standard deviation within the groups are:

(1 + 4 + 6 + 4 + 1) / 5 = 16 / 5
= 3,2 for Group A

(7 + 2 + 8 + 3 + 2) / 5 = 22 / 5
= 4,4 for Group B

The standard deviation between groups is:

122 – ((109 + 122) / 2)
= 122 – 115,5
= 6,5

This results in the following F calculation.

$$F = \frac{6{,}5^2/1}{4{,}4^2/1} = \frac{42{,}25}{19{,}36} = 2{,}18$$

Mind that the variances are divided by 1. The number is a representation of the degrees of freedom, which is calculated as the number of groups – 1. Since for now, there are only two groups; this value is 1. By doing this, the average variance over the groups is calculated.

In this case, the F-value indicates that the two groups vary from each other. In this case, it could be due to sample bias because groups were not chosen at random, or that there is an age difference between the two groups.

To test if the finding that the two groups vary from each other is not based on a coincidence, a probability value is calculated. The probability value signifies the odds that if the study is repeated with different groups, a different result will be found after the statistical analysis. Therefore, it represents the validity of the finding. Beforehand, a ***probability value*** (denoted as p) is determined. This ***p-value*** represents the factor that when the study is repeated 100 times, how often the finding will deviate from the rest. In the case of this study, the probability value needs to be p<0,05 before a variance of groups is deemed significantly. This means that there is a 95% percent chance that the measured difference has not occurred by coincidence (in the case of no sample bias).

The above given an example is a one-way ANOVA, meaning that one variable (groups of kindergarten children) is tested on variance. However, it is also possible to test multiple variables with each other. This test also results in an F-value with a related p-value. In this study, the variables activity, activity profile and workplace characteristic will be analysed in combination. While comparing multiple variables with each other, it is possible to look for an interaction effect among the variables, that explains the correlation of interacting variables on the dependent variable, in this case, stress. This is rather complex and for this research outside of the scope of detail and thus will not be taken into account.

Student's t-test

Once it is proven that there is variation within a variable, it is still not clear what (nominal) values of that variable cause the variation. To investigate this, a Student's t-test will be performed. The goal of the t-test is to check if the mean of a variable value differs from the mean of the entire variable. A t-test results in a ***T-value***. This T-value is compared to a t-distribution table to obtain the p-value. Consistent with the p-value for the ANOVA, the significance is determined at p<0,05.

2.3 RESEARCH INSTRUMENTS

Four main research instruments are used during the research. They are stated below, in chronological order:

1. Literature study
2. Survey
3. Measurements/observations
4. Focus group

Literature study

To build a solid, scientifically correct theoretical framework, on which the conceptual model and the actual model can be built, a literature study will be conducted. The literature study started using an ongoing literature study that is being conducted by the Delft University of Technology in collaboration with the Centre for People and Buildings, on the relationship between workplace and health. This literature study was in the second phase, where after a literature search on Scopus, articles were already rejected based upon their title and abstract, and the articles where grouped into different topics. By reading the abstracts of these articles, relevant articles were picked out, read and relevant information summarised and used in the theoretical framework.

Next, to this ongoing literature study, the author did a literature search himself, based on the keywords Workplace, Health, Stress, Burnout, and Smart tool. Based on title and abstract, multiple articles were selected, and these were supplemented with suggestions from mentors and other researchers. The results of the literature study can be found in Chapter 3 Theoretical Framework.

Surveys

Surveys are systematic examinations of people using a predefined set of questions. They offer the possibility to ask the same questions to a large group of people, making it useful for a gathering of quantitative data or selection of people with specific details. Surveys were used during the sample selection process for two purposes: 1) the recruitment of participants for the observations, and 2) gathering of information about the participants to be used as data during the analysis. An in-depth description of how the surveys were held can found in Appendix I.

Observations

As introduced in the research methods section, the structured observations method will use observations to collect quantitative data. These observations are not the same as Bryman (2016) describes in his book, because the observations are not done by an external observer. Besides observations, also measurements are done to collect the data. The measurements and observations due follow the structure associated with structured observations, as described in the previous subchapter.

Measurements & observations

Stress will be observed using sensor information, derived from a wearable device. No observer needs to be present to do this observation since it is performed automatically and stored digitally.

The ***workplace*** will not be observed real-time since that would require a capacity of observers that is not within the scope of the research. Therefore, the observations of the workplace will be done by the participants themselves and logged through a survey at the end of the day. More on the survey method in the next section. It is expected that this is not a big problem and can be done reliably by the participants themselves since research shows that employees that switch workplaces often.

For ***activity***, the same goes as the workplace when it comes to observers. Participants themselves will have to log their activities. It is expected that this will be harder than logging their workplace, because employees perform multiple activities throughout the day. Real-time logging is considered distracting and annoying and thus unsuitable while logging

all activities at the end of the day could create unwanted errors. The study, therefore, proposes a side method, that uses a program that tracks computer use throughout the day and will be presented at the end of the day, to serve as a reference for remembering and timing the actual activities. The tracked computer use will not be used as data, as it does not reliably convert to actual activity information.

Observation schedule

As described before, observations are done automatically using sensors and by the participants themselves. The sensors observe measured stress. Participants observe and log their workplace and activity. The workplace is a location and noted as a coded number. The activity is one of the available categories of activities stated in a list, noted by the name of the activity.

It is important that all possible observations are mutually exclusive, meaning that no overlap is possible. For workplaces, this is evident, since one cannot be at two places at the same time, but with activity, more ambiguity can arise since the line is not always that clear. Therefore, definitions and examples should be provided to minimalize deviation and disagreement among different participants on the categories.

The recording system for the observations should be clear, easy to operate and as unambiguous as possible. In most observations described by Bryman (2016) the recording system is a sheet of paper with a template on it that separates timeframes, where the observer is to write their notes according to a short description given on the top of the page on how to score.

As stated, the recording system should be as unambiguous as possible. Activity is subjected to different interpretations, in contrast to the workplace. The description of the observation schedule should minimize the deviation and disagreement; the recording system should be supportive of this as well.

Observation strategy

As stated in the previous subchapter, the ***long period's*** strategy is used, with interval periods to summarize that specific interval. In that way, 1 data point is created every 15 minutes of the values stress, workplace, and activity. In the table below, the process strategy is explained with examples.

Stress	**Workplace**	**Activity**
The average measurement during the 15-minute interval	When multiple workplaces are used within the 15-minute interval, the workplace the most time spend is used.	When multiple activities are performed, the activity with the cumulative most time is used.
Examples:		
50, 60, 40, 45, 55, 60, 50, 60, 40, 45, 55, 60, 60, 55, 45 = 780 / 15 = 52	Workplace A = 10:31 min Workplace B = 04:29 min	Regular Desk Work: 03:15 min Unplanned Meeting: 06:30 min Regular Desk Work: 05:15 min Regular Desk Work = 08:30 Unplanned Meeting = 06:30
Stress = 52	**Workplace = Workplace A**	**Activity = Regular Desk Work**

Table 8. Overview of the observation strategy with an example (own ill.)

Coding schemes

In this study, three variables are observed, stress, workplace, and activity. That means that three sets of categories would be required. Stress will be automatically measured and based on a scale, and not required to be present in the coding scheme. For the workplace, the categories are locations and the codes are references to a floorplan map with the codes written on them. For activity, the categories are the different types of activity and will be further introduced in the theoretical framework. These types all can have an abbreviation to refer to them.

Focus groups

As a qualitative way of gathering data, focus groups offer the opportunity to gather very rich data effectively. This data is not meant to be generalized, as with quantitative methods can, however, they provide quick insights into the working of things. They are excellent for feedback and evaluation structures because they show what elements people perceive as good and bad. For these types of purposes, it is not necessary to know what amount of people find it good or bad, only the statement that it works or not is enough to trigger an improvement.

In this research, focus groups are used to gather expert feedback on the proposed operational model. This research uses the perspective of stress to create the model, but more dimensions exist within real estate decision-making. Through the feedback of these experts, the limitations of the model are explored. These insights are used to improve the model as much as possible and to create recommendations for further research on the topic.

2.3 OVERVIEW OF RESEARCH DESIGN AND METHODS

As described in this chapter, multiple research methods and instruments will be used during this research. These are mapped in Figure 8, to show where in the design process they are relevant. These methods and instrument can be grouped in stages of the design process. In Figure 9, the research design is divided into these stages. The first stage starts at the problem definition and ends with the conceptual model design. This stage is the basis and start of the research. After the first stage, the first iteration begins, by conduction the empirical design and improving of the model. The last stage contains the second iteration containing the evaluation process and the end of the design process.

2.4.1 Data plan

Four foundational principles are mentioned by Wilkinson et al. (2016) on the management and stewardship of scientific data, described by the acronym FAIR. ***Findability***, ***Accessibility***, ***Interoperability***, and ***Reusability***. This is an important note since the data that will be collected is considered private biometric information, that should not be available to anyone without permission.

It is therefore important to follow the standards of FAIR while maintaining a high standard on integrity and confidentiality of certain data. The data will be stored in a safe environment and will only be available to the researcher unless specified elsewise. The data will not be altered during the analyses of the data. Anonymization of personal data and explicit consent of test subjects for every form of sharing, transferability is required. To ensure that all these considerations are taken into account, a data management plan (DMP) has been drafted. For more information on this DMP, see Appendix III.

2.4.2 Ethical considerations

The Delft University of Technology has its own ethical standard, which can be found on its site , which also provides an official checklist established by the Human Research Ethics committee . The checklist aims to minimalize the risk of data misuse during and after the participation within a study.

Since there will be extensive contact between the researcher and the test subject, this checklist will be filled in and send to the HREC. The experiment is not allowed to start without approval from this committee. The full description of privacy and confidentiality and the HREC application process, see Appendix II. Permission by the HREC has been granted before the commencing of the research.

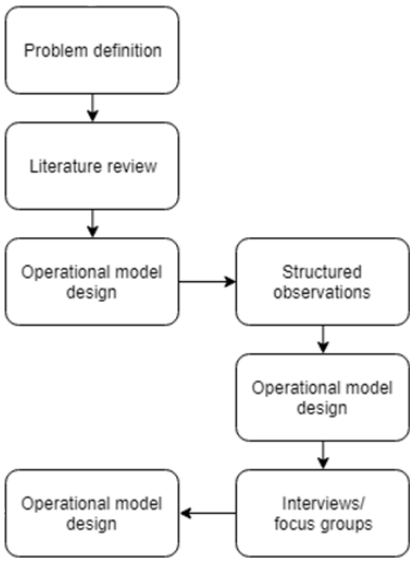


Figure 8. Research design representing research methods (own ill.)

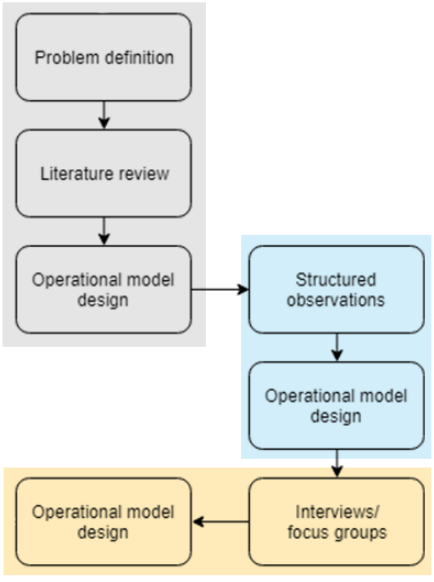
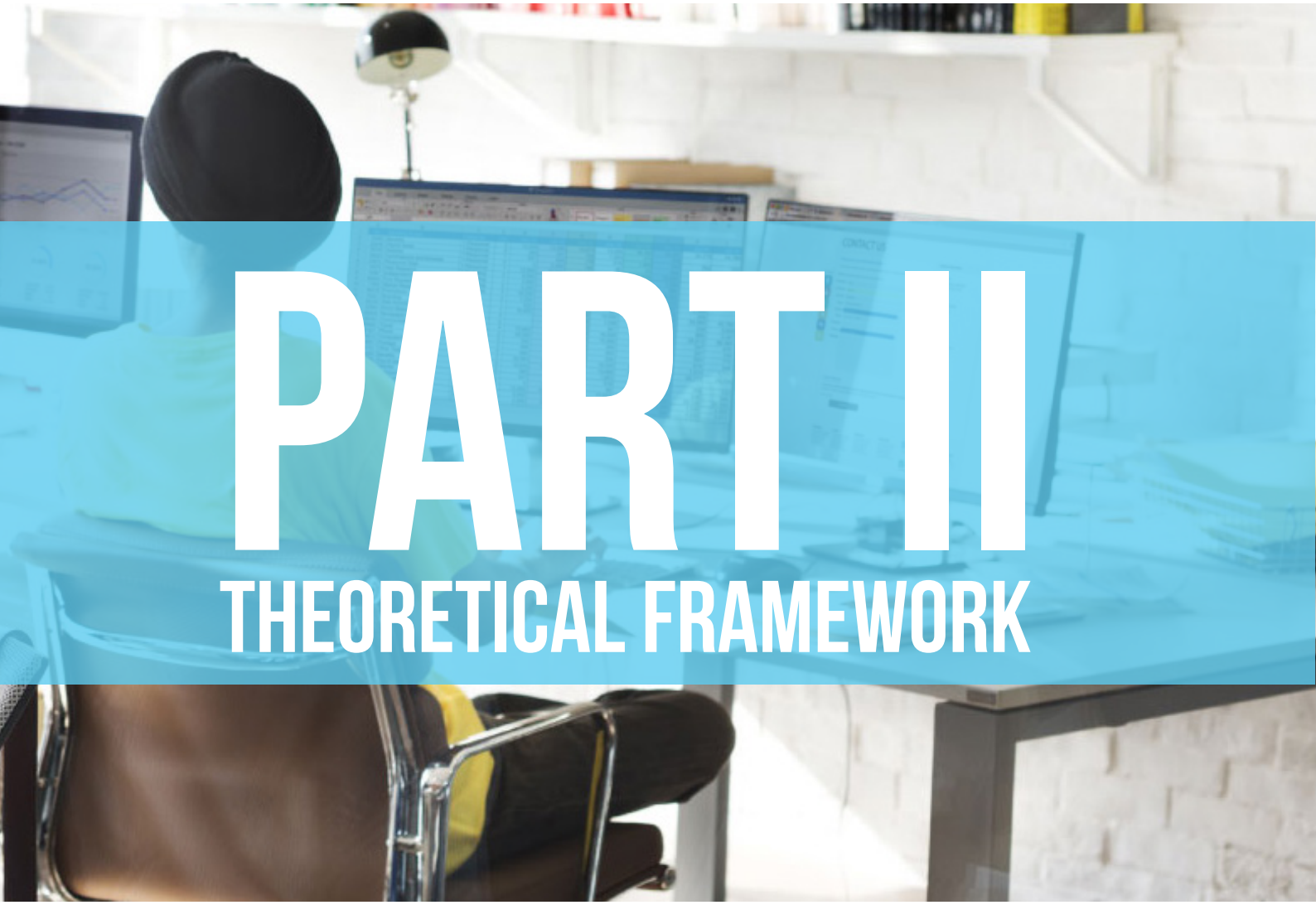


Figure 9. Research design seperated into stages (own ill.)



PART II
THEORETICAL FRAMEWORK

In this part, the theoretical framework will be laid out. It consists of four chapters: people, workplace, health, and smart tools. The theoretical framework is built upon a literature study, based on the key terms Workplace, Health, Stress and Smart Tools. The subject of people is added since a lot of theory transcends other subjects but is mainly built upon the activities that a person conducts in a workplace. Within the subchapters, different definitions will be adopted, and variables within the relation between workplace and health will be introduced. The theoretical framework will be translated into a theoretical model, that forms the basis of the conceptual model, as introduced in chapter 1.3.

3. PEOPLE

Since this research focusses on the relation between workplace and stress, it is logical to start with the central concept between those, the person. People are the users of workplaces and if human resources professionals are to be believed, are the most important business asset of an organization. This subchapter explores the characteristics of people in the context of the workplace. Since the researched literature most of the times uses the term employee for persons when in the context of organizations, this will be adopted from now on.

Since this research focusses on the relation between workplace and stress, it is logical to start with the central concept between those, the person. People are the users of workplaces and if human resources professionals are to be believed, are the most important business asset of an organization. This subchapter explores the characteristics of people in the context of the workplace. Since the researched literature most of the times uses the term employee for persons when in the context of organizations, this will be adopted from now on.

All people are different. Due to a combination of nature and nurture, people develop characteristics. There are almost endless different shapes and sizes of these characteristics, causing the person to develop a unique personality and through the years a growing amount of skills and abilities. These characteristics determine how a person is influenced by all things in life.

Edwards et al. (1998) describe how multiple theories of stress have described personal characteristics that determine how external and internal events impact a person.

When looking at employees in the work environment, the things that influence them are the environment itself and the activities that are being undertaken by the employee. In this part, the focus is on the activities that an employee undertakes during the workday.

Characteristic	Description
Coping styles	The way how someone deals with situations
Hardiness	The ability to endure difficult situations
Locus of control	The cognitive placement of responsibility of a situation, either within a person or outside of one
Individual knowledge	Information someone believes to be true and is stored in memory, related to a certain topic
Skill and ability	Proficiencies acquired through training and experience

Table 9. Personal characteristics based on Edwards et al. (1998)

3.1 ACTIVITIES

Leesman (2017) uses a long list of different activates that can be performed during the day, as can be seen in Table 10.

These activities are rather differentiated, and having a lot of overlap in certain attributes, but do give a good overview. However, in their report, they fail to translate these activities into substantiated and time related elements, leaving them unanalysable for now.

In the article published by the Center for People and Buildings by Beijer, Brunia, De Bruyne, Gosselink, and Pullen (2011), different activities are introduced that are being performed while at the office. They acknowledge that work activities can also be done at home or on the road, but since this has no direct link to the physical office, they are left out of consideration.

To come up with these different activities, Beijer et al. (2011) first took a look at relevant characteristics of the work process:

- Place of the activity; where does one perform the activity?
- Characteristics of the activity; does one need silence or interaction?
- Characteristics of the work process; number, duration, and frequency of activities during the day, autonomy, solo or groupwork?
- Special activity; activity with special aspects, requiring specific tools.

In Table 11 the eight activities are shown that are identified, and a ninth activity is added for all other activities that do not fit the descriptions.

These activities are developed for a 'regular' or 'average' office environment. This means that it is possible for some specific companies to have activities that are not mentioned in the eight activities in Table 11, but could from a large part of an employees' activities. In that case, it would be wise to revaluate this list.

Activities		
Individual focused work, desk based	Business confidential discussions	Spreading out paper or material
Planned meetings	Individual routine tasks	Individual focus work away from your desk
Telephone conversations	Learning from others	
Informal, un-planned meetings	Private conversations	Using technical / specialist equipment
Collaborating on focused work	Collaborating on creative work	Relaxing / taking a break
Reading	Hosting visitors, clients or customers	Thinking / creative thinking
Audio conferences	Video conferences	Informal social interaction

Table 10. Activities as mentioned by Leesman (2017)

Activity	**Abbreviation**	**Description**
General desk work	GDW	Routine desk work (including reading, archiving and paper work)
Undisturbed desk work	UDW	Desk work where you do not want to be disturbed
Interactive desk work	IDW	Desk work where interaction/collaboration with a colleague is necessary
Planned meeting	PMT	Arranged meeting with 1 or more colleagues
Unplanned meeting	UPM	Ad hoc meeting
Telephone call	CL	Telephone conversation (different types)
Reading	RD	Reading for more than half an hour
Archiving and paper work	ARC	Processing of documents (e.g, sorting into folders) and incoming mail
Other activities	OT	All other activities that do not fit into one of the activities above

Table 11. Different activities defined by CFPB (Beijer et al, 2011)

3.2 EMPLOYEE PROFILES

The approach of CFPB in performing a corporate real estate analysis, is based on the creation of employee profiles. This has advantages because it makes it easier and provides a clear view of the demand. In the next section, the activity profiles as introduced by Beijer et al. (2011) will be described, that answer the second and third question from the previous section. The derivative information that comes from this, is the demand for certain workplaces, since it maps the needs of the employees, answering the first question from the previous section. Section 3.2.2 takes a look at the mobility profiles, that takes a look at how employees use workplaces in combination with their work activities.

3.2.1 Activity profiles

In one of their whitepapers, CFPB (2013) define the activity profiles. These profiles describe common patterns of activities, that are grouped on a statistical basis and checked with the target groups they are based on, to check if these employers identify themselves as one of these profiles.

In an article written five years after their initial founding of the activity profiles, Beijer et al. (2018) state that these activity profiles have stayed more or less the same. This would indicate that these profiles could be used in provisional designing of the work place demand for an organization.

These profiles as described in the table above, give insight into the generic activity profiles, but since every organization is different, the usability of these generic profiles is questionable. CFPB proposes an Activity Scan , that is based on seven questions that all employees must fill in, to create an overview of the activity profiles within a certain organization.

Besides the creation of the activity profiles, the interpretation is much more important. Depending on the focus points of an organization, different activities can be found more important. Therefore, the activities that are important should also be best supported by the workplace. Leesman (2017) in their workplace surveys pay attention to this relationship, as can be seen in Figure 10 to the right.

#	Name	Main criteria	%
1	Mainly general desk work with mixed	Almost 50% GDW, other mixed	30%
2	Mixed with more focus on meetings	50% mix of GDW, UDW, IDW, 25% meetings	28,5%
3	Mainly undisturbed desk work	50% UDW, other mainly meetings	21%
4	Almost exclusively general desk work	More than 80% off the time GDW	11,5%
5	Mainly other activities (specialised activities)	OT is most common activity	5,5%
6	Almost exclusively telephone calls	More than 50% CL	3,5%

Table 12. Activity profiles in offices as defined by CFPB (2013)

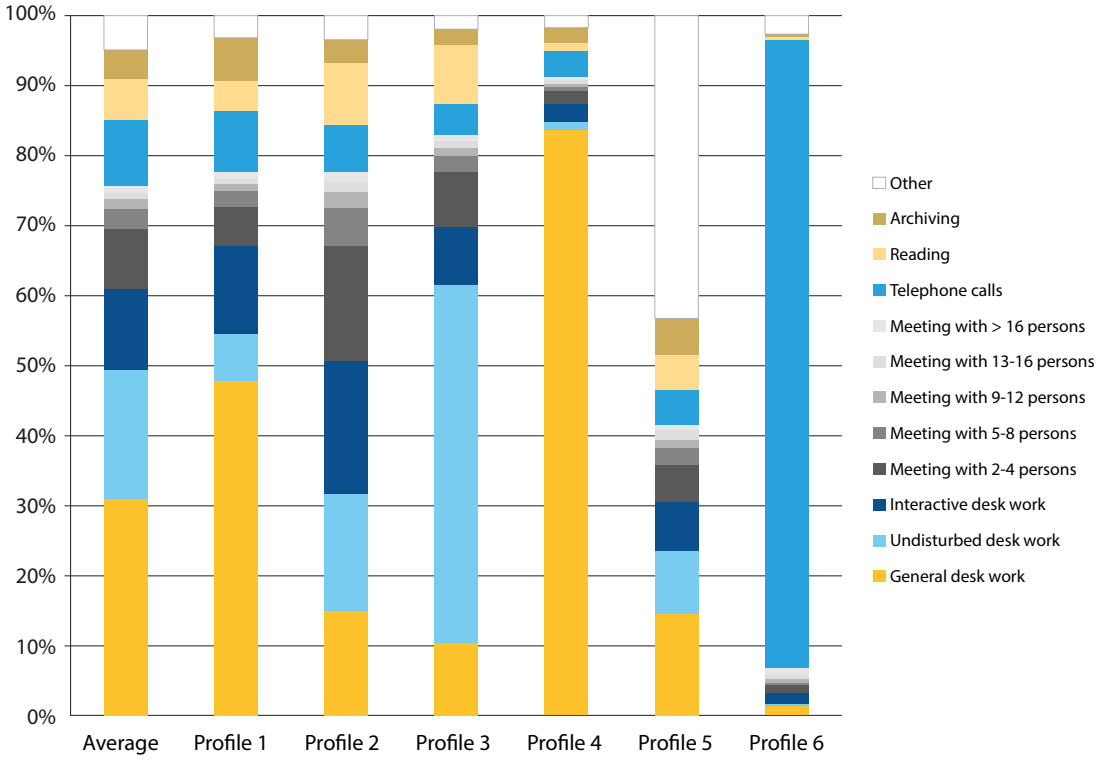


Figure 11.Activity profiles in offices as defined by CFPB (2013)

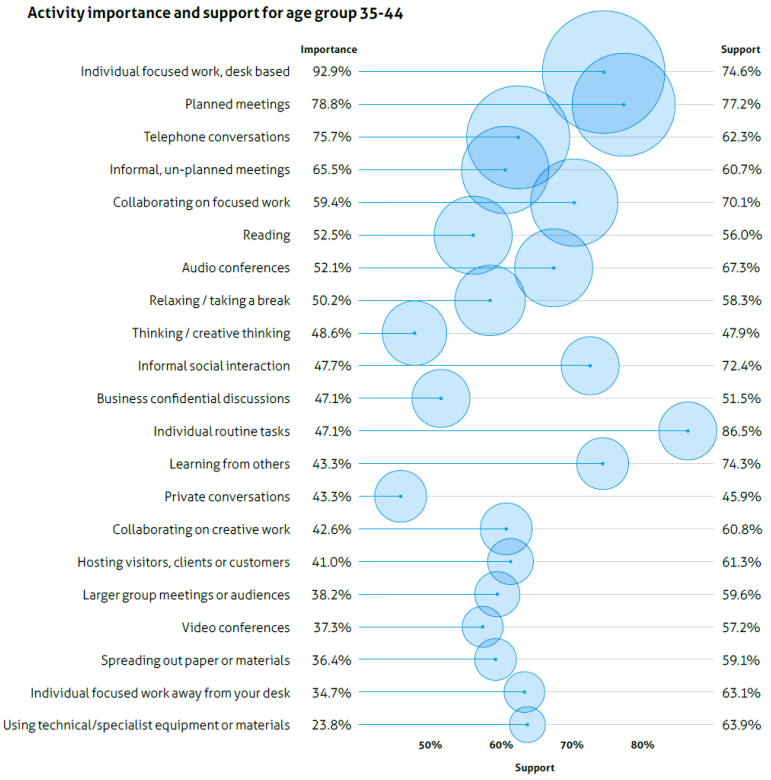


Figure 10.Activity importance and support for age group 35-44 (Leesman, 2017)

3.2.2 Mobility profiles

In Activity Based Working (ABW) the concept is to have multiple workplaces available to support a wide range of activities, that can be shared. This means that people will need to move from one workplace to another to get the full support of that specifically designed workplace. Research from Leesman (2017) states that there are four different types of mobility profiles, as can be seen inTable 12.

As can be seen, over 70% of all people below to a mobility type that rarely moves around the office, showing that most people have a preference to remain in a certain place. It, however, does not show whether in what way these people are aware of the benefits of other workplaces in their surroundings, leaving the question open how they would respond if someone made them aware of this.

	Mobility type	ABW	non ABW	Description
	The camper	30%	42%	Performs most/all activities at a single work setting and rarely use other locations within the office
	The timid traveller	41%	44%	Performs the majority of activities at a single work setting but also use other locations within the office
	The intrepid explorer	19%	11%	Performs some of the activities at a single work setting but often use other locations within the office
	The true transient	10%	3%	Uses multiple work settings and rarely bases at a single location within the office

Figure 12.Mobility types of knowledge workers as described by Leesman (2017)

	Work mode	Form of capital	Time	Description	Activities associated
	Focus	Productive	48%	Work involving concentration and attention to a particular task or project	*thinking, reflecting, analysing, writing, problem-solving, quantitative analysis, creating, imagining, reviewing, assessing*
	Collaborate	Innovative	32%	Working with another person or group to achieve a goal	*sharing knowledge and information, discussing, listening, co-creating, showing, brainstorming*
	Learn	Intellectual	6%	Working to acquire new knowledge of a subject or skill through education or experience	*training, concept exploration and development, problem solving, memorizing, discovery, teaching, reflecting, integrating and applying knowledge*
	Socialize	Social	6%	Work interactions that create common bonds and values, collective identity, collegiality, and productive relationships	*talking, laughing, networking, trust -building, recognition, celebrating, interacting, mentoring, enhancing relationships*

Table 13. The four work modes of knowledge work and their attributes as described by Gensler (2008)

3.3 MODES OF WORKING

The problem with the workplace definition from Vos, Van Meel, and Dijcks (1999), is that it does not give enough attention to the supporting activity spaces, for instance, break rooms and meeting rooms. Since this is where a large part of the daily activities is conducted, they need to be considered. But instead of defining the characteristics of these supporting activity spaces, a different perspective can be applied to the definition of the workplace.

After dividing workplace activities, Gensler (2008) defines four work modes that concern knowledge work, the type of work associated with offices: ***focus***, ***collaborate***, ***learn*** and ***socialize***. To perform the activities associated with these work modes, a specific environment can be beneficial for each work mode. Therefore, different workplaces for each work mode could improve the activities being performed. In Table 13 an overview of the work modes is given. To define what the workplace is suited for each work mode, it is needed to take a look at the factors that are of influence on the activities associated with each mode.

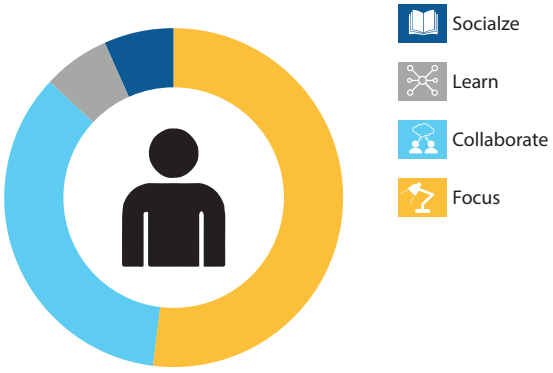


Figure 13.The average division of time spend in each Work Mode (based on Genser, 2008)

Focus

Gensler (2008) state that different studies show that interruptions and distractions are among the biggest threats to worker concentration. Production can be significantly increased if distraction-free, protected time is provided for the employee.

Another threat to employee productivity is cognitive overload, the inability to concentrate due to excessive information. This might emerge from the employee taking too few breaks or from the constant presence of external incentives. The modern pressure on diminishing real estate cost and the extra focus on the other work modes have decreased the ability to form employees to spend quality time in the focus mode.

Collaborate

Gensler (2008) and Majchrzak and Wang (1996) state environments characterized by visibility, openness and greater work mobility are linked to effective collaboration. This proximity and visual contact improve the interaction between employees, enabling collective intelligence. With this the potential of a wider range of ideas can be reached than an individual can offer, resulting in innovative ideas and solutions. Effective collaboration involves the interaction with tasks, tools, and machines. Collaborative environments are environments that enable these characteristics mentioned above.

Learn

Especially in knowledge working environments, the importance is learning is paramount. With constant changing demands for skills and knowledge of an employee, learning must be an integral part of ones work to stay relevant. Riechmann and Grasha (1974) distinguish six different learning styles, independent, dependent, avoidant, participant, collaborative and competitive. Each style has a different when, how and where learning takes place, which suggests variations in the physical environments required to support them (Gensler, 2008).

Socialize

Cross and Prusak (2002) conclude that the success of the knowledge economy will be increasingly social and relation, using informal networks to accomplish work tasks. To create these informal networks, time has to be spent creating a sense of community and strengthening the personal relationship. When looking at the activities of the socialize work mode, they can be described as non-core business activities, since they do not directly result in output. This could mean that they are viewed as distractions by employees with a current another work mode. So, the needs of the socializing mode might not be very specific. However the impact on others might be significant.

Gensler (2008) have researched the difference between top performing companies and average companies when it comes down to the effectiveness of their workplaces for each work mode. Their results show on average a 10% increase in self-reported effectiveness of the workplace for the work modes for top performing companies, which they associate directly with good workplace design.

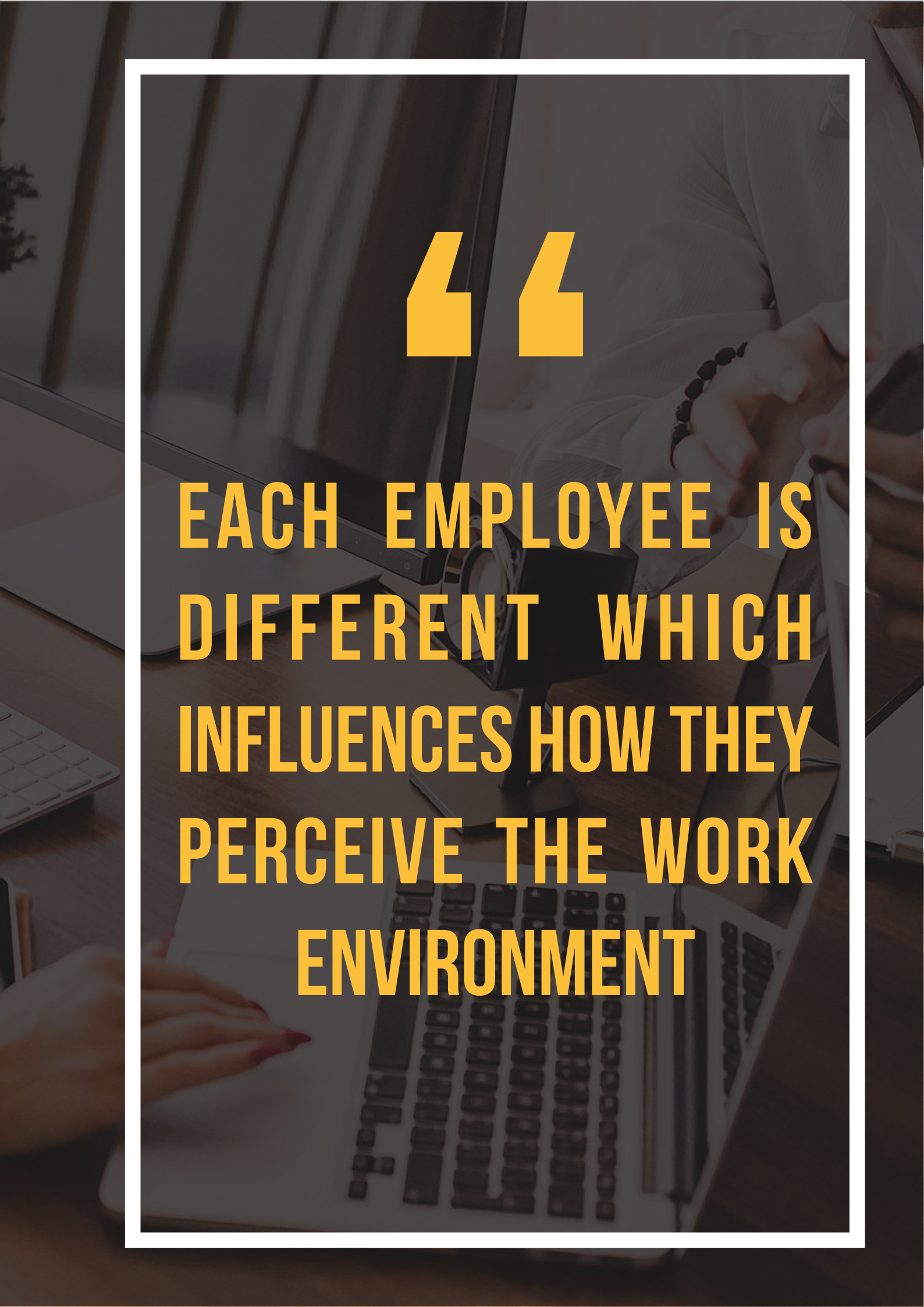
However, there is no mentioning of the use of the correct workplace for each work mode. It could be that due to a lack of available workplaces or a lack of insight, an employee will conduct its work in a workplace that is not best suited for that work mode.

3.4 CONCLUSIONS ON PEOPLE

As stated in the introduction of the People section, every person is different. This is also the main discussion on all the models that are introduced in this chapter. Leesman (2017) gives a good overview of activities that are out there but fails to put them into the context of numbers. Beijer et al. (2011) have a densified set of activities, perhaps too densified, and translate them into profiles. These profiles are rather general but do provide some diversification among employees. There is a requirement for each organization to revaluate these profiles to their business operation. But the generalisation is also the problem of this system because it remains the question what the deviation for each employee is from these profiles. These activity profiles are useful to generalise employee types because endless diversification leads to no generalised findings.

The work modes introduce an interesting perspective on activities, zooming out of the specific activity itself and introducing a mindset as a backbone for workplace creation. This backbone provides an opportunity for clear communication and direct surveying, due to the simplified modes, instead of a long list of activities. It is however arguably too simplified, lacking distinction within the work modes to pinpoint attributes required to perform an activity.

For the theoretical model, two elements are used from the described literature. First, the personal factors will be used, since they shape how a person will interact with stressors (described in chapter 5). Secondly, the activities will be used, as an external element that impacts a person.


“
EACH EMPLOYEE IS DIFFERENT WHICH INFLUENCES HOW THEY PERCEIVE THE WORK ENVIRONMENT

4. WORKPLACE

To take a closer look at the impact of the workplace on an employee's health, first, a definition must be given for the workplace itself. Dictionaries provide multiple, mainly similar definition, for instance, 'A place where people work, such as an office or factory' (Workplace, n.d.-b) in Oxford Dictionaries or 'A building or room where people perform their jobs, or these places generally' (Workplace, n.d.-a) in the Cambridge Dictionary. In general, it comes down to a location where a person can perform an activity. So, if we were to question what a good workplace is, one could argue that this is a location where a person can perform an activity well. The person and activity will remain the same. However the location and the characteristics of this location can change. Therefore, these characteristics must be of help to perform the activity.

4.1 WORKPLACE CHARACTERISTICS

One of the most common collections of multiple workplaces is an office. In the book The office, the whole office and nothing but the office from Vos et al. (1999) defines the office as a workplace: "the place where 'office work' is performed." They continue to provide a list of activities that are associated with office work and conclude that the basic characteristic of all those activities is that they are concerning the processing of information. So, to turn the definition around again, they define an office as: 'a workplace where people process information as a part of their job' (p. 12).

They continue to distinguish three basic characteristics to define and explain different workplace solutions (Vos et al., 1999):

1. Place
2. Space
3. Use

4.1.1 Place

The place refers to the location in relation from one workplace to other workplaces within the same organization. Two main types of places can be distinguished: the central office and the telework office.

The central office can be interpreted as a building which serves as the permanent workplace of an employee. In contrast to that, the telework office can be interpreted as a workplace that is physically disconnected from the central office. This can be in another office building, like a satellite office (an office building where the employees' organization facilitates teleworking), a business centre (an office building where a commercial provider facilitates teleworking) or a guest workplace (an office of a principal or client organization that facilitates teleworking). However, teleworking can also be conducted in a non-office environment, for instance at home office or an instant office, where a workplace is created by a user in an environment not primarily used for work.

4.1.2 Space

The space of a workplace refers to the spatial characteristics of an office, mainly the physical enclosure. It is defined by the way it is either connected or disconnected from other workplaces.

This space is defined differently among different articles. For instance, Vos et al. (1999) defines different types as cellular office (1-3 workplaces), group office (4-12 workplaces) and open plan office (13 or more workplaces), but Pejtersen, Allermann, Kristensen, and Poulsen (2006) defines the types of cellular office (1 workplace), shared office (2 workplaces), small open-plan offices (3-6 workplaces), medium open-plan offices (7-28) and large open-plan offices (28 or more workplaces). However, both use the physical division of space by walls as a defining element in their definitions.

Other types of spaces exist as well, such as breakrooms, meeting rooms and libraries, but are not mentioned in literature, because they are seen as supporting activity spaces and are not dedicated permanently to specific persons. Yet, these rooms can be seen of great importance for the employee's activities.

4.1.3 Use

The use of workplaces refers to the allocation of it to particular persons and is only relevant to workplaces within an office building. Vos et al. (1999) distinguish three essentially different options, the personal workplace, shared workplace, and non-territorial workplace.

The personal workplace provides a workplace that is exclusive to be used by a single employee. This has its advantages, such as the personalisation of the workplace, which has benefits for the employee through the endowment effect (Stringer, 2018). However, a problem of personal workplaces is that often they are not optimally used, especially in an organization with employees that are out of office often. To increase the use of the available workplaces, they are assigned to multiple employees at the same time, based on the assumption that not everyone is at work at the same time. This assigning of workplaces can be done in two ways: First, the shared office, where one workplace is assigned to more than one employee, who use the workplace on a rotating basis, by for instance splitting the week in half and assigning two employees each a part of that week. Second, the non-territorial office, where multiple workplaces are assigned to multiple employees. This solves the problem of the shared office that the employees assigned to the same desk can never work in the office at the same time. The non-territorial office can group certain workplaces, like a department, or a space, but it can also entail the entire office.

Use agreements

While Vos et al. (1999) provide a rather omni applicable set of characteristics, however, they do not take the behavioural aspect into account. To add this aspect, an extra basic characteristic is derived, Use Agreements. This is a similar characteristic to Use, however, the Use characteristics as described by Vos et al., focus on the physical allocation of a person, Use Agreements focus on the behavioural aspects that are agreed upon in a certain location. Agreements of this sort can be if it is allowed to eat at the workplace or only in the cafeteria, is a room is a silence room or if one is allowed to perform a telephone call in the room.

Over extensive Use Agreements could lead to a feeling of lack of control, for instance when employers force employees to do a certain action or forbid certain behaviour. In this research, Use Agreements are focussed on direct impact to other employees, in terms of noise or limiting the availability of use.

4.1.4 List of workplace characteristics

To distinguish different workplace types from each other, workplace characteristics can be used to map workplaces. To do so, the basic characteristics of Place, Space, Use and Use Agreements are translated to more practical characteristics. The list of all workplace characteristics can be seen in Table 14. Note that these are not all characteristics that exist. An almost endlessly specific list could be created; however, due to scope limitations, this list is formed in the current fashion.

For the scope of this research, no distinguishing in terms of Place will be made, since all offices used in this study are central offices. Place will therefore not be taken into account in the workplace characteristics.

Space, as discussed in section 4.1.2, refers to the physical representation of the workplace. In this research, space will be divided into two concepts, ***privacy***, and ***facilities***. Characteristics that fall under privacy relate to the manner and magnitude of the possibility of an employee to separate oneself from others in its environment. Facilities are amenities that enable the performance of work activities.

Use, as discussed in section 4.1.3, refers to the ***allocation*** of a workplace to an employee. This is divided into three characteristics. First, if a workplace is bound to a specific department or not. Second, the characteristic of being an assigned workplace or subject to flex-use arrangements. Third, the ability to book a room and thus limiting access to it in a specific time frame, is used as a characteristic.

Use Agreements, as discussed in section 4.1.3, refer to permission or restriction of certain behaviour. The characteristics that are defined for this only refer to noise creation.

4.2 CONCLUSION ON WORKPLACES

The problem with the workplace definition from Vos et al. (1999), is that it does not give enough attention to the supporting activity spaces, for instance, break rooms and meeting rooms. Since this is where a large part of the daily activities is conducted, they need to be taken into account. But instead of defining the characteristics of these supporting activity spaces, a different perspective can be applied on the definition of workplace, by using the perspective of Gensler (2008), where workplaces are divided into the work mode they support.

For this research, workplaces are a part of the work environment. This work environment contains both physical characteristics, and social and mental constructs of the place and space where someone works, that can have an impact on a person. By dividing a workplace in characteristics, it becomes possible to determine which characteristic contributes to the correlation between stress and the work environment.

	Workplace characteristic	Description	Basic characteristic
Privacy			
1.	Size of room	If the workplace is in a cellular space or open space and a number of other persons nearby	Space
2.	Openness of room	What objects provide the enclosure of the space	Space
3.	Audio privacy	Number of people that can hear the user	Space
4.	Visual division	Type of visual division between workplaces, if present	Space
Facilities			
5.	Power socket	Presence of a power socket for charging	Space
6.	Extra monitor	Presence of external monitors	Space
7.	Type of chair	Ergonomical type of chair	Space
8.	Type of desk	Ergonomical type of desk	Space
9.	Presentation hardware	Presence of large external monitor to perform presentations	Space
10.	Desk space	Amount of space the desk provides for performing work	Space
11.	Storage	Availability of storage facilities near the workplace	Space
Allocation			
12.	Department allocated	Whether or not the workplace is dedicated to a specific department	Use
13.	Assigned or flex	Whether the workplace is assigned to a specific person or has flex-use arrangements	Use
Use agreements			
14.	Silence or out loud speaking	If the workplace is located in a silence area	Use Agreements
15.	Calling	If it is allowed to call at the workplace	Use Agreements
16.	Multiple person meeting	If it is agreed that multiple person meetings can be held at the workplace	Use Agreements
17.	Bookable	If the room can be booked beforehand for a specific time and purpose	Use
18.	Focus	Type of purpose that is assigned to the workplace, based on Gensler's work modes	Use Agreements
19.	Collaborate		
20.	Socialize		
21.	Learn		

Table 14. Overview of workplace characteristics that are used in the research (own ill.)

5. HEALTH

To have a better understanding of what the relation between workplace and health is, first a definition must be given. The World Health Organization (2006) defines human health as

"state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."

This would indicate that there are two states a human can be in, the state mentioned above of health and a state of non-health or unhealthy. Where the division lies is however unclear, since that would depend on how physical, mental and social well-being is defined. The World Health Organization state that these requirements of health are determined by contexts and influenced mainly by social, economic and physical environments, the person's characteristics and behaviours. Key factors that have been found to influence a person's health are (Lalonde, 1981; Public Health Agency of Canada, 2011; World Health Organization, n.d.):

- Income and social status
- Social support networks
- Education and literacy
- Employment and working conditions
- Social environments
- Physical environments
- Personal health practices and coping skills
- Healthy child development
- Biology and genetics
- Health care services
- Gender
- Culture

In this research, a person will be regarded as healthy when their state of physical, mental and social well-being is satisfactory according to that persons own desired state. This means that health differs for each individual and can be changed by either improving the

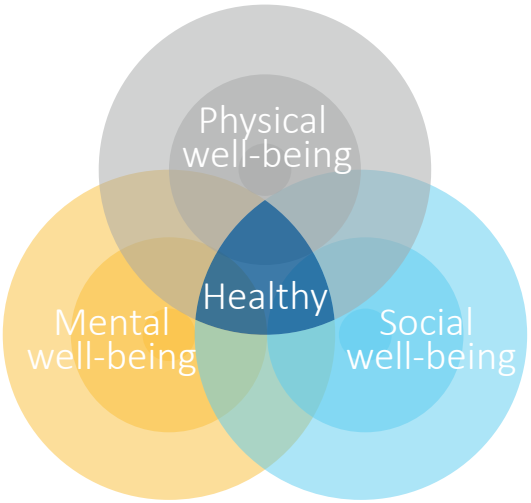


Figure 14.Definition of healthy according to the WHO

Although there are many ways to influence health, there are three main activities that stimulate health: diet, exercise, and sleep. However, there are a whole lot of activities that can be undertaken to decrease the deterioration of health, of which some examples will be given later in this research.

Numerous papers and articles have been written on the relation between workplace and health. Reduced capacity to work, increased error rates and absences from work are associated with bad working conditions (Veitch, 2011). On the contrary, well-designed workplaces can be supportive, removing potential stressors and freeing individuals to focus on productive work (Bakker & Demerouti, 2007; Gensler, 2008; Veitch, 2011). However, due to a wide variety of definitions and

variables used in this literature, it is difficult to distinguish strong evidence of impact. Examples of outcome measures that are used in the studies discussed in the literature review of De Croon et al. (2005):

- Sick leave
- Job satisfaction
- Job performance
- Muscular skeletal problems
- Headaches
- Common cold
- Fatigue
- Self-rated health
- Motivation
- Central nervous system symptoms
- Crowding stress

5.1 MENTAL HEALTH

Health is often grouped into two systems: physical health and mental health. Physical health describes the physiological state of one's body. Mental health includes concepts such as cognitive, emotional and behavioural condition. The World Health Organization (2006) defines it as

"a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community."

The WHO continues in their 2006 report to say that mental health includes (among others):

- Subjective well-being
- Perceived self-efficiency
- Autonomy
- Competence
- Inter-generational dependence
- Self-actualization of intellectual and emotional potential

As mentioned earlier in the introduction, more than one third of all sick leave is due to mental health issues, and 5% of the total workforce is prolonged with sick-leave due to burnout. In the next section burnout will be discussed and stress, one of the main contributors to burnouts.

5.1.1 Stress

Thayer, Åhs, Fredrikson, Sollers III, and Wager (2012) state that while there might not be a single definition for stress in literature, most base it as the result of a fight or flight response, which is triggered by stressors, mental events that are caused by threat or safety assessments.To illustrate this, an example is given based on Thayer et al. (2012):

Imagine an ancestor walking in the woods and notices an object on the road. Not able to see it clearly, it can be either a harmless stick or a deadly snake. If it would be judged as a stick but would later appear to be a snake, the ancestor would probably die. Therefore, the survival chances of assessing the object as a snake are far greater, being able to live another day and passing these snake-assessing genes on to future generations. Because of this evolutionary advantage we humans have a negativity bias towards assessing possible threats.

Because of this, both threat and the possibility of threat will cause a fight or flight response (Thayer et al., 2012). This fight or flight, (or fight, flight or freeze as described by Bracha (2004)), activates the sympathetic nervous system, that in turn releases adrenaline and noradrenaline into the body. These reactions have the function of preparing

the body for action, reducing the blood flow to non-primary organs and directs them mainly to the heart, the lungs, and the brain.

While this reaction is not bad by definition, too much stress or stress over too much time can be harmful, increasing the chance of cardiovascular problems (Bracha, 2004; Thayer et al., 2012). Besides that, stress can cause the immediate problem of overload, causing the cognitive functions to decrease, since the brain gives priority to possible physical action (Bracha, 2004). This is the restless feeling that people describe when they are under a lot of stress.

5.1.2 Stressors

As mentioned above, the cause of stress are stressors, events that happen in real life. While all of it happens inside someone's mind, the trigger of it can be either internal or external (e.g., an internal trigger can be a realisation that a deadline is approaching and an external trigger a dangerous traffic situation), and therefore the control over the situation can also be either internal or external. Stressors can be divided into six groups:

- Environmental (e.g., loud noise or cold temperature)
- Chemical (e.g., drugs or the absence of alcohol in an addict)
- Life changes (e.g., divorce or loss of income)
- Daily events (e.g., lost keys or traffic jam)
- Social (e.g., family demand or peer pressure)
- Work environment (e.g., high job demand and low job control or repeated exertions)

While one can do little about some events in life, for instance, an economic recession or a natural disaster, a large part of stressors can be either avoided or managed. Losing one's keys can be avoided by always hanging them on the same spot in the house or even attaching a Bluetooth searching device. Then there are also stressors that one could avoid; however, one would feel that is not an option socially, for instance, a difficult family relation or quitting a toxic job.

Stressors in the work environment are often difficult in terms of avoidance since an employee often has no control that can be perceived as socially acceptable. For instance, if an employee is bothered by talking co-workers in an open office environment, it is not always socially acceptable to silence these co-workers because the use-agreements of that space allow them to talk to one another. In other terms, external control in the work environment is or can be perceived as, low (Iacovides et al., 2003). This low feeling of control can cause stress, especially in combination with stressors from the work environment.

5.1.3 Reducing stress

How can stress be reduced? This depends on the stage of the forming of stress. Through

Stage	How to reduce	Examples of actions
1. In the presence of stressors	Preventing impact	*Removing the source* *Adjusting the source* *Adjusting reception* *Moving away from the source*
2. Stressors are impacting	Reducing impact	*Improve Coping styles* *Improve Hardiness* *Improve Locus of control* *Improve Skill and ability*
3. Stressors have caused stress	Recovering from impact	*Taking a break* *Going for a walk/exercise* *Sleeping* *Guided breathing session* *Meditation* *Greenery*

Table 15. Methods of reducing stress (own ill.)

reasoning, three stages of the forming of stress can be identified, as can be seen in Table 15.

Preventing impact

Arguably the best way to deal with stress is to prevent it from forming in the first place. This, however, is not always an option or is categorised as not feasible, since it would require an extensive organizational and physical change to reach this.

Stress is caused by stressors, as discussed in the previous section. These stressors come from a source. In the context of the workplace, this source often has a physical attribute, either by being physical itself or requiring a physical medium to reach an employee. To prevent this source from reaching the employee, multiple actions can be taken:

- The source can be removed (e.g., a loud copy machine can be moved to a closed off space)
- The source can be adjusted (e.g., a radio that can be turned to a lower volume)
- The reception can be adjusted (e.g., wearing noise cancelling headphones, or placing a soundproof wall)
- The employee can move away from the source (e.g., sitting in another room that is closed off)

Often, the source of a stressor is a co-worker. While the actions still apply, they are often less desirable from an organizational perspective, since conflict can arise, with the exception of moving away from a source.

Reducing impact

As described in section 3 People, a person has multiple personal factors that influence the way an employee deals with circumstances. Personal factors can buffer the impact of stressors (Bakker et al., 2005; Su et al., 2015), making them cause less stress. This means that if these personal factors are better developed, the impact of the stressors is reduced. The personal factors can be developed and improved over time, or with special attention.

While copings styles, (Lazarus, 1993), hardiness (Maddi, 2012), locus of control (Lefcourt, 1991; Rotter, 1971) and skills and ability (Su et al., 2015) can be trained and improved overtime, this is not something that can be instantly changed. There are multiple methods to do so. Regehr et al. (2013) created a list of interventions that are mentioned in literature and identify two possible effective broad categories: psycho-educational interventions and cognitive/behavioural/mindfulness-based interventions, where the first method aims to educate users on tools, strategies, and stories related to stress, the second category offers learning on the control of physical stress reaction and will be further discussed in the next section.

Recovering from impact

Once stress is caused, there is only one way to reduce is, and that is to let the effects wear off. It is important to note that no new stress should be added during this recovery period since that counters the effect of recovery.

While there is only one way to reduce it, the process of recovery can be sped up. Online searches will provide an extensive list of actions that can be taken to decrease the stress level. As introduced in the previous section, there are multiple cognitive, behavioural and mindfulness-based interventions. Two important actions that are mentioned numerous times in the literature review of Regehr et al. (2013) are meditation and guided breathing.

The most effective method of reducing stress is sleeping (Iacovides et al., 2003), since it ensures the absence of new stressors. However, the impact of sleeping on the stress level can be reduced by the physical and mental state just before sleeping. If these are still too active, the body first needs to normalise those, before the recovery can start, reducing the positive impact of sleep.

Taking a break helps as well in the recovery since it interrupts the cognitive process that is causing the stress. Exercising or taking a walk is proven to help reduce stress (Salmon, 2001). Surrounding oneself in greenery is also proven to help reduce stress, either real or artificial (Stigsdotter et al., 2010).

5.1.3 Burnout

In 1974 the first use of the term burnout as related to occupational burnout was recorded, to describe emotional exhaustion among nurses due to excessive work demands (Freudenberger, 1974). Bakker, Schaufeli, and Demerouti (1999) define burnout as a syndrome of three characteristics:

1. Emotional exhaustion
2. Depersonalisation
3. Decreased personal ability

Often, burnout is seen as the point where job stress simply becomes too much. However, this is a false assumption. As far as research shows, a burnout is caused by disproportionally high efforts (time, emotional involvement, empathy) and poor satisfaction (negative outcome) in addition to stressful working conditions (high job demands) (Iacovides et al., 2003). Typical professions that contain all of these elements are nurses and teachers, who work extremely hard, but are often faced with patients and students who are not grateful for their effort and do not progress, causing the professionals to become disillusioned (Lee & Ashforth, 1996). Iacovides et al. (2003) mention multiple types of research that place a specific focus on the attitude of the employee towards their work. In this meritocracy where people value status that is gained through work and money, one could link successes gained in their job as successes in life. Therefore, the failure of ones' own, or even the organization as a whole, could be personified as well and generate emotional exhaustion.

5.2 CONCLUSION ON HEALTH

As stated by the definition of health by the WHO, it encompasses physical, social and mental aspects. This research acknowledges that physical and social aspects are important, but will treat those as constant factors, meaning that it will be assumed that they will remain stable, to scope the research to the relation between workplace and mental health.

There are multiple ways to reduce employee stress, in different stages (preventive, reducing impact and reactive). While it is best to prevent stress from forming, it is sometimes not possible to exclude stressors from daily life. Thus actions must be taken to reduce the stress.

While burnout is a possible result of continuous stress, it requires other factors to emerge within an employee. Since this research does not focus on these factors, burnout will not be taken into account as a result of stress.

In the theoretical model, health will be represented only by the concept of stress, since this is the researched concept in this study. Stress has both mental and physical implications, and are interlinked. Stress impacts performance; however, performance is a stressor on its own and should, therefore, be included in the theoretical model as a sperate concept. Stressors are external factors that result in stress and form the binding factor between the external world an the internal mental health of a person.

“

NEGATIVITY BIAS DURING THREAT-SAFETY ASSESMENTS IS THE CAUSE FOR STRESS IN THE WORK ENVIRONMENT

6. THEORETICAL MODEL ON WORK ENVIRONMENT AND STRESS

All discussed concepts within the domains of the work environment and stress from the previous chapters, are to be combined in an overarching theoretical model. In literature different models already have been developed to show the relationships between stress, stressors, burnout, work environment, and personal factors. This research uses four models mentioned in De Croon et al. (2005) as a basis to develop the theoretical model for this research. The first subchapter shortly describes each model and the associated concepts that the model uses. In the second subchapter, the relevant concepts from the described models are combined with the concepts on work environment and health that are introduced in the previous chapters.

6.1 MODELS FROM LITERATURE

6.1.1 Work stressors-Energy Sources-Burnout model

The workplace is a space where a lot of stressors emerge since it is the place where demanding activities are performed. Each job has its stressors because they are linked to the specific job demands (Bakker et al., 1999; Iacovides et al., 2003). In the Work stressors-Energy, sources-Burnout model (WEB-model) a division is made between possible job stressors and energy sources that should lower the demand of the possible stressors. When an energy source is high, it reduces the impact of work stressors on a person.

This model shows that there are multiple factors of influence on both the demand side (work stressors) and the resource side (energy sources), that, when not balanced, result in a negative outcome on mental health.

Work stressors	Energy sources
Workload	Social support
Physical strain	Autonomy
Work-home conflict	Job crafting
Role ambiguity	Feedback

Table 16. Work stressors and energy sources defined by Bakker et al (1999)

6.1.2 Person-Environment Fit theory

According to the Person-Environment Fit (P-E fit) theory (Su et al., 2015) stressors, such as the work stressors mentioned in the WEB-model, will be triggered when the job demand exceeds the employees' resources. Personal resources are the mentioned energy sources, combined with individual knowledge, skill, and ability. From an organizational perspective, this is understandable, since the job application process is an assessment if the applicants' resources match the job demands. An exceeding job demand for job resources leads to either the excitement of a challenge or the fear of failure and thus stress.

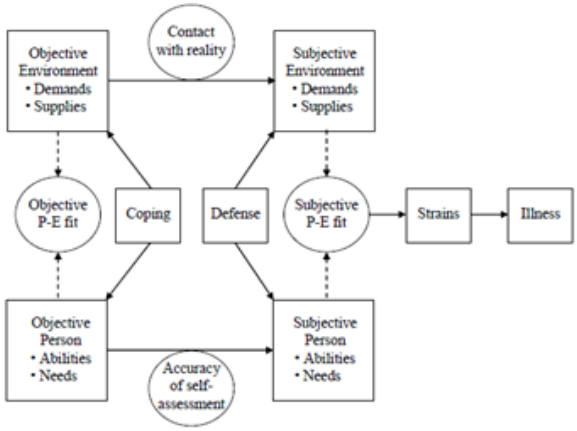


Figure 15.Person-Environment Fit model (Edwards, Caplan, & Van Harrison, 1998)

The Person-Environment Fit theory works with the same balance of (job) demands and (personal & environmental) resources as the WEB-model, however, it adds the division between objective and subjective situations, acknowledging that the subjective fit is the actual potential stressor. The Person-Environment Fit theory shows how personal factors can be of great influence on the perception of the fit, therefore, showing the importance of regarding employees as individuals that differ from each other, with different potential stressors.

6.1.3 Vitamin model

The Vitamin model uses two different types of variables, who act like vitamins. Of variables that are regarded Vitamin A, an employee requires a minimum. Otherwise this will result in stress (e.g., job security, salary, task significance). Of variables that are regarded Vitamin B, one requires a minimum, but also have a maximum, after which they become counterproductive (e.g., job autonomy, supervisor support, privacy). (Warr, 1994).

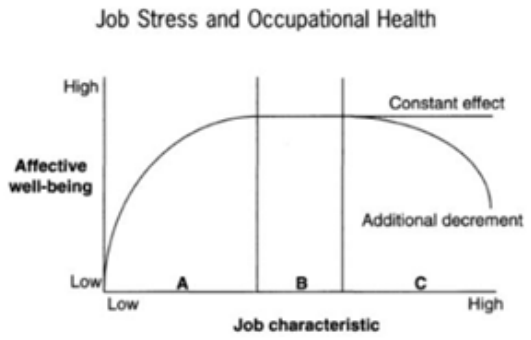
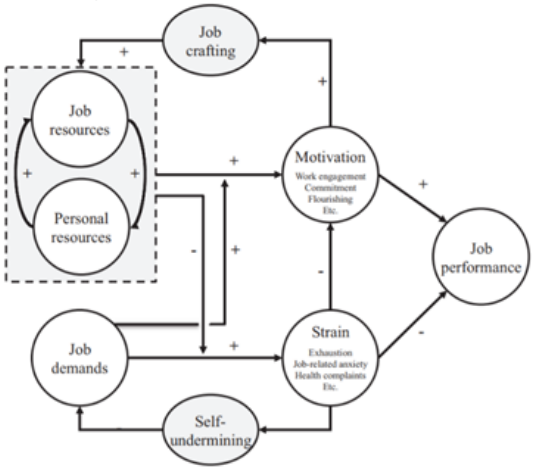


Figure 16.Vitamin model (Warr, 1994)

The Vitamin model shows that it is important to evaluate each potential variable as either a Vitamin A or B since they might not be linear as one would assume.

6.1.4 Job demand-resources model

In the Job Demand-Resources model (JD-R model) (Demerouti & Bakker, 1999; 2005; 2007) a distinction is made between job-demands and job-resources. Job demands describe the results of specific requirements for a job. Bakker et al. (2005) mention that work overload, lack of autonomy, emotional demands, low social support, and role ambiguity can lead to feelings of exhaustion and a negative attitude towards work.



The JD-R model combines the P-E fit theory and the WEB-model into a more abstract model, with less focus on personal factors, and more focus on the relationships between the separate concepts. In their description of the model, the authors elaborate on the buffer function that personal and job resources can have. This means that an employee is capable of enduring higher job demands without receiving increased strains. The work environment in this sense can serve as a job resource in a positive manner.

6.2 A THEORETICAL MODEL FOR WORK ENVIRONMENT & STRESS

While the previously discussed models provide clear insights into the concepts associated with forming of potential stress from an organisational perspective, they pay little attention to the actual physical environment. To combine the beforementioned models with the concepts found in the chapters on the person, workplace and health, the model as can be seen in Figure 17, is created.

The theoretical model contains two domains, the Work Environment, and the Person, as based on the Person Environment Fit model (Edwards et al., 1998). The person is, when at work in the office, always present within the work environment and is influenced by this work environment. The influencing factors of the environment are: job conditions (the minimal conditions one must have regarding once job, as mentioned by Warr (1994)), work activities (the actual work activities and the demands they create, as mentioned by Bakker and Demerouti (2007), the physical environment (combination of privacy, facilities, allocation and use agreements), organizational (organizational and social relations within the work environment, as mentioned by Bakker and Demerouti (2007)) and external circumstances, which are all elements that are not directly related to the work environment, but do impact them (Bakker & Demerouti, 2007; Edwards et al., 1998). It is assumed that there is an interaction between all these factors, where all factors can act as either job demand or resource.

The combination of these factors results in a potential stressor. Changing circumstances allow new stressors to occur or to fade away. These stressors then impact the persons (mental) health, by generating stress, but can be buffered by personal factors (Bakker & Demerouti, 2007; Edwards et al., 1998), which are coping styles, hardiness, locus of control and skill & ability.

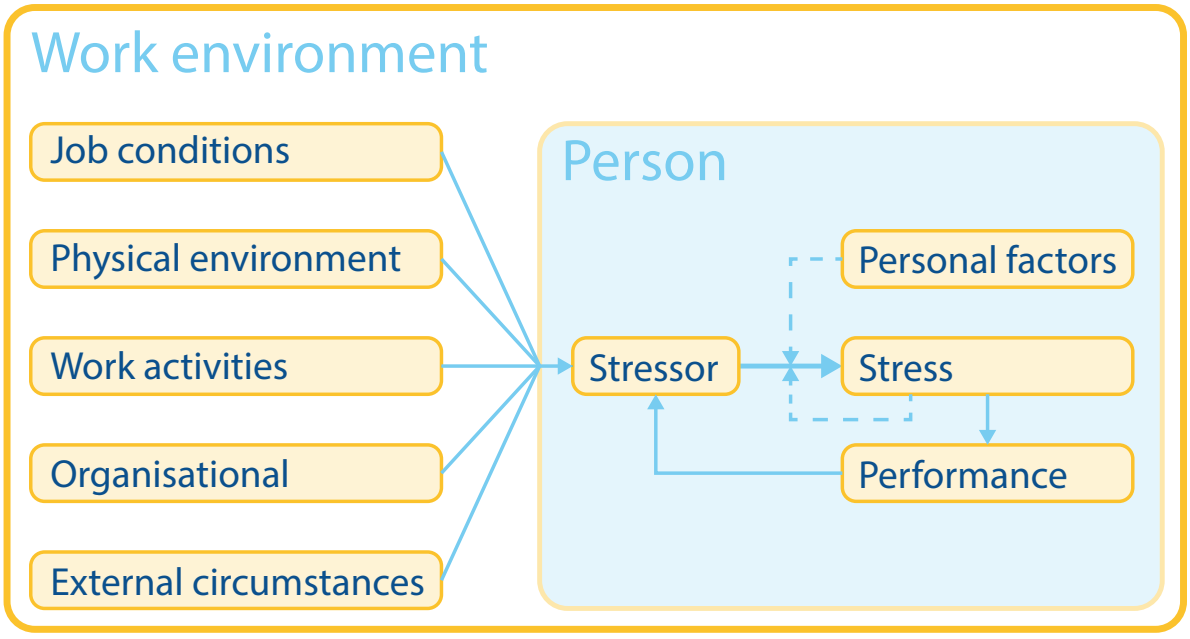


Figure 17.Theoretical model on person, work environment and health (own ill.)

“

THE IMPACT OF STRESSORS ON STRESS CAN BE BUFFERED BY PERSONAL FACTORS

7. SMART TOOLS

In this chapter, Smart Tools will be introduced, as a method for data collection. First, the term smart tool will be defined and the basic concepts surrounding it. After that, data collection measure through the smart tool will be discussed.

The initial objective of this research was to create a tool that enables employees to reduce their stress real-time, by measuring their stress and suggesting potential alternatives to their current work environment. It was found, as described in the introduction, that not enough knowledge was available to substantiate those potential alternatives. This chapter has two perspectives, the first being the perspective of the smart tool representing an automated method for stress measurement and the second perspective viewing smart tools as the decision maker that could act on behalf of the employee. While this second perspective is not yet relevant for this research, due to its scope limitations, the knowledge does run parallel with the greater objective of the research. Future research can built upon the gathered knowledge that is presentated here on this topic of smart tools.

7.1 SMART TOOL DEFINITION

In literature, the term smart tool has an ambiguous meaning, causing an unclear understanding. Both the words smart and tool mean something different in certain contexts. To focus on a workable definition, it is scoped to the domain of the built environment. For something to be smart, it needs to sense or collect information and make decisions to adapt accordingly (Valks, Arkesteijn, & den Heijer, 2018).

Over the past ten years, the term smart has been used more often about buildings (Buckman et al., 2014). The definition of a smart building, however, has not been stated clearly often, leaving it sometimes as a catch-all term. In a competitive market where sustainable and smart buildings seem to become more standard as time progresses, the need for a strong definition could be seen as desirable. Because, if you put some sensors in a building, is it then smart? And is there a different between smart, and say, really smart?

Buckman et al. (2014) use the following definition for smart buildings:

> Smart Buildings are buildings which integrate and account for intelligence, enterprise, control, and materials and construction as an entire building system, with adaptability, not reactivity, at the core, to meet the drivers for building progression: energy and efficiency, longevity, and comfort and satisfaction. The increased amount of information available from this wider range of sources will allow these systems to become adaptable and enable a Smart Building to prepare itself for context and change over all timescales.

In this definition, three drivers can be identified that aim to achieve progress: *longevity*, *energy & efficiency* and *comfort & satisfaction*. Since this definition is specified on smart buildings, the relevance of the drivers is limited to the use of smart tools, but it can still be partially adopted. Buckman et al. (2014) continue to introduce four methods to achieve the progress aimed by the drivers:

Method name	Description
Intelligence	The methods by which building operation information is gathered and responded to
Control	The interaction between occupants and the building
Materials and construction	The buildings physical from
Enterprise	The methods by which building use information is collected and used to improve occupant performance

Figure 18.Methods to achieve progress for Smart Buildings, based on Buckman et al. (2014)

These methods are introduced in the context to buildings, however, seem to be applicable to other forms of smart elements, when some terms like buildings and occupants are replaced by more general terms. In the end, a Smart Building, is a building, a static object that houses a certain function. The smart part is made up out of elements that, when integrated, create intelligence, control and enterprise.

Valks et al. (2018) introduce the concept of a smart campus tool, that is used by universities in their space allocation questions. In their book a definition was given for smart campus tool, but just like the smart building methods, they contain specific terms that makes the use singular. As a definition for smart tools in this research, the author has adjusted the definition for smart campus tools by Valks et al. (2018) to the following:

A service or product which collects real-time information to improve a current activity or process, whilst supporting decision making on the future activities or processes.

There are three important elements in this definition: collection data, improving current activity and supporting future decision making. This definition can be translated back to the methods to achieve progress for smart buildings as stated by Buckman et al. (2014) to methods to achieve progress for smart tools, as can be seen in Table 17.

As we can see, the methods translate well from Smart Building to Smart Tool, leaving only the name of *Materials & Construction* a little bit out of place. In the next sections, this name will be replaced with ***Physical Representations***, to make it more relevant.

Translating the definition of smart tool to the present research, there is a gap in the objective of the tool. The definition states that real-time information should be used to improve a current activity or process. The current study, however, does not aim to improve current situations, because of the large unknown knowledge base that is needed to decide upon what improvement would be. At the same time, the method that is developed in this research in terms of knowledge gathering, does aim to support future research to be able to add this improving capability, in the form of interventions based on the knowledge generated in the present research. Therefore, in the next sections, the methods associated with smart tools are discussed in both the perspective of knowledge gathering and situation improving capacities.

Method name	Description of Smart Building	Description of Smart Tool
Intelligence	The methods by which building operation information is gathered and responded to	The method by which the service or product operation information is gathered and responded to
Control	The interaction between occupants and the building	The interaction between the user and the service or tool
Materials & Construction	The buildings physical from	Design and physical representations of the service or product
Enterprise	The methods by which building use information is collected and used to improve occupant performance	The method by which service or product information is collected and used to improve user performance

Table 17. Methods to achieve progress for Smart Buildings and Smart Tools based on Buckman et al. (2014)

7.2 INTELLIGENCE OF THE TOOL

The method by which the service or product operation information is gathered and responded to.

The smart tool needs to interpret stress, so first and for most the tool needs to be able to measure and verify this. Stress measurements can be done in a wide variety of ways. The most basic of methods is to ask a person what their perceived stress is, for instance by means of the ***Perceived Stress Scale***, as mentioned by Cohen, Kamarck, and Mermelstein (1983). However, this is an active way of measuring, requiring time and attention form the person being measured. Direct stress measurements can be done, for instance with a *salvia sample* to measure cortisol, but this takes multiple days to process. In a review on stress recognition in offices, Alberdi et al. (2016) mention two prevailing ways of measuring stress, which are using ***bio-metrics*** for the stress indicators ***Heart Rate Variability*** (HRV) and ***Electrodermal Activity*** (EDA), with a preference in accuracy towards EDA.

HRV measures the timespan between two heartbeats. This is an indicator for stress since stress causes the HRV to increase, however, it is not the only impacting factor on HRV, making it not completely reliable, but Thayer et al. (2012) do propose HRV as a marker for stress. In practise, HRV is the most commonly used to measure stress in smart watches and wearable devices, since it is relatively easy to measure, and sensor development is in a relatively advance stage. A study shows that there is no significant difference between current wearables using PPG technology and ECG technology, used in static measurements in hospitals for instance (Weiler, Villajuan, Edkins, Cleary, & Saleem, 2017).

EDA measures the conductivity of the skin as a marker for stress. When the sympathetic nervous system is triggered, as is the case with stress, sweat glands as well as skin blood vessels are increasingly innervated. Sweat glands release more sweat to the skin, causing the skin to become increasingly conductive. This conductivity can be measured by putting an electrical signal on the skin and measuring the return signal. This measurement is preferably done on the hand. Both hands and feet have the highest density of sweat glands, but the hands are more accessible (Setz et al., 2010; Torniainen, Cowley, Henelius, Lukander, & Pakarinen, 2015). The benefit of EDA over HRV is that sweat glands are only influenced by the sympathetic nervous system, in contrary to the heart which is influenced by both the sympathetic as the parasympathetic nervous system, even at the same time (Setz et al., 2010).

Other important data that needs to be collected to be able to improve the alignment are both the *current activity* and *current workplace.* For ***current activity***, the most precise method would be to use user-input or external observers. These, however, have high demands on both time and money resources, since user-input requires time that is not spent on working and external observers need to be paid. If activity observation were to be fully automated, the activity would be derived from other information. This could be cameras translating movement patterns into proposed activities. Another option would be to use agenda information to determine activity, but that would be assumed activity, not actual and largely depends on the accurate input of the agenda upfront.

Current workplace could also be determined by user-input, however, multiple automated and digitalised localisation methods exist, as described in by Valks et al. (2016). This workplace and employee localisation methods provide two advantages, firstly automated knowledge on the user's location and surrounding and secondly automated knowledge on available workplaces in the office. Unfortunately, no cheap and easily available modular and movable systems are known, creating the need for a location to have already this type of systems installed.

Once the data is collected, it is processed through an algorithm, based on the operational model, more on that in chapter 11.

7.2 CONTROL OF THE TOOL

The interaction between the user and the service or tool.

To make use of the smart tool, some sort of interaction should be present where the information required to achieve the goal, is presented to the user. Depending on the singularity of the smart tool, control also becomes an important aspect. Because the tool can be prescriptive, meaning that the user should do what the smart tool proposes, or can be supportive, meaning that the tool provides possible solutions from which the user can choose.

When digital data is transferred to a user directly, this happens through a display, that shows information in a predetermined level of detail. This can range from a colour code to an automatically written text and should be designed in an optimal way for an easy understanding of the information. The medium of this information transfer can vary. Some smart tools have their dedicated device to display this information, but most use commonly used device such as computers, tablets, and smartphones. The main reason for this is to limit the number and size of extra devices a person has to carry around.

Information can also be transferred indirectly, for instance through the use of a supervisor, mediator or coach. Often this is a person that has experience or is educated in the interpretation of data in the relevant domain. Indirect information has the advantage of the possibility for professional interpretation and translation but has the disadvantage of creating space between the user and the original information that could result in distrust. On the other hand, some information that is generated by a user has attributes that the user might not want to share with a third party because of privacy reasons.

Next to the receiving of information by a user, there is also the possibility of interaction. The interaction could have multiple reasons, for instance simply to verify if someone received the information, but it could also be to initiate control over the outcome of the smart tool.

In the case of stress reduction, user input is desirable because it could improve the reliability of the information. One could argue that user input opens up the possibility of misinformation being used as input, and that would be true. But based on the *Garbage-In-Garbage-Out* principle, and the fact that this smart tool should be designed to support the user, a user that provides misinformation in the process, can assume that the outcome of the process will also be misinformation, resulting in information that will support the user poorly. Thus, it is one's responsibility to use the tool correctly.

When the user provides correct user input, and an outcome is generated that proposes a change of workplace, the user still has another element of control: the choice to either act upon the proposal of workplace change or not to do it. Since the smart tool will support the user, it does not fail when a user decides not to follow the proposed change. However it should be clear what the implications are when someone does or does not do so.

The interaction between the user and the smart tool provides valuable data in itself because it gives insight into the willingness of the user to adopt proposed changes. Feedback on these choices can be gathered either within the smart tool, by requesting feedback through user input, or by separately held feedback sessions.

7.3 THE PHYSICAL REPRESENTATION OF THE TOOL

Design and physical representations of the service or product.

As introduced in the previous section, the interaction between the smart tool and the user is essential to achieve the goal. This interaction can be done in multiple ways, but in the end, there will need to be a physical representation of the tool. This can either by a human representation, as a medium of information, or a device/product.

Since in the first section of Intelligence, it was established that stress measurements could only be done passively by the use of a sensor, this sensor is a physical element and needs to be attached to a holder and way of processing information. For this, wearable devices are ideal, such as smart watches, activity trackers and smart rings. The use of wearables is also encouraged by a study conducted by Nelson, Verhagen, and Noordzij (2016) indicating that wearables empowers the user in setting and monitoring health goals, and increasing one's commitment to these goals.

A quick internet search for wearable devices, yield the following outcomes: there are a lot of devices on the market with HRV sensors, but few with EDA sensor, and very few that have both.

Some activity trackers have both HRV and EDA sensors (for instance the Emphatica E4), but they are all worn around the wrist, which is not an ideal place for an EDA sensor to be.

In the end, the Moodmetric smart ring has been selected as a wearable device. The main reason for this is the accessibility of the data measured with the device. The large smart watch manufacturers do not support easy third-party data sharing, resulting in the data to remain hidden from the researchers. To manually register the data from smart watches was deemed infeasible, due to both time constraints, disruptively to the participants and inaccuracy.

The smart ring returns an indexed stress score with a range from 0 to 100, 0 indication no or minimal stress. The smart ring automatically calibrates the ring, resulting in a personal coefficient that is used to adjust the raw data.

Device type	**Smart watch** *Apple Watch3*	**Activity tracker** *Fitbit Charge*	**Heart rate band** *Polar T31*	**Smart ring** *Moodmetric*	**Research device** *Emphatica E4*
HRV	Yes (PPG)	No (PPG)	Yes (ECG)	No	Yes (PPG)
EDA	No	No	No	Yes	Yes
					

Table 18. Different types of wearable devices and their measurement methods (own ill.)

The additional part of the tool would be the method of informing the user, for future research on interventions. As stated in the previous section, the use of indirect information sharing is possible but could have negative side effects, mainly on the issue of privacy. Also, a part of the aim of the smart tool is to provide real time support. By the use of indirect information sharing, one becomes dependent on the mediator to provide the information.

As a form of direct information sharing, the user should have a personal display, that should be carried around. As discussed in the previous section, the level of detail of the information can be a determining factor for the possibilities of this display. The most logical way would be to use a display on the wearable device. In this way, all the information gathering, and sharing is done at a centralised place. This, however, requires the wearable to have display functions that meet the desired level of detail of information. The easiest and most adopted way is by use of a smartphone app. Since smartphones offer a wide arrange of possible display techniques, the demand for an extra display is diminished. Another similar way could be with a desktop program, but this requires the user to be working on a computer. Lastly, the display could be in a separate device, specially designed for that use. This does create the need for the development of that product and the carrying around of that product.

The third part of the tool is a collection of feedback. This is done on the one hand by a second stress measurement, to compare for stress reduction and on the other hand by feedback from the users. This user feedback can be collected in two ways, oral or written feedback in a feedback session or direct feedback that serves as input in the smart tool. To make this direct feedback happen, an input function must be available, either a button, keyboard or touchscreen.

The use of a smartphone app for this to work could be considered paradoxid slightly. The aim is to reduce stress and smartphones are among the top stressors in the work environment since they offer a distraction from work. One could argue that stress could be reduced by simply removing smartphones from the work environment all together. The author acknowledges such arguments, however, argues that the benefits of using a smartphone as display outweigh the negative effects of increasing non-work-related smartphone use. To counter this, the author proposes a function to use the app while keeping the phone locked, decreasing accessibility to temptation.

7.4 ENTERPRISE OF THE TOOL

The method by which service or product information is collected and used to improve user performance.

As introduced in the previous sections, the smart tool aims to reduce employee, using supporting the alignment between activity and workplace. The use of the smart tool in total is twofold. Firstly, the real time alignment of activity and workplace, and supporting improvements in that alignment. This is for now outside of the scope of the research, but will be discussed further in this section. Secondly, to provide insights that can be used to come up with solutions in a preventive way.

The alignment process will be conducted by the operation model, such as the conceptual model version 1.0 in chapter 12. The alignment is based on the attributes that are introduced in the section Activities in subchapter 3.1 and the section Workplace in subchapter 4.1. Based on the theoretical framework, stress should decrease and performance increase

when the attributes from the current activity are best aligned with characteristics from the workplace. This can be achieved by supporting the alignment process with suggestions for workplace change, if necessary.

This support can come in different levels of detail. The maximum level of detail would be achieved when all personal preferences of an employee are perfectly matched with the attributes of the current activity and characteristics of the workplace. The minimal level of detail would be achieved by indicating to the employee that the acceptable level of stress has been exceeded and suggesting that the employee should evaluate what the active stressor is and if this can be improved by changing the workplace.

For the second part of the smart tool, the provision of insights into a possible solution to prevent stress from forming, the data generated in the first part of the smart tool, will be used. As mentioned before, the feedback part of the smart tool is very important. For the forming of analysis, the more information there is, the more extensive the analysis can be. It can, however, also cast a cloud over what information is relevant and what information is secondary.

Continuous stress measurements with context mapping in the form of activity and workplace, can create a detailed picture of the work environment and the associated stress levels. By operationalizing this information, future work environments can be adapted according to positive and negative workplace characteristics. Every time an employee's stress level is exceeded, and this employee indicates that it is workplace related, valuable information is formed. This data is then stored, and patterns can be found. When common patterns are identified, they can be incorporated into the smart tool, for instance, specific timeslots that have high probability of causing stress. The rest of the data can be used to create an extensive analysis, to which a report can be written, with possible interventions to improve the work environment.

The functionality of the enterprise of the smart tool could be elaborated and increased by integrating other enterprises from different tools and systems. An example is already given in the section on Intelligence, by integrating a digital localisation system to determine the current and available workplaces. But also, other tools could be integrated, for instance, general stress reducing methods, to support stress reduction even when the stressors are not workplace related. These functionalities could be extended almost indefinitely. Therefore it is important to scope this, together with the company brief.

7.5 CONCLUSION ON SMART TOOLS

Following the definition of smart tool, a service or product which collects real-time information to improve a current activity or process, whilst supporting decision making on the future activities or processes, it can be concluded that a wearable device is needed to collect real time stress measurements. The Moodmetric smart ring has been selected, using the EDA bio-metric to collect the stress information.

The information gathered with the smart ring is combined with the logged data with a computer program, preparing it as input for the operational model, that is the main process in the smart tool for the decision-making process.

Automated processes for activity and workplace tracking are desirable to combine with the automated stress measurements,. However, no easy plug-and-play methods are available for activity and workplace, thus they remain outside of the scope of this research.


“
STRESS CAN BE MEASURED REAL-TIME THROUGH THE BIO-METRIC ELECTRODERMAL ACTIVITY

8. CONCLUSION THEORETICAL FRAMEWORK

In all the previous chapters from the theoretical framework, the basis has been laid for the research. Combining the theoretical framework developed in subchapter 6.2 with the findings from chapter 6, the theoretical framework for this research is concluded.

8.1 COMBINED CONCLUSION

To investigate the relations that are drawn in the theoretical model on the person, work environment and health, variables need to be defined. The variables are a translation of the relevant concepts to elements that, potentially, could be measured. Variables are divided into three groups, ***dependent variables***, ***independent variables***, and ***confounding variables***.

The ***dependent variable*** is the concept that is investigated and changes due to changing values of independent variables. In the case of this research, this is stress. Stress can be divided into two types, *perceived stress*, and *actual stress*. Perceived stress refers to how a person experiences stress and other feelings that the person associates with stress but are not necessary stress. Actual stress is a measured form of the physiological reaction in the body, in the form of a *bio-metric*.

The ***independent variables*** are concepts that form the context of the measurement. They are expected to influence the dependent variable. Independent variables can be manipulated to take certain values. In the case of this research, the independent variables are *personal characteristics*, *workplace*, and *activity*.

As mentioned in Chapter 3, each person differs from another and thus reacts differently to varying circumstances. *Personal characteristics* are therefore of potential influence. While *gender* and *age* are respectively linear and dichotomous, divisions of time spend on certain activities, and switching behaviours are not. To create generalised findings, it is necessary to form profiles. Thus the *Activity Profile* and *Mobility Profile* are used.

Chapter 3 also discussed the work activities that are performed by employees in the work environment. Different work activities have different demands, as stated in sub chapter 5.3. Since activities are the main concept of activity based working environment, the work environment that will be investigated during the structured observations, these activities are an important variable to be investigated. For the activities, the adapted list of activities from the CFPB is used.

In Chapter 4 workplaces are discussed, and from it, four basic characteristics were defined, *privacy*, *facilities*, *use* and *use agreements*. These basic characteristics after that were divided into 21 sub characteristics, that will be used as variables for workplace.

The above-mentioned independent variables are not the only variables that are of potential influence on stress. From the literature review in the previous chapters, five more big groups of aspects could be divided: *activity* (with the focus on the demands on the employee) (sub chapter 5.3), *personal factors* (chapter 3), *organizational factors* (sub chapter 5.1), *job conditions* (section 5.1.2) and *external circumstances* (section 5.1.2). The subdivisions of these variables are shown in the overview table.

These variables are named ***confounding variables***, meaning that there is a potential influence on the dependent variable. However, they are not taken into account during the research. If one critically looks at these

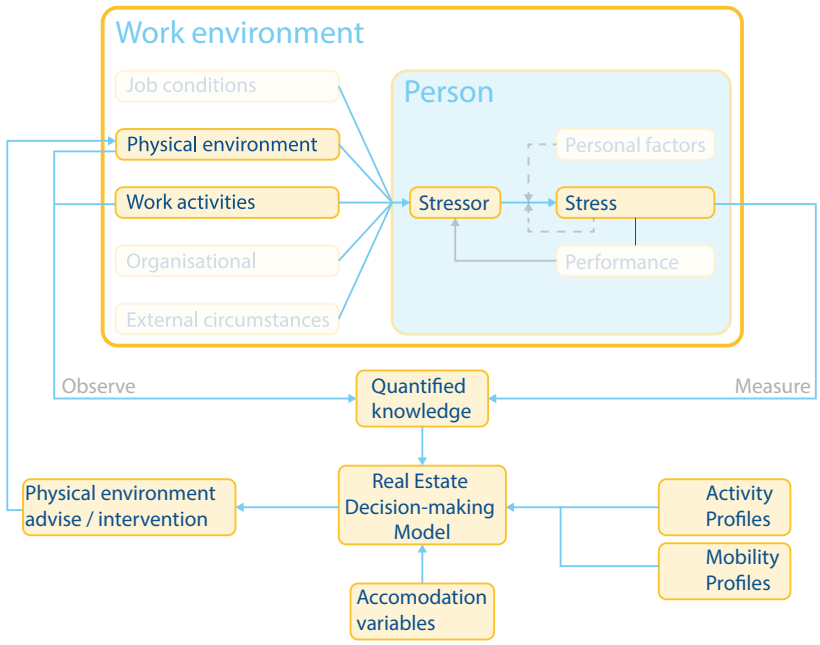


Table 19. Theoretical model derived from the theoretical framework (own ill.)

variables, it can be noted that important variables are listed among the confounding variables, that presumably have the potential to cause a lot of stress. However, as mentioned during the scoping of this research, with the current dependent and independent variables, the research does not investigate the cause of the stress. It merely determines in what variable combinations stress occurs in higher or lower levels.

Variable type	Variable	Divided
Dependent variable	Stress	*Perceived* *Actual*
Independent variable	Personal characteristics	*Age* *Gender* *Activity profile* *Mobility profile*
	Workplace	*Privacy* *Facility* *Use* *Use agreements*
	Activity	*Type*
Confounding variables	Activity	*Workload* *Skill utilization* *Skill variation*
	Personal factors	*Coping styles* *Hardiness* *Locus of control* *Individual knowledge* *Skill & ability*
	Organizational	*Level of autonomy* *Social support* *Relation supervisor* *Role ambiguity* *Feedback*
	Job conditions	*Security* *Salary* *Task significance*
	External	*Life events* *Work-home conflict* *Social*

Table 20. List of variables derived from the theoretical framework (own ill.)

8.2 THEORETICAL MODEL

The theoretical framework can be represented in the theoretical model. This model is built on the theoretical model for a person, work environment and health, adding the data gathering method and operationalisation of the knowledge about decision-making in the real estate context.

As a translation from the research question, the theoretical model shows how the process of knowledge creation can be used as input for a decision-making model, together with organizational input, to come to an advice that leads to improvements in the physical environment. These improvements could be a new accommodation strategy, but also a change in the current work environment.

PART III

EMPIRICAL RESEARCH

In this part, the empirical research section of the thesis is described. It starts with chapter 9, that describes the observations in depth. Chapter 10 introduces the results of the observations and chapter 11.2 contains the conclusions that follow from the results for the empirical research. These conclusions and results are the input for the operational model, that is described in the next part.

9. OBSERVATIONS

As stated in chapter 2 on the research methods, this study uses observations to do a quantitative statistical analysis. The aim is to look for relations between specific workplace types and activities, that correlate with increased employee stress. By translating the workplace types into the predefined characteristics, commonalities in these workplaces can be identified. Besides that, employee activity and stress types can be divided and analysed, to create a knowledge base on the differences between them. These types are important to create future solutions that work for the full range of employees and not only the average ones.

9.1 MEASURES

In the theoretical framework, the scientific view on the factors that influence stress has been described, resulting in a list of variables, as can be seen in Table 20. To measure the relevant variables for this research, they have to be chosen and to be made measurable.

The variables were split into three groups, dependent variables, independent variables, and confounding variables. Due to the scope of the research, confounding variables will not be researched further and thus not measured.

9.1.1 Dependent variable

The dependent variable for the observations is stress. As described in section 6.1.2 can stress be measured with EDA through the use of a smart ring. This smart ring measures stress on a 1 to 100 scale. The raw data of the smart ring is translated into this scale, by the internal software of the ring. It uses a calibration program to determine a personal coefficient that is used to translate the raw data, to have an average score of 50 for a day. As described in section 2.2.5.1 in the methods chapter, because of this calibration and coefficient effect, one must note that the score does not reflect the absolute stress level of a person. The smart ring cannot determine if the person has high or low general stress levels, only what is the average for this person. The smart ring, therefore, is not a tool to measure if a person is very stressed in general, but a tool to measure differences over time. These differences are analysed to determine which factors are of influence on it. The infographic on the next page shows the working principe of the ring and how the concept of calibration bias is distorting the measurements

As mentioned in the introduction chapter, most of the previous stress research is based on self-rated stress scores (Davis et al., 2011). To compare the stress scores obtained from sensors to the self-rated stress, participants were asked to log their self-rated stress ones each day, at the end of their workday.

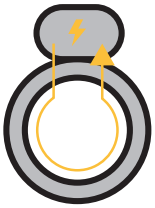
Same as self-rated stress, self-rated productivity has been a common variable in previous research. This variable is also used and logged at the same moment as the self-rated stress, ones each day. Summarising, the dependent variables that were measured during the observations are:

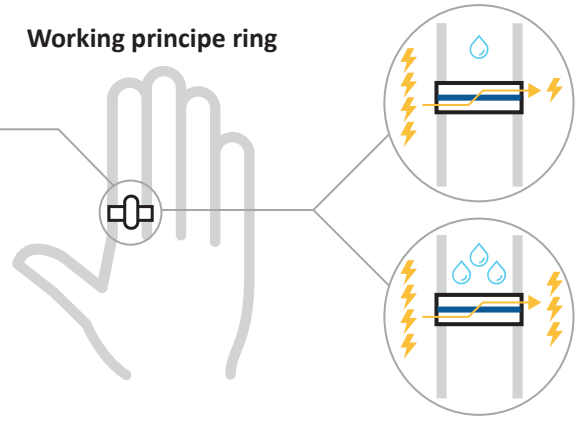
- Stress score (SS)
- Self-rated stress
- Self-rated productivity

The stress score is measured with the smart ring multiple times per minute, but an average for every interval of 15 minutes is used. The self-rated scores are logged in the logbook on a daily interval.

STRESS MEASUREMENT

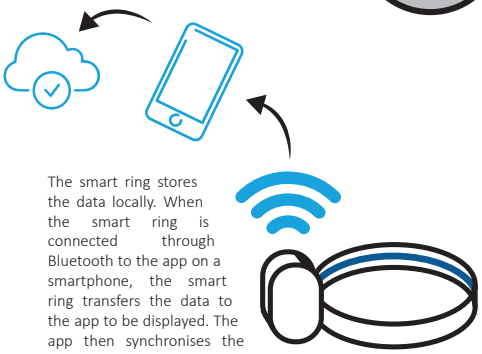
Working principe ring





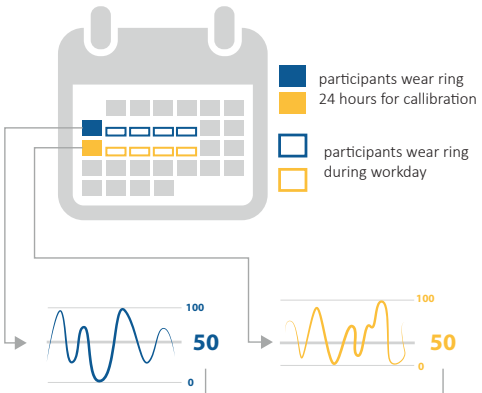
The band of the smart ring consist out of three parts: two conductive stainless steel bands, with a non-conductive plastic band in between. The smart ring sends out a very small but stable pulse of electricity through one of the stainless steel bands of the ring. The smart ring contains a sensor that measures the level of electicity returning from the other stainless steel band. In order for the electricity to reach the other band, it has to travel through the skin. The resistance of the skin determines how much electricity will pass. The amount of sweat on the skin can decrease the skins resistance, allowing more electricity to pass and to be measured.

Data transfer and storage

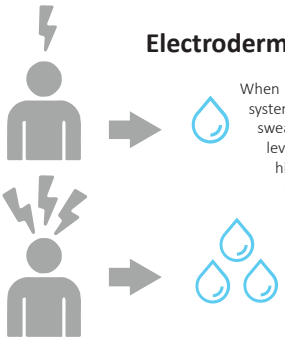


The smart ring stores the data locally. When the smart ring is connected through Bluetooth to the app on a smartphone, the smart ring transfers the data to the app to be displayed. The app then synchronises the data to the cloud storage, where it can be accessed by the user and researcher.

Observation schedule

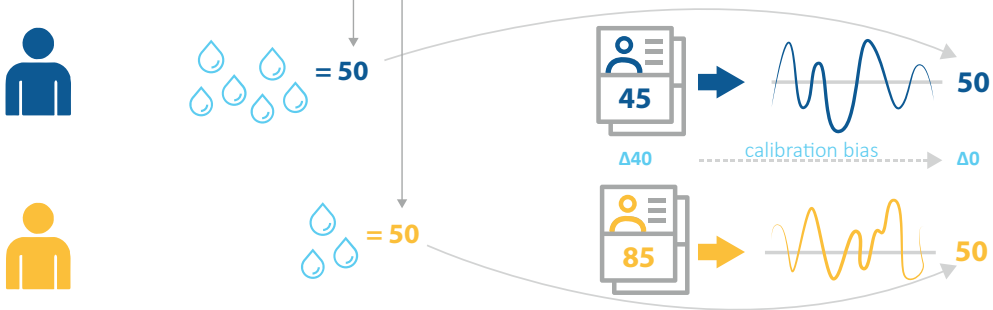


Electrodermal activity as biomarker



When stressed, the sympathetic nervous system is activated that triggers sweatglands to produce sweat. The higher level of stress is present in the body, the higher the production of sweat will be, increasing the electrodermal activity. The changes in the electrodermal activity of the skin can be rapidly measured and can change a lot in the course of minutes, making it an ideal biomarker to measure changes in the stress level of a person throughout time.

*"Your **50** is not my **50**."*



Participants

Every participant is different is many ways, but two aspects are of influence on the observations: the degree of sweatiness of hands and the current actual stress in general

Personal sweatiness

During the first day the employee's relative sweatiness is measured to callibrate a personal coefficient. All measurements are adjusted through this coefficient.

Relative stress measure

When the actual stress level of a participant would be determined (by e.g., psychological and physiological testing), this could result in a difference, as in th example above, of Δ40, however the callibration removes this difference, resulting in a distorted difference of Δ0.

9.1.2 Independent variables

From literature three independent variables have been identified. These are personal characteristics, physical environment, and work activities. These independent variables are defined in context to the observations below.

Personal characteristics

Aspects of a person that one can relate to a group. It is reasonable to expect that these aspects could have an influence and should, therefore, be investigated. The following characteristics have been chosen, due to their unambiguity and easiness to obtain:

- Age
- Gender

These variables were gathered through a pre-observation survey and remain static throughout the observational period. Gender is divided into Male, Female and Other. Age is divided into groups on an ordinal scale because the actual age is too precise and would compromise the privacy of some participants. The groups are <25, 25-34, 35-44, 45-54, 55-65, >65. Since they are gathered before the observations, they are not measured or logged during the observation period.

Physical environment

The physical environment that the participant is in during the observation is the workplace. The workplace is divided into four main categories and each category divided into multiple variables with a total of 21. The categories are:

- Privacy (4 variables)
- Facilities (7 variables)
- Use (2 variables)
- Use agreements (8 variables)

The variables were initially gathered through an evaluation of the workplaces. The researcher assigned the appropriate value to the variable, based on his insight. An overview of this can be seen on the next page in Table 23 and Table 24. The coded workplaces are displayed on a floorplan, which is used during the observations and can be seen in Figure 20 and Figure 21. During the observations, the participant logs their workplace with a specified code. During the analysis, these codes are replaced with the appropriate set of values for the workplace variables.

Work activity

The type of activity that an employee performs at the time of the observation. The activity types are related to work, described in more detail in section 3.1.1. The activities are:

- General Desk Work
- Undisturbed Desk Work
- Interactive Desk Work
- Planned Meeting
- Unplanned Meeting
- Telephone call
- Other

During the observations, the participants log their activity, the same as the workplace. A description of every activity is given to the participants as a reference.

Summarising, the independent variables that were observed during the observations are:

- Workplace (code)
- Activity Type

As stated, before the variables Age and Gender of the participants are gathered before the observations.

9.1.3 Derivative variables

During the observation, more information is gathered than these three variables, and even from these variables, other variables can be deduced. By doing this, a wider range of analyses are possible to conduct.

9.1.3.1 Dependent variables

As described in section 2.2.5.1 in the methods chapter, two derivative stress scores are added. These are:

- Stress Delta (SD)
- Stress Score Minus Mean (SSMM)

The SD displays the deviation between two consecutive measurements, showing the progression of the stress in a positive or negative way. The SSMM shows the difference from the mean of a participant, creating a more solid stress score to be used for correlation analysis. See section 2.2.5.1 for the calculation of the variables.

9.1.3.2 Independent variables

Time

It could be assumed that during the week employees become more stressed because they use the weekend to recover from the work week. The same could be said of the time during the day, beginning with low stress levels and building to the end of the day. To test this, the following two variables are used:

- Day of the week
- Time of day

These variables are determined by a combination of the timestamp of the stress measurement and the indicated time in the logbook.

While every person is different, for operationalisation purposes, the choice has been made to group persons into profiles. In other to create a complete personal profile, to better represent the diversity of people, variables were added, described in the following sections

Activity Profile

These profiles aim to divide people by their division of activities. With these profiles, similar people in for instance the same department can be identified. Four possible 'values' for the Activity Profile are available, as introduced in section 3.2.1 Below the different Activity Profiles shown, together with the method of assignment.

- ***Profile 1:***
  Almost half of time General Desk Work, other half mixed activities
- ***Profile 2:***
  Half of the time a mix of General Desk Work, Undisturbed Desk Work, and Interactive Desk Work and most of the other time Meetings (both Planned and Unplanned)
- ***Profile 3:***
  Half of time Undisturbed Desk Work, other mainly Meetings (both Planned and Unplanned)
- ***Profile 4:***
  Almost exclusively General Desk Work

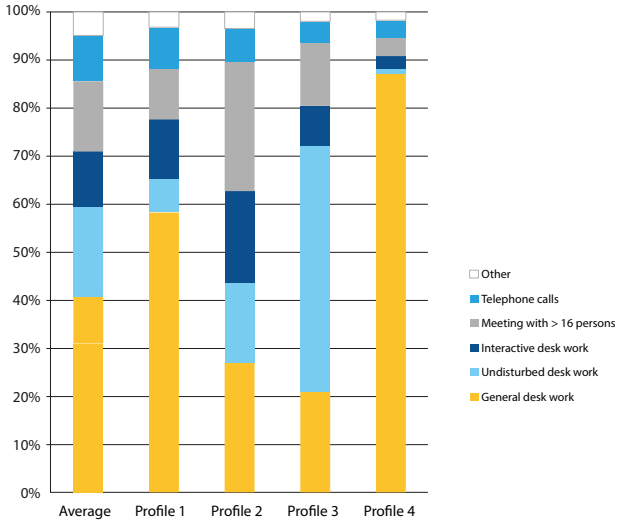


Figure 19. Activity Profiles used in the research, based on CFPB (own ill.)

			Workplace	Rotterdam B1	Rotterdam B2	Rotterdam B2.1	Rotterdam B4	Rotterdam B3	Rotterdam B5	Rotterdam B7	Rotterdam B6	Rotterdam A1	Rotterdam A2	Rotterdam A3	Rotterdam A4	Rotterdam A5	Rotterdam A6	Rotterdam C1	Rotterdam C2	Rotterdam C3	Rotterdam C4	Rotterdam C5	Rotterdam C6	Rotterdam C7
P/S/U		**Attribute**																						
Space	1	**Privacy:**																						
	1	• Size of room	*cellular 1 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
	1		*cellular 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	1		*cellular 5-10*	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
	1		*open 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0
	1		*open 5-10*	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1		*open 10+*	1	1	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	1
	2	• Openness of room	*walls & no windows*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2		*walls & windows*	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2		*walls & open*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2		*glass walls with curtains*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
	2		*glass walls*	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
	2		*curtains*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2		*open with 1 wall*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2		*open*	1	1	1	0	0	1	0	0	1	1	1	1	0	0	1	1	0	0	1	1	1
	3	• Audio privacy (how many people can [illegible])	*0*	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0
	3		*1 or 2*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	3		*2+*	1	1	1	1	0	1	0	1	1	1	1	1	0	0	1	1	0	0	1	1	1
	4	• Visual division (office partitions, [illegible])	*wall*	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0
	4		*window*	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4		*office partition*	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	1	0	0	1	1
	4		*hallway*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	4		*non*	1	0	0	1	1	0	0	0	1	1	1	0	0	0	1	0	0	0	1	0	0
		Facilities:																						
	5	• Power socket	*No*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
	5		*Yes*	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
	6	• Extra monitor	*No*	1	1	0	0	1	0	1	0	1	1	1	0	1	1	0	1	0	0	1	0	0
	6		*Yes*	0	0	1	1	0	1	0	1	0	0	0	1	0	0	1	0	1	1	0	1	1
	7	• Type of chair	*No chair/standing*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7		*Deskchair*	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	1	1	0	1	1
	7		*Barstool*	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0
	7		*Regular chair*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	8	• Type of desk (sitting, standing, [illegible])	*No desk*	0	0	0	0	0	0	0	0							0	0	0	0	0	0	0
	8		*Shared table*	1	0	0	1	1	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0
	8		*Individual desk*	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
	8		*Individual desk, adjustable*	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	1	0	0	1	1
	8		*Special desk*	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
	9	• Presentation hardware (screen & [illegible])	*No*	1	1	1	0	0	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1
	9		*Yes*	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
	10	• Desk space (able to use papers [illegible])	*no desk*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10		*small*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	10		*regular*	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1	0	1	1	0	1	1
	10		*spacious*	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	1	0	0
	11	• Storage	*No*	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0
	11		*Yes*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1
Use		**Access:**																						
	12	Department based or free use	*Free use*	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	1	1	1
	12		*Department*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0
	13	Flex use or assigned desk	*Flex use*	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1
	13		*Assigned*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
		Use agreements:																						
	14	• Out loud speaking or silence	*out loud speaking*	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
	14		*silence*	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	• Calling	*no*	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	15		*yes*	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
	16	• Multiple person meeting	*No*	0	0	0	1	1	0	0	0	0	1	1	1	0	1	1	0	1	1	0	1	1
	16		*Yes*	1	1	1	0	0	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	0
	17	• Bookable – temporarily use	*No*	1	1	1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1
	17		*Yes*	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	18	• Purpose (focus)	*Yes*	1	1	1	0	0	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	1
	18		*No*	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0
	19	• Purpose (Collaborate)	*Yes*	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
	19		*No*	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	20	• Purpose (Social)	*Yes*	0	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0
	20		*No*	1	1	1	0	0	1	1	1	0	0	0	1	1	0	1	1	1	1	1	1	1
	21	• Purpose (Learn)	*Yes*	0	0	0	1	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0
	21		*No*	1	1	1	0	0	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1

Table 23. Workplace characteristics for the Rotterdam location of the case company (own ill.)

ROTTERDAM BASED LOCATION

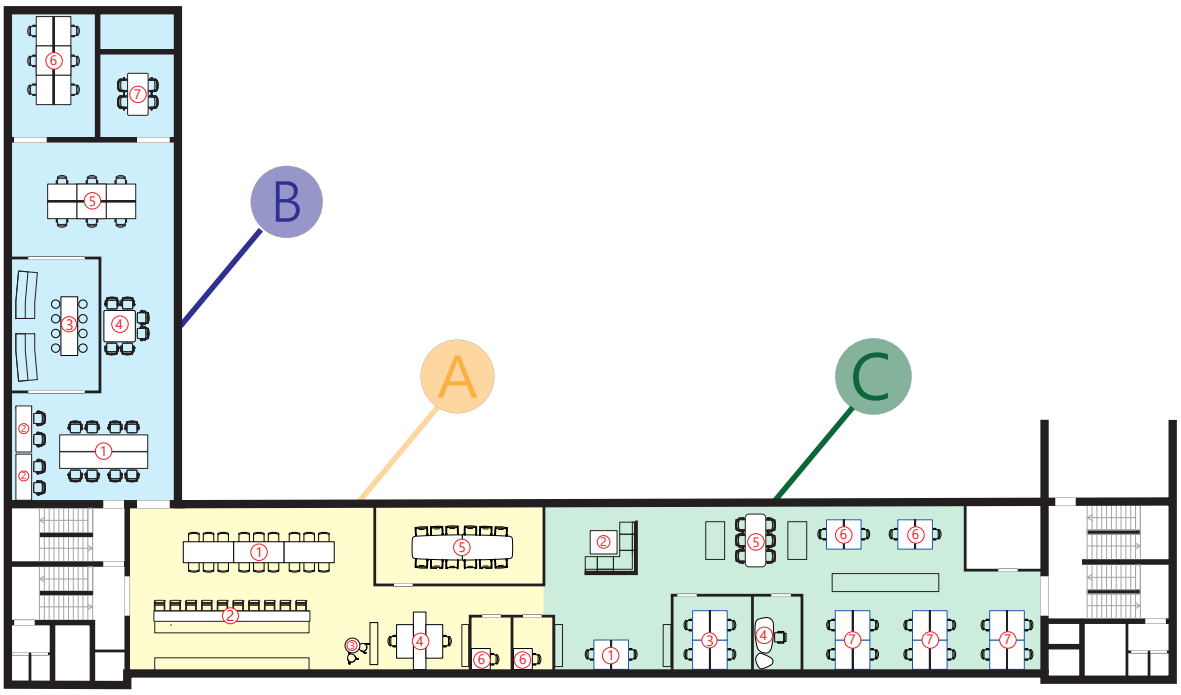


Figure 20. Workplace codes for the Rotterdam location of the case company (own ill.)

P/S/U		Attribute	Workplace	Amsterdam A1	Amsterdam A2	Amsterdam B1	Amsterdam B2	Amsterdam B3	Amsterdam B4	Amsterdam B6	Amsterdam B7	Amsterdam B8	Amsterdam B9	Amsterdam C1	Amsterdam C2	Amsterdam C3	Amsterdam C4	Amsterdam C5	Amsterdam C6	Amsterdam C7	Amsterdam C8	Amsterdam C9	Amsterdam C10	Amsterdam D1	Amsterdam D2	Amsterdam D3	Amsterdam D4
Space		**Privacy:**																									
	1	• Size of room	cellular 1 person	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			cellular 2-4 person	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0
	1		cellular 5-10	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
	1		open 2-4 person	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1		open 5-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1		open 10+	1	1	0	1	1	1	0	0	0	0	1	1	0	0	0	1	1	1	0	1	1	1	1	0
	2	• Openness of room	walls & no windows	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	2		walls & windows	0	0	1	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	1
	2		walls & open	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	2		glass walls with curtains	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2		glass walls	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	2		curtains	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2		open with 1 wall	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	2		open	0	1	0	1	1	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	1	0	0
	3	• Audio privacy (how many people can hear you)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3		1 or 2	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
	3		2+	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1
	4	• Visual division (office partitions,	wall	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
	4		window	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	4		office partition	1	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0
	4		hallway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4		non	0	0	0	0	1	1	0	1	1	1	0	0	1	0	1	0	1	0	1	0	1	0	1	1
		Facilities:																									
	5	• Power socket	No	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5		Yes	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	6	• Extra monitor	No	0	0	0	1	1	1	1	1	0	1	0	0	1	0	1	1	0	0	0	0	1	0	0	1
	6		Yes	1	1	1	0	0	0	0	0	1	0	1	1	0	1	0	0	1	1	1	1	0	1	1	0
	7	• Type of chair	No chair/standing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7		Deskchair	1	1	1	0	0	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1
	7		Barstool	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	7		Regular chair	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
	8	• Type of desk (sitting, standing,	No desk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8		Shared table	0	0	0	1	1	1	1	1	0	1	0	0	1	0	1	1	0	0	0	0	1	0	0	1
	8		Individual desk	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
	8		Individual desk, adjustable	1	1	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	1	0	1	0	0
	9		Special desk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
	9	• Presentation hardware (screen & sound)	No	1	1	1	0	1	1	0	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0
	9		Yes	0	0	0	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
	10	• Desk space (able to use papers	no desk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10		small	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	10		regular	1	1	1	0	0	0	0	0	1	0	1	1	0	1	1	0	1	0	1	1	0	1	1	0
	10		spacious	0	0	0	1	1	1	1	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1
	11	• Storage	No	0	1	1	1	1	1	1	0	1	1	0	1	0	0	1	1	1	1	1	0	1	1	0	1
	11		Yes	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	1	1	0	1	1	0
Use		**Access:**																									
	12	Department based or free use	Free use	0	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1
	12		Department	1	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0
	13	Flex use or assigned desk	Flex use	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1
	13		Assigned	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
		Use agreements:																									
	14	• Out loud speaking or silence	out loud speaking	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	14		silence	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
	15	• Calling	no	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15		yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	16	• Multiple person meeting	No	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
	16		Yes	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	17	• Bookable – temporarily use	No	1	1	1	0	0	0	0	0	1	0	1	1	0	1	0	0	1	1	1	1	1	1	1	0
	17		Yes	0	0	0	1	1	1	1	1	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	1
	18	• Purpose (focus)	Yes	1	1	1	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0
	18		No	0	0	0	1	1	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1
	19	• Purpose (Collaborate)	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1
	19		No	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
	20	• Purpose (Social)	Yes	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	20		No	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
	21	• Purpose (Learn)	Yes	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	21		No	1	1	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0

Table 24. Workplace characteristics for the Amsterdam location of the case company (own ill.)

AMSTERDAM BASED LOCATION

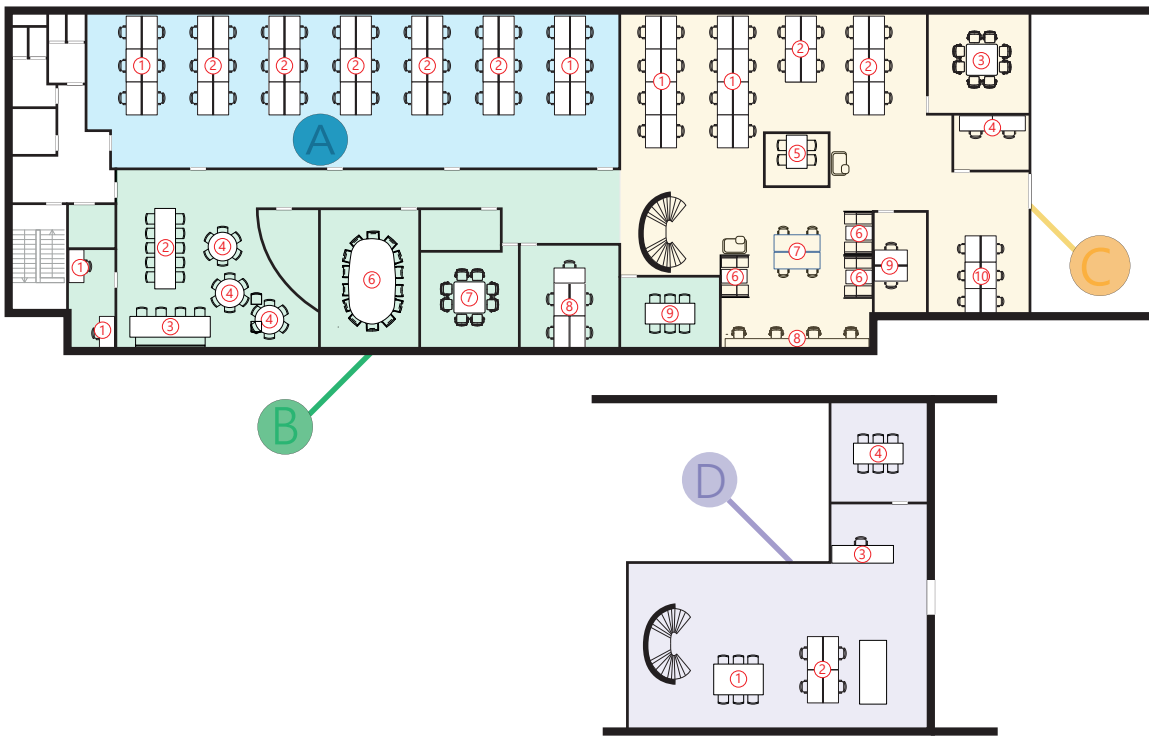


Figure 21.Workplace codes for the Amsterdam location of the case company (own ill.)

The profiles are created after the observations, by analysing the logged activities. It calculates how much each activity differs from the values in Table 21 and selects the profile with the lowest sum of differences.

Activity Profile	% of GDW	% of UDW	% of IDW	% of Meeting
Profile 1	47	10	15	10
Profile 2	15	15	20	25
Profile 3	10	50	8	15
Profile 4	80	2	3	2

Table 21. Division criteeria for Activity Profiles (own ill.)

Mobility Profile

Since the research is aimed for ABW environments, the switching behaviour of an employee influences their experience in this environment. This could impact their stress levels as well. There are four 'values' for Mobility Profiles, that increment in switching frequency. Below they are shown, together with the method of assignment.

- ***Camper:***
  Employee who spends almost all his or her time at the same workplace and rarely moves
- ***Timid Traveller:***
  Employee who spends the majority of his or her time at the same workplace, however, sometimes uses another workplace
- ***Explorer:***
  Employee who uses different workplaces throughout the day, though often uses the same workplaces for certain tasks
- ***Nomad:***
  Employee who is not bound to a single workplace and uses a multitude of workplaces throughout the day

To quantify these profiles, two scoring variables are defined, based on the used workplaces. Firstly, the percentage of the most commonly used workplace and secondly the average of switches throughout the day. A switch is defined when the workplace of the previous observation is not the same as the workplace of the current observation.

The average of switches is calculated by counting all switches during the measurement period of the participant, dividing it by five resulting in switches per day and then subtracting two from that number, to adjust for the 'switch' when arriving and leaving. Table 22 shows an overview of the assignment criteria for Mobility Profiles.

Mobility Profile	Assignment criteria	
	% of most common workplace	*Average switches per day*
Camper	> 80	<= 4
Timid Traveller	> 60	> 4
Explorer	<= 60	< 5
Nomad	<= 60	>= 5

Table 22. Assignment criteria for Mobility Profile (own ill.)

Summarising, the additional independent variables deduced from the data gathered during the observations are:

- Day of week
- Time of day
- Activity Profile
- Mobility Profile

All these variables combined result in pieces of data that are gathered during the observations with an interval of 15 minutes. These pieces of data are called Databites in the research and contain the following data:

- ID
- Age
- Gender
- Stress Score (SS)
- Self-rated stress (SRS)
- Self-rated Productivity (SRP)
- Day of week
- Time of day
- Workplace (code)
- Activity Type

The Activity-, Mobility- and Stress Profiles and the Stress Delta and Stress Score Minus Mean will be added after the observation period, since are a derivative of the totality of data of another variable.

9.2 OBSERVATION VALIDITY

In terms of observational reliability, Cohen's Kappa is used to determine how reliable the observations are. Kappa is based on an agreement calculation, that is calculated by comparing two observations of two observers of the same situation. It compares the agreement among observers. The agreement is calculated by the following formula, resulting in a score between 0 and 1:

$$Agreement = \frac{number\ of\ corresponding\ observations\ between\ two\ observers}{number\ of\ total\ observations\ of\ one\ observer}$$

To calculate this, three participants have been followed for one day by the researcher. The first observer is the participant self, as described in the observation method. The second observer is the researcher. The agreement is calculated for workplace (0,83), activity (0,67) and overall (0,76).

Cohen's Kappa goes one step further, by taking into account agreement occurrence by chance. It has a slightly more complex formula that goes as follows:

$$Kappa = \frac{observed\ agreement - probability\ of\ chance\ agreement}{1 - probability\ of\ chance\ agreement}$$

The probability of chance agreement is normally relatively simple to calculate because often an observation has binary answers of yes or no. If so, the probability is calculated as follows:

- Observer A:
  Amount stated yes is XY_a.
  Amount stated no is XN_a.
- Observer B:
  Amount stated yes is XY_b.
  Amount stated no is XN_b.

$$p(Yes) = XY_a \times XY_b$$

$$p(No) = XN_a \times XN_b$$

$$probabillity\ of\ chance = p(Yes) + p(No)$$

However, for multivariable observations, the calculation becomes even more complex.

		Observer B			Row totals
Observer A	Var_1	Var_2	...	Var_n	
Var_1	A_1	B_1		N_1	$\sum(A_1, B_1 ... N_1)$
Var_2	A_2	B_2		N_2	$\sum(A_2, B_2 ... N_2)$
...					
Var_n	A_n	B_n		N_n	$\sum(A_n, B_n ... N_n)$
Column totals	$\sum(A_1, A_2 ... A_n)$	$\sum(B_1, B_1 ... B_n)$		$\sum(N_1, N_2 ... N_n)$	$\sum(total)$

Step 1: the total number of agreements are calculated:

$$\sum agreements = A_1 + B_2 + \ ... \ N_n$$

Step 2: calculate the expected frequency for each variable:

$$expected\ frequency(Var) = \frac{row\ total + column\ total}{overall\ total}$$

Step 3: calculate the sum of the expected frequency of the agreements by chance:

$$\sum_{expected\ frequency} = \frac{\sum(A_1, A_2 ... A_n) \times \sum(A_1, B_1 ... N_1)}{\sum(total)} + \frac{\sum(B_1, B_2 ... B_n) \times \sum(A_2, B_2 ... N_2)}{\sum(total)} + ... \frac{\sum(N_1, N_2 ... N_n) \times \sum(A_2, B_2 ... N_2)}{\sum(total)}$$

As for assigning meaning the Kappa score, Landis and Koch (1977) introduced an arbitrary characterization of the values with 0> as *no agreement*, 0-0.20 as *slight*, 0.21-0.40 as *fair*, 0.41-60 as *moderate*, 0.61-80 as *substantial* and 0.81-100 as *near perfect*. Another, even simpler characterisation is made by Fleiss (1981), dividing the Kappa scores into 0-0.40 as *poor*, 0.41-0.70 as *fair to good* and 0.71< as *excellent*.

The Kappa score for these observations is calculated to be 0,49 which can be interpreted as ***fair to good***. For the total overview of the Kappa calculation, and reasons for possible disagreements within the observations, see Appendix VI.

10. RESULTS EMPERICAL RESEARCH

In the introduction of this chapter, a reflection is given on what results are required from the empirical research and further discusses the steps that are taken in the analysis process and introducing some descriptive statistics. The second part of this chapter describes the actual analysis process, by showing the complete analysis of a single workplace characteristic. The third part of this chapter then continuous by giving an overview of the final result of the analysis.

10.1 INTRODUCTION

The structured observation resulted in a dataset with over 3000 measured Databites (a complete set of observation data on a 15-minute interval) observed from 36 participants. Analysing all this data, resulted into such a large number of tables, that it is not manageable to publish them in this chapter. The complete set of tables can be seen in Appendix IV. But before diving into these numbers and insights, first it is needed to reflect on the aims of this study, which goes as follows:

This thesis aims to broaden the knowledge base of the relation between workplace and stress by performing quantitative research with objective data and aims to investigate the feasibility of creating a tool through operational-empirical research that can help decision-makers and users use the generated knowledge to decrease stress in the work environment.

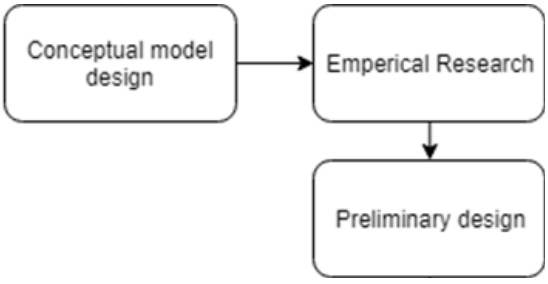


Figure 22.Section of the research design (own ill.)

The mentioned knowledge base is needed to develop the tool. As can be seen in Figure 22, the outline of the conceptual model is drafted, in the form of a translation from the theoretical framework. In this outline, the variables were defined that are derived from literature and deepend with common workplace characteristics. To come to a preliminary design, these variables needed to be researched and quantified, for the tool to be able to perform mathematical calculations on it, to find optimised solutions.

The complete results will be represented in a table. This table represents the quantified knowledge base as it is before the anlysis of the structured observations. While relationships have been indicated in the literature, no quantified knowledge is available to be used as input. Therefore, if one would use this input for a tool, no outcome would be possible, since all possibilities have the same zero value.

In the next part of this chapter, the analysis process will be explained to come to the actual value that will be filled in the large overview. Because of the large number of different variables, a part has been selected that will be discussed. The process will be the same for all other parts of the overview.

As can be seen in the overview, the table has been divided over two axes, the vertical axis being the different workplace characteristics and the horizontal axis containing the activities.

Each activity is also divided for each of the four acitivity profiles. The concept behind this is that the question that needs to be answered in the operational model is the following:

What is the least stressful workplace for an employee?

This question can be divided into two subquestions, based on the theoretical framework:

1. What activity is the employee performing?
2. What are the characteristics of the employee?

The activities are rather straightforward, being the list of eight activities derived from the Center for People and Buildings. The employee charactersitics are more complex, existing out of *Age*, *Gender*, *Activity Profile* and *Mobility Profile*. While all of them have been analysed, based on the Person-Environment Fit theory, the assumption has been made that employees are chosen for their skill and ability in certain activities and thus experiencing less stress from these activities. The decision based on this assumption has been made to divide employees in these four *Activity Profiles*. Therefore, to find the least stressful workplaces, the most suitable workplaces need to be found for every activity and activity profile combination.

To go more in-depth into the *most suitable* workplace, one can argue if this workplace already exists. If not, the best course of action would be to split a workplace into characteristics, analyse these characteristics seperatly and propose a most suitable workplace variant that is comprosed out of these best scoring characteristics. Whether this comprised workplace results in a lower stress level, is something that will have to be tested through means of interventions, which is outside of the scope of this thesis.

As mentioned in the previous chapter, 21 workplace characteristics divided over four categories have beend defined.

This means, that for every combination of *activity*, *activity profile* and *workplace characteristic* every average stress measurement for all of the nominal values of that workplace charateristic is needed. The result of that is a large table below and consists of ***4*** (activity profiles) * ***8*** (activities) * ***59*** (values divided over ***21*** workplace characteristics) = ***1888*** cells. It is not possible to discuss every combination in this thesis. Therefore a selection has been chosen. This selection consists all combination for the workplace characteristics ***Size of Room (V1)***, the activities ***Undisturbed Desk Work*** and ***Planned Meeting*** and all four ***Acitivity Profiles*** and will be discussed in section 9.3.

Before this, using descriptive statistics, an introduction is given into the dataset and the outcomes of the variables in subchapter 10.2.

10.2 DESCRIPTIVE STATISTICS

As discussed in section 2.2.5.1, careful considerations are needed when formulating the findings when based on the stress score mean. This will be illustrated with descriptive statistics of ***Age*** and ***Gender*** in combination with the ***stress scores***.

	Mean	Stdv	Variance	n
Female	47,34	13,85	191,76	17
Male	55,56	18,15	329,52	19

Table 25. Descriptive statistics of variable Gender (own ill.)

	Mean	Stdv	Variance	n
<25	n/a	n/a	n/a	2
25-34	49,42	17,57	308,80	18
35-44	55,43	17,94	321,84	11
45-54	44,96	5,48	29,99	4
55-65	n/a	n/a	n/a	1

Table 26. Descriptive statistics of variable Age (own ill.)

When looking at the table for *Gender*, a rather large difference in means between ***Male*** and ***Female*** can be seen (Δ= 8,2). But this does not mean that females are less stressed at work. A stress score is a relative number that refers to the average score of approximately 50 for the total day. But it does not tell something about the absolute stress level of a person since this is not measurable through EDA. The person could be extremely stressed throughout the total observation period or extremely relaxed, and the average value would still be 50. The only thing that can be said is since the daily average should be near to 50, that ***Males*** are more stressed at work than when they are not at work and for ***Females*** the other way around. This insight is not of interest for this study, since the focus is on the work environment. But what can be said of these findings, is that the standard deviation of ***Females*** is lower than that of ***Males***, indicating that there is a larger difference among men.

When looking at the table for *Age*, the same problem occurs when comparing the means, that no relevant conclusions can be drawn. For *Age*, an additional limitation of sample size can be seen, since there are not enough persons in the groups ***<25*** and ***55-65*** to prevent invasion of privacy. This number needs to be at least three when comparing persons. Looking at the standard deviation, the group of ***45-54***-year olds seems to be more homogeneous. This could indicate that the work environment has less perceptive to changes of stress, however further statistical evidence of other variables is needed to proof such statement.

To say something more meaningful, the two derivative stress variables should be used, ***SD*** (Stress Deviation) and ***SSMM*** (Stress Score Minus Mean), for more detail about these variables see section 2.2.5.1. These variables remove the calibration bias of the ***SS*** (Stress Score) variable, which is the inaccuracy in the stress measurement due to the unknown actual stress level of a person. The SSMM, therefore, is only a representation of the deviation of the SS measurement from the mean SS of that participant. By removing the calibration bias in the SSMM, it becomes appropriate to compare variable values with each other. The SSMM is to be used to analyse the average stress levels of variable values, to compare for instance activities or workplace characteristics.

The SD is to be used to show the average direction of the stress score of being the independent variable. This is particularly useful for workplace characteristics that are used in stressful moments. One could image a room that people tend to go to when they are feeling very stressed. The average SS and SSMM of this room would be very high, but the SD could show a negative number, indicating that when people spend time in this room, their stress level decreases. By combining the SSMM and SD, a more complete picture of the measurement can be given for interpreting the results.

The SD and SSMM are in terms of means not useful when comparing groups of people with each other since in the case of SSMM the mean is automatically 0 for groups and SD close to

0. The standard deviation does tell something. Where the standard deviation of the SS indicates the homogeneity of the means of the persons, the standard deviation of the SSMM indicates the homogeneity of the measured values within those groups. A lower standard deviation means a stronger homogeneity and would indicate that a group reacts in a more similar way to stressors.

In the case of Age and Gender, if one would look at the descriptive statistics of the groups, the mean would be 0 for SSMM and the standard deviation as well, since all means are 0. Thus no variance exists among the participants. For the SD this is slightly different, but it more or less comes down to the same thing, not being able to compare the groups. If one looks at the descriptive statistics of all the observations (being the cumulative of all measurements done on the 15-minute interval) deviation starts to exist, as can be seen in Table 27 and Table 28. This method has a limitation in the form of overrepresentation of certain participants compared to other but does give a strong indication.

SD	Mean	stdv	variance	n
Female	0,06	13,59	184,72	1478
Male	-0,12	12,91	166,78	1640

Table 27. Descriptive statistics for Gender with dependent variable SD (own ill.)

SSMM	Mean	stdv	variance	n
Female	0,0	14,43	208,09	1478
Male	0,0	13,73	188,44	1640

Table 28. Descriptive statistics for Gender with dependent variable SD (own ill.)

10.2.1Sample representation

The original sample size was n=50. However, due to no shows (9 person, most common reason no availability in the first days of the week) and failing measuring equipment (5 person, no battery for extended period of time, inability to connect to the smart ring with smartphone or readings that were indicated by the manufacturer as false) the actual sample size was n=36 (19 ***male***, 17 ***female***).

Age distribution was representative, with ***<25***(n=2), ***25-34***(n=18), ***35-44***(n=11), ***45-54***(n=4), ***55-65***(n=1). There were no participants with the age of ***65+***.

Employee profiles

As introduced in the previous chapter, the employee profiles are used as a tool to create a more diverse representation of the population. While individual approaches are eventually desired, for knowledge creation and generalisation, profiling is a good tool to take a step in the right direction. Below an overview of the occurrences of each profile is given.

Activity Profile	n	Mobility Profile	n
P1	9	Camper	10
P2	19	Timid Traveller	12
P3	2	Explorer	12
P4	6	Nomad	2

Table 29. Overview of the occurences for both Activity Profile (AP) and Mobility Profile (MP) (own ill.)

As can be seen, for both profiles types there is one profile that has only two occurrences. This is a low amount and hard to conclude on during the statistical analysis since it is the standard deviation of a group with only two values is not a valid calculation. It can be expected that very few significant values will occur for both these profiles.

10.2.2Distributions

To quickly see if the acquired data seems to be logical, it is good to look at the distribution of the data. If the data represents a normal distribution, this means assumption can be made in the future regarding the predictability of the dependent variable under the influence of the independent variables.

Two types of distributions are shown, the earlier mentioned normal distribution (or also called Gaussian) and the cumulative distribution. The normal distribution shows how often a measured value is present in a data set and states that the mean (average of all data points) should be very close to the median (the middle data point in an ascendingly sorted data set). Normal distributions have a peak at the mean that evenly decreases to both ways, representing equal variance. The cumulative distribution plots the value of a data point to the percentage point of how many data points are equal or smaller than it and are S-curved. As can be seen in the distribution graphs, the data appears to be normally distributed when a trendline is drawn through the data.

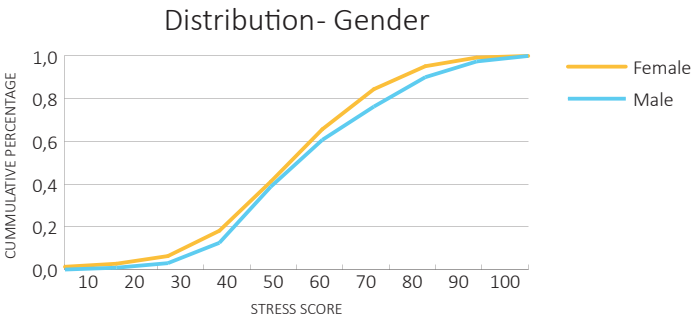


Figure 23. Distribution of Stress Score on a percentage scale for the variable Gender (own ill.)

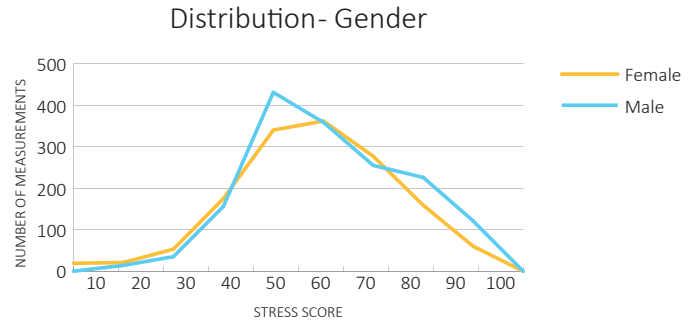


Figure 24. Normal distribution representation of the variable Gender (own ill.)

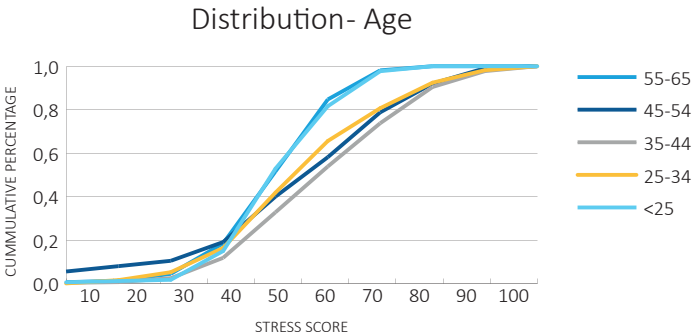


Figure 25. Distribution of Stress Score on a percentage scale for the variable Age (own ill.)

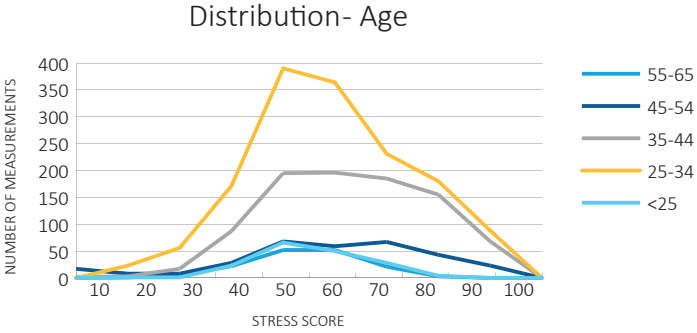


Figure 26. Normal distribution representation of the variable Age (own ill.)

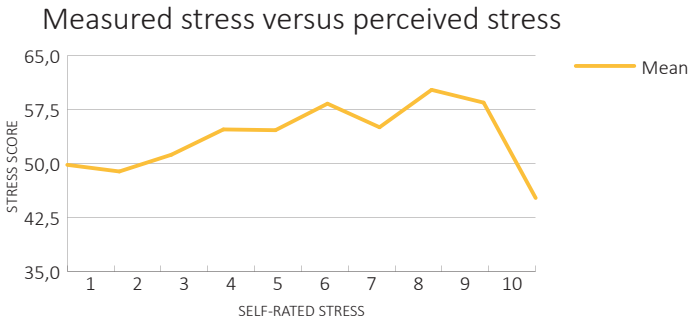


Figure 27. Comparison of self-rated stress (SRS) and measured stress score (SS) (own ill.)

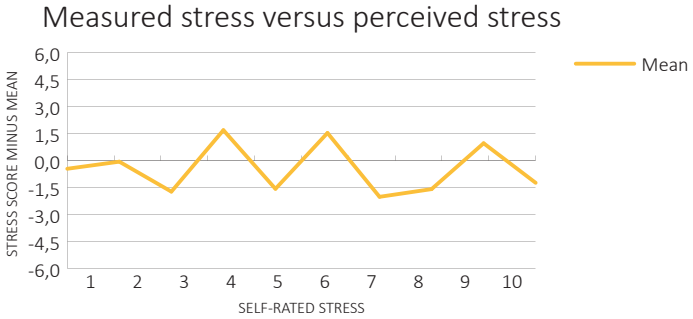


Figure 28. Comparison of self-rated stress (SRS) and stress score minus mean (SSMM) (own ill.)

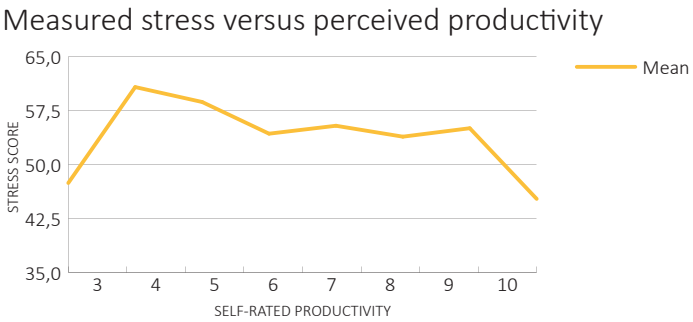


Figure 29. Comparison of self-rated productivity (SRP) and stress score (SS) (own ill.)

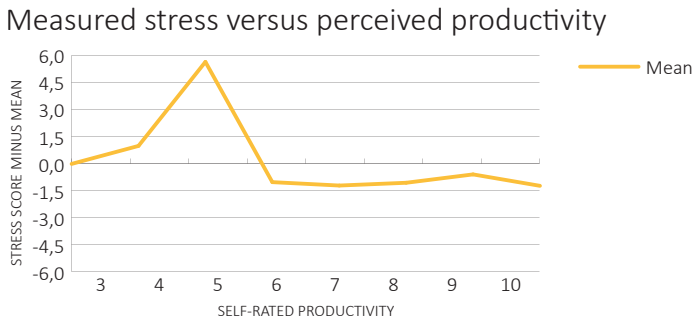


Figure 30. Comparison of self-rated productivity (SRP) and stress score minus mean (SSMM) (own ill.)

10.2.3Measured stress versus perceived variables

While there is a problem with the SS in terms of calibration bias, the SS can still be compared to the perceived variables of self-rated stress (SRS) and self-rated productivity (SRP). No conclusions can be drawn from this comparison; however, it does give some insight into the relationship of the two variables.

The first two graphs show the relationship between the self-rated stress scores and the SS and SSMM. Some remarks can be made about this. There appears to be a somewhat linear relationship between SRS and SS (Figure 27), which is logical since they represent the same dependent variable in different measurement forms. Interestingly, the value of 10 for the SRS, which indicates the highest perceived stress possible, gives the lowest SS.

While this might seem strange, it perfectly shows the limitations of the SRS variable. This score is given by only two participants, one day. Since participants only log one SRS (and SRP) value per day, all SS values of that day will be compared to this SRS value. Participants usually logged their SRS value around 17:00, at the end of their workday. It is possible that a participant had had a very relaxed day, but just before the day ended, something very stressful happened. This could have stimulated the participant to log a high SRS value, while their average daily perception of stress might have been low. The SS measurements of these participants indicate this, but the method does not support concluding evidence for this statement.

Looking at the graph with the SRS and SSMM comparison in Figure 28, something remarkable happens. Where the SRS and SS comparison seemed linear, this graph shows a nonconclusive fluctuating line. One would expect a line that is also linear, growing with the increased SRS value. No clear reason for this could be found. However bias of the participants towards certain numbers could

have an impact.

For the Self-rated Productivity (SRP) the comparison to the SS show a mostly linear relationship, except the SRP value 3 (Figure 29). This value is given only one time and could have the same problem as the previously described SRS value of 10. The SRP and SSMM comparison (Figure 30) give no clear insights, although it presents a more stable flow than the SRS variable. There appears to be a strong linear relationship between SRS and SRP (Figure 31), where the increase in productivity is linked to an increase in stress. This is interesting when compared to the SRS and productivity relationship because the relationship moves in a different direction. Previously it was discussed that from the SS no clear conclusions could be drawn. However the difference between both SS & SSMM and the SRS cannot be ignored. It indicates that the self-rated stress levels might not be based on the actual stress, but more on the feeling of productivity. This could strengthen the statement that the method of measuring stress with self-administered questionnaires resulting in self-rated stress does not lead to good insights into the actual relations of stress.

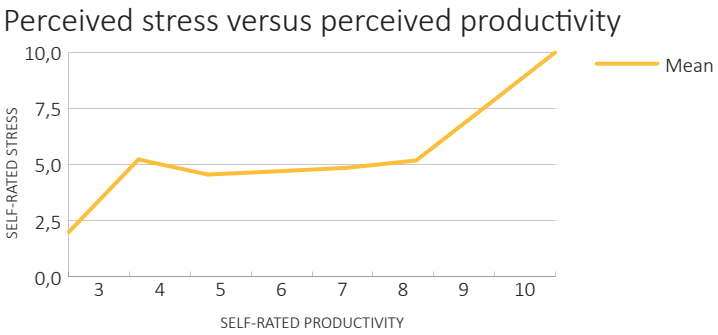


Figure 31. Comparison of self-rated productivity (SRP) and self-rated stress (SRS) (own ill.)

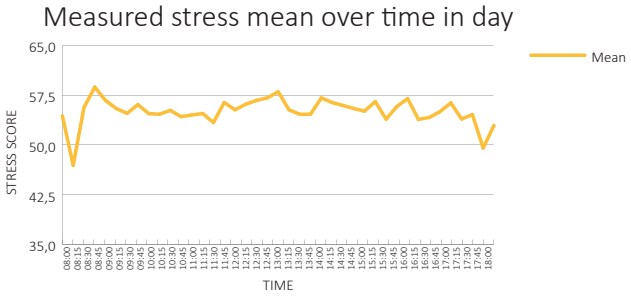


Figure 32. Average stress score (SS) for each quarter of the day (own ill.)

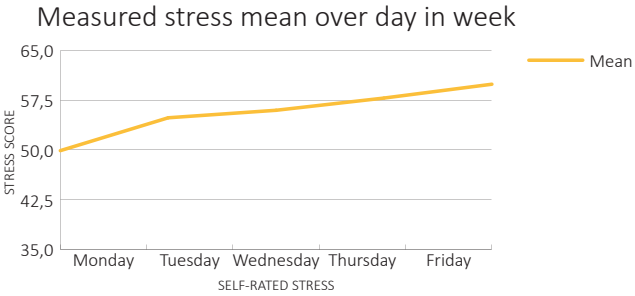


Figure 33. Average stress score minus mean (SSMM) for each quarter of the day (own ill.)

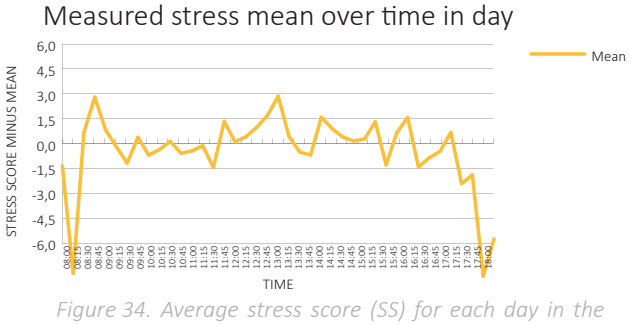


Figure 34. Average stress score (SS) for each day in the week (own ill.)

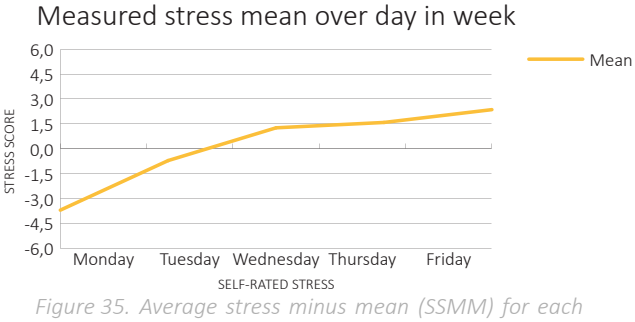


Figure 35. Average stress minus mean (SSMM) for each day in the week (own ill.)

10.3 QUANTITATIVE ANALYSIS PROCESS

As stated in the introduction section of this chapter, not the totality of the quantified knowledge base will be discussed, simply because of its size. Table 32 shows the selection that will be used as an example for the total overview. In this selection, the characteristic workplace ***Size of Room (V1)*** can be seen on the vertical axis. This variable has six different nominal values in the form of different sizes of room. They are divided first on whether they are cellular (closed off by walls and a door with no other group of workplaces in the same space) or open (multiple groups of workplaces in the same space or no clear divisions in the space) and after that on the number of people in these rooms.

On the horizontal axis, on the top the activities are represented, the middle section for ***Undisturbed Desk Work (UDW)*** and the right section for ***Planned Meeting (PMT)***. On the left side of the table on an overview of the average of all activities is placed, to give a reference indication.

Below the activities on the horizontal axis, the ***Activity Profiles (AP)*** are represented. For every activity, all activity types are placed below it. On the left of the activity profiles, also an average is given for all profiles combined. An important note for this is that the average of the activity profiles is a weighted average because some activity profiles are more common than other.

The analysis process starts with the largest scale, starting with the average of all activities and all activity profiles and zooms into more detail, ending with all values for every activity and every activity profile.

Worplace characteristics			**Associated stress levels Average**					**Associated stress levels UDW**					**Associated stress levels PMT**				
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
1.1	Size of room (V1)	*cellular 1 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2		*cellular 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3		*cellular 5-10*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.4		*open 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5		*open 5-10*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.6		*open 10+*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 30. Selection of required quantified knowledge base of the characteristic workplace Size of Room (V1) (own ill.)

10.3.1 ANOVA and Student's t-test

Workplace Characteristic

The first step is to get the mean of the SSMM of all observations for every nominal value of the variable ***Size of Room (V1)*** and check if within the variable V1 a strong enough variance is present, to argue that the variable differs from the overall mean. This is done by an ***Analysis of Variance*** (ANOVA). The ANOVA for the variable ***V1*** can be seen below.

Variable	SSMM
Size of Room (V1)	F(5, 7707)=7,88**

*Table 31. ANOVA result for variable V1, *p<0,05 **p<0,01 (own ill.)*

An ANOVA results into a F-value and a p-value. If the (absolute) F value is larger than 1 and the p-value smaller than 0,05, the variable is considered to have a significantly variation within the variable, implying that at least one of the values of the variable differs significantly from the overall mean of the variable. The ANOVA is denoted as:

F(degrees of freedom, sum of squares) = F-value

with asterixis indicating significant p-values. ***Degrees of freedom*** are *number of different nominal values – 1*. ***Sum of squares*** is the *sum of the variance* (square of the standard deviation) of each nominal value. As can be seen in Table 31, the variable *V1* is significant in terms of variance, and must be further analysed.

The second step is to look at the values of the variable *V1*, to see which of them actually cause the variance. In order to reasonably argue that these outcomes are not based on coincidence, a ***Student's t-test*** is performed for every value to see if it significantly differs from the total mean of all measurements, as can be seen in Table 31. A value is significant if the p-value is below 0,05, implying that there is a 95% chance that the measurements are not caused by coincidence. When p-values are significant, they arehighlighted in blue in the table.

When the SSMM mean is a positive number (marked in orange), this indicates that the employee experiences higher stress levels than their own total average, for the associated variable value. When the SSMM mean has a negative number (marked in green) the opposite is the case, indicating that the associated variable value is correlated with lower stress levels than their own total average.

Value	Mean SSMM	n	p(T)
V1, open 10+ person	0,78	2035	0,01
V1, cellular 2-4 person	-0,83	470	0,23
V1, cellular 5-10 person	-4,05	303	<0,01
V1, open 5-10' person	0,72	276	0,32
V1, cellular 1 person	-5,96	29	0,02
V1, open 2-4 person	-0,68	5	0,77

Table 32. Mean and t-test for workplace characteristic Size of Room (V1) (own ill.)

Worplace characteristics			Associated stress levels Average					Associated stress levels UDW					Associated stress levels PMT				
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
1.1	Size of room (V1)	*cellular 1 person*	-5,96	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2		*cellular 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3		*cellular 5-10*	-4,05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.4		*open 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5		*open 5-10*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.6		*open 10+*	0,78	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 33. Selection of required quantified knowledge base of the workplace characteristic Size of Room (V1) with filled in average (own ill.)

For variable *V1*, three values appear to be significant.

- ***Open 10+ person*** and the ***SSMM*** are significantly correlated to be more stressful.
- ***Cellular 5-10 person*** and the ***SSMM*** are significantly correlated to be less stressful.
- For ***Cellular 1 person*** and the ***SSMM*** are significantly correlated to be less stressful.

It is important to note that only something can be said about the designed or intendent workplace characteristic, because in this case no occupancy rate is known for the specific observations. It could be possible that rooms designed for 5 to 10 persons often are used by only one employee at the time.

Due to the previously decided probability value, all findings that have a higher p-value than 0,05 are regarded as not significant findings, thus disregarded in further conclusions. Filling in the overview of the knowledge base, the following preliminary result is shown.

Only the significant values resulted from the t-test are filled in and their effect direction are indicated by color-code, green indicating lower stress level and orange higher stress level. The other values remain 0, since no correlation has been found.

Workplace Characteristics and Activity Profile

Moving one step to the right in the overview, the Activity Profiles come into view. Again, first an ANOVA is performed to test for variance within the combination of the variables *Workplace Characteristic V1* and *Activity Profile*. The results of this ANOVA are shown in the table below.

Variable	SSMM
Size of Room (V1) + Activity Profiles (AP)	F(15, 10105)=3,47**

*Table 34. ANOVA result for variable V1 + Activity Profiles (AP), *p<0,05 **p<0,01 (own ill.)*

The results appear to be significant, thus the t-tests should be inspected. The t-test is performed on the combination of *AP* value (4) and *V1* value (6) that occur in the data, resulting in Table 35.

When looking closely, it is noted that not all combinations possible are represented in the table. Of the 24 possible combination, 18 are represented in the table. This is because the remaining 6 combinations are not chosen as workplaces during the observations. At the same time, not all combinations that are chosen, occur in the same amount. This makes it difficult to conclude whether the measured combinations are representative for the total population of knowledge workers in general, because it is not known what the measurements would be if these combinations would be chosen.

AP value	V1 (Size of room) value	Mean SSMM	p(T)
P1	open 10+	0,50	0,38
P1	cellular 2-4 person	-1,41	0,46
P1	cellular 5-10	1,81	0,33
P1	open 5-10	-5,74	<0,01
P2	open 10+	1,59	<0,01
P2	cellular 2-4 person	-0,64	0,40
P2	cellular 5-10	-5,75	<0,01
P2	open 5-10	2,10	0,01
P2	cellular 1 person	-6,55	0,01
P2	open 2-4 person	-0,68	0,77
P3	open 10+	0,34	0,76
P3	cellular 2-4 person	-10,90	0,08
P3	cellular 5-10	1,71	0,84
P4	open 10+	-0,12	0,83
P4	cellular 5-10	0,59	0,87
P4	cellular 2-4 person	0,53	0,90
P4	open 5-10	5,33	0,19
P4	cellular 1 person	2,04	0,74

Table 35. Mean and t-test for workplace characteristic Size of Room (V1) in combination with Activity Profiles (AP) (own ill.)

Also, an increase in occurrence from some of the chosen combinations could have led to significant results. For the scope of this research, it is not possible to further investigate this lack of observations, thus must for now be concluded that no correlation exists for these combinations of variables. Repeating the same process as with the previous results from the t-tests, the significant values will be entered into the overview.

The fact that not all combinations are chosen, can implicate two things; firstly, that the combination is not possible due to practical limitations, such as there not being workplaces with the specific variable values, or a specific activity profile only occurs in a department that has no access to those workplace types. Secondly, it could be conscious decisions not to use those specific variable values. The motivation for these decisions can not be traced within the observation, but can be substantiated during evaluation with the users of the work environment.

Notable in Table 36 is the difference for the nominal value ***Open 5-10 person***, that has no overall average significant value, but when divided among activity profiles, ***AP1*** has a significant lower stress level and ***AP2*** a significant higher value. This is why it is important to perform this analysis on this level, to prevent that all employee types are regarded as the same and differences from each other are overlooked.

Worplace characteristics			**Associated stress levels Average**					**Associated stress levels UDW**					**Associated stress levels PMT**				
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
1.1	Size of room (V1)	*cellular 1 person*	-5,96	0	-6,55	0	0	0	0	0	0	0	0	0	0	0	0
1.2		*cellular 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3		*cellular 5-10*	-4,05	0	-5,75	0	0	0	0	0	0	0	0	0	0	0	0
1.4		*open 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5		*open 5-10*	0	-5,74	2,10	0	0	0	0	0	0	0	0	0	0	0	0
1.6		*open 10+*	0,78	0	1,59	0	0	0	0	0	0	0	0	0	0	0	0

Table 36. Selection of required quantified knowledge base of the workplace characteristic Size of Room (V1) with filled in average for Activity Profile (AP) (own ill.)

Workplace Characteristics and Activity

While the average might say something about a workplace characteristic in general, in this research the focus lays on the Activity Based Working environment, requiring further analysis into the possible correlations between different activities and these workplace characteristics. The ANOVA for the combination of the variables workplace characteristic (***V1***) and Activity (***AC***) can be seen in Table 37.

Variable	SSMM
Size of Room (V1) + Activity (AC)	F(35, 24978)=3,77**

*Table 37. ANOVA result for variable V1 + Activity (AC), *p<0,05 **p<0,01 (own ill.)*

The combination of workplace characteristic *V1* and variable *Activity* appears to be significant, thus the t-tests for the value combinations is performed. Since this example limits itself to only two activities, ***UDW*** and ***PMT***, only the relevant combinations are shown in the table below.

For the activity ***Planned Meeting*** only one value appears to be significant and for ***Undisturbed Desk Work***, two values come out significantly. Repeating the process of filling in the significant values in the overview, results in the next preliminary table.

Activity value	V1 (Size of room) value	Mean SSMM	p(T)
Planned Meeting	open 10+	2,18	0,07
Planned Meeting	celluar 5-10	-0,68	0,56
Planned Meeting	cellular 2-4	0,38	0,89
Planned Meeting	cellular 1	1,31	0,38
Planned Meeting	open 2-4	1,03	0,60
Planned Meeting	open 5-10	3,22	0,03
Undisturbed Desk Work	open 10+	-0,28	0,62
Undisturbed Desk Work	cellular 2-4	-0,90	0,38
Undisturbed Desk Work	cellular 5-10	-10,25	<0,01
Undisturbed Desk Work	open 5-10	-0,52	0,58
Undisturbed Desk Work	cellular 1	-12,41	<0,01

Table 38. Mean and t-test for workplace characteristic Size of Room (V1) in combination with Activities (AC) (own ill.)

Worplace characteristics			Associated stress levels Average					Associated stress levels UDW					Associated stress levels PMT				
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
1.1	Size of room (V1)	*cellular 1 person*	-5,96	0	-6,55	0	0	-12,41	0	0	0	0	0	0	0	0	0
1.2		*cellular 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3		*cellular 5-10*	-4,05	0	-5,75	0	0	-10,25	0	0	0	0	0	0	0	0	0
1.4		*open 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5		*open 5-10*	0	-5,74	2,10	0	0	0	0	0	0	0	3,22	0	0	0	0
1.6		*open 10+*	0,78	0	1,59	0	0	0	0	0	0	0	0	0	0	0	0

Table 39. Selection of required quantified knowledge base of the workplace characteristic Size of Room (V1) with filled in average for Activity (AP) (own ill.)

Workplace Characteristics, Activity and Activity Profile

The last step for filling in the overview, is to add the activity profile to the ANOVA and check for variance. The result of that analysis can be seen in the table below.

Variable	SSMM
Size of Room (V1) + Activity (AC) + Activity Profile (AP)	F(105, 187)=0,01

*Table 40. ANOVA result for variable V1 + Activity (AC) + Activity Profile (AP), *p<0,05 **p<0,01 (own ill.)*

The result from this ANOVA is not significant, indicating that there is not enough variance among the combinations of the groups to result into a significant F-value. This is most likely due to the fact that relatively a lot of combinations possible, have no occurrences during the observation period, thus being represented in the analysis with a mean of 0 and a variance of 0. This makes for the other remaining combinations that they have to have high variances to come to a significant result. This is not the case for the *V1* variable. Therefore, it cannot be concluded that there is a correlation between Size of Room, Activity and Activity Profile. In this case, two approaches can be chosen. First approach is to not further investigate the t-tests for the value combinations and fill in 0 in all of the appropriate cells. However, the lack of variance can also be caused because of the large number of values, as can be seen from the number of degrees of freedom of 105. This eliminates the findings of small, yet significant variation among the value combinations. The second approach would be to perform the t-tests and use the results, yet acknowledge that there is no overall correlation between the three variables. Because this thesis aims to develop the knowledge base as much as possible, the second approach is used.

The results for the t-tests are shown below, again only taking into account the activities ***PMT*** and ***UDW***.

AP	AC	V1	Mean SSMM	p(T)
P1	Planned Meeting	open 10+	-5,48	0,01
P1	Planned Meeting	cellular 5-10	4,47	0,09
P1	Planned Meeting	open 5-10	-3,07	0,39
P1	Undisturbed Desk Work	open 10+	2,03	0,04
P1	Undisturbed Desk Work	cellular 2-4	-1,97	0,49
P1	Undisturbed Desk Work	cellular 5-10	-9,57	0,23
P1	Undisturbed Desk Work	open 5-10	-5,74	0,21
P2	Undisturbed Desk Work	open 10+	-2,74	<0,01
P2	Undisturbed Desk Work	cellular 2-4	-0,79	0,47
P2	Undisturbed Desk Work	cellular 5-10	-10,36	<0,01
P2	Undisturbed Desk Work	open 5-10	0,01	1,00
P2	Undisturbed Desk Work	cellular 1	-12,41	<0,01
P2	Planned Meeting	cellular 5-10	-1,76	0,20
P2	Planned Meeting	open 10+	5,38	<0,01
P2	Planned Meeting	cellular 2-4	0,38	0,89
P2	Planned Meeting	cellular 1	1,31	0,38
P2	Planned Meeting	open 2-4	1,03	0,60
P2	Planned Meeting	open 5-10	3,62	0,03
P3	Undisturbed Desk Work	open 10+	2,78	0,14
P3	Planned Meeting	open 10+	10,44	0,02
P3	Planned Meeting	cellular 5-10	1,71	0,84
P4	Undisturbed Desk Work	open 10+	-1,29	0,35
P4	Planned Meeting	open 10+	4,68	0,17
P4	Planned Meeting	cellular 5-10	0,73	0,86
P4	Planned Meeting	open 5-10	8,53	0,19

Table 41. Mean and t-test for workplace characteristic Size of Room (V1) in combination with Activities (AC) and Activity Profiles (AP) (own ill.)

As can be seen in Table 41, there are multiple combinations that yield a significant result. Again, there are also a lot of possible combinations that are not present in the list, due to no occurrences during the observations. Repeating the process of filling in the overview, results into Table 42.

As can be seen, the larger part over the overview remains without significant results. This is not surprisingly, because of two reasons. The first reason is a combination of the limited sample size and the personal preference of participants, resulting into a limited amount of diverse workplace use. Employees use often the same workplace, resulting in strong statistical evidence for those workplaces, but leave the other workplaces under observed. Also, not all activity profiles are populated evenly, as can be seen in the descriptive statistics. The second reason is because of design decision, a limited amount of variation exist of workplace characteristics, making some very rare in the work environment or in extremer case even non-existing. This logically leads to underrepresentation of these characteristics. It is notable that ***AP 4*** has no significant values and ***AP 3*** only one. For ***AP*** 3 this was expected because of the low number of participants falling into this group. For ***AP 4*** no conclusion can be drawn on the reason why, but it could indicate to a high variation within the group, creating low homogeneity in the data, resulting in not reaching statistical significance.

Worplace characteristics			**Associated stress levels Average**					**Associated stress levels UDW**					**Associated stress levels PMT**				
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
1.1	Size of room (V1)	*cellular 1 person*	-5,96	0	-6,55	0	0	-12,41	0	-12,41	0	0	0	0	0	0	0
1.2		*cellular 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3		*cellular 5-10*	-4,05	0	-5,75	0	0	-10,25	0	-10,36	0	0	0	0	0	0	0
1.4		*open 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5		*open 5-10*	0	-5,74	2,10	0	0	0	0	0	0	0	3,22	0	3,62	0	0
1.6		*open 10+*	0,78	0	1,59	0	0	0	2,03	-2,74	0	0	0	-5,48	5,38	10,44	0

Table 42. Finalised selection of required quantified knowledge base of the workplace characteristic Size of Room (V1) (own ill.)

Workplace characteristics		Value	Average	Average	Average	Average	Average	UDW	UDW	UDW	UDW	UDW	GDW	GDW	GDW	GDW	GDW	IDW	IDW	IDW	IDW	IDW
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
V1	Size of room	cellular 1 person	-5,96	0,00	-6,55	0,00	0,00	-12,41	0,00	-12,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		cellular 2-4 person	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V1		cellular 5-10	-4,05	0,00	-5,75	0,00	0,00	-10,25	0,00	-10,36	0,00	0,00	6,82	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 2-4 person	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 5-10	0,00	-5,74	2,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 10+	0,78	0,00	1,59	0,00	0,00	0,00	2,03	-2,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
			-5,96	-5,74	-6,55	0,00	0,00	-12,41	0,00	-12,41	0,00	0,00	0,00	-6,05	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	-8,03
V2	Openness of room	walls & no windows	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V2		walls & windows	-2,04	0,00	-3,37	0,00	0,00	-8,41	0,00	-12,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V2		walls & open	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-6,09	0,00	0,00	0,00
V2		glass walls with curtains	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V2		glass walls	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,98	0,00	-10,98	0,00	0,00
V2		curtains	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V2		open with 1 wall	0,00	10,88	0,00	0,00	0,00	-3,23	0,00	-6,67	0,00	0,00	0,00	19,64	0,00	0,00	0,00	0,00	12,85	0,00	0,00	0,00
V2		open	0,78	0,00	1,80	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,19	-2,17	0,00	0,00	0,00	0,00	0,00	4,26	0,00	0,00
			-2,04	0,00	-3,37	0,00	0,00	-8,41	0,00	-12,10	0,00	0,00	-1,19	-2,17	0,00	0,00	0,00	-10,98	-6,09	-10,98	0,00	0,00
V3	Audio privacy (how many people can hear you)	0	0,00	0,00	0,00	0,00	0,00	-7,63	0,00	-7,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V3		1 or 2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V3		2+	0,00	0,00	0,00	0,00	0,00	-1,06	0,00	-3,03	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-7,63	0,00	-7,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V4	Visual division (office partitions, facing a wall)	wall	0,00	0,00	0,00	0,00	0,00	-5,23	0,00	-12,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,55	0,00	0,00	0,00
V4		window	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-15,65	0,00	0,00	14,33	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00
V4		office partition	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,55	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V4		hallway	0,00	0,00	0,00	0,00	0,00	11,61	0,00	11,61	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V4		non	0,00	0,00	0,00	0,00	0,00	-4,48	0,00	-4,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-5,23	0,00	-15,65	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	-4,55	0,00	-10,32	0,00
Facilities:																						
V5	Power socket	No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V5		Yes	0,00	0,00	0,00	0,00	0,00	-1,26	0,00	-2,43	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-1,26	0,00	-2,43	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V6	Extra monitor	No	0,00	2,66	0,00	0,00	0,00	-8,96	0,00	-8,96	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-10,98	0,00	0,00
V6		Yes	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,54	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,22	0,00	-8,03
			0,00	0,00	0,00	0,00	0,00	-8,96	0,00	-8,96	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-10,98	0,00	-8,03
V7	Type of chair	No chair/standing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V7		Deskchair	-0,61	0,00	-0,96	0,00	0,00	-1,31	0,00	-2,52	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,22	0,00	0,00
V7		Barstool	3,23	0,00	2,84	0,00	7,34	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V7		Regular chair	4,42	6,03	5,32	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,89	-6,09	-10,98	0,00	0,00
			-0,61	0,00	-0,96	0,00	0,00	-1,31	0,00	-2,52	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,89	-6,09	-10,98	0,00	0,00
V8	Type of desk (sitting, standing, walking etc)	No desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V8		Shared table	0,00	2,66	0,00	0,00	0,00	-8,29	0,00	-8,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00
V8		Individual desk	0,00	0,00	0,00	0,00	0,00	-2,68	0,00	-2,90	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V8		Individual desk, adjustable	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,55	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V8		Special desk	0,00	0,00	2,62	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00
			0,00	0,00	0,00	0,00	0,00	-8,29	0,00	-8,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	-6,09	0,00	-10,32	-8,03
V9	Presentation hardware (screen & sound)	Yes	-2,06	0,00	-3,72	0,00	0,00	-18,14	0,00	-18,14	0,00	0,00	0,00	0,00	8,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V9		No	0,00	0,00	0,73	0,00	0,00	0,00	0,00	-1,64	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
			-2,06	0,00	-3,72	0,00	0,00	-18,14	0,00	-18,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V10	Desk space (able to use papers conveniently)	no desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V10		small	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00
V10		regular	0,00	0,00	0,00	0,00	0,00	-0,92	0,00	-1,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V10		spacious	0,00	3,36	0,00	0,00	0,00	-16,14	0,00	-16,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-16,14	0,00	-16,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	-6,09	0,00	-10,32	-8,03
V11	Storage	Yes	0,00	8,71	0,00	7,09	0,00	-2,12	0,00	-2,26	0,00	0,00	0,00	19,64	0,00	0,00	0,00	0,00	12,85	0,00	0,00	-7,29
V11		No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,51	0,00	0,00	0,00	-1,87	2,40	0,00	0,00	0,00	0,00	0,00	-6,07	0,00
			0,00	0,00	0,00	0,00	0,00	-2,12	0,00	-2,51	0,00	0,00	0,00	-1,87	0,00	0,00	0,00	0,00	0,00	0,00	-6,07	-7,29
Access:																						
V12	Department based or free use	Free use	0,00	0,00	0,00	0,00	0,00	-2,71	0,00	-3,53	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V12		Department	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-2,71	0,00	-3,53	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V13	Flex use or assigned desk	Flex use	0,00	0,00	0,00	0,00	0,00	-1,23	0,00	-2,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V13		Assigned	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-1,23	0,00	-2,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Use agreements:																						
V14	Out loud speaking or silence	out loud speaking	0,00	0,00	0,00	0,00	0,00	-1,12	2,03	-2,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V14		silence	0,00	-2,70	0,00	0,00	0,00	-1,77	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
			0,00	-2,70	0,00	0,00	0,00	-1,77	0,00	-2,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V15	Calling	no	0,00	-3,65	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V15		yes	0,00	0,00	0,00	0,00	0,00	-1,23	0,00	-2,80	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	-3,65	0,00	0,00	0,00	-1,23	0,00	-2,80	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V16	Multiple person meeting	No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,92	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V16		Yes	0,00	0,00	0,00	0,00	0,00	-4,20	0,00	-3,83	0,00	0,00	0,00	0,00	3,47	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-4,20	0,00	-3,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V17	Bookable – temporarily use	No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V17		Yes	0,00	0,00	-2,64	0,00	0,00	-11,81	0,00	-11,81	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00
			0,00	0,00	-2,64	0,00	0,00	-11,81	0,00	-11,81	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	-8,03
V18		focus	Yes	0,00	0,00	0,00	0,00	0,00	0,00	-1,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V18			No					-14,19		-14,19												
V19		collaborate	Yes	0,00	0,00	0,00	0,00	-1,37	0,00	-2,70	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V19			No		-4,61									-5,19				-9,42			-10,27	
V20		social	Yes	3,46	0,00	3,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00
V20			No	-0,53		-0,79		-1,13		-2,25												
V21		learn	Yes	0,00	0,00	0,00	0,00	-13,71	0,00	-13,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V21			No	0,00	0,00	0,00	0,00	0,00	0,00	-1,85	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
			-0,53	-4,61	-0,79	0,00	0,00	-14,19	0,00	-14,19	0,00	0,00	0,00	-5,19	0,00	0,00	0,00	-9,42	-6,09	0,00	-10,27	-8,03

Table 43. Model Input overview with p<0,05 (own ill.)

PMT	PMT	PMT	PMT	PMT	UPM	UPM	UPM	UPM	UPM	CL	CL	CL	CL	CL	SCL	SCL	SCL	SCL	SCL	OTH	OTH	OTH	OTH	OTH
Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-18,17	0,00	-19,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3,22	0,00	3,62	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-5,48	5,38	10,44	0,00	0,00	0,00	0,00	0,00	0,00	5,01	6,11	4,80	0,00	0,00	2,40	0,00	0,00	0,00	0,00	3,34	0,00	3,88	0,00	0,00
0,00	-5,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-18,17	-12,46	-19,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,95	0,00	-10,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,31	0,00	-5,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
6,95	0,00	10,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-8,77	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
8,01	0,00	8,01	0,00	0,00	-26,16	0,00	-26,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-9,69	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-5,48	0,00	10,44	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,77	0,00	2,66	0,00	0,00	4,09	0,00	4,70	0,00	0,00
0,00	-5,48	0,00	0,00	0,00	-26,16	0,00	-26,16	0,00	0,00	-5,95	0,00	-10,16	0,00	0,00	0,00	0,00	-9,69	0,00	0,00	-4,31	0,00	-5,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-6,83	0,00	-6,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	1,95	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,19	0,00	0,00	0,00	0,00	2,35	4,20	2,34	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-6,83	0,00	-6,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-9,22	3,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,42	0,00	4,03	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-5,10	0,00	-5,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2,49	0,00	0,00	0,00	7,98	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,01	0,00	0,00	2,44	0,00	2,70	0,00	0,00
-5,10	-9,22	-5,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,01	0,00	0,00	0,00	0,00	1,74	4,77	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,78	0,00	-7,36	0,00	0,00	0,00	0,00	2,95	0,00	0,00	2,45	0,00	0,00	0,00	0,00
0,00	-10,42	2,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,68	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-10,42	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,78	0,00	-7,36	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-4,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
6,06	0,00	7,39	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
7,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,72	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,38	0,00	7,79	0,00	0,00
0,00	-4,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,23	0,00	-8,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,45	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-10,42	2,76	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,95	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-10,42	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,23	0,00	-8,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-16,87	0,00	-18,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,04	0,00	0,00
0,00	-6,33	2,82	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,92	0,00	3,13	0,00	0,00	2,01	0,00	0,00	0,00	0,00	2,82	4,87	3,03	0,00	0,00
0,00	-6,33	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-16,87	0,00	-18,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-8,74	3,55	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	5,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-7,91	0,00	-11,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,98	0,00	3,06	0,00	0,00
0,00	-8,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-7,91	0,00	-11,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3,95	0,00	3,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,87	0,00	4,45	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,58	0,00	0,00	2,33	0,00	2,92	0,00	0,00	2,21	4,27	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,58	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,33	0,00	0,00	1,79	10,16	0,00	0,00	0,00
0,00	-10,42	4,75	0,00	0,00	0,00	0,00	-19,24	0,00	0,00	4,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-10,42	0,00	0,00	0,00	0,00	0,00	-19,24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,04	0,00	2,24	0,00	0,00	1,73	4,87	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1,86	0,00	2,69	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5,23	0,00	0,00	0,00	2,26	0,00	0,00	0,00	0,00	1,73	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	27,15	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,11	0,00	2,32	0,00	0,00	1,55	4,19	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2,40	-7,54	4,88	10,44	6,43	0,00	0,00	0,00	0,00	0,00	3,44	0,00	0,00	0,00	0,00	2,41	0,00	2,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	6,24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,62	-10,00	-10,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,08	0,00	0,00	0,00	0,00
0,00	-7,54	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,62	-10,00	-10,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-6,18	2,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,57	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,98	4,77	2,93	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,13	0,00	-10,81	0,00	0,00	0,00	0,00	7,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-6,18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,13	0,00	-10,81	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2,86										-8,01										3,07		3,18		
0,00	0,00	0,00	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,07	0,00	0,00	0,00	0,00	1,60	4,48	0,00	0,00	0,00
											-12,46													
6,14	0,00	6,60	0,00	8,57	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5,34	0,00	6,15	0,00	0,00
	-4,22																							
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,94	0,00	-11,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,07	0,00	3,18	0,00	0,00
0,00	-9,91	2,51	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,94	-12,46	-11,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

10.4 FINDINGS OF THE QUANTITATIVE ANALYSIS

On the previous page, the total overview is shown of the results from the quantitative analysis. This subchapter discusses the findings from these results. The findings are divided into sections that first describe the expected findings as mentioned in existing literature in Table 1, secondly describe additional findings that are not directly related to the findings from the literature overview and thirdly, a short discussion on the findings of that subject.

The total overview of the results can be found in Appendix IV. There, four tables are shown, each with a different p-value threshold. As mentioned before, the probability value threshold for this research is p<0,05. However, to investigate what happens if a less strict probability requirement is used, also the p¬-values 0,20 and 0,50 are tested. In order to visualize all measurements, a last overview is created with no p-value threshold.

The first section will describe the general findings, focussing on the measuring method and the differences between measured and perceived stress. The second section is on the workplace characteristics, followed by the section on the activities and finally the section on the combinations of those two.

10.4.1 Method findings

This section takes a look at the findings on the designed method of this research for doing stress measurements. The method is designed to challenge and improve the current methods of stress measurements and has therefore used the suggestions from previous research and recommendations found in the literature reviews.

In Table 44 the findings from literature on stress measurement methods are compared to the findings from the emperical research.

Additional findings

The first finding that needs to be mentioned is that not all combinations of workplace & activity have been chosen. This is because the choice of an employee for a specific workplace is not a random choice. Almost two third of the participants spend over 60% of their time at the same workplace. Therefore, no equal distribution of workplaces is present, nor expected for future research with an increased sample size. This distribution has resulted in strong statistical evidence for those workplaces chosen often and medium to non-statistical evidence for other workplaces.

There is a linear correlation between perceived stress and perceived productivity, indicating that people feel more stressed when they are more productive or more productive when they are feeling stressed. However, there appears to be a negative correlation between measured stress and perceived productivity. The difference between these two deviates from the finding that people have a good sense of their stress.

Discussion of the findings

The current method achieves what it was designed for: getting quantified insights into stress in relation to workplace and activity combinations. While future research may still improve the understanding and sensitivity of the biomarker electrodermal activity, the current use of the biomarker is to investigate differences and changes, which it is able to do.

Improving the method to obtain an actual stress level, or a manner of relating the measurement to the actual stress of a participant would increase the usability of the current method in terms of comparability between participants in an absolute stress context, instead of the current relative context.

Because the observations are self-administered and done in retrospect, the accuracy and reliability of the data are limited. At the same time, the current interval of 15 minutes could still be considered too large, since people can change activities or workplace more often within this timespan. An automated observing method could provide the solution to this but could prove to be difficult to implement, due to costs, privacy concerns, and technical limitations.

Findings from literature	Hypothesis	Findings from research	Conclusion
Biomarkers for stress should be investigated as a potential measuring method	Using a smart ring that measures electrodermal activity, reliable stress measurements can be done	Literature suggests that electrodermal activity is a reliable biomarker for stress and that the used smart ring outputs reliable results in comparison to medical equipment. The actual validity of the obtained measurements in terms of being a precise representation of someone's actual stress level is unknown since it is not verified during the research. However, it is reasonable to assume that the measurements are credible when displaying the measurements and regarding them in the context of the before mentioned scientific evidence.	Findings suggest that electrodermal activity obtained through a smart ring is a suitable measuring method for stress research; however, further study in the relationship between the measurement and the actual stress level of a person can help to sensitize the measurements
A measuring method that adapts itself to individual physiology should be considered	By using the calibration function of the smart ring, the output will result in comparable stress values	The calibration function of the smart ring resulted in adjusted measurements that could be compared with other participants. However, due to its adaptive nature, calibration bias causes the outputted measurements to be stripped of a reference point, dismissing the potential of obtaining someone's actual stress level, making the method not suitable for doing research into comparing persons or groups on the basis of their average measurements, but only to how) much' the measurements change under certain circumstances	Adaptivity to an individuals physiology is possible and recommended, in order to make measurements comparable. A new method, however, must be introduced to remove calibration bias and to make it possible to compare persons and groups
A (quasi) real-time measuring method is needed to capture the changing nature of task and space	By using a combined method of obtaining biometric data and self-observing through a logbook, significant findings can be done relating to the nature of the combination of workplace and activity to stress	Significant findings have been done, using the combined method during the structured observations; however, the accuracy of the observations are regarded fair, as measured with Cohens Kappa. The method used in this research works with an interval of 15 minutes, which was assumed to be the smallest interval possible for the current method. This interval is not supported by testing, and no other methods have been researched.	In contrary to existing methods, the combined method used allows specifying certain workplaces and activities from each other, resulting in more precise results. The method of obtaining biometric data through a smart ring has been found to be very precise and appropriate. The accuracy of the logged observations, however, can still be reviewed as limited, where automatization of the observations is proposed as a solution.
Physiological measurements instead of perceptual and self-report measurements should be investigated in terms of usability for workplace research	There are differences between physiological stress measurements and perceptual self-reported stress measurements in relation to workplace research	Self-rated stress and Stress Score appear to be correlated; however, due to the calibration bias, this finding cannot be regarded as definitive. It does point it that direction. Self-rated stress and Stress Score Minus Mean do not result in a significant correlation. Self-rated stress data is gathered only once every day, making it by definition less accurate than the physiological measurements, that are recorded every second and used per 15 minutes.	No definitive conclusion can be drawn on the differences between physiological measurements and self-reported measurements; however, findings strongly point to the direction that they should not be regarded the same. Further research in the relation of actual and perceived stress is needed, together with additional research on the actual stress in relation to the Stress Score

Table 44. Comparison of literature findings and research findings on method

10.4.2 Workplace characteristics

Previous work environment research on stress, focuses on workplace characteristics. The findings that are mentioned in Table 1 Literature Overview, almost exclusively mention characteristics of workplaces without other context. In this section, the findings on the characteristics that are mentioned in literature are discussed, as well as the additional findings on other workplace characteristics.

In Table 45 the findings from literature on stress measurement methods are compared to the findings from the emperical research.

Additional findings

Out of 21 characteristics, seven resulted in significant ANOVA results, meaning that within these variables one or more nominal values differ from the mean. These characteristics are:

- V1. Size of room
- V2. Openness of room
- V7. Type of chair
- V9. Presentation hardware
- V17. Bookable
- V18. Purpose (Focus)
- V20. Purpose (Social)

From these characteristics, the following values are worth mentioning:

As expected, and also concluded in other researches, rooms that are ***open with more than 10 persons*** result in significantly more stress than other rooms. ***Cellular for 1 person*** results into the lowest stress level, which is also supported by literature.

No division of a room, thus being open in general, results in a higher stress level, while the combination of ***walls with windows*** results in less stress.

From an ergonomically perspective, ***desk chairs*** result in lower stress than ***barstools*** or ***regular chair***, supporting the use of ergonomically equipment.

Surprisingly, the presence of ***presentation hardware*** results in a lower stress level. The reason for this is unclear, and no findings from literature support this finding.

Discussion on workplace characteristics

While some findings from literature are supported by findings from this research, others do not have significant findings to support them. No contradictory findings have been found to reject the findings from literature, which might suggest that with an adjusted research method or an increased sample size significant results that do support those findings could be found.

Most of the findings relate to the concepts of ***privacy*** and ***control*** in the work environment. Literature has suggested that these are main concepts in the perception of work environments, where an increase in both would result in a more positive perception and respectively in lower aggravation on job demands. The current results support this statement, however, it cannot yet be concluded fully that these are the most important factors.

Findings from literature	Hypothesis	Findings from research	Conclusion
Employees in open plan offices are more likely to experience stress Open plan offices reduce privacy Open plan offices increase job demands	V1: open 5-10 and open 10+ are more stressful V2: open and open with 1 wall are more stressful	V1 open 5-10 is not significantly more stressful V1 open 10+ is significantly more stressful V2 open with 1 wall is not significantly more stressful V2 open is significantly more stressful	There are inconsistent findings that indicate a correlation between the size of room and stress, suggesting an increase in size results in an increase of stress There are inconsistent findings that indicate a correlation between the openness of room and stress, suggesting an increase in openness results in an increase in stress
Workplaces with increased possibility for distraction, have higher job demands Physical enclosure is an important factor for the perception of privacy Privacy is important in the perception of the work environment Privacy and control are important factors in the work environment in relation to satisfaction and stress	V3: 1 or 2 and 2+ are more stressful	V3 Audio privacy on average results in no significant findings V4 Visual division on average result in no significant results	Findings do not support the statements from literature
Visual division in combination with crowding is associated with job demands	V1 & V4 are correlated; High crowding with a low level of visual division is more stressful Low crowding with a high level of visual division is less stressful	V1 cellular 1 person combined with V4 wall results in less stress V1 cellular 5-10 combined with V4 non, results in less stress V1 open 5-10 combined with V4 non results in more stress V1 open 10+ combined with V4 non results in more stress	There are inconsistent findings on the combination between visual divisions and size of room. However, it appears there might be a correlation where crowding in combination with low levels of visual division results in more stress
Desk-sharing increase job demands	V13: flex use is more stressful	V13 Flex use is not significantly more stressful	Findings do not support the statement from literature

Table 45. Comparison of literature findings and research findings on workplace characteristics

10.4.3 Activities

What previous work environmental research does not specifically study, is the influence of specific *activities* on the stress level of a person. The main reason for this is that with self-reported stress measurements the method would be far too demanding of participants since they would have to assess themselves every time they change activity, in combination with common method bias influencing the measurement itself. The present method is designed to deal with this real-time passive measuring demand, making it possible to do findings on activities.

Literature findings

Since no existing literature is mentioned in the literature overview, no comparison will be made in this section. The significant findings that have been done during the research will be discussed in the next section and related to concepts from literature, which are mainly introduced in the Theoretical Framework.

Additional findings

The most stressful activity during the observation turned out to be ***Social***. While this might be surprising, it is supported by the concept of *negativity bias*, as can be read in section 5.1.1. Social interactions have great potential to result in negative outcomes, such as embarrassment or loss of status. That this triggers stress is, therefore, a logical response.

The least stressful (significant) activity is ***Undisturbed Desk Work***. From the perspective with the Person-Environment Fit model in mind, this is logical, since employees perform this activity for tasks they are required to do as a core part of their job. Their proficiency in these tasks should, therefore, be high. From a work environment perspective, this outcome is against expectation. The assumption was that when employees performed these tasks, disturbances that occur would exponentially increase their stress since underperformance becomes a possible fear.

Unplanned Meetings appear to be less stressful than ***Planned Meetings***, which would be unexpected, however, both activities are not significant. Further research in these activities could reveal more in their correlation to stress.

Discussion on activities

The means of only two activities have a significant difference from the total mean. This does not provide the research with a lot of knowledge. However, this was also not the purpose of the research because the *activities* in the analysis of this section have no context of *workplace*.

A point has to be made in terms of common method bias. Because most employees often perform certain activities far more than others, these activities have a bigger impact on the measured stress level mean of that employee. Since the current findings are based on the SSMM variable, which is the Stress Score minus the personal mean of the employee, those activities that are performed more often have an automatic statistically higher probability to have a mean closer to 0. This could still result in a significant result but less likely.

In order to find out what workplace characteristics are correlated to stress levels for certain activities the next section combines both variables.

10.4.4 Activity and workplace combinations

Literature findings

Since no previous research aimed at this activity based measuring method, no previous findings are found in literature. Therefore, hypotheses are derived based on the Person-Environment-Fit theory and the Job Demand-Resources model. These models describe how certain resources (***workplace characteristics***) can reduce job demands (***activities***) or buffer stress. This can be seen in Table 46.

Model	Hypothesis	Findings from research	Conclusion
Person-Environment Fit: Employees performing activities that are a core part of their job activities can handle higher job demands	AP: AP2 performing PMT or UPM is less stressful AP3 performing UDW is less stressful AP4 performing GDW is less stressful	AP2 has no significantly lower stress for activities PMT and UPM AP3 has no significantly lower stress for the activity UDW AP4 has no significantly lower stress for the activity GDW	Employees of specific activity profiles are not less stressed performing more common activities for their activity profiles
JD-R model: Facilities that support certain activities are job resources	V5: availability of power sockets reduces stress in general V6: availability extra monitor reduces stress for UDW, GDW and IDW V7: desk chairs reduce stress for UDW, GDW and IDW, other chairs increase stress for UDW, GDW and IDW V8: Individual desks reduces UDW, GDW and IDW Individual desks increase stress for PMT and UPM V9: Presentation hardware reduces stress for PMT and UPM V10: Spacious desks reduce stress for GDW and IDW V11: No storage increases stress for GDW	V5 Power sockets is not significantly less stressful V6 Extra monitor in combination with UDW, GDW or IDW is not significantly less stressful V7 Desk chairs in combination with UDW results in less stress. Desk chairs in combination with GDW or IDW is not significantly less stressful. Other chairs types in combination with UDW, GDW or IDW are not significantly more stressful V8 individual desk in combination with UDW results in less stress. Individual desks in combination with GDW or IDW are not significantly less stressful V9 Presentation hardware in combination with PMT or UPM are not significantly less stressful V10 spacious desks in combination with GDW or IDW are not significantly less stressful V11 Storage in combination with GDW is not significantly less stressful	There is very limited evidence that facilities that support certain activities as job resources, result in less stress

Table 46. Comparison of literature findings and research findings on activities

Additional findings

For the combination of activity and workplace, it is expected that workplace characteristics that do not support certain activities, result in more stress and vice versa. Not all combinations yield significant ANOVAs, those that do, are shown below:

- Activity (AC) & Size of room (V1)
- Activity (AC) & Audio privacy (V3)
- Activity (AC) & Visual division (V4)
- Activity (AC) & Extra monitor (V6)
- Activity (AC) & Type of chair (V7)
- Activity (AC) & Type of desk (V8)
- Activity (AC) & Presentation hardware (V9)
- Activity (AC) & Desk space (V10)
- Activity (AC) & Storage (V11)
- Activity (AC) & Department base (V12)
- Activity (AC) & Possible meeting (V16)
- Activity (AC) & Bookable (V17)
- Activity (AC) & Focus purpose (V18)
- Activity (AC) & Social purpose (V20)
- Activity (AC) & Learn purpose (V21)

Similar to the last section, the findings that stand out are described below:

General desk work in ***cellular rooms 5-10 persons*** results in higher stress levels. This shows an interesting combination of a room that is closed on the one hand yet contains a multitude of people in it on the other hand. This could indicate that there is a balance when the number of people in a room becomes a nuisance, instead of the room being a benefit due to possibly low amounts of distraction. When this activity is performed with a ***window*** as a ***visual division***, employees have a higher stress level.

Social in an ***open 10+*** workplace yields high-stress levels, unsurprisingly, supporting the potential cause of possible public embarrassment grows with the number of people that can hear someone. This is strengthened by the finding that social and audio privacy ***2+*** (meaning that more than 2 persons can hear your conversations) yields a higher stress level. This is logical since all open 10+ rooms have an audio privacy of 2+.

The same concept goes for ***calling*** in an ***open 10+*** since co-workers can listen in on a conversation techniques. However surprisingly, calling in a ***cellular 5-10*** yields lower stress levels. This concept could also be linked to the finding that calling in a ***department-based*** workplace yields higher stress levels. Calling at workplaces that have ***office partitions*** dividing them, result in higher stress levels. Calling at a workplace *with* ***extra monitors*** results in significantly higher stress levels, while workplaces *without* them result in significantly lower stress levels. Calling at a workplace that is ***suitable for meeting***, results in a lower stress level.

As literature would suggest, ***undisturbed desk work*** in a ***cellular 1-person*** workplace yields lower stress levels. Against expectation, undisturbed desk work in ***open 10+*** does not yield a significantly higher stress level. Similar to the finding for audio privacy with social, audio privacy of ***0*** results in less stress. Logically, all ***cellular 1-person*** workplaces have an audio privacy of ***0***. Performing this activity without ***extra monitors*** results in lower stress levels, which is interesting, because based on the Job Demand-Resources model, extra monitors could be regarded as a job resource, supporting the activity, thus expecting a lower stress level than without. Undisturbed desk work at a ***non-department-based*** workplace results in lower

stress scores, which could potentially be linked to the fact that fewer co-workers interrupt an employee's activity at such workplace. Perhaps most surprising of all is the finding that undisturbed desk work that is performed at workplaces that have ***no focus purpose***, yield much lower stress score than workplaces that do. If employees would consciously make this choice, they would do this because workplaces that are designed for the focus purpose do not support them in performing undisturbed desk work. This could indicate a design flaw when it comes to these focus purpose workplaces or a flaw in the behavior of the employees within these workplaces.

Meetings that are held at workplaces that have ***no visual division*** result in higher stress, while ***hallways*** score for low-stress levels. Meetings on ***regular chairs*** and ***barstools*** result in higher stress levels. Meetings that are held at workplaces that do ***not support meetings*** result in higher stress levels.

Unplanned Meeting has a lower stress level when performed in a workplace with audio privacy ***0***. While this seems not possible, the audio privacy is rated on the intended purpose. This outcome is possible for when two persons have a meeting in a room designed for one.

Discussion on activity and workplace combinations

Similar to the discussion on activities, common method bias for activity and workplace combinations must be considered. For the activity and workplace combinations, the mean is less of a problem since there is a greater variation among the analyzed variables (every activity now is split for the chosen workplace characteristics, thus every combination has a lesser impact on the mean).

However, caution is required when regarding the findings, more specific when regarding the findings that are not found. Due to the unequal distribution caused by the choices of the participants, statistical strength is not equally divided among the combinations. When a combination does not result in a significant result, this not automatically means that there is non. The current method only focusses on the combinations that are chosen. However, these choices are influenced by the current design of the office and to the preferences of the employee. Both are mainly based on common practices and might hinder the development of new possible combinations with beneficial outcomes in terms of stress.

10.4.5 Limitations of the data

The current method for data collection resulted in a large data set, however, with limited findings, when compared to the findings from literature. When regarding the workplace characteristics, less than half of the characteristics resulted in significant ANOVA results. This is not against expectation, but further research is required to support statements that the current findings are the only findings that will be achieved using this method.

The statistical analysis is designed with a probability value of $p<0,05$, meaning that one in every twenty findings could be based on coincidence. The current research design has over 20 workplace characteristics, which means that statistically, it is probable that a finding in at least one of those is caused by coincidence. The is a big limitation for the current research design which could be resolved by increasing the probability value to $p<0,01$. In this case, only 1 in 100 findings would be based on

coincidence. Due to the unequal distribution of data that would result in a lot fewer findings. Using a p<0,01 is a good method when trying to be certain that a certain correlation exists due to its preciseness. However, in this research the aim is more of an explorative nature, thus using a less strict p-value is more appropriate.

It is hard to draw conclusions out of these results because of the inability to tell if the result is ***causal*** or ***circumstantial***. With causality, the concept of one variable being the cause of influence on the outcome of another. Eating much food is causal to gaining weight. A circumstantial relation occurs when one variable is not the direct cause of another but is somehow linked to it due to it.

Example: the number of visits per week to a McDonalds could be linear with increased weight, but it is not the cause of that increased weight. Eating fast-food would be the cause. For instance, an employee of the McDonald also frequently visits a McDonalds, but might not have increased weight, thus the number of visits is circumstantial.

In the context of this research, causal and circumstantial are very important, yet hard to prove. It is mostly not possible to conclude causal relationships, because the variables could be circumstantially linked to other variables or even confounding factors.

In the case of the combination AP2 and UDW resulting in less stress, this could be because employees that are in AP2 can handle UDW very well due to hardiness and coping skills (causal). However, it could also be that employees in AP2 only perform UDW work when almost no people are around to distract them and wear noise-canceling headphones to block out sound. In this case, the number of people present, and lack of noise distraction would be the causal relationship and employees being AP2 is circumstantial.

Another example of uncertain causality is the finding that UDW in workplaces that have presentation hardware result in substantially lower stress levels. Does the presentation hardware enable the employees to perform their activity, or is the employee working in a meeting room while it is empty to avoid other co-workers?

While not discussed in the findings, the *Activity Profiles* also deserve a place in this discussion. They can be viewed in the quantified knowledge overview. As mentioned in the last part of the previous subchapter, underrepresentation of Activity Profile 3 and Activity Profile 4, results in limited insights in these Activity Profiles.

10.5 EVALUATION OF THE FINDINGS

In order to evaluate the findings and put them into the perspective of the work environment domain, a focus group has been performed with a combination of interior designers and office users. The focus group aimed to discuss the data from the experiment and the relationship between the design process and the findings. It focussed on the following points: *expected findings*, *unexpected findings*, *limitations in the design process* and *variable ranking of importance*. During the focus group not all of the elements received equal attention and the main focus was on the design process. The results of the evaluation are described below.

Choice of workplace by an employee is not random, but based on *social* (e.g., being near co-workers), *behavioral* (e.g., force of habit), *pragmatic* (e.g., appropriate for activity) and *environmental* (e.g., lack of nuisance) considerations. These considerations are often the same every day, resulting in a limited variation of choices in workplace.

It is proposed that employee perceive workplace mainly in terms of space and related to that their feeling of privacy. Employees have a privacy bubble in which they feel comfortable. If this bubble is breached, discomfort is caused. This privacy bubble, however, is proposed to be contextual. The example is given of a room of about 25 m2 that have six workplaces in them. If all of these workplaces are taken, that could result in the feeling that the privacy bubble is breached, since there is a person next to you that could look onto your screen, see you move, etc. If only four people are in that room, with an empty workplace between them, the privacy bubble could remain intact. However, if in that same room only four workplaces would be present and all of these workplaces would be occupied, the privacy bubble could still be breached, since a feeling of fullness and crowding occurs. Therefore, the privacy bubble might not be related to a m2 per employee perspective but crowding in terms of maximum occupancy.

The ability to focus is supported by the absence of distraction. Noise distraction is one of the greatest causes of this. Places that are silent prevent this and can be achieved in two ways; by use agreements or voluntary choice. This can be related to the size of the room. A library is often a large room with the use agreement of silence that people respect. A small closed office of two people without a use agreement could also be silent. However, there is no control of this silence and the other person could talk at any chosen moment. From the focus group, it is proposed that the absence of silence in itself is not the leading factor but more the feeling of privacy, since a full library that is silent still might feel uncomfortable.

Relate to privacy, the concept of open versus closed is relevant. From the focus group, it is indicated that clients do not necessarily steer in either open or close, but work environments that are fully open or fully closed are regarded as a no-go. It should always be a balance between open and close. In the research, it is found that closed offices are less stressful and more beneficial. On the question why not only closed offices are designed, the point is made that organization do require employees to work together and closed offices are not ideal for that. On the perspective of open workplaces where employees perform individual work, it is suggested that this is related to a reduction in square meters and an increase of future flexibility, rather than a functional work-related aspect. From the focus group, the question is raised if open workplaces are a form of sacrifice in terms of health and productivity to increase communication and cultural coherence since it is known what the negative effects of open offices are.

As a conclusion, it is proposed that three concepts are the most important related to the feeling of satisfaction in the work environment and the forming of stressors: *privacy*, *control*, and *job demands*.

- *Job demands* are the activities that are performed and their related cognitive workload.
- *Privacy* is a feeling of being comfortable to perform daily and job-related activities.
- *Control* is a feeling of influence on ones being, in both one's mental state, physical and mental mobility and physical environment.

Together they create a perception of the current being of the employee in the work environment that, when being a negative perception, is a potential stressor.

Workplace design is based on mainly three things: client statement/wishes, employee analysis and physical constraints of the core building. While physical constraints are something that, in terms of interior design, not a lot can be done about, the client statement and employee analysis contribute greatly to the outcome of the design. There is a discussion about which of the two has a greater say in the matter. At first, the designer dispute the workplace design is focused on the needs of the client rather than the user, as stated by Mylonas and Carstairs (2008), that results in more focus on aesthetic environments than functionality but after some deliberation, they tend to agree more on it. Reasons for this are often time and budget since a focus on functionality would require more research, for example in the form of pilot studies, which the client often is not willing to do. Therefore, most of the quality of the design tends to focus on the quality of the (new) furniture. At the same time, clients are not capable of realistically imaganing what changes in the functionality of the workplace will do for their organization, resulting in that their desire becomes visual design changes instead of functional. This is paired with that employees are afraid of change and only regard future workplace design in terms of what they have to give up.

Workplace design evaluation is mainly based on post-occupancy questionnaires, that investigate which elements contribute to the satisfaction of the employee in the work environment. From these evaluations quality of furniture for instance scores high, resulting in an increase of budget allocation to this element. The downside of the questionnaires is that they focus on the active perception of employees of the work environment and less on the subconscious experiences that employees have in the work environment. This limits the learning process in workplace design.

“

THE MOST IMPORTANT CONCEPTS RELATED TO STRESS IN THE WORK ENVIRONMENT ARE PRIVACY, CONTROL AND JOB DEMANDS

PART IV

OPERATIONAL RESEARCH

In this part, the operational research is described and focusses mainly on the model design. It uses the findings from the empirical research to develop the model and uses the empirical results as an input for the model itself.

11. OPERATIONALISATION OF THE QUANTITATIVE FINDINGS

This chapter forms the bridge from empirical research to the operational research. It uses the results from the empirical part and translates these into workable information that will serve as the input for the operational model. Because there is no reference research for turning this quantified knowledge into mathematical information, this chapter will introduce multiple assumptions that will be used in the operational model design.

11.1 DETERMINING THE REQUIRED INPUT

Operational models aim to, as described in the methods chapter, to maximize an objective function. For this research, this objective function would be the combined stress of all workplaces. In order to know this, the following information needs to be available:

1. The number of employees
2. The activity profile of these employees
3. The number of workplaces
4. The number of different workplace categories
5. The expected use of each workplace for each employee
6. The expected stress for each workplace for each employee

The number of employees can be random since the model should be able to adapt to a changing workforce. The activity profiles of these employees are more important. As stated in section 3.2.1, it is possible to determine the activity profiles of employees with a survey. For the design of the operational model, it is assumed that the activity profiles will be determined in this way. This information can then be represented in two ways, an absolute number for each profile or a percentage of the total number of employees for each profile. By using the percentages, a database of percentage division could be stored, to make predictions on the division and changing a number of employees could be easily accommodated within the model. For the current model, percentages will be used and be based on an random division.

The number of workplaces could be stated as an absolute number if this is the requirement from the client. However, FTE ratios can also be used. These FTE ratios could be determined for each activity profile since it is logical to assume that some profiles spend more time outdoors than others.

The number of different workplaces categories could be almost infinite. In an ABW environment, for every different activity, a workplace could exist. However, it would make sense to limit this, both from a budget perspective as from a practical one. For now, the workplace categories will be based on the work modus that Gensler (2008) introduced, *Focus*, *Collaborate*, *Socialize* and *Learn*. However, instead of Learn, the category of Meet is introduced, for performing meetings. For this, it will be assumed that specific activities will be performed on the dedicated workplace categories. These are classified as follows:

Workplace category	Activities
Focus	Undisturbed Desk Work, General Desk Work
Collaborate	Interactive Desk Work
Meet	Planned Meeting, Unplanned Meeting, Calling
Social	Social

Table 47. Division of activities among workplace categories (own ill.)

The expected use of each workplace for each employee is determined on the base of the information from the activity profiles. It would be possible to revaluate the activity profiles for a specific organization if it appears that the time spent does not match, but then the analysis for the knowledge base should be re-done as well.

The last required input would be the actually expected stress for each workplace for each employee. Two actions are needed before this information can be known. First, the ***best workplace*** needs to be defined for each category. Ideally, every person would get a set of personalized workplaces for each activity, to reduce their stress level as much as possible. This, however, is far from possible budget wise, but also knowledge wise, since every person needs to be extensively measured before significant statements could be made. Therefore, the maximum differentiation that will be used in the model is that on the activity profile level. This means, a maximum of four workplaces for each activity, resulting in 16 different types. However, it would be wise to assume that 16 different types of workplaces are too much for an organization, budget wise. Therefore, this number somehow must be able to shrink if needed. To do so, also the *best workplace* is to be calculated for possible combinations of activity profiles. By determining which activities score similarly to specific workplace characteristics, it is possible to choose which activity types should be combined in making a less differentiated workplace portfolio.

11.1.1 Discussion on the usability of the findings

The information that is needed in order to perform calculations to determine the best workplace portfolio, are the results from the analysis of the empirical research. However, it is needed to make assumption on the mathematical nature of this information. Since workplace characteristics are going to be compared with one another, the associated stress values of these workplace characteristics is required to be comparable. All of these stress values are calculated in identical ways, according to the *SSMM* variable principle. Therefore, these values can be compared in terms of the *SSMM* variable, but it must be considered that the *SSMM* variable might not represent a linear representation of reality, meaning that an increase of *SSMM* 1 to 2 might not be the same as *SSMM* 10 to 11 in terms of feeling and experience for an employee.

A second assumption that will be made, is that all variables are regarded *Vitamin A*, referring to the Vitamin model of Warr (1994). The meaning of this is that a minimum of a certain variable is required otherwise it might become a stressor. Variables could also be *Vitamin B*, meaning that there is a minimum but also a maximum outside which the variable could become a stressor. However, the current research is not equipped to determine if this is the case, since the variables are almost all of the nominal nature. Further research through intervention testing might provide insight into this.

The third assumption is that all *confounding variables* remain relatively stable. Confounding variables are changing constantly, for instance *skill utilization* and *workload*, but also *external circumstances* and *daily events*. The assumption is that the impact of these confounding factors are balanced through time and divided equally over different workplaces and activities, thus removing the need to adjust the findings for these factors. Further research on the impact of the confounding factors and especially the connection to the independent variables could improve the mathematical validity of the findings.

Due to these assumptions and inaccuracies, critical notes have to be placed in terms of usability of the output data. As always, output of an operational model represents that optimal solution of a reality, the reality that the

constraints and input of the model create. The difference between the model reality and the actual reality is unknown until further research is performed, testing the model output and reviewing the new measurements that the adjusted reality gives. Doing intervention testing is outside of the scope of this research, thus no statements will be made about the validity of the model.

11.2 FINDINGS FROM EMPIRICAL RESEARCH

As discussed in the conclusion of the quantitative analysis section, when having the probability value of p<0,05, the findings from the structured observation are limited. There are a lot of not significant results that are represented as a 0 in the quantified knowledge base. This means, when determining the best workplace if a certain workplace characteristic has four values scoring above 0 and one value scoring 0, due to insignificance, this value will be chosen. If multiple values score 0 and no values score below 0, it must be assumed that all the values scoring 0 are equally suitable. In an ideal world, this is positive since more feasible values mean more freedom for the designer. However, when the values of 0 are derived because of insignificant information, unknown scenarios are created, in which the characteristic could result in an actual 0 average in reality or score above or below. This cannot be predicted, only by performing additional observations to strengthen the statistical evidence.

Two choices can be made, the first being to accept the unknown variables and pretend they will react in a balanced manner, sometimes resulting in more stress and sometimes less, balancing the average. The second choice could be to accept findings with a lower probability level, for instance with p-values of 0,20 or even 0,50. Doing this also creates unknown scenarios. However they are based on stronger statistics than no statistics, thus could be argued to have a greater chance of achieving reduced stress in the proposed work environment. For this study, in the academic context, it is chosen to use the p<0,05 level.

11.2.1 Creating the variants

As mentioned at the end of the first sub chapter, four different variants for each activity will be researched. As an example, the ***Focus category*** will be used. The four different variants are to be determined as described in the table below.

Variant name	Description	Possible combinations
F1	One workplace type that scores best for all activity profiles	AC1-AC2-AC3-AC4
F2	Two workplace types that score best for combined activity profiles	AC1-AC2 & AC3-AC4 AC1-AC3 & AC2-AC4 AC1-AC4 & AC2-AC3 AC1-AC2-AC3 & AC4 AC1-AC3-AC4 & AC2 AC2-AC3-AC4 & AC1
F3	Three workplace types that score best for combined activity profiles	AC1-AC2 & AC3 & AC4 AC1-AC3 & AC2 & AC4 AC1-AC4 & AC2 & AC3 AC2-AC3 & AC1 & AC4 AC2-AC4 & AC1 & AC3 AC3-AC4 & AC1 & AC2
F4	Four workplace types, one for each activity profile	AC1 AC2 AC3 AC4

The F*ocus category* is determined to accommodate the activities *UDW* and *GDW*. Below, the example for the variants for the workplace characteristics *Size of Room (V1)* is given.

Worplace characteristics			Average					UDW					GDW				
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
1.1	Size of room (V1)	*cellular 1 person*	-5,96	0	-6,55	0	0	-12,41	0	-12,41	0	0	0	0	0	0	0
1.2		*cellular 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3		*cellular 5-10*	-4,05	0	-5,75	0	0	-10,25	0	-10,36	0	0	6,82	0	0	0	0
1.4		*open 2-4 person*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5		*open 5-10*	0	-5,74	2,10	0	0	0	0	0	0	0	0	-6,05	0	0	0
1.6		*open 10+*	0,78	0	1,59	0	0	0	2,03	-2,74	0	0	0	0	0	0	0
			-5.96	-5,74	-6,55	0	0	-12,41	0	-12,41	0	0	0	-6,05	0	0	0

Table 48. Overview quantified knowledge base for the workplace characteristic V1 and activities UDW and GDW (own ill.)

In the bottom row, the lowest found stress scores of each activity profile are represented. Starting with the creation of F1, have the given that only one workplace will be created. Therefore, first, the lowest scoring values for the average of both UDW and GDW are found. In this case, that would be Cellular 1 person for UDW with -12,41 and non for GDW. However, when looking at the scores for the individual profiles, something else is visible. For UDW, only AP2 has a significant negative score, and for GDW, only AP1. The other profiles all score 0. To get a representative number out of this workplace characteristic, it is important to make a weighted average, based on the input numbers of the current organization that will be used in the operational model. This example states the following division, based on 1000 employees:

Code	Activity types	Share	Flex ratio	#
AP1	Mainly general desk work with mixed	30%	0,7	210
AP2	Mixed with more focus on meetings	29%	0,7	203
AP3	Mainly undisturbed desk work	21%	0,7	147
AP4	Almost exclusively general desk work	12%	0,7	84
			Total	**1000**

To score this, the scores per activity profile for both UDW and GDW is added and then multiplied with the number of employees in that profile. These scores are summed up and divided by the total number of employees. For this workplace characteristic, it is evident that Cellular 1 person will have the best score, resulting in a weighted average for the value Cellular one person:

F1	UDW	GDW	n	Weighted score
AP1	0	0	210	0
AP2	-12,41	0	203	-2519,23
AP3	0	0	147	0
AP4	0	0	84	0
Total			**1000**	**-2,52**

For F1, therefore the value Cellular one person is chosen for characteristic workplace Size of Room.

F1	Size of Room	-2,52

The F4 variant results in no difficult calculation since only the corresponding values for the numbers in the last row need to be found and test if combined, they yield to the lowest combination.

F4	Value	Score UDW + GDW	n	Weighted score
AP1	Open 5-10	(0 +-6,05) =-6,05	210	-1270,5
AP2	Cellular 1	(-12,41 + 0) =-12,41	203	-2519,23
AP3	All values	(0 + 0) = 0	147	0
AP4	All values	(0 + 0) = 0	84	0
Total			1000	-3,79

For F4, therefore, the combination of the four profiles yield the following contribution to the workplace:

F4	Size of Room	-3,79

For F2 it becomes more complex since multiple combinations need to be tested.

Because only AP1 and AP2 have significant values, the results of the weighted scores are rather similar, yielding the best results when AP1 and AP2 are not combined. Interestingly to see, is that this division has the same result as F4 and will have the same as F3 since no new combinations will be made that will have significant values within the combination.

F2	Size of Room	-3,79

F3	Size of Room	-3,79

However, if more significant values in the combinations are present, the variant will result in more differentiated weighted scores.

	Combi 1		Combi 2		Weighted score
	UDW	*GDW*	*UDW*	*GDW*	
AC1-AC2 & AC3-AC4	(0 * 210) + (-12,41 * 203) =-2519,23	(0 * 210) + (0 * 203) = 0	(0 * 147) + (0 * 84) = 0	(0 * 147) + (0 * 84) = 0	-2,52
AC1-AC3 & AC2-AC4	(0 * 210) + (0 * 147) = 0	(-6,05 * 210) + (0 * 147) =-1270,5	(-12,41 * 203) + (0 * 84) =-2519,23	(0 * 203) + (0 * 84) = 0	-3,79
AC1-AC4 & AC2-AC3	(0 * 210) + (0 * 84) = 0	(-6,05 * 210) + (0 * 84) =-1270,05	(-12,41 * 203) + (0 * 147) =-2519,23	(0 * 203) + (0 * 147) = 0	-3,79
AC1-AC2-AC3 & AC4	(0 * 210) + (12,41 * 203) + (0 * 147) =-2519,23	(0 * 210) + (0 * 203) + (0 * 147) = 0	0 * 84 = 0	0 * 84 = 0	-2,52
AC1-AC3-AC4 & AC2	(0 *210) + (0 * 147) + (0 * 84) = 0	(-6,05 *210) + (0 * 147) + (0 * 84) = 1270,5	-12,41 * 203 =-2519,23	0 * 203 = 0	-3,79
AC2-AC3-AC4 & AC1	(-12,41 * 203) + (0 * 147) + (0 * 84) =-2519,23	(0 * 203) + (0 * 147) + (0 * 84) = 0	0 * 210 = 0	-6,05 * 210 =-1270,5	-3,79

From this, all the weighted averages for each variant are summed and yield the final score of that variant. Theoretically, it is possible that one of the combinations yields a positive number, indicating that it is the least stressful combination, but still stressful. With the current numbers, however, this will not happen. There is always a 0 value in the matrix. Thus the combination will not get higher than 0 for now. By adding new research findings by repeating the observations in new organizations, the values can be added.

Finalising the variants

Now that the method of creating the variants is known, the actual variants are to be created. Due to time constraints, not all variants are fully created. Therefore, fictive variant numbers are used.

The final table of stress information to be used in the operational model for the variants, for now, is shown below. These are based on 1000 employees and the activity type divisions as mentioned in this chapter.

Focus				**Collaborate**				**Meet**				**Socialize**			
F1	F2	F3	F4	C1	C2	C3	C4	M1	M2	M3	M4	S1	S2	S3	S4
-46	*-51*	*-52*	*-56*	*-50*	*-55*	*-60*	*-70*	*-30*	*-32*	*-36*	*-37*	*-5*	*-20*	*-25*	*-27*

12. MODEL DESIGN

This chapter described the process of the model design, by going through the steps of the design process. First, the problem definition will be given in chapter 4.1. In chapter 4.2 the conceptual design will be introduced and proposed how further development will continue. The chapter chronologically follows the process of the model creation this research has known. This includes the change of the goal of the operational model, the altered from an allocation model, to an accommodation strategy model.

12.1 PROBLEM DEFINITION

For an engineer to design a solution, first, the problem definition needs to be clear. The clearer this definition is, the more specific the solution can be designed. In this research, this will be done by empirical research, as described in the methodology section. The client statement provides the problem, and through the use of the theoretical framework, the variables have been defined.

From the research aim, a goal for which the model is designed is to be derived:

This thesis aims to broaden the knowledge base of the relation between workplace and stress by performing quantitative research with objective data and aims to investigate the feasibility of creating a tool through operational-empirical research that can help decision-makers and users use the generated knowledge to decrease stress in the work environment.

However, at the start point of the research, the aim was to create a smart tool that supports the user in choosing a workplace that reduces the employees' stress. This chapter describes the chronological development of the model through the versions that has seen. Through an iterative process of designing and evaluating, the problem definition is adjusted and the model is improved to solve the problems.

12.1.1 Linear programming

All designed operational models are based on the method of linear programming (LP), to be able to optimize the available solutions. This solution has changed through the different version of the model, first from the proposing of a *best workplace* in the form of an allocation model to the presented constraints (activity and user preferences). Later this has changed to the distribution (or allocation) of resources to create a program of requirements for a work environment.

Linear programming uses a design space, a mental construct that defines a space that holds all possible solutions to a problem, within the domain of all possible outcomes (Dym & Little, 2004). For the problem of this research, the space of all possible outcomes would be all the possible combinations of workplaces in a work environment, and the solution space is the most suitable outcome for the given constraints. In the version 1.0 the solution space is based on the best match between the current activity, preferences of the employee and workplace. In the later versions the solution space is based on the division of activity profiles in combination with budget and stress associated with the workplaces.

One of the conclusions on Linear Programming from Barendse et al. (2012) state that the concept can be extended to multi-criteria optimization but choosing values for the constraints is completely arbitrary and still

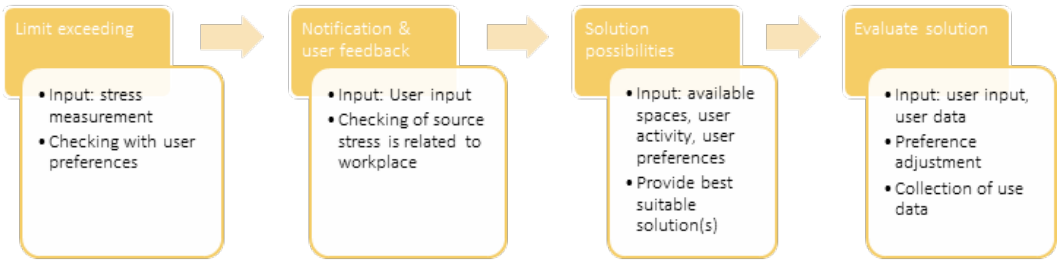


Figure 36.Steps of the smart tool after a stress measurement, stage version 1.0 (own ill.)

relies on unstructured negotiation. This means that even though an optimal solution could be provided, negotiations that shift preferences and requirements could make the user decide for an alternative that is not decided by the model.

In the research methodology part, the formula for operations research has been introduced.

$$U = f(Di, Rk, Fj)$$

Van Loon (1998)

Linear programming uses three requirements for being able to find an optimal solution (Barendse et al., 2012):

- A ***constraint*** is a fixed requirement which cannot be violated in a given problem formulation. In this research, these are the attributes of the activity and the workplace, and the availability of the workplace.
- A ***goal*** is a fixed requirement which is to be satisfied as closely in a given formulation. In this research, this is the match between workplace and activity.
- An ***objective*** is a requirement which is to be followed to the greatest extent possible, given the problems constraint. In this research, this is the match between activity and best suitable workplace.

12.2 CONCEPTUAL DESIGN VERSION 1.0

12.2.1Problem definition

The original hypothesis was that by aligning the workplace and the activity of the employee better, stress could be reduced. This means that the solution for a high amount of stress would be for the employee to move to an assigned workplace that better fits their needs. The requirements of this first model are deduced from literature and the author's input:

1. The model must eliminate confounding variables to focus on stress that is related to the workplace.
2. The model needs to take into account a user's factors and preferences.
3. The user needs to be provided with the best possible solution and be aware of the implications of that solution.
4. The model needs to evaluate the user's choices and adept to them.

For now, the model will only take into account the requirements 1 and 3, since further research is required to develop a system for requirement 2 and requirement 4 is based on requirement 2. At the first stage of the model development, the method of stress measurement was not defined yet, thus this model is based on the steps that are taken after a stress measurement indicates that a pre-arranged stress limit for an employee has been exceeded, and a solution for stress reduction needs to be found. The steps that the model takes are shown in Figure 36.

Since this research focusses on the relation between the workplace and stress, it is desirable to filter out confounding variables (as can be seen in Table 20), as stated in requirement 1, before a solution is provided.

It is perfectly possible and maybe even more common than not that a stress reaction is related to one of the confounding variables. For instance, a stressful personal life event like the ending of a relationship can cause stress when confronted in the work environment but has nothing to do with the workplace of that specific employee. To only focus on the relation between the cofounding variable activity type, a system is required to check for the influence of the other confounding variables.

This is proposed to be done by user input. While stress can be measured by EDA as discussed in the chapter on smart tools, the confounding variables are often private and hard or even impossible to measure automatically. Therefore, the users will need to provide this information themselves. A quick questionnaire can suffice in this. This will not eliminate the chance of wrong input or bias, and an understanding of the concepts is required.

12.2.2 Model design version 1.0

The conceptual model design is the second design stage and tries to combine the requirements and variables into a model that should yield a (possible) solution as output. In this stage no actual input values are used. The model remains a conceptualised version of the model that will be designed in the next design stage and has no working functionalities.

Allocation model

The model that is created is shown in Table 49, and is an LP Allocation model. This model becomes active in the third step as can be seen in Figure 36. The goal of the model is to search for a workplace that matches the requirements for the activity.

The model is an example and contains, for now, three types of possible activities (uninterrupted desk work, regular desk work, and a 2-person meeting) and three possible workplaces (workplace in a silence room, a collaboration room and a collaboration table). In Table 50, attributes are assigned to both the activities and the workplaces and represent the requirements that need to be met for an activity to match with a workplace. These matches can be seen in Table 49, for instance between a Silence room and a Meeting 2p, as a31 = 0. A 0 indicates that the requirement is not met, a one indicates that the requirement is met, and that assignment is allowed.

Besides the match between activity and workplace, the workplace also needs to be available. It Table 49, this is represented for each workplace by the code AV(n), where 0 indicates that the workplace is not taken, a one indicates that the workplace is available.

For the case of an employee that has the activity Uninterrupted desk work, only the Silence room workplaces are allowed, and the first available spot would be assigned to the employee.

12.2.3Evaluation of the model

At this stage, the model is not very complex due to the limited amount of activities and workplaces. In future models, the activities will be increased according to the activities mentioned in 3.1.1 Activities. The workplaces should be increased based on the test case since each work environment has its type of workplaces, but more importantly, these workplaces can have different characteristics.

The characteristics assigned at this moment are also very limited and serve as an example. In future models, this will be further developed as far as is required. Besides primary characteristics of the workplace itself, such as functionalities as power sockets, adjustable height chairs, and vision screens, secondary characteristics linking to other facilities or surroundings can be added — for instance, distance to the toilet or coffee machine, print facilities, but also available view, to differentiate the workplaces.

When the model becomes more complex, personal preferences will become more important in matching with the best solution. The model should be able to handle scores assigned by the user to specific characteristics, which are taken into account when calculating the optimal solution. This also goes for when no match can be found. It is possible for certain workplaces to be fully occupied. Then the solution goes to the next best thing. To do so, a more complex system needs to be adopted, where multiple points based on a scale can be assigned. An example of this is the Assignment Model, based on the assignment of employees to tasks. The skill of an employee for certain tasks is scored on a scale from 0 to 10, and the model assigns the employees to the tasks based on the highest combined score.

	Activity 1			*Activity 2*			*Activity3*				
	Uninterrupted desk work			**Regular desk work**			**Meeting 2p**				
Workplace											
Silence room	a11	=	1	a21	=	1	a31	=	0		
Spot 1	AV1	=	0 / 1	AV1	=	0 / 1	AV1	=	0 / 1	≤	1
Spot 2	AV2	=	0 / 1	AV2	=	0 / 1	AV2	=	0 / 1	≤	1
…	…	…	…	…	…	…	…	…	…	…	…
Spot n	Avn	=	0 / 1	Avn	=	0 / 1	Avn	=	0 / 1	≤	1
Collaboration room	a12	=	0	a22	=	0	a32	=	1		
Room 1	AV1	=	0 / 1	AV1	=	0 / 1	AV1	=	0 / 1	≤	1
Room 2	AV2	=	0 / 1	AV2	=	0 / 1	AV2	=	0 / 1	≤	1
…	…	…	…	…	…	…	…	…	…	…	…
Room n	Avn	=	0 / 1	Avn	=	0 / 1	Avn	=	0 / 1	≤	1
Collaboration table	a13	=	0	a23	=	1	a33	=	1		
Table 1	AV1	=	0 / 1	AV1	=	0 / 1	AV1	=	0 / 1	≤	1
Table 2	AV2	=	0 / 1	AV2	=	0 / 1	AV2	=	0 / 1	≤	1
…	…	…	…	…	…	…	…	…	…	…	…
Table n	Avn	=	0 / 1	Avn	=	0 / 1	Avn	=	0 / 1	≤	1

Table 49. Conceptual model version 1.0 as allocation model (own ill.)

Characteristics	**Silence**	**Able to communicate verbally**	**Able to (conference) call**
Activity 1	1	1	0
Activity 2	0	0	1
Activity 3	0	1	0
Silence room	1	0	0
Collaboration room	0	1	1
Collaboration table	0	1	0

	ACT1	**ACT2**	**ACT3**
SR	1	0	0
CR	0	1	0
CT	0	1	1

Table 50. Attribute assignment to Activities and Workplaces within allocation model (own ill.)

12.1 CONCEPTUAL DESIGN VERSION 2.0

At the P2 stage, the first conceptual design of the model, was an allocation model, to find the best possible available workplace. It was based on the notion that an intervention would be done while measuring employees stress. The next step in that process was to look in depth to the available workplaces and adjust the model accordingly. This section describes the process of workplace analysis. This subchapter is a description of the process and is not in line with the final model design, due to changes in the research design, that will be later described.

12.1.1 Problem definition

The operational model is designed in an iterative process and follows the cycles of the operational design method. In these cycles, the model is evaluated for each version of the positive and negative aspects. This way necessary changes to the foundation of the model can be made. At the start of the second conceptual design for the operational model, the goal and aim of the model are revaluated. It is based on the problem definition from the version 1.0.

The goal of the model is to support the reduction of employee stress levels.

The aim describes how the model is going to reach this goal.

The model aims to reduce an elevated stress level by aligning the users' needs with the most suitable workplaces.

Since literature supports the statement that employees want to have a feeling of control of their environment, the model should not force employees into making choices, rather support them and give them opportunities to make positive choices.

Another important element to keep in mind is who the target group of the model is, or in more scientific terms, the population. For this research, the population is knowledge workers in Activity Based Working offices. People that are promoted to use it, will be people that are actively encouraged to evaluate and improve their health by stress. However the entire population should be able to use the model.

Why does the office need to be Activity Based Working? Because for an employee to have a choice in workplace types, multiple should be present and available. Traditional offices usually have assigned workplaces where employees should work throughout the entire day. That means that no choice is available to change to a different workplace. This does not have to be a bad thing; some jobs are very specific that requires a specialised workplace to conduct their activities. In support of ABW offices' ability to improve employee experience, the paper of Hoendervanger (2016) states that increased switching behaviour in ABW offices leads to higher satisfaction of the work environment.

12.1.2 Model design version 2.0

To make the conceptual model for version 2.0, the elements that should be measured are taken from the previously introduced literature. These elements are:

- ***Work environmental characteristics***
  - o Climate
  - o Lighting
  - o Noise
- ***Workplace characteristics***
  - o Lay-out
  - o Interior & facilities
  - o Allocation & protocol

Since this research does not focus on indoor climate impact, it will be assumed that these will be the same throughout the office. This results that changing from one place to the other will not change temperature, lighting, ventilation, etc. Thus they should be removed as possible parameters.

Lay-out refers to the spatial design of the office and takes into account distances between objects, how the separation between single workplaces is designed and how areas, in general, are closed off (or not).

Interior & facilities refer to the aspects of objects that are present in the workplace, such as furniture, possibility to adjust furniture, equipment, supportive devices, etc.

Allocation & protocol refer to agreements that are made on who can use what workplaces and how. It takes into account if some workplaces are only available for certain departments or are free to use. It also takes into account what use agreements are made, such as it being a silence zone and no meetings or calls are allowed. Hot-desking and not being allowed to leave personal stuff for extended periods on the workplace is also protocol.

To reflect on the literature from Vos et al. (2000), the three scale levels of offices will be used to try and identify chances in workplace types: *place*, *space*, and *use*.

- ***Place***
  - o Where in the office is the workplace?
  - o Distances to other facilities and co-workers
- ***Space***
  - o What is the lay-out of the work environment?
  - o What are the physical characteristics of a workplace regarding privacy?
  - o What are the facilities in the workplace?
- ***Use***
  - o What are the allocation agreements?
  - o What are the use of agreements?

Within a ***place***, the focus now lays on the relative distance of the workplace. One could argue that this is a reason for employees to choose a workplace, but literature does not support evidence that it is of direct influence on stress. It does support that active design, in which employees are encouraged to move more, can have a positive influence on stress. It could also give an extra dimension to workplace choosing analyses. However the significance of the results will be doubtful in case of a too large number of variables.

For ***space***, the workplace and the space the workplace is in is defined by physical elements. This is based on the notion of *privacy* and *control*, as mentioned in the literature. Lay-out and separations between workplaces can have a large impact on how an employee experiences the workplace. More separated workplace could provide longer periods of concentration but decrease team communication. More facilities could increase the feeling of control since one can choose to use or not use it, while at the same time provide unnecessary distractions and disturbances.

The ***use*** of the workplace describes the *protocol* that is in place. The protocol encompasses all organizational agreements that are made about how to use certain workplaces. This can be divided into *allocation agreements,* that define on who can use a workplace and on what terms, and *use agreements*, that define what can and cannot be done while at the workplace. Allocation within ABW is often flexed use, but at the same time can be constrained to only a certain department. Use agreements often limit disturbances, both visual and auditive, but can also be digital and activity based.

Looking at this list, at some fronts, it seemed rather lacking practical elements, so the initial facilities were extended beyond the literary findings. Tested with an example piece of office lay-out as can been seen on the picture, a first conceptual overview was made.

1. Reading table
2. Docking space
3. Docking space with monitors
4. Open table for short meetings
5. Closable space for presentations and meetings
6. Adjacent desks, open space
7. Meeting room
8. Adjacent desks, closed space

This resulted into the two models that can be seen in Table 53 and Table 54 (on the next page), one for activities and one for workplaces. This results in the following match/mismatch matrix, as can be seen in Table 52.

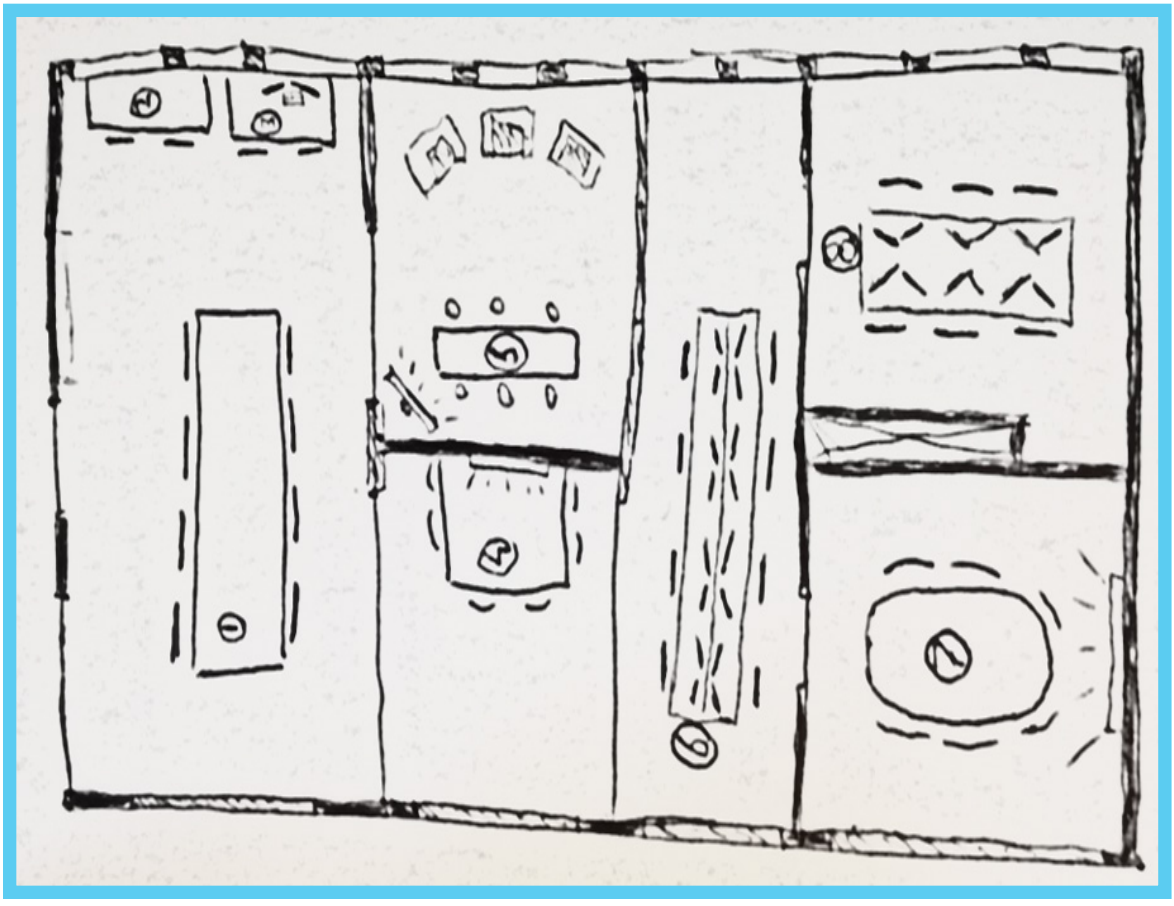


Figure 38.Sketch of the floorplan at case company (own ill.)

Activity	1 Reading table	2 Dock (left)	3 Dock (right)	4 Open table	5 Overval	6 Desks (spacer)	7 Wissel-kamer	8 Desks (back)
General desk work	1	1	1	1	1	1	1	1
Undisturbed desk work	0	0	0	0	0	1	0	1
Interactive desk work	1	0	1	0	0	0	1	0
Planned meeting	0	0	0	0	0	0	1	0
Unplanned meeting	1	0	1	0	0	0	0	0
Telephone call	0	0	0	0	0	0	0	0
Reading	0	0	0	1	0	0	1	0
Archiving and paper work	1	0	1	1	0	1	1	1
Other activities	1	0	1	0	1	1	0	1

Table 52. (Mis)match table for workplaces at case company and activities (own ill.)

Workplace			1	2	3	4	5	6	7	8
P/S/U	***Attribute***									
	Distance to:									
Place	Entrance/exit	m								
	Panty/kitchen	m								
	Toilet	m								
	Office supply	m								
	Printer	m								
	Nearest door	m								
	Nearest person	m								
	Number of people nearby									
Space	**Privacy**									
	Size of room	0 = cellular 1 person	0	0	0	0	0	0	0	0
		1 = cellular 2-4 person	0	0	0	0	0	0	0	0
		2 = cellular 5-10	0	0	0	0	1	0	1	1
		3 = open 2-4 person	0	0	0	0	0	0	0	0
		4 = open 5-10	0	0	0	1	1	0	0	0
		5 = open 10+	1	1	1	0	0	1	0	0
	Openness of room	0 = walls & no windows	0	0	0	0	0	0	0	0
		1 = walls & windows	0	0	0	0	0	0	1	1
		2 = glass walls with curtains	0	0	0	0	1	0	0	0
		3 = glass walls	0	0	0	0	0	0	0	0
		4 = curtains	0	0	0	1	0	0	0	0
		5 = open	1	1	1	0	0	1	0	0
	Audio privacy (how many people can hear you)	0	0	0	0	0	0	0	0	0
		1 or 2	0	0	0	0	0	0	0	0
		2+	1	1	1	1	1	1	1	1
	Visual division (office partitions, facing a wall)	0 = wall	0	0	0	0	0	0	1	0
		1 = window	0	1	1	0	0	0	1	0
		2 = office partition	0	0	0	0	0	1	0	1
		3 = hallway	0	0	0	0	0	0	0	0
		4 = non	1	0	0	1	1	0	0	0
	Facilities:									
	Power socket	0 = no; 1 = yes	1	1	1	1	1	1	1	1
	Extra monitor	0 = no; 1 = yes	0	0	1	1	0	1	0	1
	Type of chair (desk chair, barstool, hard chair + adjustment capability)	No chair/standing	0	0	0	0	0	0	0	0
		Desk chair	1	1	1	1	0	1	1	1
		Barstool	0	0	0	0	1	0	0	0
		Regular chair	0	0	0	0	0	0	0	0
	Type of desk (sitting, standing, walking etc)	No desk	0	0	0	0	0	0	0	0
		Shared table	1	0	0	1	1	0	1	0
		Individual desk	0	1	1	0	0	0	0	0
		Individual desk, adjustable	0	0	0	0	0	1	0	1
		Special desk	0	0	0	0	0	0	0	0
	Presentation hardware (screen & sound)	0 = no; 1 = yes	0	0	0	1	1	0	1	0
	Desk space (able to use papers conveniently)	no desk	0	0	0	0	0	0	0	0
		small	0	0	0	0	0	0	0	0
		regular	1	1	1	1	1	1	1	1
		spacious	0	0	0	0	0	0	0	0
	Storage	0 = no; 1 = yes	0	0	0	0	0	0	0	0
Use	**Access:**									
	Department based or free use	0 = free use; 1 = department A	0	0	0	0	0	0	0	0
	Flex use or assigned desk	0 = flex use; 1 = assigned	0	0	0	0	0	0	0	0
	Use agreements:									
	Out loud speaking or silence	0 = out loud speaking	1	1	1	1	1	0	1	0
		1 = silence	0	0	0	0	0	1	0	1
	Calling	0 = no	0	0	0	0	0	1	0	1
		1 = yes	1	1	1	1	1	0	0	0
	Multiple person meeting	0 = no; 1 = yes	1	1	1	0	0	1	0	1
	Bookable – temporarily use	0 = no; 1 = yes	0	0	0	1	1	0	1	0
	Purpose (focus, collaborate, social, learn)	0 = focus	1	1	1	0	0	1	1	1
		1 = collaborate	1	1	1	1	1	0	1	1
		2 = social	0	0	0	1	1	0	0	0
		3 = learn	0	0	0	1	1	0	0	0

Table 53. Workplace characteristics assignment model for analysed workplaces of case company (own ill.)

Workplace			General desk work	Undisturbed desk work	Interactive desk work	Planned meeting	Unplanned meeting	Telephone call	Reading	Archiving and paper work	Other activities
P/S/U	***Attribute***										
Space	**Privacy**										
	Size of room	0 = cellular 1 person	1	1	0	0	0	1	1	1	1
		1 = cellular 2-4 person	1	1	1	1	1	1	1	1	1
		2 = cellular 5-10	1	1	1	1	1	0	0	1	1
		3 = open 2-4 person	1	1	1	0	1	0	1	1	1
		4 = open 5-10	1	1	1	0	1	0	0	1	1
		5 = open 10+	1	1	1	0	1	0	0	1	1
	Openness of room	0 = walls & no windows	1	1	1	1	1	1	1	1	1
		1 = walls & windows	1	1	1	1	1	1	1	1	1
		2 = glass walls with curtains	1	1	1	1	1	1	1	1	1
		3 = glass walls	1	1	1	1	1	1	1	1	1
		4 = curtains	1	1	1	1	1	0	1	1	1
		5 = open	1	1	1	0	1	0	1	1	1
	Audio privacy (how many people can hear you)	0	1	1	0	0	1	1	1	1	1
		1 or 2	1	1	1	1	1	0	1	1	1
		2+	1	1	1	1	1	0	1	1	1
	Visual division (office partitions, facing a wall)	0 = wall	1	1	1	1	1	1	1	1	1
		1 = window	1	1	1	1	1	1	1	1	1
		2 = office partition	1	1	1	1	1	1	1	1	1
		3 = hallway	1	0	1	1	1	1	0	1	1
		4 = non	1	0	1	1	1	1	0	1	1
	Facilities:										
	Power socket	0 = no; 1 = yes	1	1	1	1	1	0	1	1	0
	Extra monitor	0 = no; 1 = yes	0	0	0	0	0	0	0	0	0
	Type of chair (desk chair, barstool, hard chair + adjustment capability)	No chair/standing	0	0	0	1	1	1	0	0	1
		Desk chair	1	1	1	1	1	1	1	1	1
		Barstool	1	0	1	1	1	1	0	0	1
		Regular chair	1	1	1	1	1	1	1	1	1
	Type of desk (sitting, standing, walking etc)	No desk	0	0	0	1	1	1	0	0	1
		Shared table	1	0	1	1	1	1	1	1	1
		Individual desk	1	1	1	0	1	1	1	1	1
		Individual desk, adjustable	1	1	1	0	1	1	1	1	1
		Special desk	1	1	1	0	1	1	1	1	1
	Presentation hardware (screen & sound)	0 = no; 1 = yes	0	0	0	0	0	0	0	0	0
	Desk space (able to use papers conveniently)	no desk	0	0	0	1	1	1	0	0	1
		small	1	1	1	1	1	1	1	1	1
		regular	1	1	1	1	1	1	1	1	1
		spacious	1	1	1	1	1	1	1	1	1
	Storage	0 = no; 1 = yes	0	0	0	0	0	0	0	0	0
Use	**Access:**										
	Department based or free use	0 = free use; 1 = department A	0	0	0	0	0	0	0	0	0
	Flex use or assigned desk	0 = flex use; 1 = assigned	0	0	0	0	0	0	0	0	0
	Use agreements:										
	Out loud speaking or silence	0 = out loud speaking	0	0	1	1	1	1	0	0	0
		1 = silence	0	1	0	0	0	0	1	0	
	Calling	0 = no	0	1	0	0	0	0	0	0	0
		1 = yes	0	0	1	0	0	1	0	0	
	Multiple person meeting	0 = no; 1 = yes	0	0	1	1	1	0	0	0	0
	Bookable – temporarily use	0 = no; 1 = yes	0	0	0	1	0	0	0	0	0
	Purpose (focus, collaborate, social, learn)	0 = focus	1	1	0	0	0	0	1	1	1
		1 = collaborate	1	0	1	1	1	1	1	1	1
		2 = social	0	0	1	1	1	1	0	0	1
		3 = learn	0	0	1	1	1	1	1	0	1

Table 54. Matching model for workplace characteristics and activities (own ill.)

12.3.2 Evaluation of the model 2.0

The model 2.0 provides an extensive analysis of the characteristics of these spaces. By assigning these characteristics to the most logical types of activities, a proposed use can be reasoned for each of these spaces. However, reality shows that actual use differs from proposed use. For instance, workplaces 6 are no silent workplaces, since a lot of interactive desk work is being performed there, with the occasional call as well. Reality also shows that 4, 7 and especially five are often used for telephone calls. This is because the designed telephone spaces are quite far away, and telephone calls require quick responding.

Therefore, while this analysis is useful, the reality of how the workplaces are used limited the usability of the model since it becomes less representative. At this stage, the workplace only is a match when *all* the characteristics match with the activity. This results in a limited number of possible workplaces. However, when actual use differs from how the model proposes, another room, that might not have completely matched, could be the best workplace.

In technical terms, the solution space provided by this model is limited and not representative. Often user chooses a workplace that is outside the solution space. Therefore the model is not correct according to reality. This could be solved in three ways:

9. Broaden the possible solution space, by allowing the constraints to be released more. This could be done by being less strict in assigning the criteria and allowing more discomfort.
10. Lower the number of criteria to only *hard* criteria and losing the *soft* criteria.
11. Create a different, preference-based model.

If the criteria of the current model will be released, the accuracy of the model will only decrease. Since there are already so much characteristics/criteria present, the significance of these will only be less. Therefore, it could yield stronger results when the criteria are lowered and more focused.

However, when limiting the criteria, a strong line within the solution space is created. This is the basis of linear programming because it results in a solution space where one could optimize towards a certain solution. The question than is, should the solution space be the same for everyone? Earlier in the thesis, it is discussed that stressors are very personal and differ from one person to the other.

To take into account different perspectives and stressors, preference measurement could provide the solution. This method is used in multi stakeholder decision making because it takes into account multiple variables and gives them a weighing of importance. This could also be the case for this model, where the stressors represent the variables. That would mean cutting a lot of unnecessary characteristics that are based on facilities, causing the model to be more condensed.

While working on this model and with the practical considerations in mind, some requirements for the model sifted somewhat.

When does the model need to be active?

While stress can occur throughout the day, the moments that something actually can be done about it, are far less. For instance, during a planned meeting the user cannot change the workplace, since the place is most likely a meeting room and automatically the best match for that activity. The same goes for a telephone call.

This means that the model should be active when someone is in a stationary position/ workplace. For knowledge workers, this is most often behind a computer or laptop. Since within the activities, these have been identified as General Desk Work, Uninterrupted Desk

Work, and Interactive Desk Work, these should be the activities the model focusses on.

This also means that the smart tool itself could be mainly desktop based, with maybe smartphone app support functions.

What will be the actual result?

This comes down to a hypothesis of the smart tool. The smart tool is most likely to suggest that employees, who are doing uninterrupted desk work, will be advised to move to a workplace with a Silent attribute, since that is the most defining characteristic of that activity. This could be supported by the article of Hoendervanger, that identifies Noise a one of three most important reasons to move. It could also be related to other disturbances factors should as visual separation. Other important factors from previous literature, such as control and privacy do not seem to have the character as instant stressors, but more long-term ones. This is not something that can be measured real time, so it might be left out of consideration.

The second part of this version of the model, version 2.1 will focus on the factor of silence within activities and workplace, to create a more simplified model.

Expected problems for V2.1

Regular, Interactive and Uninterrupted desk work (now to be called R, I, U for short) are expected to be very intertwined and logically naturally flow into each other. This could provide a great resistance to switching workplaces when these activities are not grouped throughout a day and do not have long periods of doing the same thing. Since working together with a college is often an important reason to choose a workplace, thus important in the general activities, the question is if people can split this.

Within Agile working, there are sometimes agreements to be silent for an hour after a Stand-Up, so everyone can do focus work. This seems to work well. However, when there are no agreements, different work types seem to flow constantly through each other.

12.3.3 Model design version 2.1

As the basis for the V2.1 model, the illustration belowdescribes the desired situation for a regular office.

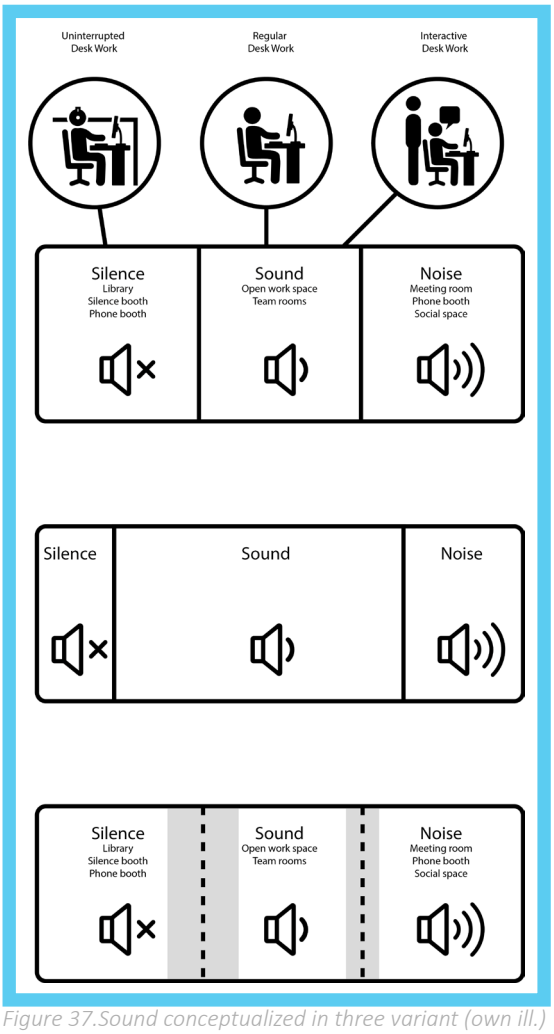


Figure 37.Sound conceptualized in three variant (own ill.)

It starts with a division between three degrees of noise within the office: 1) *silence*, 2) *sound* and 3) *noise*.

Silent spaces are meant for focus work and support the activity of UDW. Besides a few audio disturbances, they should also avoid having a lot of visual activity, to minimalize the number of disturbances of the concentration.

Spaces that have ***sound*** and allow for it to be present are necessary for verbal communication. This is a requirement for a lot of collaborative activities. People often like to be near colleges to be able to quickly discuss a problem that comes up during their work. Therefore, these spaces are a fit for IDW, but also for RDW, since they do not necessarily require silence to perform the activities.

The ***noise*** degree describes spaces that are designed for continues communication, such as meeting rooms, phone booths, and social spaces. They are necessarily for both privacy reasons in meetings and minimizing unnecessary verbal disturbances to other people.

Ideally, in ABW, these spaces should be equally divided according to the ratios of work that are needed when created fixedly. However, a lot of offices do not have ABW or have ABW that does not match their required profiles. That would result in the middle division, with a too great presence of regular sound spaces, enough noise spaces, and too few silence spaces.

Another option is, often when ABW is implemented, that the actual use of those spaces is not according to the design. This could be that the transition space becomes blurred or that whole spaces become misused, for instance speaking to colleges within silence rooms.

A model would result in the following table, where the three main activity types are matched with the workplace types, resulting in not surprising combinations. As a contrast, the activities meeting, socializing and calling are added, because these are the main activities that are conducted in the Noise environment.

The hypothesis is that people in the Noise and Sound environment will suffer from the most stress, due to environmental disturbances. Therefore, these people shall have to move towards the silence environment.

	Number of workplaces	% of the total
Silence environment	6	5,5%
Sound environment	40	36,7%
Noise (meeting) environment	33	30,3%
Noise (other) environment	28	25,7%
Telephone booth	2	1,8%
Total	109	100%

Table 51. Division of workplace based on case company situation (own ill.)

When looking at the activity profiles from the CFPB, the typical knowledge worker profiles are 1, 2 and three. They have an average of more than 20% undisturbed desk work. For this, 5,5% would seem a little low. However, another variable that becomes important is the occupancy rate of the organization, since this greatly influences the estimated available workplaces.

For this organization, the occupancy rate greatly differs throughout the week, due to non-regular meetings outside of the office. This reduces the pressure on the work environment in general, causing fewer disturbances and stress (assumed) to the employees. This could indicate that there is/should be a relation between FTE and silence spaces and FTE and stress.

	Many silence spaces	Few silence spaces
High FTE	Low stress	High stress
Low FTE	Low stress	Low stress

Or maybe with a little more difference in stress:

	Many silence spaces	Few silence spaces
High FTE	Medium stress	High stress
Low FTE	Low stress	Medium stress

Workplace type			Activity	UDW				RDW				IDW				Meeting	Socialize	Calling
				Silence	Consult	Meeting	Total	Silence	Consult	Meeting	Total	Silence	Consult	Meeting	Total	Meeting		
				1	0	0		1	1	0		1	1	0		1		
Silence	*Silence*	*1*		*1*				*1*				*1*						
	Consult	*0*			*1*				*0*				*0*					
	Meeting	*0*				*1*				*1*				*1*		*0*		
							1				**0**				**0**	**0**	**0**	**0**
Sound	*Silence*	*1*		*1*				*1*				*1*						
	Consult	*1*			*0*				*1*				*1*					
	Meeting	*0*				*1*				*1*				*1*		*0*		
							0				**1**				**1**	**0**	**0**	**0**
Noise	*Silence*	*1*		*1*				*1*				*1*						
	Consult	*1*			*0*				*1*				*1*					
	Meeting	*1*				*0*				*0*				*0*		*1*		
							0				**0**				**0**	**1**	**1**	**1**

1 Reading table	0	1	1	0	0	0
2 Dock (left)	0	1	1	0	0	0
3 Dock (right)	0	1	1	0	0	0
4 Open table	0	1	1	1	1	1
5 Overval	1	1	1	1	1	1
6 esks (spacer)	0	1	1	0	0	0
7 Wisselkamer	1	1	1	1	1	1
8 sks (left back)	1	0	0	0	0	0

1 Reading table	2 Dock (left)	3 Dock (right)	4 Open table	5 Overval	esks (spacer) 6	7 Wisselkamer	sks (left back) 8
0	0	0	0	1	0	1	1
1	1	1	1	1	1	1	0
0	0	0	1	1	0	1	0

The question then also is: what does one do when there are not a lot of silence spaces within the work environment to go to? If we look back at the possibilities for stress reduction, the stressors need to be eliminated. The ways to do that were:

- Remove the source
- Move the source
- Move away from the source
- Change the perception of the source

Moving from a Noise or Sound environment to a Silence environment is what up until now is proposed to reduce stress. If moving away from the source is not possible, one of the other solutions should be undertaken. In office environments, it is often not possible to change the source of the disturbance. This mainly is due to the social constructs within an organization and the unwillingness to speak up to a direct college to change his/her behaviour. Therefore, the most effective direct thing to do is to change the perception.

Depending on what the stressor/source is, action can be taken. Noise is often the biggest disturbance within the work environment. This could be solved by the use of noise cancelling headphones. Noise often does not need to be removed completely, but it must become undistinctive. For visual inputs, the solution is harder, since often some sort of visual barrier would be required.

12.3.4 Evaluation of the model

During the creation of the v2.0 and v2.1 model, a lot of thought has gone into the actual working of the model and what information is necessary to make it working and valuable. Two big realisations came out of that reflection.

1. For the model to be valuable, it needs to be very developed and refined. That means that very well-defined information about the working of stress on the work environment needs to be present. For every model goes, garbage in garbage out (*GIGO*). Since the v.21 model aims to help employees improve their productivity and reduce their stress, knowledge is needed on what respectively actually improves and reduces these. If the output of the model does not fully match and serve the requirements of the employee, the chances are great that they will simple disregard it (based on the fact that employees do not switch workplaces often anyways, even though they are aware of possible benefits). In the start of the research, it was assumed that this knowledge would come along the way, but it became clearer that this knowledge is not yet available. That means that the first part of this research, the development of the knowledge for this smart tool, has become a study on its own.
2. Therefore, the proposed intervention has become secondary behind the first study for knowledge about the relation between stress and workplace types.

To do this, the focus on the intervention has to be changed. This means that the previous investigation about the allocation model based on assignment is not relevant any more for this research.

However, the knowledge created in this study will still be developed into a model. This model does not have the aim any more to support employees in their real-time decision of choosing a workplace. The model will translate the findings on stress and workplaces into a decision-making model for accommodation strategies, with the possibility to optimize on stress reduction.

12.4 CONCEPTUAL DESIGN VERSION 3.0

As described in the last section of the previous subchapter, the focus of the model has changed greatly. Therefore, a new approach is used to build the model. In this subchapter, the new models will be introduced. These models will use the methods of linear programming (LP) in version 3.0.

The aim of the current model is to maximise an office design (new or renovation) based on information gathered on the relation between stress and workplace types. It uses three different input variables:

1. The current situation
2. Employee activity types
3. Relation between workplace and stress

In the third variable, also productivity is added. This is not based on the test measurements but based on subjective answers of employees on the workplace types.

For now, the model uses the current situation to determine the range for the future situation. This is done by using the current percentages of each workplace type and creating a minimum and maximum by offsetting these percentages with a prefixed amount (between 5-20%), for testing purposes. This creates the range that is used as a constraint for the solution space. This is not a good way of determining a range, but for the model designs sake, it will be used for now. Later, this will be changed based on interviews with real estate managers.

The employee's activity types are incorporated to increase the representation of diversity among employees. All people are different and react different to workplace types. By creating multiple profiles, this can represent these differences and makes sure that this model could be more easily used for different organizations.

The relation between workplace and stress represents the impact of the workplace types on stress and productivity. By having these variables, it becomes possible to optimise the office design according to these variables.

The current model allows optimisation for three objective functions: 1) *Stress*, 2) *Productivity* and 3) *Costs*.

12.4.1 Evaluation of the model

As stated, the model is not yet ready to be used because the input data is not correct yet and the minimum and maximum values are not verified. This will be done later.

LP has the benefit of easy optimisation according to constraints on one objective function. However, it misses nuances that generally follow from people's preferences. This could be done with LP, if all variables were fully identified and all maximum and minimum values were very strict. This is not a feasible thing to accomplish. Therefore, another method will be researched that takes these things more into account: preference-based design. This will be introduced in the next section.

Endogenous Variables	Silence	Sound - 1	Sound - 2	Sound -3	Meeting	Social	Tot. WP
Outcome	188	50	600	50	75	37	1000
Stress	17	35	55	75	39	34	**Tot. Stress**
Objective function Stress	3189	1766	32975	3784	2934	1248	45896
Productivity	72,5	49,5	54,5	39,5	52,5	5	**Tot. Prod**
Objective function Productivity	13602	2498	32675	1993	3950	183	54901
Costs per m2	€300	€250	€225	€200	€325	€175	**Tot. Costs**
Objective function Costs	€ 56.284	€ 12.615	€ 134.897	€ 10.092	€ 24.450	€ 6.422	€ 244.759

								Required		*Available*
Max. total workplaces							1	1000	=<=	1000
Min. Total workplaces							1	1000	>=	950
Max. % Silence	1						-0,188	0	=<=	0
Min. % Silence	1						-0,088	100	>=	0
Max. % Sound - 1		1					-0,750	-700	<=	0
Min. % Sound - 1		1					-0,050	0	=>=	0
Max. % Sound - 2			1				-0,750	-151	<=	0
Min. % Sound - 2			1				-0,050	549	>=	0
Max. % Sound - 3				1			-0,750	-700	<=	0
Min. % Sound - 3				1			-0,050	0	=>=	0
Max. % Meeting					1		-0,475	-400	<=	0
Min. % Meeting					1		-0,075	0	=>=	0
Max. % Social						1	-0,237	-200	<=	0
Min. % Social						1	-0,037	0	=>=	0
Tot workplaces	-1	-1	-1	-1	-1	-1	1	0	=	0
High productivity	1		1		1			862	>=	400
Low stress	1	1			1			313	>=	130

Table 55. Model design version 3.0

	Number of workplaces	% of total
Silence environment	150	13,76%
Sound environment	600	55,05%
Noise (meeting) environment	300	27,52%
Noise (other) environment	40	3,67%
Total	**1090**	**100%**

Table 56. Model input: current situation

Amount in %		
30%	A-Type 1	Lots of general work
20%	A-Type 2	Lots of meetings
40%	A-Type 3	Lots of focus work
10%	A-Type 4	Lots of calling

Table 57. Model input: employees activity types

	Stress factor						Productivity					
	Average	A-Type 1	A-Type 2	A-Type 3	A-Type 4	Adjusted	Average	A-Type 1	A-Type 2	A-Type 3	A-Type 4	Adjusted
Silence environment	20	10	25	15	30	17	70	70	65	80	65	72,5
Sound environment	50	50	40	70	40	55	51,25	60	50	40	55	49,5
Noise (meeting) environment	36,25	50	25	40	30	39	53,75	50	60	50	55	52,5
Noise (Social) environment	32,5	40	25	35	30	34	5	5	5	5	5	5

Table 58. Model input: fictive results relationship workplace type and stress

12.5 FINAL DESIGN VERSION 4.0

12.5.1 Problem definition

As stated in the previous section, the problem definition changed from being short time focussed that resulted in an allocation model that should reduce an employees stress, to an accommodation strategy model that reduces stress in the entire work environment. Therefore, the model aims ***to yield the best possible solution for a work environment with minimized stress levels***, by providing a program of requirements on a workplace level. This program of requirements consists of a list of different workplace types and their amount.

In Chapter 10, it is described how these different workplaces are determined, resulting in a set of workplace types with each a resulting stress score per workplace. Below an overview is shown of the four variant for the ***work mode Focus***. Below the name of each variant, the associated stress score of that variant per workplace is stated.

Endogenous Variables	Focus							
	F1	F2	F3	F4	B.F1	B.F2	B.F3	B.F4
Outcome	0	0	0	0	0	0	1	0
Stress	-46,0	-51,0	-62,0	-56,0				

Figure 39. View of variant representation for the work mode Focus (own ill.)

In practise, one seldomly gets to execute an optimized solution based on only one factor, which would be stress in the context of this research. When multiple stakeholders are involved, they have interests that often differ from each other. They have a different view on how the resources needed for the creation of the solutions should be divided. These stakeholders, therefore, define limits on the use of certain resources, such as time or money, but also the content of the solution can be limited. In case of the workplace types, limits are posed on the number of workplace for each working mode, to prevent that one work mode gets all of the workplaces and another gets none.

These limits are called the constraints of the model. Within these constraints, the model aims to find the optimized solution of a work environment with the lowest potential stress.

The objective function of the model

The finding of the outcome variant with the lowest potential stress is the objective of the model. This objective can be translated into an objective function, is a mathematical representation of the objective. In the case of this model, the objective function is

$$Total\ stress=(s(F_v)*F_n)+(s(C_v)*C_n)+(s(M_v)*M_n)+(s(S_v)*S_n)$$

- ***s*** is stress score
- ***F*** is Focus work mode
- ***C*** is Collaboration work mode
- ***M*** is Meeting work mode
- ***S*** is Socialize work mode
- ***v*** is variant number
- ***n*** is amount of workplaces

By using the *WhatsBest* plugin for Microsoft Excel, it is possible to calculate the maximum outcome of the objective function, by letting WhatsBest adjust certain values of the variables. For this objective function, these values are the number of workplaces for each work mode.

Because only one variant for each work mode can be chosen (for Focus, for instance, either F1, F2, F3 or F4), it is important that the model understands that it has to choose between these. This is done by assigning binary constraints to these variants, allow only one to be chosen. These are the B.Fn numbers in Figure 39.

12.5.2Model design

Input variables as constraints

To reach a solution, certain inputs are needed. Otherwise the model does not know what it is calculating. The input can be divided into three categories and will be discussed in the next section. The input variables form the constraints that the model takes into account. If for instance no input is given on the maximum number of workplaces, the model will choose to have an infinite number of workplaces, since some workplaces have a negatively related amount of stress, thus having more workplace result in a more maximised objective function. Having a maximum number of workplaces is not realistic since an organization has a budget to spend on their real estate. There, both constraints of a maximum number of workplaces and budget are added.

Accommodation variables based on activity profiles

In terms of accommodation, this model will take into account the number of workplaces. However, to determine the division among the different work modes, more information is needed than just a flat number.

First, off al, the total number of workplaces need to be decided upon. This is done by taking the number of employees that will work at the specific office. For this example, that number will be 1000. Of these employees, the activity profile will be assessed by the tool of the Center for People and Buildings. This will result in a division of those 1000 employees among the four activity profiles in percentages, as can be seen in Figure 37.

Next, to the activity profile, additional knowledge is required from these employees and that is their presence in the office. This is represented in a FTE ratio. A FTE ratio of 1.0 indicates that the employee of this activity type spends 100% of their workweek at the office.

Related to the activity profiles, are the numbers that show the division of time spend in each work mode. This time spend is for now assumed to be equal to time spend at workplaces of these work modes. In reality this could differ largely. The time spend is represented also in a ratio of 0 to 1. These numbers combined, result in a number of workplaces for each work mode for each activity profile. Summed up vertically, they result in the number of workplaces for each work mode and summed up again horizontally, results in the total number of workplaces. This results in the number 708.

From this number, a range can be developed, stating that 708 is the minimum number of workplaces required in the office. The maximum number, for now, will be set at 1000, meaning that the office could accommodate all employees at the same time if needed.

The same thought process is used to determine maximum and minimum numbers for each specific work mode. For instance, for Focus the minimum will be 368 and the maximum 368 / 7 * 10 = 525,7. Since no half workplaces exist, numbers are always rounded to integers.

	Input variables							Workplaces								
I1	Number of empbyees	1000		Code	Activ	Amou	Flexra	Focus		Collaboratior		Meet		Socialize		
I2	Budget	€ 2.500.000						R	N	R	N	R	N	R	N	
I3	Available space			A1	Mainl	30%	0,7	0,4	84	0,3	63	0,2	42	0	21	
				A2	Mixed	29%	0,7	0,5	100	0,1	20	0,3	60	0	20	
				A3	Mainl	21%	0,7	0,7	103	0,15	23	0,1	15	0	8	
				A4	Almos	12%	0,7	0,85	69	0	0	0,1	5	0	9	
				A5	Mainl	6%	0,7	0,3	12	0,3	12	0,3	12	0	4	
				A6	Almos	4%	0,7	0	0	0,8	20	0,1	3	0	3	
								Totaal	368		138		137		65	
																708

Figure 40.Overview of the input variables (own ill.)

General information about workplaces

As in more in-depth described in Chapter 10, the data of the quantified knowledge base is used to determine the best workplaces for each work mode variant. This results in a list of potential workplaces with a related stress score.

In practise, budget is often a big constraint. This results in not having a maximised diversified work environment. Therefore, the constraint of the budget is introduced. Each workplace costs money. The assumption is that when workplaces are more generalized and the same, the costs become lower because of two reasons. First, the square meters per workplace needed are lower, since repetitive workplaces can be better optimised in terms of layout. Secondly, because of the volume discount, resulting in lower purchase prices. Both these variables are added, based on fictional numbers.

Due to this budget constraint, when the budget does not support the most optimal solution without the budget, the model must adjust the possible solution. When doing this, it takes into account the different input variables, resulting in a solution is optimizes the stress reduction based on money, resulting in the best value for money system.

12.6 CONCLUSION ON THE OPERATIONAL MODEL

The current model can translate the gathered knowledge into a concrete program of requirements, based on the given constraints. This program of requirements can be used as a starting point or reference point for further designing and analysis.

The model takes into account four different work modes. This could be increased to a diversification of the required workplace types, making the model more complex. The model is in a way parametric that it is easily adjustable and variables can be added without harming the core structure of the model.

The current model is not yet capable of dealing with the uncertainties and inaccuracies of the quantified knowledge base. This is something that needs to be assumed to be correct. Therefore, the outcome of the model should not be considered to be an absolute truth, but rather serve as an assisting tool in developing finalised programs of requirements, providing a new perspective of optimizing on stress in the work environment.

Endogenous Variables	Focus								Collaboration								Meet								Socialize								
	F1	F2	F3	F4	B.F1	B.F2	B.F3	B.F4	C1	C2	C3	C4	B.C1	B.C2	B.C3	B.C4	M1	M2	M3	M4	B.M1	B.M2	B.M3	B.M4	S1	S2	S3	S4	B.S1	B.S2	B.S3	B.S4	Total
Outcome	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	4
Stress	-46,0	-51,0	-62,0	-56,0					-50,0	-55,0	-60,0	-70,0					-30,0	-32,0	-36,0	-37,0					-5,0	-20,0	-25,0	-27,0					
Objective function Stress	-46,0	-51,0	-62,0	-56,0					-50,0	-55,0	-60,0	-70,0					-30,0	-32,0	-36,0	-37,0					-5,0	-20,0	-25,0	-27,0					0,0
Costs per m2	300,0	300,0	300,0	300,0					200,0	200,0	200,0	200,0					400,0	400,0	400,0	400,0					150,0	150,0	150,0	150,0					
M2 per workplace	8,0	9,0	10,0	11,0					8,0	9,0	10,0	11,0					8,0	9,0	10,0	11,0					8,0	9,0	10,0	11,0					0,0
Objective function Costs	2400	2700	3000	3300					1600	1800	2000	2200					3200	3600	4000	4400					1200	1350	1500	1650					0,0
Max. workplaces																																	1
Min. workplaces																																	1
Max. Focus	1	1	1	1																													
Min. Focus	1	1	1	1																													
Select F1-4					1	1	1	1																									
Select F1	1				-10000																												
Select F2		1				-10000																											
Select F3			1				-10000																										
Select F4				1				-10000																									
Max. Collaboration									1	1	1	1																					
Min. Collaboration									1	1	1	1																					
Select C1-4													1	1	1	1																	
Select C1									1				-10000																				
Select C2										1				-10000																			
Select C3											1				-10000																		
Select C4												1				-10000																	
Max. Meeting																	1	1	1	1													
Min. Meeting																	1	1	1	1													
Select M1-4																					1	1	1	1									
Select M1																	1				-10000												
Select M2																		1				-10000											
Select M3																			1				-10000										
Select M4																				1				-10000									
Max. Social																									1	1	1	1					
Min. Social																									1	1	1	1					
Select S1-4																													1	1	1	1	
Select S1																									1				-10000				
Select S2																										1				-10000			
Select S3																											1				-10000		
Select S4																												1				-10000	
Budget	1	1	1	1					1	1	1	1					1	1	1	1					1	1	1	1					

Required		Available
4	<=	1000
4	Not >=	950
0	<=	526
0	Not >=	368
1	=	1
0	=<=	0
0	=<=	0
-10000	<=	0
0	=<=	0
0	<=	197
0	Not >=	138
1	=	1
0	=<=	0
-10000	<=	0
0	=<=	0
0	=<=	0
0	<=	196
0	Not >=	137
1	=	1
-10000	<=	0
0	=<=	0
0	=<=	0
0	=<=	0
0	<=	93
0	Not >=	65
1	=	1
0	=<=	0
0	=<=	0
-10000	<=	0
0	=<=	0
0	<=	2500000

Figure 41.Snapshot of the operational model version 4.0 (own ill.)

PART V
RESULTS

In this last part of the thesis, the results of the research are combined to form the conclusion in Chapter 13. In Chapter 14 the discussion on the research findings and research process is stated and in Chapter 15 an overview of the recommendations is given. This part ends with the Reflection, a personal view on the process and research as a whole.

13. CONCLUSIONS

In this chapter, the research questions will be answered based on the research that has been performed and the information gathered and presented in the previous chapters. First, all of the sub research questions are answered in sub chapter 13.1 and finally the main research question is answered in sub chapter 13.2

13.1 ANSWERING THE SUB RESEARCH QUESTIONS

The main research question of this research was stated as follows:

How can insights in the relation between workplace and activity on employee stress be used to develop a real estate decision-making model?

In order to answer this research question, five sub research questions were drafted and repeated below:

1. What is the relation between workplace types and activities on employee stress?
2. How can employee stress be measured?
3. What workplace characteristics are of influence on employee stress?
4. What are input and output variables for a decision-making model that can reduce employee stress?
5. How can real estate managers use the decision-making model?

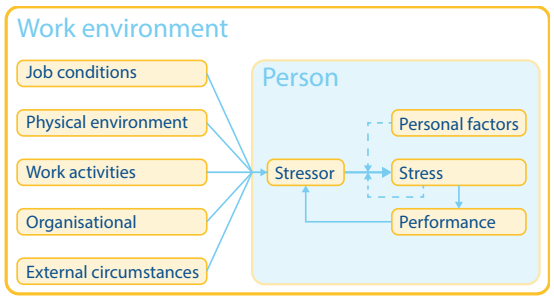
Each research question will be answered in a separate section below.

Relation between workplace types and activities on employee stress

The first sub question of this research is:

What is the relation between workplace types and activities on employee stress?

To answer this question, a literature review has been conducted to conceptualize the related elements of this question. Based on the findings on health, workplace and person, the following model was drafted.



In this model it can be seen that stress is caused by a *stressor*, which is the perception of an external stimulus. This stimulus can come from five different categories, *job conditions*, *physical environment*, *work activities*, *organizational* and *external circumstances*.

A stressor is evaluated in a *threat-safety assessment*. Because of *negativity bias*, this assessment is biased to result in a threat assessment more often than necessary, triggering the *stress response*.

Thus, the biggest stressors are the aspects that have the greatest perceived potential danger. This is different for every person; therefore, no singular conclusion can be drawn on what triggers the most stress.

In terms of *work activities*, they are a part of the potential danger, due to the possibility of not succeeding (sufficiently) in that activity. Activities are therefore marked as a potential stressor.

Workplaces are the physical environment of the work environment where all of the categories are perceived. The cause of the

stressor might be outside of the workplace, but the workplace is the location where the stressor becomes active and thus creates the current context of that stressor. An employee performs each activity at a workplace. The tasks of this activity have certain demands on intellectual abilities and skills. The workplace by means of *workplace characteristics* can either support these demands in the form of acting as a resource, or frustrate the person, making it harder to satisfy these demands.

To conclude this sub research question, activities place demands on an employee and a workplace can provide resources to satisfy these demands or frustrate attempts of fulfilling them. When potential danger arises from the combination of an activity and workplace, the stress response could be triggered, resulting in an elevated stress level.

Measuring stress

The second sub research question is:

How can employee stress be measured?

This question was answered in two steps. First, by an explorative literature and online research and secondly by testing the data gathering method during the structured observations.

Stress can be measured with one of two generic methods. The first and most used method in research relating stress to the work environment, is to ask a person for their perceived stress level on an ordinal scale of, for instance, 0-10. This is by far the easiest and quickest method, because it can be done in a matter of seconds and be gathered by large self-administered questionnaires. A slightly more elaborate version of this method is using the Perceived Stress Scale, a self-administered questionnaire with 10 questions, resulting in one of three ordinal levels, low, moderate of high.

However, the score only indicates the *perceived stress level,* and does not say something about the *actual stress level.* What the actual stress level is, is subject to definition and measuring method (see section 8.1.1). The second method of measuring stress is by means of bio-metrics. A bio-metric gives a numerical representation of a physiological value.

Because of practical implications and limitations, medical forms of measuring stress, such as by saliva samples that measure cortisol, are not feasible. It is possible to measure stress through bio-markers. A bio-markers is a derivative physiological value that is correlated to the researched value (stress) and is also a bio-metric. For stress, two main bio-markers have been identified in literature that proof to be valid and fairly easy to obtain. These are *heart rate variability* (HRV) and *electrodermal activity* (EDA). Both of these bio-metrics can be measured with wireless wearable devices. Being wireless is necessary to not disrupt activities and mobility of an employee, in order to decrease measurement bias.

Due to practical constraints, the HRV wearables are deemed infeasible for this research, either by cost or by limitation of data sharing. The EDA wearable device, in the form of a smart ring, does accommodate easy data sharing and is relatively affordable. Actual stress with this device is represented on a ratio scale from 0 to 100 and is calibrated the first day of wearing to result in an average of 50 for that day.

The second step of answering this question, was by testing the smart ring before and during the structured observations. This resulted in a positive evaluation of the method for investigating differences between combinations of workplace characteristics and activities.

To conclude this sub research question, employee stress can be measured by the use of a wearable device that measures a bio-maker for stress, EDA.

Workplace characteristics on influence on employee stress

The third research question is:

What workplace characteristics are of influence on employee stress?

This question is answered by analysing the data from the structured observations. A distinction is made between workplace characteristics and the combination of workplace characteristics with activity and activity profiles, since the influence of workplace characteristics alone do not tell the complete story of how diversification among employees can influence the correlation with employee stress.

The short answer to this question is a list of workplace characteristics that have a significant result. These are size of room, openness of room, type of chair, presence of presentation hardware, ability to book a room, whether the purpose of the room is to focus and whether the purpose of the room is to have social interaction.

In the conclusions of the empirical result chapter, in section 10.4.4, a more in-depth elaboration is given to the correlated findings on workplace characteristics and activities. In Appendix VII, the complete results and correlated findings between the combination of workplace characteristics, activities and activity profiles can be found.

The answer to this research question, however, should not only consist a long list of significant combinations. It is important to remark that in many combinations no significant correlation is found, either to the fact that there is no correlation, but also mainly due to the fact that the choice for workplace activity combination is not random, thus it is not to be expected that all 1880 combinations will result a significant result. It must therefore be concluded that it is not fully known what workplace characteristics are of influence on employee stress.

Decision-making model

The fourth sub research question is:

What are input and output variables for a decision-making model that can reduce employee stress?

This question is divided into three parts, the input of the model, the output of the model and the process of the model itself. As stated in the question, the goal of the model is to reduce employee stress. The aim is to do this by providing a real estate accommodation advise on a workplace level by optimising a draft for a program of requirement.

The output of the model, therefore, should be a program of requirement in the form of a list of workplace types and their amount.

The process of the model should calculate an optimal solution by minimizing the amount of stress for the total program of requirement within the given constraints. As shown in the adjusted theoretical model, the given constraints are the accommodation variables and the information of the profiles. These accommodation variables are seen as input and will be discussed in the next section. The input can be divided into four categories:

1. Accommodation variables
2. Activity profile characteristics
3. Quantified knowledge on the workplaces
4. General information about workplaces

The first accommodation variable is the required number of workplaces. This is built up from the number of employees, their activity profile and their FTE ratio. The second accommodation variable is budget of the accommodation intervention.

The activity profile characteristics input is based on the activity profiles as mentioned by the Center for People and Building, and divide the time spend of an employee into different activity modes.

The quantified knowledge on the workplaces is the third input category. By using this information, all possible combinations between different activity types can be investigated, yielding in four variants for best workplaces with the lowest predicted stress levels for each work mode.

And lastly, the general information about the workplaces is needed, in terms of the size of each workplace and the expected costs.

Using the decision-making model

The last sub research question is:

How can real estate managers use the decision-making model?

Real Estate Managers should always aim to improve their real estate, in order to obtain maximum added value for their core business processes. For companies that employ knowledge workers, a well-functioning office that reduces stress increases the potential productivity of their employees. The current decision-making model provides Real Estate Managers with a tool to critically look at their own organization and their current work environment.

By using the decision-making model, the Real Estate Managers can compare the outcomes to their own work environments and identify differences. If in combination with feedback session from the employees, it turns out that these differences indicate to be more stressful, the decision for interventions can be made, based on valid argumentation. This is in contrast to the process of designing from the perspective of both the companies and the employees wishes, because it uses objectively gathered information, instead of subjective preferences.

At the same time, the decision-making model makes it more insightful what changes in variation among variants results in. By adding a cost component to the model, the model aims to generate the highest value-for-money solution, in which value is the most stress reduction.

13.2 ANSWERING THE MAIN RESEARCH QUESTION

To conclude, a comprehensive answer will be given to the main research question:

How can insights in the relation between workplace and activity on employee stress be used to develop a real estate decision-making model?

In order to develop a real estate decision-making model, profound insights into the correlation between the work environment and stress are needed. To improve a situation, first it is necessary to know what the situation actually is and how possible interventions will influence that situation.

By performing structured observations to determine stress levels in a variety of workplace and activity combinations, quantified knowledge can be generated that can be used to evaluate possible interventions beforehand.

Combining the quantified knowledge and practical information and processes together in a real estate decision-making model, a new perspective is created that can help real estate managers make future decision in reducing stress in the work environment.

“

NEW PERSPECTIVES CAN HELP REAL ESTATE MANGERS MAKE FUTURE DECISION TO REDUCE STRESS IN THE WORK ENVIRONMENT

14. DISCUSSION

The aim of this research was to broaden the knowledge on stress in the work environment and to develop a decision-making model to help practitioners reduce stress in the work environment. Both of these aims have been achieved in the research, however, it can be discussed in what gravity.

14.1 INTERPRETING THE RESULTS

14.1.1 Validity of the research design

Logbook

The validity of the logged information during the structured observations is determined by doing a Cohen's Kappa calculation. This resulted in the outcome fair. While this can be considered sufficient, there is room for improvement for the manner the logged information is gathered. The logged information for workplace had a higher Kappa than activity. This is logical, since one does not change workplace as often as activity and thus workplace is easier to remember.

For both, if a feasible automated method could be found, this would highly be advised. Occupancy tracking could already provide a solution for workplaces, but activity tracking is difficult, from both an accuracy perspective as a privacy perspective.

Smart ring

The method of measuring stress through the use of bio-markers is deemed valid in other researches (Alberdi et al., 2016), however, always side notes can be placed by the accuracy of the method. Participants indicated that they sometimes received high measurements, while they were not feeling stressed and doing the same activity as before. The participant could be wrong, but more likely is that the smart ring sometimes gives incorrect readings. For now, it is assumed based on the validity from literature, that the measurements in the long term balance out the incorrect readings for the greater part.

The smart rings did not always work as expected. Multiple hours of potential observations have been lost due to batteries being depleted, which is not a problem in terms of validity but is an issue in the research design by placing the responsibility at the participant.

14.1.2Findings

The findings done in the empirical part of this research have mixed similarities to terms of existing academic research. It is therefore difficult to determine the validity of the research. It is already stated that due the limited amount of research data, certain gaps have appeared in the proposed quantified knowledge base. These gaps, for a large part, could be filled by conducting more research, in the form of repeating the structured observations and adding interventions to investigate particular combinations more in depth.

Perceived versus measured

One of the most interesting findings was the negative linear correlation between perceived productivity and measured stress, in contrary to the correlation for both perceived variables (see 9.2.3). This proposes an important discussion point on the validity of using perceived stress in the context of stress research. More research should be done about this, to develop better insights.

Causality

It is hard to draw conclusions based on these results because of the inability to tell if the result is causal or circumstantial. With

causality, the concept of one variable being the cause of influence on the outcome of another. Eating a lot of food is causal to gaining weight. A circumstantial relation occurs when one variable is not the direct cause of another but is somehow linked to it.

In the context of this research, causal and circumstantial are very important, yet hard to proof. It is mostly not possible to conclude causal relationships, because the variables could be circumstantially linked to other variables or even confounding factors.

In the case of the combination AP2 and UDW resulting in less stress, this could be because employees that are in AP2 can handle UDW very well due to hardiness and coping skills (causal), but it could also be that employees in AP2 only perform UDW work when almost no people are around to distract them and wear noise cancelling headphones to block out sound. In this case the number of people present, and lack of noise distraction would be the causal relationship and employees being AP2 is circumstantial.

A finding that the researcher expects to be circumstantial is the significance of presentation hardware in general and in combination with the activity UDW. Nothing in literature would support presentation hardware to result in a lower stress level than average. The reason behind this could be that presentation hardware is present in meeting rooms and that employees sometimes use empty meeting rooms to perform work away from co-workers.

Due to the uncertainty of causality, very careful consideration needs to be made before using these findings in practise. Therefore, dialogue between researchers and designers is vital for correct translation into actual interventions.

14.2 LIMITATIONS OF THE RESEARCH

This research is a graduation research and thus has been scoped to fit in the proposed time frame. Due to this scoping limitation, some elements have been left out that might have proven relevant to the research.

Confounding factors

A large limitations of this research are the lack of investigating of the confounding factors. It could be argued that the most elements that directly cause stress, could be among the confounding factors. A more in-depth analysis of the personal circumstances of the participants could have generated more interesting findings. However, since this research falls within the domain of the built environment and not sociology or psychology, this is not done. Future research in a multi disciplinarily team could investigate this.

The lack of absolute stress levels

Due to the measurement methodology, it was not possible to determine absolute stress levels. This made it impossible to compare groups with each other on their characteristics. Only differences could be measured within specific groups, by using the Stress Minus Mean score. For this research, this was not a problem, however, it can be considered unfortunate, because it could have increased the insights generated from the rich data set.

The absolute stress level could be figured out; however, this would require either saliva samples or psychological evaluation, both not considered feasible within small short term researches.

Weighted means

The Stress Score Minus Mean was determined by subtracting the personal mean of the participant from the stress score. Since participants often spend a lot of time at the same workplace, the means of those workplaces automatically moved close to 0, since they made up for most of the weighted score that determined the personal mean. While this can still be countered by looking at standard deviation score to determine the homogeneity of those workplaces, it does complicate the reading of the result.

15. RECOMMENDATIONS

This chapter contains a set of recommendations that follow from the research findings and the research process, for both practical implications and future academic research.

15.1 PRACTICAL IMPLICATIONS

15.1.1 Improving the work environment

While the problem of causality is important in interpreting the findings, much of the findings can be reasoned to logical possible interventions.

The findings indicate that the higher the privacy level of an employee is, the lower the stress level becomes. This is no new findings, as it is mentioned in multiple studies. However, to this day, still almost no consideration to this is given in work environments. Arguments of better communication among employees and creativity are still being made, but this research again supports the statement that more privacy is needed in the work environment. While cubicles are also not the best workplace type, experimenting with more private forms of workplaces could decrease stress in the work environment.

15.1.2Using the tool

It is recommended to explore using the decision-making model, by testing it in organization. By using the activity profile tool from the Center for People and Building, relatively easily the activity profile division can be determined.

By comparing the results from the tool with current situations and proposed designs, the practical limitations can be better understood, as well as unexpected advice can be given. Using quantified knowledge could improve arguments to convince clients to improve their work environments above their requested level.

15.2 FUTURE ACADEMIC RESEARCH

This research was of an operations-empirical design, with the main focus on the empirical part. Besides continuing with the current research setup and gathering more data to further statistically strengthen and broaden the findings on stress in the work environment, other aspects were found that require further academic research.

15.2.1 Empirical research

The first recommendation for future research would be to further investigate the correlation between self-rated stress and measured stress. Better insights could steer the method of stress research more into the direction of bio-metric measuring, with the potential of increasing the accuracy of the findings.

Surprisingly, no findings on the variable of silence were made. However, from observations of the researcher, it was concluded that workplaces that were assigned to be in silence areas, did not function in that manner. It is therefore suggested that in future research the two variables of occupancy rate and noise level are to be added.

Alternative solutions for the logbook during the structured observations should be researched, with the aim to automate them, creating higher observation agreements and more valid results.

Currently, the personal characteristics of the participants were limited. Adding additional information could result in new findings, for instance job role. It is important to note that

due privacy considerations, this might be hard and requires a large sample size.

15.2.2 Operations research

In terms of operations research, the current model could be further developed, by adding new constraints and further dividing inputs and variables into sub variables. However, the most important step in the operations research, would be to test an outcome in practise and use the results from that test to evaluate and develop the model.

Intervention testing was the starting point of this research and will therefore be the end. With the starting point of the quantified knowledge base, it is now possible to start intervention research.

The current operational model could be transformed into a personalised one, by removing the quantified knowledge base by a self-updating one, that uses the information gathered from a participant real-time and processing that into a real-time evolving quantified knowledge base. By creating a living-lab-for-one, a n=1 study could be performed, focussing on developing a smart tool that combines the generalised knowledge with personal information. From this knowledge, personalised interventions can be proposed, using for instance workplace preferences and predictive systems.

16. REFLECTION

The P5 thesis stage marks the end of both this graduation research as my student period as a whole. In other to reflect on the process and content of this research, this chapter dives into the different aspects of the journey, from topic selection to changing research designs and learning how to program to findings limitations due to privacy. The chapter aims to reflect in two ways, the first being the reflection on the intended research and how this developed over time and the second being the connection of the research to the master track Management in the Built Environment.

16.1 TOPIC SELECTION AND INITIAL RESEARCH

16.1.1 From Management in the Built Environment to Stress in the Work Environment

This research is written as a graduation requirement for the master track Management in the Built Environment (MBE) of the master program Architecture, Urbanism and Building Sciences (AUBS) at the Faculty of Architecture and the Built Environment (ABE) from the Delft University of Technology (DUT).

The master track MBE prides itself in being a managerial program, educating future decision-makers, but having a background in design and stimulating design thinking. The faculty ABE in general states that one of their greatest qualities is that not only the immediate problem is taking into account, but the wider context of its environment. With these perspectives and skills in mind, my graduation journey started a little over a year ago during the MBE Graduation Lab introduction days in February of 2018.

Real Estate Management

For me it was fairly quickly decided that my graduation domain was going to be Real Estate Management (REM). Being very user-minded throughout my entire education, the domain of REM offered in my view the best context to study and develop something that could improve the lives of the users of real estate.

The (work)place to be (healthy)

Within the domain of REM of wide range of possible graduation themes were available, but the theme Workplace & Health caught my eye. The statement associated with this theme was that two folded. On the one hand, a lack of knowledge was growing with the impact of new office concepts in the current society that has a growing problem with stress and burn-outs and on the other hand, new technologies were on the rise that were not known and investigated in the context of the work environment. This seemed for me the perfect theme to do research with the aim to improve the lives of the employees in these work environments that were causing these stress and burn-out complaints.

But stress, is that not a psychological phenomenon? How does that relate to the work environment and REM in general? True, stress is a psychological phenomenon, as well as a physiological one. The danger of this research topic was that it would drift too much to the psychological side, by dissecting all the involved factors and variables that cause stress. In order to put this to a halt, I early on made a choice to not look too deep into the causes of stress, because these are very hard to measure as well, but to focus on the manifestation of that stress in the work environment. In other words, it is not about what actually causes that

stress, the research is about influence the work environment has on the reception and buffering of that stress. The end goal of this research is not to eliminate stress, but to reduce it in the work environment, by being able to develop workplaces that support users in not generating too much of it throughout the day. For future (larger scale) research, it would be advisable to team up in a cross-disciplinary research team, to incorporate other perspectives as well, making the research even more valuable.

Geeks and Gadgets

But how to investigate this? During a first quick literature scan, a lot of similar research designs were found, mainly based on big occupational surveys, investigating work environment and workplaces on a general level, combining it with self-rated stress scores. The question that rose from this was: 'Stress is not something new and present in the work environment for decades. Why is it still not better, but might even be worse?' I could come up with two hypotheses based on my own assumptions for this. The first is that employers and decision-makers simply do not want to pay too much attention and money to this, due to a feeling that it will not be solved anyways and is a part of the work life. The second one is linked to the first, being that no actual knowledge exists that tries to quantify stress knowledge about the work environment and thus interventions and programs cannot be properly tested and evaluated.

How to solve this? Besides being a hardworking MBE student, I also have a passion for nerdy stuff and gadgets. With the quick rise of fitness trackers and such over the last few years, the ability to measure oneself on a variety of bio-metrics has become more and more easily available. Most people already use a fitness app for running of cycling, track their step count and some even monitor their heartrate 24/7. So why not do this for stress? And use this information to identify stressful moments in the work environment and perform interventions. Sounds like a plan.

16.1.2Motivation versus reality

This motivation and ambition to improve the lives of the users of the workplace, the employees, could be done in two ways, a real-time intervention or a long-term structural change. In the context of the work environment, the responsibility of execution the real-time intervention would be that of the employee, while the long-term structural change responsibility lays with the real estate manager.

The initial plan was to provide a solution for both, however this appeared to be a bit too ambitious. This will be further explained in section 16.2.2.

Ethics of quantified metrics

How does one measure stress in a person? The answer to this was determined to be the use of a smart ring that collects Electrodermal Activity (EDA). This information is a bio-metric and falls under the category of personal health information. This means that it is very privacy sensitive information. In order to be able to collect this, a well-documented plan needed to be drafted, considering a multitude of aspects.

One of the first limitations when it comes to privacy that was identified, was the role of employer and employee. Because I performed my thesis research at an internship company, agreements needed to be made about who owns what data and who is responsible for what. The GDPR states that an employer may not monitor personal health information, even with consent from the employee, because of an uneven power situation. So even if the employees were willing to share their data with the company, this wasn't allowed. This resulted into strict privacy management throughout the entire process.

To comply with regulation and legislation, also an application needed to be done to the Human Research Ethics Committee of the DUT. Preparing for this application was an educational experience that helped the process to become

more developed. No privacy complaints have been noted throughout the entire process of the research.

A second question about privacy and ethics in terms of quantified metrics that arises, is we even should want to perform quantified metrics in a large scale. Things as stress are natural processes and one could argue that we should leave them be, since they have a purpose in live, to protect your body. Reducing or even eliminating stress in once life could lead to unforeseen problems, we are not yet aware of. However, in my opinion stress is a problem in this society caused by society, not by our natural processes. It would therefore be, in my opinion, unethical to not investigate this phenomenal with the tools available. A part of scientific research has always been based on investigating personal information and quantified metrics are in my opinion just the next step in this process.

16.2 RESEARCH DESIGN AND METHODS

The research design is based on an operational-empirical research, which is a mixed method approach, combining quantified research with operations research. This research design has remained the same throughout the entire research process. However, some rather large changes have been made after the P2 moment, because it became evident that the focus point of the research plan was off. This will be discussed below.

16.2.1 Before P2

The research aim was two-folded, by creating a smart tool that could support the employee to reduce their stress real-time and help real estate managers reduce stress in the work environment long term. Empirical research before the P2 was conducted by means of a literature study and resulted into a list of variables that were indicated to be of influence on stress. At the same time, the first conceptual designs of the smart tool were created, defining the problems that is needed to solve. The focus of the smart tool for the employee was on supporting the choice for a suitable workplace when his or her stress would become too high. The focus for the real estate manager was to create a new improved version of the work environment, based on the data generated from smart tool.

P2 much on my plate

Just after the P2, it became evident that a large piece of information was missing. Since the aim of the smart tool was to support choosing suitable workplaces, knowledge was needed what workplace are suitable for which situation. And this knowledge was not available. Obtaining this knowledge needed a study on its own, leaving no more room to translate this knowledge into a tool that would work for an employee. It became time to kill my darlings.

16.2.2 After P2

The choice was made to change the purpose of the study from creating a smart tool that would support workplace choices for employees, to the quantified knowledge creation of stress in the work environment. This knowledge base could then, in time, serve as a starting point for future research. Thus, the focus became on the empirical creation of knowledge and as method structured observations were chosen. The results from these structured observations would serve as the input for the operational model.

Watch and learn

Drawing from the research that had been performed already, it was still chosen to use the smart ring to perform the stress measurements. Creating objective and quantifiable information was still very important, in order to create a new method in doing stress research in the

built environment, thus having sensor data promised a solid new method. There was literature on this measure method, validating its use, however, it still needed to be introduced and prove its use in the context of the built environment. In hindsight, the method delivers on its promises, creating new insights. From now on, this method can be used to do further research, for instance by testing interventions or doing more specific research to fill in gaps in existing knowledge.

16.3 STRUCTURED OBSERVATIONS

The structured observations need four elements to perform: a location, participants, observers and an observation protocol. This process is designed before the observations start and are limited to the scope of the research, technological limitations, privacy limitations and practical limitations.

16.3.1 Company and location

As mentioned earlier, the observations (or the experiment as it was called towards the participants) was performed at the internship company, Colliers International. This is a company that employs almost exclusively knowledge workers, which are the target population of this research.

The research also focusses on Activity Based Working environments, since these are work environments that stimulate mobility among different workplaces. For the observations, two of the offices of the internship company were used, one in Rotterdam and one in Amsterdam. The Rotterdam office is a fully ABW environment, however the Amsterdam office was more of a hybrid between a traditional and an ABW office. It contained a large part that was dedicated to a single department and other department huddled up together as well, but this is common in ABW as well. While this might not be perfect for the observations in terms of diversification of the workplace use, it also does not harm the observations.

16.3.2 Sample selection procedure

With sample selection, the risk of sample bias is always present. In this research, participants were recruited by recruitment messages. One can always wonder that, in the context of stress, more stressful people are inclined to answer the recruitment call, thus distorting the observations. One limitation that was foreseen, but could not be steered or adjusted, is that people who perceive themselves as very busy, are less inclined to participate, since they have the feeling that it would take up even more of their time.

Initially, there seemed to be a relatively low response rate to the email and the intranet message, but after some time, the mouth to mouth marketing gave an uptake in registrations, resulting in a satisfactory response rate. From these responses, the participants were chosen. The limiting factor in the participant selection, were the available ring sizes. This resulted into a natural division of male and female. In companies with an uneven gender division, this could result in distorted measurements, but this could be adjusted through analysis.

Privacy and ethics

During the selection procedure, privacy was an important aspect. As mentioned earlier, the company was not allowed to know who would participate, but also not who refused to participate, to avoid pressure on employees. Due to this fact, no extra help from the organization could be given in the recruitment of the participants, outside of the dispersion of the recruitment messages on the intranet. This in hindsight probable did decrease sample bias, since no specific departments or groups were targeted in the selection procedure.

In order to have well informed participants, all of the participants that started the observations were obligated to sign an Informed Consent Form, that contained information about the research procedures and future use of the acquired data. No (potential) participants refused to fill in the Informed Consent Form.

16.3.3 Observations

The actual data collection was done in two stages, a pre-observation survey and the observation period. The combination of these data formed the basis for the analysis.

Initial surveying

Alongside and partially after the selecting procedure, through survey inquiry some personal information was gathered about the potential participants. Only participants were allowed who filled in all the informed were eligible to participate in the actual observations.

Smart ring

Using the smart ring during the observations was experimental. While the ring is validated as a research instrument in literature, it was not exactly known what type of dataset would result from it. After having performed the observations, it was realized that the data from it, the stress score, could not be interpret as a representation of someone's absolute stress level. This was no problem for the important analysis but did remove the possibility to compare groups of people with each other, eliminating the chance to investigate the correlation between age and stress. Since this is not the core question of this research, this was no problem. However, due to the fact that this was not realized beforehand, it could have harmed the potential outcome of the research. Absolute stress is not possible to get from this smart ring but could be investigated by comparing it to the results from a psychological study on the same participant.

The smart ring worked well, but not without any problems. Sometimes the battery of the rings depleted more quickly than expected, resulting in parts of day with no measurements. One participant could not remove the ring anymore due to a swollen finger and had to be removed in the hospital. No lasting injury incurred, and the ring could, after receiving a replacement band, be used again. After this incident, extra attention was payed to make sure that participants did not select a ring that was too tight for them.

The smart rings (10 pieces) were bought from a Finnish Company by the internship company and later sold to the DUT. As compensation for buying these rings, an agreement was made that a part of the results of the research are going to be used to write a white-paper on the topic. This will be done by me, in combination with the internship company. No actual data is in ownership of the internship company, nor are they allowed to see any raw un-anonymized data.

Logbook

During the observation period, participants had to log their workplaces and activities on an interval of 15 minutes. They did not have to do this real-time but were allowed to do this at the end of the day. Observations aim to be as less intrusive in order to capture reality as much as possible, but at the same time, by filling in the logbook at the end of the day, the accuracy of the observations decreases. For workplace this was not such a big problem, because employees do not switch often and when they do, they have a relatively good feeling for when they did. For activity, this is much harder and resulted in a lower Kappa score.

Before the structured observations started, there was a plan to use tracking software to collect and reflect what programs the participants were using at what point in time during the workday. This would be used to map the activities of a person during the day. This method, however, raised two objections. The first being the accuracy and usability of the method. An email program would come up as an email program, but not as the task that was

performed in that email program. The same as a webbrower, or a Word-document, the actual task that someone is doing, is not obvious. The alternative to this, would be to present the findings to the participant at the end of the day, to help them fill in the logbook. The effort-benefit of this structure was deemed infeasible, thus not performed. The second objection was the willingness of the participants to allow their computer being tracked by a third person. Privacy objections could have been made, and with good reason, to someone looking at their computer use.

Black Box

This raised an interesting disposition to quantified metrics and the concept of 'black box'. With black box is meant that if a system is fully automated, one gives input and receives output, without knowing what happens in the actual system. One cannot know if the system sends the input to another system, if it is stored or used for something else then only giving the output. People accept this lack of transparency, because they want the benefit of receiving the output of the black box. While the structured observations were relatively visible in terms of data sharing, if this method is commercialised, probably a black box will be created in which someone's stress information goes. Collecting all of this stress information could be beneficial for future academic research but could also be sold to insurance companies or even future employers.

Plan for the worse hope for the best

When it came down to the observations, it was tried to make it as failproof as possible, eliminating complicating concepts, limiting variations of variables and mainly not taking into account the confounding variables. In hindsight, this was a good choice, when looking at the Kappa score, which resulted in fair. A more complex observation protocol would have only lowered this.

Two elements were not taken into account, that could have been very interesting in my opinion. These are sound level and occupancy rate. Both could have a profound effect on stress as suggested by literature. However, due to practical limitations, it was not possible to perform these measurements. I would highly suggest taking these into account when performing future research.

16.4 DATA ANALYSIS

One of the objectives for the data analysis, was that it was, for a large part, automated, so that it becomes transferable and allows for easy addition of extra data. This way, the proposed method in this thesis could be strengthened. To automate the analysis process, programming was used.

16.4.1 Python programming

The programming language Python is relatively accessible language, quick to learn, easy to read and easy to interpret, mind it is written in clear code. One of my learning goals for this thesis was to further develop my beginning Python skills and to be able to automate the analysis process. In the end, I succeeded in this objective. However, in hindsight, it costed me more time than I calculated that could have been spend on other things. At the same time, by using a programming perspective, it forced me to dive very deep into my data, getting a good grip and understanding of what data was available and how it could be analysed.

In the end I regard it as a great added value that I used programming, but due to the fact that I had no guidance in my programming process, some parts of it took longer than necessary. Also, programming is an emotional rollercoaster, that really confronts you with your own coping styles. A very relevant insight when doing research into stress.

I would recommend other students to learn how to program and apply it in their research process and analysis. However, I would advise to seek council in an early stage to help design the intended program.

16.4.2 Data limitations

Having collected over 3000 data bites and analysed them, it can be concluded that the introduced method does what is was intended for. However, it does have some limitations, some of which were not foreseen.

The level of detail of the stress score is very high, resulting a score with multiple numbers behind the comma. This does not represent the same level of detail for the actual stress level of a person, since the precise quantified relation is unknown. Thus, it does not make a whole lot of sense to use two decimals as statistical denotation prescribes. This is related to the fact that no absolute stress levels are known. It is also very hard to create an absolute stress level. This would probably require a salvia sample to determine cortisol levels, psychological assessment and physiological assessment. Way outside of the scope of this research. Therefore, no statements can be made about a person's absolute stress level and only about the differences between situations.

The last big limitation is the large amount of variable combinations of workplace characteristics, activities and activities types that do not result in significant values. While this is not strange, since there are over 1800 combinations and only 3000 data bites, it is still unfortunate, because the knowledge base becomes stronger with more significant values. This problem can be solved by doing more observations. A choice, however, needs to be made if regular observations should be performed in order to represent the actual situation, or interventions and experiments are to be done to fill in the gaps. From my perspective, I would like to see a proposed 'stress less' work environment tested based on the current findings as a next step.

16.5 DISSEMINATION

16.5.1Transferability

The current transferability of the findings is something that needs to be further investigated. Because only one organization is observed, confounding factors such as organizational culture might have a large impact on the findings but are not known. As previously discussed, there is still a large gap of variable combination to which no significant values have been found. Further research might display deviation from the findings or might strengthen current findings.

The method, however, is developed in a way that it is replicable. Since the entire analysis process is programmed, the only need for replicability is to change the input, thus the observation results. In terms of the structured observations, an extensive handout is written for users on how to perform and all related document such as the logbook are online documents that can be copied and used again.

16.5.2Validity

The biggest risk of the current research design comes from the observation protocol. Since the participants are also the observer in this design, personal perspectives could distort the way people perceive certain aspects. In this case that would be the different activities. While the activities have been defined and explained to the participants, their own perception and inaccuracy could lead to different results for each person. Ideally, this would be eliminated by assigning an external consequent observer, or even automate observations, but practical limitations prevent this for this study.

There can still be some debate on the possibility of making the stress score mathematical. No research has been into this phenomenon. The current operational model assumes a linear connection between the stress score and its impact. For now, there is no way of knowing if this is valid. This could be researched by doing an intervention study and seeing what differences result in what stress scores.

16.5.3Relevance

Societal

The research as it currently is, has less of a social impact than I imagined it to have at the start of the graduation process. In my mind, the new methods that were developed would allow for employees the immediately experience reduction in their stress levels. As discussed before, due to the knowledge gap that was not discovered yet, this turned out to be outside of the scope of the research.

At the same time, were there some expectations that deep and profound new insights in workplace characteristics would have found after the analysis of the results, that could lead to immediate improvements in the work environment. However, due to uncertainty in the cause of correlations, not a lot of hard statements can be made, without testing interventions first.

At the other hand, did this research strengthen some findings and supported some complaints in the work environment, giving those an improved argument to do something about it.

Stress is something that emerges within a person, and this person alone can deal with it. By performing this research, awareness about stress in the people surrounding me and the participants did increase, which could lead to an improved attitude towards stress. The interest in the research from outsiders was astounding, resulting in a lot of knowledge sharing among both professionals and interested persons.

Scientific

While the scientific results are limited in terms of findings on the relation between stress, activity and workplace characteristics, the findings on the developed method are far more important. With this research it is shown that stress research with objective sensor information is possible. This opens up a wide field of new research types that could be performed in the work environment. Not only stress could be researched, other bio-metrics could be used as well, as long as a feasible measurement device is found.

The methods developed in this research is especially useful for the testing of interventions. In contrast to surveys, continuous measurements can be done, with low disruption of daily routine and no questionnaire bias. While there are still limitations and accuracy risks, future research could improve the measurement method and diminish these. Combination of bio-metrics with other sensor data could create an even more profound overview of the workings of the work environment.

Data analysis of these types of studies are, however, more complicated when more data is added. This researched used a very large number of different variables that all can be analysed in combination, but not all findings are evenly relevant. Well defined research designs could positively scope these researches and create manageable studies.

Sectoral

In the real estate management profession some tools for accommodation advises exists, however, they are all completely reliable on the complexity and accuracy of the input. Currently, often due time and cost constraints, these inputs are flattened, removing the complexity. This is a shame, especially since the users for which these advises are produced, are diverse in desired and needs. This harms their satisfaction and productivity, which is something that decision-makers should want to avoid.

By adding a tool that gives more quantified and generalised insight into the representation of a diverse and complex problem, more arguments become available to open the dialogue about the added value of real estate, the quality of the work environment and in the end health

REFERENCES

Ackoff, R. L., & Sasieni, M. W. (1968). *Fundamentels of Operations Research*: Oxford: Wiley.

Alberdi, A., Aztiria, A., & Basarab, A. (2016). Towards an automatic early stress recognition system for office environments based on multimodal measurements: A review. *Journal of biomedical informatics, 59*, 49-75.

Allen, H., Hubbard, D., & Sullivan, S. (2005). The burden of pain on employee health and productivity at a major provider of business services. *Journal of Occupational and Environmental Medicine, 47*(7), 658-670.

Bakker, A. B., & Demerouti, E. (2007). The job demands-resources model: State of the art. *Journal of managerial psychology, 22*(3), 309-328.

Bakker, A. B., Demerouti, E., & Euwema, M. C. (2005). Job resources buffer the impact of job demands on burnout. *Journal of occupational health psychology, 10(*2), 170.

Bakker, A. B., Schaufeli, W. B., & Demerouti, E. (1999). Werkstressoren, energiebronnen, en burnout: het WEB-model. *J. Winnubst, F. Schuur & J. Dam (red.). Praktijkboek gezond werken*, 1-19.

Barendse, P., Binnekamp, R., De Graaf, R., Van Gunsteren, L., & Van Loon, P. (2012). Operations Research Methods: For managerial multi-actor design and decision analysis. In: Amsterdam: IOS Press.

Beijer, M., Brunia, S., De Bruyne, E., Gosselink, A., & Pullen, W. (2011). Activity wizard: Kennis over activiteitenpatronen van medewerkers.

Bodin Danielsson, C., Chungkham, H. S., Wulff, C., & Westerlund, H. (2014). Office design's impact on sick leave rates. *Ergonomics, 57*(2), 139-147.

Bracha, H. S. (2004). Freeze, flight, fight, fright, faint: Adaptationist perspectives on the acute stress response spectrum. *CNS spectrums, 9*(9), 679-685.

Bryman, A. (2016). *Social research methods*. Oxford: Oxford university press.

Buckman, A. H., Mayfield, M., & Beck, S. B. M. (2014). What is a smart building? *Smart and Sustainable Built Environment, 3*(2), 92-109.

Burton, W. N., Conti, D. J., Chen, C.-Y., Schultz, A. B., & Edington, D. W. (1999). The role of health risk factors and disease on worker productivity. *Journal of Occupational and Environmental Medicine, 41*(10), 863-877.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. J*ournal of health and social behavior,* 385-396.

Cross, R., & Prusak, L. (2002). The people who make organizations go–or stop.

Davis, M. C., Leach, D. J., & Clegg, C. W. (2011). The Physical Environment of the Office: Contemporary and Emerging Issues. *International review of industrial and organizational psychology, 26*(1), 193-237.

De Croon, E., Sluiter, J., Kuijer, P. P., & Frings-Dresen, M. (2005). The effect of office concepts on worker health and performance: a systematic review of the literature. *Ergonomics, 48*(2), 119-134.

Dewulf, G. P., Krumm, P. J. M. M., & De Jonge, H. (2000). *Successful corporate real estate strategies*: Arko Publishers.

Dym, C., & Little, P. (2004). *Engineering Design: A Project-Based Introduction*. Oxford: Wiley: John Wiley & Sons, Inc.

Edwards, J. R., Caplan, R. D., & Van Harrison, R. (1998). Person-environment fit theory. *Theories of organizational stress, 28*, 67.

Fleiss, J. L. (1981). *Statistical Methods for Rates and Proportions*. Second Edition: Wiley, John and Sons, Incorporated, New York, N.Y.

Flynn, B. B., Sakakibara, S., Schroeder, R. G., Bates, K. A., & Flynn, E. J. (1990). Empirical research methods in operations management. *Journal of operations management, 9*(2), 250-284.

Freudenberger, H. J. (1974). Staff burn-out. J*ournal of social issues, 30*(1), 159-165.

Gensler. (2008). *Gensler Design+Performance Report*. Retrieved from https://www.gensler.com/uploads/documents/2008_Gensler_Workplace_Survey_US_09_30_2009.pdf:

Iacovides, A., Fountoulakis, K., Kaprinis, S., & Kaprinis, G. (2003). The relationship between job stress, burnout and clinical depression. J*ournal of affective disorders, 75*(3), 209-221.

Kim, J., & De Dear, R. (2013). Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *Journal of Environmental Psychology, 36*, 18-26.

Lalonde, M. (1981). *New perspective on the health of Canadians a working document*: Minister of supply and services.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 159-174.

Lazarus, R. S. (1993). Coping theory and research: Past, present, and future. F*ifty years of the research and theory of RS Lazarus: An analysis of historical and perennial issues*, 366-388.

Lee, R. T., & Ashforth, B. E. (1996). A meta-analytic examination of the correlates of the three dimensions of job burnout. *Journal of applied Psychology, 81*(2), 123.

Leesman. (2017). *The Rise and Rise of Activity Based Working*. Retrieved from http://www.leesmanindex.com/The_Rise_and_Rise_of_Activity_Based_Working_Research_book.pdf:

Lefcourt, H. M. (1991). *Locus of control:* Academic Press.

Maddi, S. R. (2012). *Hardiness: Turning stressful circumstances into resilient growth*: Springer Science & Business Media.

Majchrzak, A., & Wang, Q. (1996). Breaking the Functional Mind-Set in Process Organizations. *Harvard Business Review, 7*4(5), 8.

Müller, J. (2017). Engaging with sensor-based methods for social sciences research is necessary, overdue and potentially rewarding [Blog post]. Retrieved from http://blogs.lse.ac.uk/impactofsocialsciences/2017/04/17/engaging-with-sensor-based-methods-for-social-sciences-research-is-necessary-overdue-and-potentially-rewarding/

Mylonas, G., & Carstairs, J. R. (2008). Open plan office environments: rhetoric and reality. *Advances in Organisational Psychology*, 443.

Nelson, E. C., Verhagen, T., & Noordzij, M. L. (2016). Health empowerment through activity trackers: An empirical smart wristband study. *Computers in human behavior, 62,* 364-374.

Pejtersen, J., Allermann, L., Kristensen, T., & Poulsen, O. (2006). Indoor climate, psychosocial work environment and symptoms in open-plan offices. *Indoor air, 16*(5), 392-401.

Public Health Agency of Canada. (2011). What Determines Health.

Regehr, C., Glancy, D., & Pitts, A. (2013). Interventions to reduce stress in university students: A review and meta-analysis. *Journal of affective disorders, 148*(1), 1-11.

Riechmann, S. W., & Grasha, A. F. (1974). A rational approach to developing and assessing the construct validity of a student learning style scales instrument. *The Journal of Psychology, 87*(2), 213-223.

Riratanaphong, C. (2014). Performance measurement of workplace change. *Architecture and the Built Environment*, 2, 378.

Rotter, J. B. (1971). Locus of control scale. *Psychology Today, 42.*

Salmon, P. (2001). Effects of physical exercise on anxiety, depression, and sensitivity to stress: a unifying theory. *Clinical psychology review, 21*(1), 33-61.

Setz, C., Arnrich, B., Schumm, J., La Marca, R., Tröster, G., & Ehlert, U. (2010). Discriminating stress from cognitive load using a wearable EDA device. *IEEE Transactions on information technology in biomedicine, 14*(2), 410-417.

Sohail, M., & Rehman, C. A. (2015). Stress and health at the workplace-a review of the literature. *Journal of Business Studies Quarterly, 6*(3), 94.

Stigsdotter, U. K., Ekholm, O., Schipperijn, J., Toftager, M., Kamper-Jørgensen, F., & Randrup, T. B. (2010). Health promoting outdoor environments-Associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey. S*candinavian journal of public health, 38*(4), 411-417.

Stringer, L. (2018). The Nesting Instinct: Why we "need" our own stuff and our own space at work.

Su, R., Murdock, C. D., & Rounds, J. (2015). Person-environment fit. *APA handbook of career intervention, 1*, 81-98.

Thayer, J. F., Åhs, F., Fredrikson, M., Sollers III, J. J., & Wager, T. D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: implications for heart rate variability as a marker of stress and health. *Neuroscience & Biobehavioral Reviews, 36*(2), 747-756.

TNO. (2017). *Factsheet NEA 2017*. Retrieved from http://www.monitorarbeid.tno.nl/publicaties/factsheet-nea-2017:

Torniainen, J., Cowley, B., Henelius, A., Lukander, K., & Pakarinen, S. (2015). *Feasibility of an electrodermal activity ring prototype as a research tool*. Paper presented at the Engineering in Medicine and Biology Society (EMBC), 2015 37th Annual International Conference of the IEEE.

Valks, B., Arkesteijn, M. H., & den Heijer, A. C. (2018). *Smart campus tools 2.0: An international comparison*. Delft: Delft University of Technology.

Valks, B., Arkesteijn, M. H., Den Heijer, A. C., & Vande Putte, H. (2016). *Smart campus tools: Een verkenning bij Nederlandse universiteiten en lessen uit andere sectoren*. Delft: TU Delft.

Van Loon, P. P. (1998). *Interorganisational design; a new approach to team design in architecture and urban planning*. (Phd dissertation), Delft University of Technology, Delft.

Veitch, J. A. (2011). Workplace design contributions to mental health and well-being. *Healthcare Papers, 11*(Special Issue), 38-46.

Vos, P. G. J. C., Van Meel, J. J., & Dijcks, A. A. M. (1999). *The Office, the whole office and nothing but the office*. Delft: Delft University of Technology.

Warr, P. (1994). A conceptual framework for the study of work and mental health. *Work & Stress, 8*(2), 84-97.

Weiler, D. T., Villajuan, S. O., Edkins, L., Cleary, S., & Saleem, J. J. (2017). *Wearable Heart Rate Monitor Technology Accuracy in Research: A Comparative Study Between PPG and ECG Technology*. Paper presented at the Proceedings of the Human Factors and Ergonomics Society Annual Meeting.

Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., . . . Bourne, P. E. (2016). The FAIR Guiding Principles for scientific data management and stewardship. S*cientific data, 3*.

Workplace. (n.d.-a). *In Cambrdige Dictionary*. Retrieved from: https://dictionary.cambridge.org/dictionary/english/workplace.

Workplace. (n.d.-b). *In Oxford Dictionaries*. Retrieved from: https://en.oxforddictionaries.com/definition/workplace.

World Health Organization. (2006). Constitution of the World Health Organization. *Basic Documents, 45*, 1-18.

World Health Organization. (n.d.). The determinants of Health. *Health Impact Assessment (HIA)*.

LIST OF FIGURES

LIST OF TABLES

APPENDICES TABLE OF CONTENT

APPENDIX I SAMPLE SELECTION

This appendix describes the sample selection process more in depth. It contains the texts used to recruit and inform the potential participants, the sample selection criteria and process.

RECRUITMENT MESSAGES

Participants are recruited in two stages: initial interest stage and the specified stage. This is done in two stages in order to reduce dropouts due to big commitments in the first contact stage.

Initial interest stage

For the first contact, employees of Colliers International were contacted through three methods:

1. An email
2. A stand-alone message on the intranet (Colliers Hub)
3. Reoccurring displayed on screen within the offices.

Email send to all employees of Colliers International Netherlands.

Beste medewerker van Colliers,

Mijn naam is Ruben den Uyl en voor mijn afstudeeronderzoek voor mijn masteropleiding *Management in the Built Environment* van de TU Delft, doe ik bij Colliers onderzoek naar de relatie tussen werkplek en stress. Hiervoor heb ik deelnemers nodig voor een experiment.

Stress in de werkomgeving is niets nieuws, maar staat de laatste jaren weer vol in de aandacht. Deze nieuwe methode is het direct meten van stress met een smart ring, waardoor real-time inzichten gegenereerd kunnen worden met betrekking tot de werkomgeving. Om deze methode te testen, wordt er onder de medewerkers van Colliers een experiment uitgevoerd.

Met de onderstaande link kunt u via een enquête heel simpel kenbaar maken dat u geïnteresseerd bent om deel te nemen aan het onderzoek.

[link to survey]

Wat houdt het onderzoek in voor u:
U zal gedurende 1 werkweek (maandag t/m vrijdag) de smart ring dragen. Deze ring zal gedurende de gehele werkdag gedragen moeten worden en tenminste één nacht. Ook zal u gevraagd worden om uw werkplekken en activiteiten bij te houden door aan het eind van elke dag een enquête in te vullen. Dit kost u ongeveer 5 minuten per dag.
Het totale experiment duurt meerdere weken, waarin elke week een nieuwe groep deelnemers gemeten zal worden.
Wat krijgt u ervoor terug:
Indien gewenst, ontvangt u na afloop van het onderzoek een overzicht van uw gemeten week, met eventuele inzichten die daar uit voortvloeien.
Privacy:
Al uw gegevens worden beschermd en zijn alleen direct inzichtelijk voor de TU Delft en uzelf. Uw werkgever heeft in geen enkel opzicht recht op de gegenereerde gegevens en zal deze nooit direct in kunnen zien. Dit geldt voor zowel de antwoorden op deze enquête, als de data uit het onderzoek.
In het kort:
Duur per deelnemer: 1 week
Wat: Dragen van smart ring + bijhouden werkplekken & activiteiten
Wanneer: Tussen 22 oktober en 21 december
Waarom: Inzicht krijgen in relatie werkplek en stress
Hoe: Vul de enquête in ([link to survey])
Als er vragen zijn over de enquête of over het onderzoek, neem dan contact op met Ruben den Uyl:
Email: XX of XX
Tel: XX
Bij voorbaat dank voor het invullen van de enquête!
Met vriendelijke groet,
Ruben den Uyl

Message on the intranet of Collier International Netherlands

MARKETING AND COMMUNICATIONS | Posted By Evers, Florine | 17 October 2018

Onderzoek naar stress op onze werkvloer: doe mee!

Ruben den Uyl doet voor de masteropleiding Management in the Built Environment van de TU Delft zijn afstudeeronderzoek bij Colliers. Zijn onderzoek gaat over de relatie tussen werkplek en stress. Hiervoor heeft hij deelnemers nodig voor een experiment.

'Stress in de werkomgeving is niets nieuws, maar staat de laatste jaren weer vol in de aandacht. Dit onderzoekt gebruikt een nieuwe methode om dit in kaart te brengen door direct meten van stress met een smart ring, waardoor er real-time inzichten gegenereerd over de werkomgeving', vertelt Ruben. 'Om deze methode te testen, wordt er onder de medewerkers van Colliers een experiment uitgevoerd. Het totale experiment duurt meerdere weken, waarbij iedere week een nieuwe groep deelnemers wordt gemeten.

Wat houdt het onderzoek in:
Iedere deelnemer draagt één werkweek (maandag t/m vrijdag) een smart ring. Deze ring moet tijdens het werk en minimaal één nacht gedragen worden. Aan het eind van de dag vul je als deelnemer een enquête in over je werkplekken en activiteiten. Dit kost ongeveer vijf minuten per dag.

Wat krijg je ervoor terug?
Als je het interessant vindt, ontvang je na afloop van het onderzoek een overzicht van de gemeten week, inclusief eventuele inzichten die daar uit voortkomen.

Privacy:
Alle gegevens worden beschermd en zijn alleen direct inzichtelijk voor de TU Delft en jezelf. Je werkgever heeft in geen enkel opzicht recht op de gegenereerde gegevens en zal deze nooit direct in kunnen zien. Dit geldt voor zowel de antwoorden op deze enquête, als de data uit het onderzoek.

Wil je meedoen aan het onderzoek? Vul dan hier de enquête in. Of scan de QR code.

First survey

The survey was created with Microsoft Forms, an online tool to make surveys. It allows for path redirection (answer dependable routing) and easy collectable answers, by extracting CSV files. Below the questions are stated, with the dependable routing of the answers. The survey is in Dutch, since all potential participants are Dutch speaking.

Introduction

Beste deelnemer,

Met deze enquête kunt u heel simpel kenbaar maken dat u geïnteresseerd bent om deel te nemen aan het onderzoek.

Privacy:
Al uw gegevens worden beschermd en zijn alleen direct inzichtelijk voor de TU Delft en uzelf. Uw werkgever heeft in geen enkel opzicht recht op de gegenereerde gegevens en zal deze nooit direct in kunnen zien. Dit geldt voor zowel de antwoorden op deze enquête, als de data uit het onderzoek.

Deze enquête duurt minder dan 5 minuten en bevat 6 korte vragen.

Mochten er vragen zijn over het onderzoek of deze enquête, neem dan contact op met Ruben den Uyl:
Email: ruben.denuyl@colliers.com of rgdenuyl@gmail.com
Tel: +316 10 22 34 82
Bij voorbaat dank voor het invullen van de enquête!
Met vriendelijke groet,
Ruben den Uyl

Sectie 1		
Vraag 1		
Bent u geïnteresseerd in deelname van het onderzoek?		
• Ja		Naar Sectie 3
• Nee		Naar Sectie 2
Sectie 2		
Vraag 1.b		
Waarom bent u niet geïnteresseerd in deelname van het onderzoek?		
• Geen interesse		Naar Einde
• Geen tijd		Naar Einde
• Vanwege privacy		Naar Einde
• Anders…	[Tekst]	Naar Einde
Sectie 3		
Vraag 2		
Wat is uw naam		
[Tekst]		Naar Vraag 3
Vraag 3		
Wat is uw email? (Zowel werk als privé wordt geaccepteerd		
[Tekst]		Naar Vraag 4
Vraag 4		
Hoeveel procent van uw werkweek bent u op kantoor?		
• 0-20%		Naar Vraag 5
• 20-40%		Naar Vraag 5
• 40-60%		Naar Vraag 5
• 60-80%		Naar Vraag 5
• 80-100%		Naar Vraag 5
Vraag 5		
Op welk kantoor bent u het meest?		
• Amsterdam		Naar Vraag 6
• Amsterdam Zuidoost		Naar Vraag 6
• Rotterdam		Naar Vraag 6
• Eindhoven		Naar Vraag 6
• Den Bosch		Naar Vraag 6
• Eindhoven		Naar Vraag 6
• Zwolle		Naar Vraag 6
Vraag 6		
Wilt u nog iets kwijt over het onderzoek of de enquête of heeft u een vraag?		
[Tekst]		Naar Einde
Einde		
Uw antwoord is verzonden. Bedankt voor het invullen van de enquête. U zult per mail op de hoogte worden gesteld of u in aanmerking komt voor het experiment.		

Second survey

Introduction

Beste deelnemer,

In deze enquête zullen vragen gesteld worden over persoonlijke gegevens van u. Deze gegevens zijn nodig om analyses te kunnen verrichten en om de logistiek van het experiment mogelijk te maken. Denk hierbij aan de grootte van uw vinger, zodat er een passende ring aanwezig is en welke week u zich het meest op kantoor bevindt.

Als er vragen zijn over de enquête of over het onderzoek, neem dan contact op met Ruben den Uyl:
Email: ruben.denuyl@colliers.com of rgdenuyl@gmail.com
Tel: +316 10 22 34 82

Bij voorbaat dank voor het invullen van de enquête!
Met vriendelijke groet,
Ruben den Uyl

Sectie 1

Vraag 1
Wat is uw naam?
[Tekst] — Naar Vraag 2

Vraag 2
Wat is uw email die u wilt gebruiken tijdens het experiment?
[Tekst] — Naar Vraag 3

Vraag 3
Hoe vaak bent u gemiddeld op kantoor gedurende de werkweek?

• 0-20%	Naar Vraag 4
• 20-40%	Naar Vraag 4
• 40-60%	Naar Vraag 4
• 60-80%	Naar Vraag 4
• 80-100%	Naar Vraag 4

Vraag 4
Op welk kantoor bent u het meest?

• Amsterdam	Naar Vraag 5
• Rotterdam	Naar Vraag 5
• Den Bosch	Naar Vraag 5
• Nieuwegein	Naar Vraag 5
• Anders	Naar Vraag 5

Vraag 5
Hoe vaak verandert u van werkplek (Onder werkplek wordt een specifiek bureau bedoeld)

• Nooit	Naar Vraag 6
• Minder dan een keer per week	Naar Vraag 6
• 1-2 keer per week	Naar Vraag 6
• 3-4 keer per week	Naar Vraag 6
• Bij de start van elke dag	Naar Vraag 6
• Eenmaal tijdens de dag	Naar Vraag 6
• Meerdere malen tijdens de dag	Naar Vraag 6

Vraag 6
Welke ringmaat heeft u?
(Weet u uw ringmaat niet? Gebruik de volgende site https://findmyringsize.com/en/choose-your-ring-for-ring-size-chart.aspx, en gebruik Nederlandse maten)
[Tekst] — Naar Vraag 7

Vraag 7
Voor de komende3 weken, geef aan of u beschikbaar bent voor het experiment.
(Om beschikbaar te zijn, moet u op de maandag van de week een korte introductie bijwonen en op vrijdag de ring inleveren op kantoor. Bij minder dan 50% aanwezigheid op kantoor in die week, of de maandag en vrijdag zijn een probleem, geef Verminderd Beschikbaar op.)

	Beschikbaar	Verminderd beschikbaar	Niet beschikbaar	Nog niet bekend
5-9 november	○	○	○	○
12-16 november	○	○	○	○
19-23 november	○	○	○	○
26-30 november	○	○	○	○
3-7 december	○	○	○	○
10 -14 december	○	○	○	○
17-21 december	○	○	○	○

Einde

Uw antwoord is verzonden.
Bedankt voor het invullen van de enquête. U zult per mail op de hoogte worden gesteld of u in aanmerking komt voor het experiment.

APPENDIX II PRIVACY AND CONFIDENTIALITY

The observations that take please during the research aim to gather different types of data that are all can be identified as personal information. Personal information is something delicate and needs to be protected, to ensure that no advantage is taken of the participants. This appendix contains a detailed description of the steps taken in order to ensure both privacy and confidentiality of the data. It also describes the process of the Human Research Ethics Committee application and approval.

RELEVANCE OF PRIVACY AND CONFIDENTIALITY

In 1890 the article The Right to Privacy was written by Samuel Warren and Louis Brandeis, which they introduced the concept privacy as the right to be let alone. This means that a person can choose seclusion from the attention of others, in a physical or behavioural manner. (Solove, 2008)

Later, this term privacy has been further developed and becoming a right to people by law. The definition of the right to privacy has not often been given in literature, due to it being hard to find common grounds between leading kinds of privacy (Onn, Y. et al, 2005), however an attempt has been made with regards to the digital environment:

"The right to privacy is our right to keep a domain around us, which includes all those things that are part of us, such as our body, home, property, thoughts, feelings, secrets and identity. The right to privacy gives us the ability to choose which parts in this domain can be accessed by others, and to control the extent, manner and timing of the use of those parts we choose to disclose."

The ability to close of information and the choice to disclose are two main concepts in this definition. This can be seen in current legislation as well, such as the in 2018 adopted General Data Protection Regulation (GDPR), the Algemene Verordening Gegevensbescherming (AVG) in Dutch. This legislation focusses mainly on the use of personal information and data.

In the GDPR Article 4, personal information or personal data is defined as:

"any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person"

This is definition comprises a wide variety of data. Because of the delicate nature, the often invisibility of the data and the boundlessness of the digital world, the European Union decided that centralized legislation was in order to protect the rights of its citizens.

GENERAL DATA PROTECTION REGULATIONS

The GDPR is a European law that suggests Member States to create an Implementation Act General Data Protection Regelation (IAGDPR), on the basis of regard number 8 of the GDPR. Within the IAGDPR, the national implications are stated regarding the data protection of its citizens.

The Dutch Data Protection Agency (Dutch DPA) summarized the IAGGDPR with the overview as can be seen in Figure A1.

For this research, the following articles and paragraphs of the IAGDPR are of importance:

- Article 22, paragraph 1: it is allowed to collect personal data with the permission of that person.
- Article 24: allowance to gather person data for scientific research, taken into account to minimize the use as much as possible.
- Article 44: the allowance to process personal data by scientific entities for research or statistics, if precautions have been taken to ensure use of the data is exclusive to the research.

These articles state that it is allowed for research to use personal data, with permission of the participant.

Example: Separation between employee and employer

In 2016, Colliers International performed the Quantified Workplace experiment. During this experiment, 40 employees of their Rotterdam office accepted the challenge to wear a wearable device (Fitbit Charge) for a year to collect and share measured information. While all participants voluntarily applied to the experiment, the Dutch DPA ruled that what they were doing was unlawful (Autoriteit Persoonsgegevens, 2016). They ruled that an employee is never completely free to choose to say yes or no to such experiment, due to an unequal relationship between employee and employer. This creates an exception on the previously discussed rule that with permission of the user personal data can be shared. This can never be the case between employees and employer.

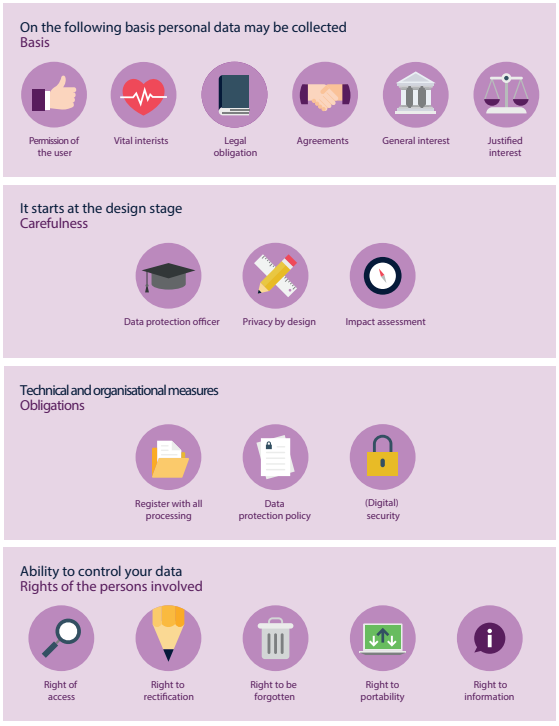


Figure A1. GDPR in a nutshell (source: own ill. adopted from Autoriteit Persoonsgegevens)

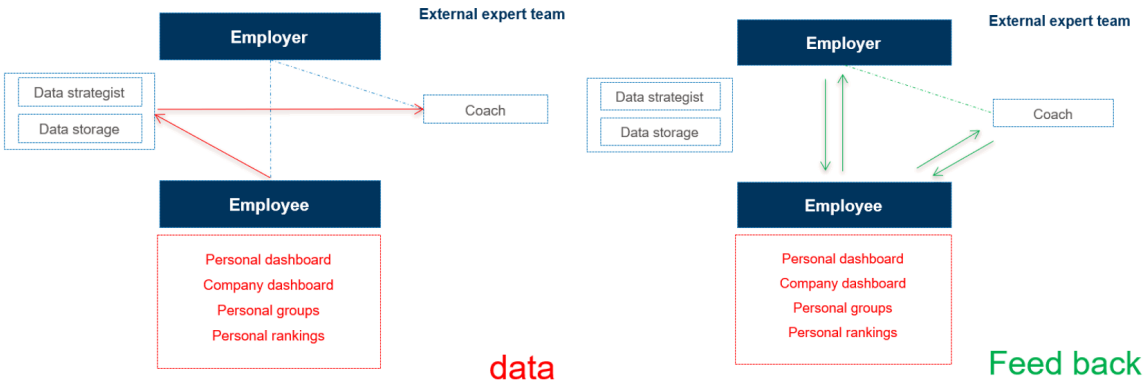


Figure A2. Data collection method within organizations (source: Colliers International, 2016)

Because of this decision, Colliers International decided to stop the experiment. They continued to investigate ways that this type of health monitoring for employees would be possible. In doing so, they came up with the following construction as can be seen in Figure A2. This construction aims to remove the direct connection between the employee and employer when it comes to personal data. Data can only be transferred to a data specialist that processes the data. The outcomes of this data, in the form of an advice can be shared to a coach. This coach than has the ability to provide feedback. This feedback contains no detailed personal data, only processed elements. The coach can then give this feedback to the employee. It could be possible for the coach to provide the feedback to the employer, but only in a structure that would be similar to a manager giving information to a human resources department on things they noticed of the employee, for instance signs of burn out, distraction etc.

GDPR IMPLICATIONS

Although the legislation allows the research to collect personal data with the permission of the participants, it still obligates to review the research on the basis of different aspect of the data collection, processing and retention. Following the four stages as mentioned in Figure 42, the section below shortly describes how this research takes this into account.

Basis

The personal data is collected on the basis of permission of the user, by means of a signed Informed Consent form, describing the research procedures, data storage, data processing and data use.

Carefulness

Data protection officer

In the case of this research, the principal researcher Ruben den Uyl is the data protection officer, managing all data collection, storage and use.

Privacy by design

The privacy of the personal data has been a requirement within the design of the Data Management Plan (DMP, see 0). This ensures that a structure exists before the actual data is gathered, and guidelines exist to process the data.

Impact assessment

For the application for the Human Research Ethics Committee, the Ethics Review Application is written (see section Application Human Research Ethics Committee). Within this document an impact assessment is done to identify risks and generate solutions to minimise these risks.

Technical and organizational measures

Register with all processing

The gathered data will be stored at multiple places, the main storage place being a cloud service provided by the university (Surfcloud). Within this storage, the raw data is stored. Every time the data is processed, new version will be created. These versions will be logged in a file, containing the original documents, new documents and processing steps. Besides that, a document will be stored were all the use of the data is logged, both internal of the research, as external.

Data protection policy

In order to be allowed to store the personal data of the participants, an Informed Consent Form (see 0) must be signed. In this document the policy for data protection is described and approved by the participant for each step.

(Digital) security

The security of the data is being managed by password protection. The data is threefold:

1. the personal data provided by the user in the online form, that they can view and change online. The link for this page is sent to their private email.
2. The stored raw data is being protected by means of passwords and stored on the university cloud storage and on local storage.
3. The stored processed (anonymised) data that will be available for future research, is protected by means of a data request protocol on a certified repository.

Ability to control your data

The GDPR gives more rights to the people of whom information is collected. Article 89, Paragraph 2 of the GDPR states that when personal data is processed for archiving purposes in the public interest, derogations of the right stated below can be made. Therefore, within scientific research in the public interest, the below stated rights do not have to be taken into account. What research for the public interest exactly is, is not that well defined. The Delft University of Technology (n.d. a) states that these rights should be taken into account. For this study all the rights will be taken into account, due to the sensitive history of the case company with the Dutch DPA (see the example above) and as a test for future possible applications that do not fall under the exceptions mentioned in Article 89, Paragraph 2 of the GDPR.

Right of access

Users have the right to see the data that is collected of them. Within the research, participants can request to see their data by contacting the researcher, who will make the data available to them, as stated in the Informed Consent Form.

Right to rectification

Users have the right to change information that is gathered about them. The participants can change the data that is gathered about them by contacting the researcher. Due to the scientific value of the information, only data that is changed within one day will be accepted for further analysis, because it is expected that human error in memory will increase over time.

Right to be forgotten

Users have the right for their data to be erased. For this study, the personal raw data will be erased by default, unless specifically permission is granted within the Informed Consent Form. However, it is always possible for participants to later on enforce their right to be forgotten, by informing the researcher of this request. It will not be possible to remove the anonymised data after the study, since it does not contain personal information anymore and it should not be possible to trace it back, therefore the right to be forgotten does not apply anymore.

Right to data portability

When the processing of personal data is based on contract or consent, such as this study, the data subject has a right to data portability. The data that should be provided is data concerning the data subject and data provided by the data subject. In the case of this study, this is all the collected and processed data of the specific participant. The data will be shared by email, with a CSV or Excel file type, to ensure enabling of use for the participant.

Right to information

Users have the right to information about the use and storage of their data. This must be as transparent as possible. Normally, this would be done with a Privacy Policy that users can agree with. For this study, the information is provided within the Informed Consent Form, and contains all information that is needed for the participant.

APPLICATION HUMAN RESEARCH ETHICS COMMITTEE

Since this study contains human participants, an application to the Human Research Ethics Committee (HREC) is required (Delft University of Technology, n.d. b). This commission reviews studies on the basis of their ethical impact on the human participants of these studies. It is mandatory to do a screening of the proposed study by this committee. This study uses personal data, which is considered as sensitive and must therefore be adequately be managed and protected.

In order to apply for the HREC for a study that uses personal data such as this study, the following documents need to be prepared:

1. Ethics Review Checklist for Human Research
2. Ethics Review Application
3. Data Management Plan
4. Informed Consent Form

While documents 1 and 2 are application forms, the Data Management Plan (DMP) and Informed Consent Form (ICF) are documents actually describing the data process. The DMP (see 0) is defined as the following: ***"A data management plan is a document that describes how the data will be generated or used within a given project, how they will be collected, managed, stored and made available during the study, and how they will be shared upon completion of the research project."*** (Delft University of Technology, n.d. c). This document serves the purpose of introducing the researcher to research different methods for data management. The result is a data use strategy for the study and increases the quality of the final data processing design. The Informed Consent Form (ICF, see 0) is needed to comply with the GDPR regulations and with the standards of the NWO (Dutch Organization of Scientific Research). In this ICF participation are made aware of the implications of the research, mainly of the grounds of the use of personal information. They are required to sign the document before being eligible to participate.

Once the HREC has reviewed the documents, they will decide if the proposed study meets the demands for sufficient protection of the human participants. This study received its approval of the HREC on 30th of October, 2018.

REFERENCES

Autoriteit Persoonsgegevens. (2018). AP: Verwerking gezondheidsgegevens wearables door werkgevers mag niet. Retrieved 5-10-2018 from: https://autoriteitpersoonsgegevens.nl/nl/nieuws/ap-verwerking-gezondheidsgegevens-wearables-door-werkgevers-mag-niet

Autoriteit Persoonsgegevens. (2018). AVG in een notendop. Retrieved 5-10-2018 from: https://autoriteitpersoonsgegevens.nl/sites/default/files/atoms/files/avg_in_een_notendop_2.pdf

Colliers International. (2016). Health, well-being & empowerment [PowerPoint slides].

Delft University of Technology. (n.d. c). Data paragraphs and data management plans. Retrieved 5-10-2018 from: https://www.tudelft.nl/en/library/current-topics/research-data-management/research-data-management/setting-up-research/data-paragraphs-and-data-management-plans/

Delft University of Technology. (n.d. a). GDPR. Retrieved 8-10-2018 from: https://www.tudelft.nl/en/about-tu-delft/strategy/strategy-documents-tu-delft/integrity-policy/human-research-ethics/gdpr/#c369111

Delft University of Technology. (n.d. b). Human Research Ethics. Retrieved 4-10-2018 from: https://www.tudelft.nl/en/about-tu-delft/strategy/strategy-documents-tu-delft/integrity-policy/human-research-ethics/

General Data Protection Regulation. (2018, EU 2016/679). Retrieved 5-10-2018 from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32016R0679

Onn, Y., Geva, M., Druckman, Y., Zyssman, A., Timor, R. L., Lev, I., ... & Sicklai, S. (2005). Privacy in the digital environment. Haifa Center of Law & Technology, 1-12.

Solove, D.J. (2008). Understanding Privacy. Cambridge, Massachusetts: Harvard University Press.

Uitvoeringswet Algemene verordening gegevensbescherming. (2018). Retrieved 5-10-2018 from: http://wetten.overheid.nl/BWBR0040940/2018-05-25#Hoofdstuk4_Artikel44

APPENDIX III DATA MANAGEMENT PLAN

This appendix contains the Data Management Plan (DMP), drafted according to a template provided by the Delft University of Technology. The DMP contains a description of what data is being collected, how this is done, how it is stored, how it is processed and how it is shared for reuse.
The plan strives to be according to the FAIR principles (Wilkinson et al, 2016), as is mentioned in the instructions for data paragraphs and management plans (Delft University of Technology, n.d.)

A. DATA COLLECTION

1) What type of research will be carried out?

The research will involve observations based on sensor readings and survey results. The sensor readings will come from a Moodmetric ring, a wearable device that measures electrodermal activity (EDA), a biomarker for stress. Participants will fill in a survey at the end of each day in order to determine their workplaces and activities throughout the day, and their self-rated productivity and stress.

2) Will you also use pre-existing data? From where?

No

3) What type of data will be collected for each type of research stated in question #1?

All raw data that will be collected is personal data: EDA (biometric data), workplace (location data), current activity, self-rated productivity and self-rated stress (health data), contact information (name, email) and personal characteristics (age, function, gender).

After processing, the data will be depersonalised, meaning that workplace becomes workplace type, activity becomes activity type. For the analysis of this thesis, the personal characteristics will be used, however this will be removed from the reusable processed data after the research, due to privacy reasons.

4) How will the data be collected?

Please specify how data collection will be carried out for each type of research stated in question #1.

- *EDA will be gathered through the use of a Moodmetric ring.*
- *Workplace data will be gathered through a survey.*
- *Activity will be gathered through a survey.*
- *Self-rated productivity will be gathered through a survey.*
- *Self-rated stress will be gathered through a survey.*
- *Personal characteristics will be gathered through a survey.*

5) In what file formats?

Please specify this for each type of research stated in question #1.

All data will be stored as .csv.

6) What is the estimated size of the data?

Please specify this for each type of research stated in question #1.

The total data size is estimated to not exceed 1GB.

7) Which tools or software are needed to create/process/visualize the data? Are these tools/ software already available or must be acquired?

Excel and SPSS. These tools are available via the university.

8) How will version control be handled?

Every time data is altered, a new file is created, separating from the original data file. This is only needed when analysis and data alteration is being done. Therefore, the data becomes reproductible once it is gathered and stored. A backup on a different storage place will be created, to prevent accidental loss of information.

B. DATA STORAGE AND BACK-UP

9***) How will the raw/processed/models/codes/other data be physically stored during the research?***

Raw (stress, workplace, activity, self-rated productivity, self-rated stress and personal characteristics) and processed data (combined data and analysis) and consent forms will be stored locally.

10) How will the backups be carried out during research?

Raw (stress, workplace, activity, self-rated productivity, self-rated stress and personal characteristics) and processed data (combined data and analysis) and consent forms backups will be stored in a cloud storage of the TU Delft (Surfdrive).

11) How will the data be shared with supervisor or collaborators when needed?

Data will be shared with supervisor by means of cloud storage of the TU Delft (Surfdrive)

C. DATA DOCUMENTATION

12) How will your data be documented during the research?

The master thesis will come available on the TU Delft repository and is accessible for all.

General protocols (participate manual, data processing protocol) and questionnaires are added in the appendix of this thesis. In this thesis, processed data can be included, if sufficiently anonymized, so that no back tracing to the participants is possible.

Research data will be stored on the Surfdrive and can be accessed with authorization of the researcher. A readme.txt file will be added in the directories (both locally and at the Surfdrive backups) that provide data documentation of all gathered data.

No raw data will be made publicly after the project is finished, due to the possibility of identification. Raw data can be requested and be made available with consent of the researcher and the participants.

D. DATA ACCESS

13) Who owns the raw data and deliverables from the project?

The participants (data subjects) own the data about their personal data and activity. The researcher and TU Delft own the raw data based on consent received from the participants. The ownership of the processed data after anonymization, belongs to TU Delft and the researcher. However, publishing rights are limited, and consent of the researcher are needed.

E. DATA SHARING, REUSE AND ARCHIVING

14) Which data will remain closed and why? Where will it be stored?

The contact information (name and email), some raw data (age, function, gender, workplace and activity) and the consent forms that indicated to be willing to be contacted regarding future research, will remain closed. This data contains information that can lead back to participants, thus infringing privacy. It will be stored in a separate folder on the cloud storage (Surfdrive).

In the informed consent form, a box indicates that participants can choose to be contacted in the future to either participate in a new research or make their data available for that research. Thus, for future research, this data can be requested, however new consent will be to be asked.

15) Which data will be suitable for reuse?

Processed data will be available and suitable for reuse. This data will be data without participant IDs, age, gender and function. This limits the potential reuse, since no personal profiles can be recreated.

16) Regarding the data that will be suitable for reuse, how will it be made accessible to the public?

The reusable data will be uploaded to a data repository with a doi for public access. A proper open access license will be chosen for data sharing for the purpose of research and education only.

REFERENCES

Delft University of Technology. (n.d.). Data paragraphs and data management plans. Retrieved 5-10-2018 from: https://www.tudelft.nl/en/library/current-topics/research-data-management/research-data-management/setting-up-research/data-paragraphs-and-data-management-plans/

Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., . . . Bourne, P. E. (2016). The FAIR Guiding Principles for scientific data management and stewardship. Scientific data, 3.

APPENDIX IV INFORMED CONSENT FORM

This appendix contains the Informed Consent Form that has been distributed to the participants of the study. In order for the participant to be eligible to participate, boxes 1 to 6 need to be ticked YES. Box 7 and 8 are optional, but desired. However, this is not communicated to the potential participants in advance, in order to minimize external pressure.

Informed consent form

Stress in the Work Environment Study

Authors : Ruben den Uyl
Last edited: 04 October 2018

You are invited to participate in a research study conducted by Ruben den Uyl, who is a Master student from the Management in the Built Environment Department at the Technical University Delft. Ruben den Uyl is conducting this study for his Masters degree. Ir Monique Arkesteijn is the faculty mentor associated with this project.

Your participation in this study is entirely voluntary. You should read the information below and ask questions about anything you do not understand, before deciding whether or not to participate. You are being asked to participate in this study because you are a employee of Colliers International.

1. Purpose of the research

The purpose of this study is to create insights into the relation between stress and the work environment, by means of measuring real-time stress data. Real-time stress measurements have never before been used to investigate this phenomenon. By combining data on the participants current workplace, current activity and current stress level, we hope to come to conclusions that could improve the understanding and use of work environments for employees. The observation period for one participant is 5 consecutive days, from Monday to Friday.

2. Benefits and risks of participating

By participation in this research, you help creating insight in the before mentioned problems, and also gain some knowledge and insight into your own health. At the end of the study the participants can choose to receive an overview of their measurements.
We expect that any risks, discomforts, or inconveniences will be minor and we believe that they are not likely to happen. If discomforts become a problem, you may discontinue your participation.

3. Procedures for withdrawal from the study

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study and you will not lose any benefits to which you are otherwise entitled.
A participant can withdraw by contacting the researcher either by email or phone. The participant will have to return all project related material. After that, the researcher will delete all generated data of the participant. No mentioning of the participant or the withdrawal will be done.

4. Gathering of personal data during the research

During this research, personal data will be gathered. This includes demographical data, location data and health data. The data will be protected and anonymised as can be read in section 5.
Before the start of the observation period, participants will have to fill in some personal information, namely: *name, email, age, gender, function* and *main work location*. This data will be analysed to see if they are of influence on the measurements done during the observation period.
There are four types of data that will be collected during the observation period.

I. *Current stress level of participant*
   The participant will wear a wearable device (a *Moodmetric* ring) that measures the electrodermal activity (EDA), a indicator of stress of the body. No actions by the participants are needed, besides wearing the device.
II. *Current workplace of participant*
   Participants will have to indicate which workplaces they use during the day, with a precision of 15 minutes. This will be done by an online form that participants will have to

fill in at the end of each day. This workplace information will be translated into a workplace type. This means that no actual location data will be used for the analysis.

III. *Current activity of participant*
Participants will have to indicate which activity they are performing during the day, with a precision of 15 minutes. This will be done by an online form that participants will have to fill in at the end of each day. To help them with this, the program *RescueTime* will be installed on their computer for the duration of the observation period. This program collects data on the computer use and sorts it into categories. This will be presented to the participant at the end of the day in order to help them fill in the online activity form, which is the guiding information used in the analysis.

IV. *Daily self-rated stress and productivity*
At the end of the day, in the online form, participants will be asked to rate their stress and productivity of that day.

After the observation period, the data will be analysed to see if certain combinations between workplaces and activities yield higher stress levels. The data will be adjusted for possible influential personal characteristics.

Participants can request to see and rectify their gathered data during the observation. After the observation they can request to see and erase it. If a participant chooses to rectify data after the observation period, it is possible, but the data will not be used during the analysis.

5. Use of data, anonymization, storage and reuse.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of a participation ID to let the researchers know who you are. We will not use your name in any of the information we get from this study or in any of the research reports. When the study is finished, the list that links your name, email, age, gender and function to your participation ID, will be secured and stored separately, not to be accessed anymore without further consent from the participant, unless you choose No for consent point 8, than it will be erased.

Information that can identify you individually will not be released to anyone outside the study. This includes *name, email, age* and *function* The researcher will, however, use the information collected in his thesis and other publications. We also may use any information that we get from this study in any way we think is best for publication or education. Any information we use for publication will not identify you individually.

6. Retention of data for further use

The retention period of the data is 10 years. Anonymized data (participant ID, stress level, workplace type, activity type, self-rated productivity and stress) will be available for future research. Personal information (*name, email, age, gender* and *function* will be stored separately and is not accessible without explicit consent of the participant, unless you choose No for consent point 8, then it will be erased.

7. Contact details of the researcher

If you have any questions or concerns about the research, please feel free to contact us.

Ruben den Uyl
Principal Investigator
Faculty of Architecture and the Built Environment
Delft University of Technology
Julianalaan 134, 2628 BL, Delft
+316 10 22 34 82
rgdenuyl@gmail.com

Ir Monique Arkesteijn
Associate Professor
Faculty of Architecture and the Built Environment
Delft University of Technology
Julianalaan 134, 2628 BL, Delft
+316 39 25 14 47
m.h.arkesteijn@tudelft.nl

If there are any complaints on how the data is handled during or after the study, please contact:

Yan Wang
Data Steward
Faculty of Architecture and the Built Environment
Delft University of Technology
Julianalaan 134, 2628 BL, Delft
y.wang-16@tudelft.nl

Consent Form for Stress in the Work Environment Study

Please tick the appropriate boxes	Yes	No
Taking part in the study		
1. I have read and understood the study information dated 01/10/2018, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	□	□
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	□	□
3. I understand that taking part in the study involves wearing a wearable devices that measures electrodermal activity for the duration of 5 days, filling in a daily survey form on my workplaces, activities and self-rated stress and productivity.	□	□
4. I understand that taking part in the study involves the following risks: - minor physical discomfort - risk of participant identity being revealed	□	□
Use of the information in the study		
5. I understand that information I provide will be used for the master thesis of the researcher, possible publications on the findings of the research, future research and educational purposes.	□	□
6. I understand that personal information collected about me that can identify me, such as my name, will not be shared beyond the study team.	□	□
Future use and reuse of the information by others		
7. I give permission for the measured stress level, workplace type, activity type, self-rated stress and self-rated productivity that I provide to be archived in 4TU Research Data repository as a database so it can be used for future research and learning. I understand that the data is anonymized by the exclusion of personal information, so that it can't be traced back to the identity of the participant. I understand that access to the data is restricted and can only by accessed with consent of the researcher. Data can only accessed for research or educational purposes.	□	□
8. I give permission to be contacted by the researcher to either participate in future research or to give permission to use my personal information for future research.	□	□

Signatures

_____ _____ _____

Name of participant _____ Signature Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____ _____ _____

Researcher: Ruben den Uyl Signature Date

Study contact details for further information: Ruben den Uyl | tel: +31610223482 | email: rgdenuyl@gmail.com

APPENDIX V USER MANUAL OBSERVATIONS

This appendix ....

OPSTART EXPERIMENT

INTRODUCTIE ONDERZOEKER

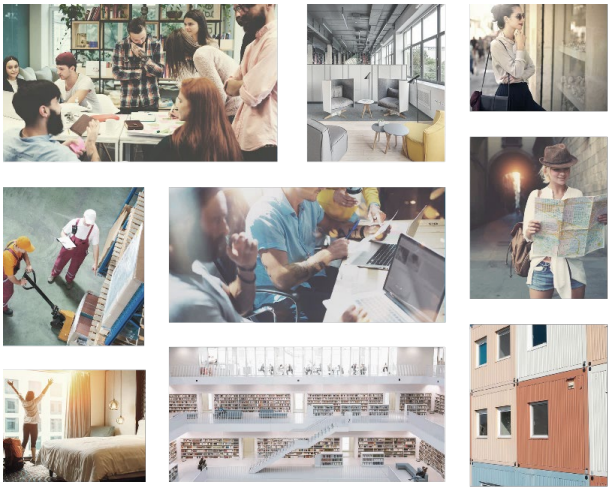
AFSTUDEER ONDERZOEKER RUBEN DEN UYL

[redacted]

www.linkedin.com/in/rubendenuyl

Rgdenuyl@gmail.com

Ruben studeert af aan de Technische Universiteit Delft met zijn onderzoek ‘Stress in the Work Environment’ voor de masteropleiding Management in the Built Environment. Voor vragen over het uitvoeren van het experiment, de data analyse en de privacy kan je bij hem terecht. Namens Ruben bedankt voor de deelname aan het experiment!



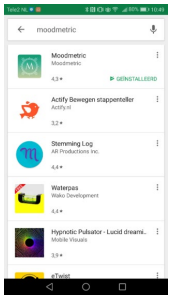
INHOUD

HOE WERKT HET?

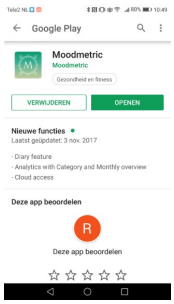
- Het experiment bestaat uit twee delen:
  - De smart ring die automatisch jouw stresslevel meet
  - Het loggen van jouw werkplek en werk activiteiten
- Hoe werkt de ring?
  - Slaat eerst de data in de ring zelf op
  - Als met mobile via Bluetooth verbonden is en gesynchroniseerd wordt, verplaatst de data van de ring naar de app op je telefoon.
  - Eens in de zoveel tijd synchroniseert de data uit de app met de Cloud van Moodmetric (de ring fabricant)
- Gegevens over werplek, activiteit en stress worden aan elkaar gekoppeld om te kijken welke aspecten van de werk omgeving voor extra stress zorgen a.h.d.v. quantatieve analyse
- Einde van de week (laatste dag aanwezig) de ring inleveren bij servicedesk F&H op de 10e

VERBINDEN MET DE RING (1/3)

Hang de ring aan de oplader voor ongeveer 15 minuten. Zo begin je het experiment met een volle ring.



TYPE “MOODMETRIC” IN DE PLAYSTORE/APP STORE

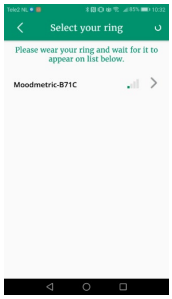


DOWNLOAD DE APP

Let erop dat je alle toestemmingen geeft (locatie & contacten) Locatie is nodig om beter verbinding te maken, contacten om jouw account goed op te slaan.

KLIK IN HET MENU OP SELECT RING

Let op dat je Bluetooth op je telefoon aanstaat!



SELECTEER JOUW RING

Het kan zijn dat jouw ring niet meteen zichtbaar is. Doe de ring om en wacht even.

Nog steeds geen ring? Doe de ring in de oplader! Het kan zijn dat de stroom leeg is, of dat de ring even een ‘kickstart’ nodig heeft om verbinding te maken.

VERBINDEN MET DE RING (2/3)

DRUK OP DE CONNECT KNOP

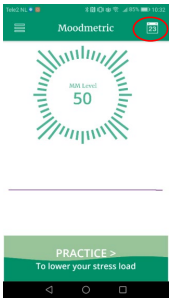
De informatie van de ring verschijnt en je bent nu verbonden met de ring!

NAVIGEER TERUG NAAR DE RING EN DRUK OP CALIBRATE

De ring zal in eerste instantie je terug naar het hoofdmenu sturen, dus je moet weer op het menu klikken en naar jouw ring gaan.

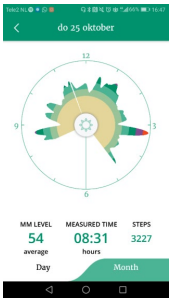
LET OP! Als je op Calibrate drukt, gebeurt er niets, je krijgt geen feedback dat het gelukt is, maar maak je geen zorgen, het is gelukt.

LET OP!(2) Nadat je op Calibrate hebt gedrukt, moet je dit de rest van de week NIET meer doen.



DRUK OP HET AGENDA LOGO

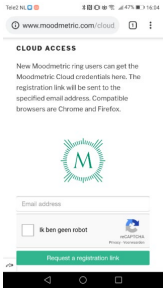
Check voor de zekerheid ook of er een waarde in de middelste cirkel staat. Als hier een getal staat, betekent dat de ring succesvol verbonden is!



BEKIJK JOUW STRESSNIVEAU!

Daar zijn we dan, jouw stressniveau! De ring & app hebben ongeveer 5 minuten aan data nodig voordat deze gesynchroniseerd wordt! Je mag dit zo vaak bekijken als je wilt, maar probeer er nog niet jouw gedrag op aan te passen. Dat is voor ná het experiment ;)

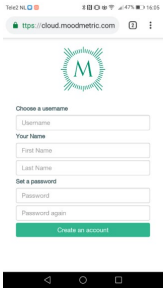
VERBINDEN MET DE RING (3/3)



MAAK EEN ACCOUNT AAN

Bijna klaar, eerst nog een account aanmaken. Ga naar www.moodmetric.com/cloud

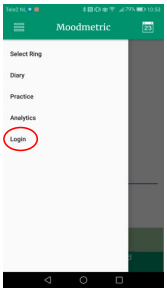
Vul hier jouw emailadres in, je krijgt nu een link opgestuurd naar jouw email die je moet openenen



VUL JOUW GEGEVENS IN

LET OP! Gebruik voor jouw Username het volgende: voornaam.achternaam

Zo kunnen de onderzoekers jouw vinden! Wachtwoord moet je natuurlijk zelf beslissen.



LOGIN IN DE APP

Na het account aanmaken, krijg je een inlogscherm te zien. Dit is jouw persoonlijke Dashboard.

Maar, LET OP! Je moet óók nog inloggen in de app. Open dus de app en druk op Login, onderin het menu en login met jouw gegevens.

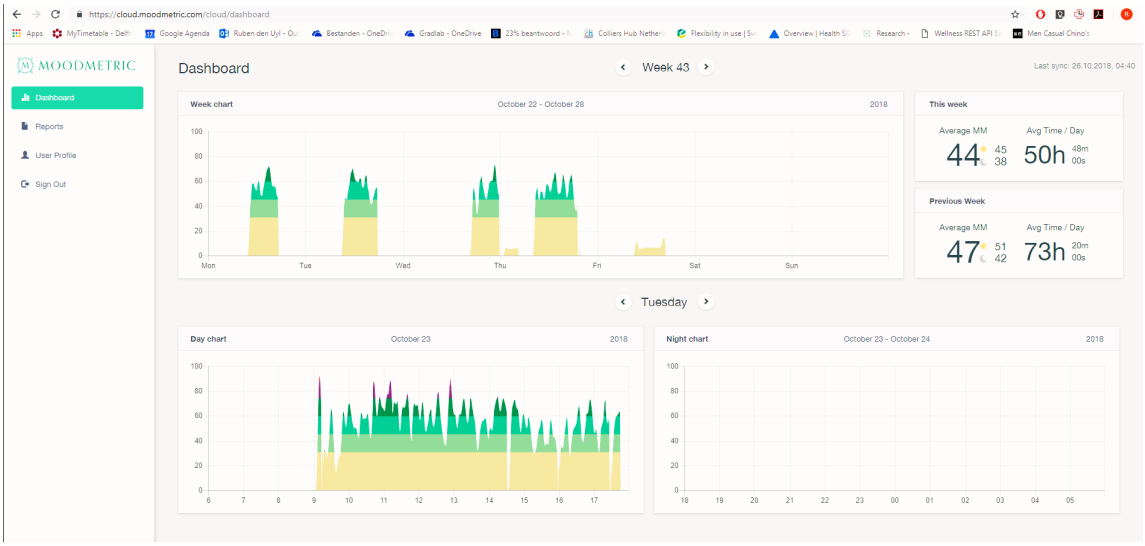
LAATSTE CHECK

Om zeker te zijn dat het gelukt is, open opnieuw het menu. Als er nu onderin Logout staat en Sync Now en Sync Settings in het menu staan, is het allemaal gelukt! Staat er Login, dan moet er nog even ingelogd worden. Dit is erg belangrijk, dus vergeet het niet!

Is het niet gelukt? Neem dan contact op!

ONLINE DASHBOARD OP:

https://cloud.moodmetric.com/cloud/dashboard



EN NU?

- Zorg dat je met een opgelade ring begint, door deze 15 minuten aan de oplader te hangen. Bij Select Ring kan gezien worden hoeveel batterij de ring heeft, alleen leert de pratijk dat ze vaak niet klopt. Liever een keer te veel opgeladen dan te weinig!

- MINSTENS twee keer per dag de ring synchroniseren met de app. Doe dit door op het Agenda Icoontje te drukken en check of de 'klok' bij is!

- Draag de ring de eerste dag voor 24 uur, dus ook 's nachts. Dit komt omdat de ring moet kalibreren, waardoor deze ook de rust periode moet meepakken. Daarna hoeft de ring alleen tijdens werktijd gedragen te worden (maar mag natuurlijk ook buiten werktijd. Deze data wordt niet ingezien door de onderzoekers).

- De ring is niet waterdicht! Doe deze af tijdens het douchen en handenwassen. Sporten kan echter wel gewoon!

LOGGEN VAN DE GEGEVENS

- Loggen gebeurt in een persoonlijk online logbook. Jullie ontvangen hiervoor een link. Check de gegevens van jouw Deelnemer ID en jouw Ring ID linksboven.

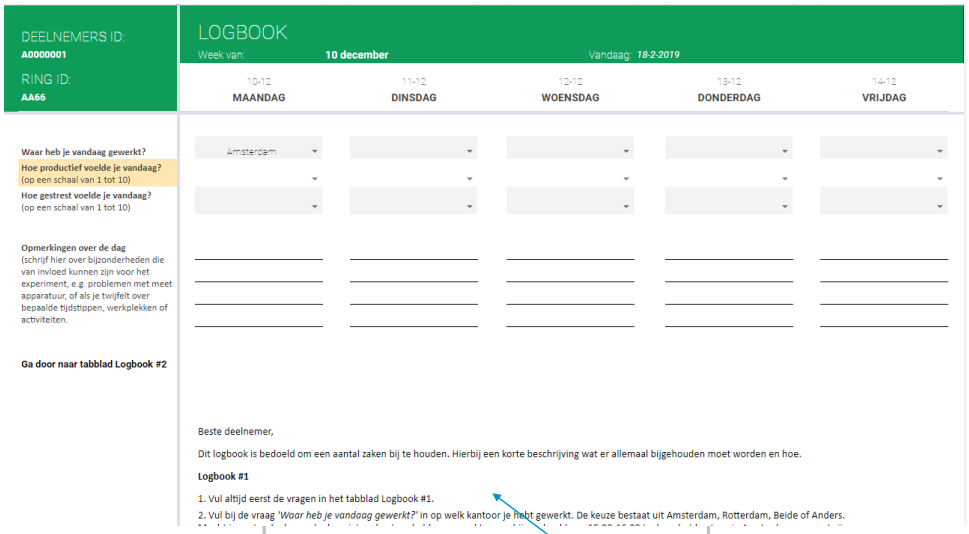
- De variabelen Werkplek en Activiteit worden gelogd

- Kijk voor Werkplek in het tabblad Werkplek Stadskantoor voor een plattegrond met gecodeerde werkplekken.

- Er wordt gelogd met een interval van 15 minute (hoeft niet *real-time*)

- Loggen mag aan het eind van de dag, maar tijdens de dag een aantal keer updaten wordt geadviseerd. Op een kladje aantekeningen maken, of je bel- of mailgeschiedenis gebruiken kan enorm helpen om dit preciezer te onhouden!

- Elke dag om 16:45 zal je een reminder toegestuurd krijgen met een link naar jouw logbook om jouw dag te loggen.



LOCATIE

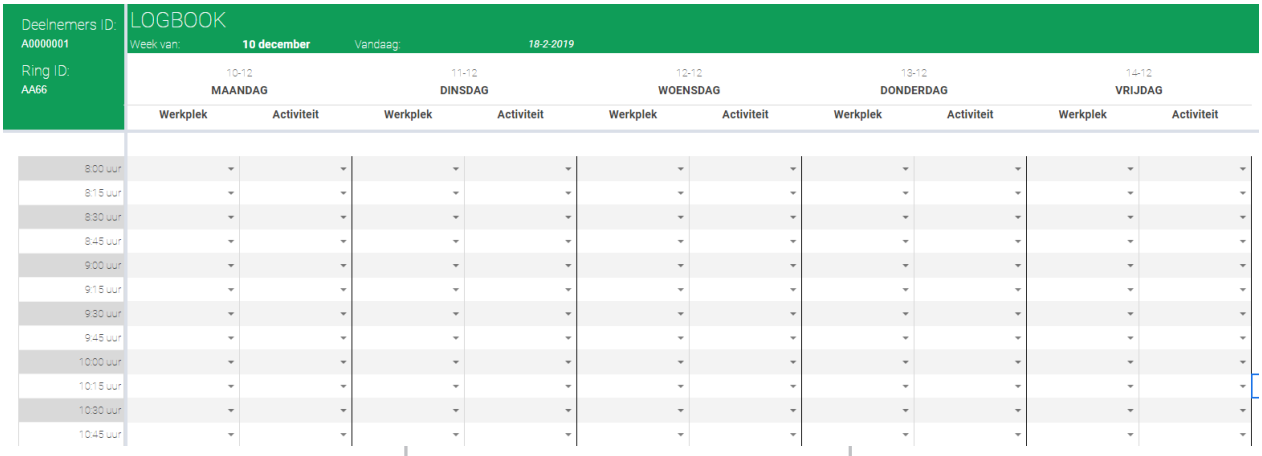
- Vul in 'Stadskantoor' of 'Anders'
- Alleen 'Anders' als je de GEHELE dag niet op Stadskantoor bent geweest
- Als 'Anders' vul in bij opmerkingen 'Niet op Locatie' of 'Geen werkdag' , zodat het duidelijk is dat het niet vergeten is.

GEVOELSVRAGEN

- Over de vragen in over hoe je je voelde die dag
- Probeer hierbij de hele dag in gedachte te houden en niet alleen het laatste uur

OPMERKINGEN

- Mocht je opmerkingen hebben, vul deze dan in op de lijntjes. Denk hierbij aan bijzonderheden over de ring (batterij leeg voor een dagdeel).
- Kijk bij de tekst voor een uitgebreidere uitleg



WERKPLEK

- Gebruik de codering die is aangeven voor jouw werkplek
- Niet op kantoor? Dan hoef je niets in te vullen

ACTIVITEIT

- Zie beschrijving volgende slide voor uitgebreide uitleg
- Activiteiten onthouden is redelijk lastig. Vul vaker per dag in of schrijf het op een kladje!

OPMERKINGEN

- Staan er geen codes bij de Werkplek? Dan ben je waarschijnlijk vergeten de Locatie in te vullen op het tabblad Logbook1

LOGGEN: UITLEG ACTIVITEITEN

Normaal bureauwerk	Voornamelijk computerwerk gebaseerd op routine. Administratieve taken, archiveren, simpele emails beantwoorden, zoekopdrachten uitvoeren etc. Hoeft geen computer voor gebruikt te worden.
Interactief bureauwerk	Taken die aan een bureau worden uitgevoerd, waarbij meer dan één persoon aan dezelfde taak werken en overleg hierover hebben. Let op, dit is wat anders dan een *Meeting*. De focus ligt op het uitvoeren van een taak.
Gefocust bureauwerk	Taken waarbij een cognitief proces plaatsvindt, die hoge mate van concentratie vereist. Het opstellen van nieuwe documenten, langdurig aangesloten lezen, ingewikkelde emails beantwoorden. Hoeft geen computer voor gebruikt te worden.
Meeting	Een afgesproken vergader/overleg moment tussen 2+ personen.
Ongeplande meeting	Een niet afgesproken vergader/overleg moment tussen 2+ personen.
Sociaal	Een niet werk gerelateerde ontmoeting/gesprek of communicatie. Kan ook online zijn.
Bellen	Het telefoneren met een ander persoon.
Anders	Denk aan eten, toileteren, koffie halen, uitrusten, wandelen etc.

NOTITIES BIJ ACTIVITEITEN LOGGEN

- Zorg dat je de *leidende* activiteit uit een kwartier opschrijft. Bellen duurt vaak niet 15 minuten, maar heeft wel veel impact.
- Gebruik dingen als belgeschiedenis of Agenda afspraken ter referentie van jouw activiteiten
- Normaal bureauwerk is administratief/repetatief, Gefocust bureauwerk is taken waarbij concentratie voor nodig zijn
- Lunchen doet men meestal niet op dezelfde plek als waar men werkt. Log de lunch!

DO'S AND DONT'S

DO

- De ring een kwartier per dag aan de oplader hangen
- Minstens 2x per dag de data synchroniseren door op het Agenda icoontje te drukken
- Referentiepunten zoeken voor tijdens het loggen
- Laatste dag van de week de ring weer inleveren

DONT

- Douchen of handenwassen met de ring aan. Niet waterdicht!
- De ring thuis vergeten…

SAMENVATTING

- Experiment duurt 5 dagen
  - Eerste nacht de ring omhouden om te laten kalibreren
  - Per dag even aan de oplader hangen (ring kan meerdere dagen mee, maar voor de zekeheid)
  - Laatste dag van de week dat je aanwezig bent op het Stadskantoor, de ring inleveren bij servicedesk F&H op de 10e
- Ring 2x per dag laten synchroniseren
- Elke dag om 16:45 een link om het logbook in te vullen.
  - Eerste Tabblad 1, dan Tabblad 2
  - Alleen als je de gehele dag niet aanwezig bent op Stadskantoor, vul je 'Anders' in bij locatie
  - Als je niet op het kantoor bent, hoef je die tijd niet te loggen

APPENDIX VI DIARY EXPERIMENT

This appendix contains a diary describing the process of the experiment and the first stages of the statistical analysis. Parts of the text are written in Dutch and the purpose of them are to provide context into the observation period. The diary does not cover the total period of the observation, but mainly the start and contains lessons learned during this phase. The second part of this appendix discusses the begining of the analysis phase, together with descriptions of a number of modules of written Python code. The complete set of Python code is not included, but can be transfered on request to the author.

EXPERIMENT

Voorbereiding

TO DO: Maak alle logbooken aan met alvast de Deelnemer ID in. Ring ID toevoegen na de introductie op maandag.

TO DO voor nu: : Logbook_Template aanpassen zodat Den Bosch ook toegevoegd is.

Week 1 (5-11 tot 9-11)

9-11-18

Op 5 november is het experiment begonnen. De testgroep voor deze eerste week bestond uit 7 personen. Er waren 8 mensen ingepland, echter bleek er één iemand ziek te zijn. Om 9:00 was er een meeting waarbij twee deelnemers niet aanwezig konden zijn, i.v.m. afspraken. Deze zijn later op de dag (om 14:00) geïnstrueerd.

De deelnemers hadden allemaal al de app op hun telefoon geïnstalleerd. Tijdens de introductie zijn alle ringen aan de telefoons gekoppeld. Dit ging relatief soepel, toch bleek dat veel ringen leeg waren gelopen. Dit is wel een aandachtspunt voor de volgende keer.

Tijdens de introductie werd ook verteld hoe het account gemaakt kon worden, echter deed niet iedereen dit direct. Dit is verder geen probleem, echter zorgde dit er wel voor dat niet iedereen zich aan de *voornaam.achternaam* methode voor de gebruikersnaam hield.

Het logbook werd redelijk consequent ingevuld. 4 maal zijn mensen er de volgende dag op aangesproken dat zijn nog niet hun logbook hadden ingevuld.

Op een of andere manier bleek niet iedereen meteen hun Stress & Productiviteit gevoelsscore te noteren. Dit werd echter daarna wel vaker gedaan.

Eén persoon is één dag zijn ring vergeten mee te nemen.

Eén persoon is haar ring verloren. Deze is tot op heden nog niet terug gevonden. (hier moet dan dus wel een vervanging voor geregeld worden.

Er waren hier en daar wat connectie problemen, die veelal verholpen konden worden door de ring in de oplader te stoppen.

Eén ring gaf aparte waardes (hele lage waardes, die niet boven de 20 uitkwamen). Hierover is contact met de producent opgenomen, en die stelde voor om de ring te kalibreren. Het resultaat hiervan is nog niet duidelijk.

De gedownloade metingen van de cloudsite bevatten fouten, gezien de MM waardes veel te hoge waardes bevatten (ver boven de 100). Hierover is gemaild met de producent, die contact heeft gezocht met de developers. Er schijnt een fout te zitten in een update, die gecorrigeerd gaat worden. Dit is op dit moment nog niet opgelost.

Week 2 (12-11 tot 16-11)

12-11-18

Vandaag is de tweede groep begonnen. Het opstarten ging licht chaotisch, gezien mensen na elkaar binnen kwamen, wat ervoor zorgde dat mijn verhaal onderbroken werd/soms opnieuw gedaan moest worden.

Ik denk dat ik hierdoor extra moet opletten of het goed gaat met synchroniseren en het logbook invullen, zodat ik hier snel op kan inspelen.

Ook wordt er voor de verbinding etc niet heel veel gebruik gemaakt van de hand-out (wel voor het bijhouden overigens!). Ik wil hier eigenlijk een PP-presentatie format voor maken, zodat deze misschien wat natuurlijker aanvoelt. Dat ga ik komende week op maandag uitproberen met de Rotterdam groep. Hierdoor zou ik evt niet aanwezig hoeven zijn bij de introductie in het vervolg.

Het Emailer programma lijkt te werken, alleen moet ik wel opletten met testen, om zo onnodige emailtjes te voorkomen.

TO DO: Logbook_Template aanpassen zodat Den Bosch ook toegevoegd is.

TO DO: checken of de groep gemaakt is en alle deelnemers een account hebben gemaakt.

TO DO: checken of alle ringen goed werken en synchroniseren.

15-11-18

Last day (Wednesday) two people did not fill in their logbook.

1 persoon heeft zijn account nog steeds niet, doordat het niet lukt. Ik heb voor dit persoon zelf even een account aangemaakt.

Week 3 (19-11 tot 23-11)

19-11-18

De derde groep mensen is begonnen, nu voor het eerst in Rotterdam.

Bericht ontvangen van één van de deelnemers van vorige week, die kreeg de ring niet af en is naar de huisarts gegaan. Deze heeft de ring ook niet af gekregen. Volgende post is de Spoedeisende Hulp.

EDIT: de ring is uiteindelijk afgekomen na het gebruik van heel veel gel. De ring is geprobeerd door te knippen, maar doordat de ring van roestvrij staal is (en dus sterker dan normaal ring materiaal) ging dit niet zo makkelijk. Het is nog onduidelijk of de ring het doet, maar ik ga er vanuit van niet.

Dit betekent: beter opletten bij de instructie dat de ring niet te strak zit. Kans op vingerzwelling dus aanwezig.

Week 4 (26-11 tot 30-11)

Tweede week meten in Rotterdam.

Één van de ringen (5889) geeft vanaf woensdag erg lage waardes. Heb hierover contact opgenomen met de producent.

Week ging relatief goed, met weinig bijzonderheden/opmerkingen

Week 5 (4-12 tot 7-12)

Deze week weer meten in Amsterdam. Er wordt in het gebouw verbouwd, wat extra rumoer kan veroorzaken.

Ik heb de ring die in het ziekenhuis afgedaan is weer terug. Deze blijkt tot iedereens verwondering gewoon nog steeds te werken. (Dit zou kunnen betekenen dat de ringen veel beter tegen water kunnen dan doet vermoeden, gezien er op een gegeven moment gewoon mee gedoucht is)

Een ring wilt geen verbinding meer maken met een telefoon. Dit geprobeerd op meerdere telefoons en in de oplader (lampje brand wel, maar doet niets). Contact opgenomen met de producent.

EDIT: waarschijnlijk gaan er wat ringen gemaakt/geruild worden bij de producent. Dit zou gunstig zijn, mits er in de toekomst geen extra problemen ontstaan.

Iemand was zijn wachtwoord vergeten. Blijkbaar kan iemand dit niet zelf resetten, maar moet dit via Moodmetric, de cloudbeheerder. Dit is niet erg, maar wel onhandig, gezien dit via de onderzoeker moet gebeuren en niet iemand zelf kan regelen.

ANALYSE

9-11-18

Met de tijdelijke resultaten is gekeken naar een methode om de resultaten inzichtelijk te maken.

Hiervoor is er gekozen om een draaitabel te maken in Excel. Hiervoor is het bestand Testdata_week1_metkloppendeformules.xlsx aangemaakt.

De data is nu per kwartier geordend per ring en bevat de gemiddelde MM scores van dat kwartier. Alle gemeten waardes staan in de tabel, maar dichtgeklapt, gezien er maar één waarde per kwartier gebruikt kan worden.

De tijdstippen van 18:00 tot 8:30 worden weg gelaten in de tabel, gezien deze nooit tot bruikbare informatie kan leiden.

De vervolgstap is om een gecombineerde tabel te maken met de stress scores en de informatie uit het logbook, waarbij de sets ontstaan. Ik ga nog kijken of dit te automatiseren is d.m.v. een script.

12-11-18

Bij het downloaden van de data wordt er nog steeds een foute MM waarde gestuurd.

EDIT: de MM waardes blijken toch goed te zijn. De fout zit in de conversie van CSV naar XLSX, waarbij het scheiding teken van decimale waarde (gescheiden door een punt), niet herkend werd en het getal dus veel te groot werd. Dit kan opgelost worden door bij het importeren van de gegevens de MM scores als tekst te importeren i.p.v. als getal.

13-11-18

Begonnen met het schrijven van een Python script om de data verwerking automatisch te laten gebeuren. In de volgende sectie worden de modules en de methode beschreven

22-11-18

Een van de deelnemers kwam aan met het feit dat zijn nachten volgens de metingen stressvoller zijn dan zijn dagen, wat op z'n minst opvallend te noemen is. Dit schets wel een interessant punt van het experiment, gezien dit buiten de reguliere 'meetperiode' van de werkdagen valt en er dus niets met deze data gedaan wordt. Het roept wel vragen over de meetmethode op, onder welke omstandigheden de ring onnauwkeurige metingen doet. Te verwachten omstandigheden zijn:

- Na het handen wassen/douchen
- Wanneer de ring verschoven is en voornamelijk af is
- 'Freak' metingen van 0 of 100
- Wanneer de vinger/hand (deels) bedekt is
- Grote temperatuur verschillen

KAPPA CALCULATION

Ik ben aan de gang gegaan met een Kappa test. Hieronder de uitkomsten voor 3 personen.

Participant	Workplace	Activity	Total	Remarks
Person 1	32/32 = 1	30/32 = 0,93	0,97	*Very singular activities and workplaces*
Person 2	10/14 = 0,71	8/14 = 0,57	0,64	*Calling is the activity that differs the most*
Person 3	15/19 = 0,79	10/19 = 0,53	0,66	*Very diverse activities and workplaces*
Totals	**0,83**	**0,67**	**0,76**	

	UDW	IDW	GDW	PMT	UPM	CL	SCL	OT	Tot.	Sum agreements	Agreement per activity	
P1												
UDW	23						1		24		18,75	
IDW									0		0	
GDW	1								1		0	
PMT				4					4		0,5	
UPM									0		0	
CL									0		0	
SCL	1						2		3		0,28125	
OT									0		0	Kappa:
Tot.	25	0	0	4	0	0	3	0	32	29	19,53125	0,759398

P3	UDW	IDW	GDW	PMT	UPM	CL	SCL	OT	Tot			
UDW	2		1						3		0,8	
IDW									0		0	
GDW	2		3			2	2		9		2,4	
PMT									0		0	
UPM									0		0	
CL						1			1		0,2	
SCL							2		2		0,533333	
OT									0		0	Kappa:
Tot.	4	0	4	0	0	3	4	0	15	8	3,933333	0,36747

P4	UDW	IDW	GDW	PMT	UPM	CL	SCL	OT	Tot			
UDW	1	2					1		4		0,6	
IDW	2	1							3		0,45	
GDW									0		0	
PMT			3	6	2				11		3,3	
UPM									0		0	
CL									0		0	
SCL							2		2		0,3	
OT									0		0	Kappa:
Tot.	3	3	3	6	2	0	3	0	20	10	4,65	0,348534

Kappa tot. 0,491801

Een Kappa wordt berekend door twee observanten te vergelijken met elkaar. In dit geval is dat dus mijn observatie en de observatie van de deelnemer. Hierbij wordt gekeken naar hoeveel overeenkomsten er zijn. Een Kappa van 0,75-1 wordt gezien als goed, 0,5-0,75 acceptabel en daaronder wordt de observatie als onbetrouwbaar gezien.

Bij deze meting komen mijn verwachtingen redelijk overeen. De Kappa voor *Workplace* is redelijk hoog. Dit is te verwachten gezien mensen niet heel veel verplaatsen van werkplek, dus het redelijk makkelijk is om in te vullen. De verschillen die naar voren kwamen, waren bijna uitsluitend verschillen in de tijd van een mutatie en niet een daadwerkelijk andere werkplek.

De Kappa voor *Activity* is een stuk lager. Dit heeft naar mijn mening twee mogelijke oorzaken. De eerste is dat mensen de activiteiten 'nivelleren' als het ware, waarbij ze veranderende activiteiten uit gemakzucht niet registreren. Hierbij komt ook naar voren dat bellen bijvoorbeeld de activiteit was die vanuit mijn observatie het meest verschilde met de deelnemers. Bellen is vaak een kortdurende activiteit van minder dan 5 minuten, waardoor deze niet goed geregistreerd wordt, gezien de rest van het kwartier er een andere activiteit wordt ondernomen. Echter is er wel aangegeven om de 'leidende' activiteit/de activiteit met de meeste impact te gebruiken.

De tweede oorzaak is interpretatie van de activiteit. In principe is er een uitleg gegeven wat welke activiteit is en is er een geschreven tekst bijgesloten, echter kan de deelnemer de activiteit nog steeds anders invullen. Veel van de verschillen in activiteiten zitten dan ook bij *Normaal bureauwerk* en *Gefocust bureauwerk*, twee activiteiten die redelijk dicht bij elkaar liggen.

Andere activiteiten die dicht bij elkaar liggen zijn:

- *Meeting en Ongeplande meeting*
- *Ongeplande meeting en Interactief bureauwerk*
- *Interactief bureauwerk en bellen*
- *Sociaal en Anders*
- *Normaal bureauwerk en Interactief bureauwerk*

29-11-2018

Wat wil ik allemaal analyseren/verbeteren?

PYTHON SCRIPT

This section contains a description of the script that is used to perform the analysis. In order to improve the efficiency of the experiment, the choice has been made to program a script that automatically performs the processing and analysis of the gathered data from the experiment.

Because it is aimed to continue doing the experiment as long as possible, it is greatly beneficial to do this, because it will not take any extra time processing the data in the future. The script is written in the programming language Python. Python is relatively descriptive, meaning that the syntax of the programming language is largely similar to syntax of the regular English language. Besides that, Python offers multiple pre-scripted plugins that allow for easy data analysis and writing and reading documents.

The Python script is divided into different modules. A module can be seen as a program on its own. Within these modules, functions are present. Functions perform one or multiples actions, such as processing data, reading data from a file or writing data in a file.

Module: Writer.py

Goal:

To create the excel file and create the first outlines.
To be able to write the gathered data in the excel file.

Functions:

Function	Arguments	Purpose	Calls function
XlsxW	[Data, Time], filename	Is used to do all the writing. Contains multiple sub functions	Write_time Write_ID Write_MM
Write_index	Index	Writes the indexed numbers above each column as a reference	
Write_time	Time	writes the time intervals in the file	
Write_week	Row, column	writes for 1 participant all days of the week, with the sub header of the variables (MM, Workplace, Activity)	
Write_WP_AC	ID	writes for 1 participant their Workplace data and Activity data in the file. Uses the data from the module SPREADSHEET.	Get_GSS_data
Write_ID		writes the ID number of the participant and uses the write_week function.	Write_week
Write_MM		writes the MM values in the file. Also calls the write_WP_AC function.	

How to use:

- Check in the if __name__ == '__main__' function if the workday section contains the correct input ("08:00", "18:00", 15).
- Get the ID's of the participant from the file 'Deelnemers.xlsx'. Check if all participants are represented in that file.
- Check if the File has the correct file behind it. This should be the file with the MM data (that has been downloaded from the Moodmetric cloud).
- Call the XlsxW function with the desired filename (for now 'data_test_X.xlsx')

Related files:

py_data_test.xlsx | output file from the function Xwrite (using Pandas)
data_test_X.xlsx | output file from the function XlsXw (using Xlsxwriter)

Module: Get_data.py

Goal:

Retrieve data from different files and format them into usable list.

Functions:

Function	Arguments	Purpose	Calls function
Workday	Start of day, end of day, interval	Creates a list containing the representation of a workday with a specific interval in time	
Dict_IDS	ID	Creates a dictionary with key Participant ID and value Ring ID, in order to assign the ring measurements to the correct participant	
Date_time	Timestamp	Calculates the correct time form the timestamp of the MM measurement. Timestamp is in milliseconds from the time 00:00 1-1-1970.	
DATA_Week	Data	Divides the data of one participant into the different days of the week, based on the date of the timestamp in the data	
Get_MM	ID, Time, file	Creates a list with MM data for one participant, with date and timestamp, for the whole week	Dict_IDS Date_time
MM_to_quater	Data, Time	Translates the MM list of a participant into a list divided by days and according to the workday time intervals. Creates averages of the MM values for each quarter.	

How to use:

Use the module Writer to use the Get_data functions.

Related files:

Deelnemers_copy.xlsw | input file for the participant ID and ring ID
mm_data_week1.csv | input file for the MM data

Module: spreadsheet.py

Goal:

To retrieve the information of the participants from their online logbooks. Uses the Google API to call the information.

Functions:

Function	Arguments	Purpose	Calls function
Get_GSS_data	ID	Reads and imports the data in the specific Google Spreadsheet, based on the participant ID.	Translate_data
Translate_data	Data	Removes unwanted items from the list, that contain empty cells	

How to use:

In order to be able to call information from the Google API, first a request email address needs to be added into the Google Spreadsheet with permission to edit information in the file, which can be done with the Share function in the Google Spreadsheet.

Related files:

(Multiple) Logbook_XXXXXX | The online Google Spreadsheet documents that are named Logbook_ + ID number.

Module: Checker.py

Goal:

To remove data that is not wanted or complete, meaning all data outside of the workday and that contain data that misses 1 or more variables.

Functions:

Function	Arguments	Purpose	Calls function
checker	File, Range	Reads the raw combined data from the output file from Writer module and uses the cleaner function to remove unwanted cells	cleaner
cleaner	Data	Replaces unwanted cells with empty cells. It checks for every timeslot if 1 or more variables are empty and if so, makes all three variables empty.	
Cwrite	Input, Filename, Range, Week	Writes a new file with the cleaned data, ready to be analysed.	

How to use:

Check if the file = 'data_test_X.xlsx' corresponds with the file of the data that has been output from the Writer module.

Use a filename that is recognisable from the new file, such as 'data_cleaned_week1.xlsx'.

Run the module.

Related files:

data_test_X.xlsx | input file with the raw combined data.

data_cleaned_week1.xlsx | output file with the cleaned data.

Module: Analyser.py

Goal:

To perform analyses on the gathered data. For now, it only works with data from one week. Displays the results on the screen, does not write it in a file yet.

Functions:

Function	Arguments	Purpose	Calls function
reader	File, Range	Reads the input file and converts it into a list	
Person_maker	Data, File, # columns of data	Divides the data into a list of lists containing the data of one person per list.	
Day_maker	Data	Divides the data into respective days	
Counter_person	Data (one person)	Outputs statistical values for a specific person	
Ranker_WP	Data	Ranks Workplaces based on their average MM score	
Ranker_AC	data	Ranks Activities based on their average MM score	
Ranker_WP_AC	Data	Ranks the combinations of Workplace and Activity based on the average MM score	
Counter_days	Data (days)	Uses the data divided by days to perform the counter function	
Counter	Data	Counts general statistical values	

How to use:

Make sure that the input file is the correct one (data_cleaned_week1.xlsx).

In the def main() function, make sure that all the functions that you want to use as analysis are included.

Run the module.

Related files:

Data_cleaned_week1.xlsx | input file with the cleaned data.

APPENDIX VII ANALYSES OF THE OBSERVATION RESULTS

The result section is built up as follows:

Firstly, an analysis of variance (ANOVA) is conducted to see if there is a variance within a variable or group of variables. The ANOVA is done for the dependent variable ***Stress Score Minus Mean*** (SSMM). For the workplace characteristics also the variable ***Stress Deviation*** (SD) is analysed. The SSMM is always displayed on the left side, the SD on the right side of the page. If the p(F) value is below 0,05, the variance is concluded to be significant.

Secondly, if the variable is significant, a series of Student's T-tests are conducted on all values of that variable on the basis of mean deviation contrasts, to see which (nominal) value differs significantly from the mean.

RESULTS

Employee profiles

Activity profile

ANOVA

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3	0,00	1
Residual	616195,64	3114		

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3	0,00	1
Residual	616195,64	3114		

The variable Activity Profile is not significant for either SSMM or SD. No T-tests are performed.

Mobility profile

ANOVA

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3	0,00	1
Residual	616195,64	3114		

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3	0,00	1
Residual	616195,64	3114		

The variable Activity Profile is not significant for either SSMM or SD. No T-tests are performed.

Activities

Activities

ANOVA

	sum_sq	df	F	PR(>F)
C(AC)	4377,00	7	3,18	<0,01
Residual	611818,64	3110		

The variable Activities is significant with a p value of less than 0,05. In the next section, the T-tests are displayed to show which nominal values are significantly different from the mean.

T-test

Value	Mean	p(T)
Meeting	1,13	0,10
Normaal bureauwerk	-0,41	0,36
Sociaal	2,04	0,02
Bellen	-0,19	0,88
Gefocust bureauwerk	-1,23	0,01
Interactief bureauwerk	-0,04	0,97
Ongeplande meeting	-2,18	0,14
Anders	1,73	0,02

The following values are significant:

- Social (+)
- Undisturbed Desk Work (-)
- Other (+)

Activities and profiles

ANOVA

	sum_sq	df	F	PR(>F)
C(AP)	118,34	3,00	0,20	0,90
C(AC)	4495,34	7,00	3,28	<0,01
C(AP):C(AC)	8270,92	21,00	2,01	<0,01
Residual	603429,38	3086,00		

	sum_sq	df	F	PR(>F)
C(AP)	118,34	3,00	0,20	0,90
C(AC)	4495,34	7,00	3,28	<0,01
C(AP):C(AC)	8270,92	21,00	2,01	<0,01
Residual	603429,38	3086,00		

The combination of the variables Activities & Activity Profiles is significant with a p value of less than 0,05. In the next section, the T-tests are displayed to show which nominal values are significantly different from the mean.

T-test

Value	Mean	p(T)
P1+Meeting	-2,32	0,15
P1+Normaal bureauwerk	-1,45	0,10
P1+Sociaal	0,49	0,79
P1+Bellen	0,92	0,70
P1+Gefocust bureauwerk	0,92	0,32
P1+Interactief bureauwerk	1,40	0,45
P1+Ongeplande meeting	-0,85	0,72
P1+Anders	4,87	0,02
P2+Anders	1,45	0,11
P2+Gefocust bureauwerk	-2,37	<0,01
P2+Bellen	-1,35	0,41
P2+Interactief bureauwerk	2,52	0,09
P2+Sociaal	2,24	0,04
P2+Normaal bureauwerk	1,06	0,29
P2+Meeting	1,48	0,07
P2+Ongeplande meeting	-3,34	0,11
P4+Normaal bureauwerk	-0,36	0,56
P4+Anders	0,79	0,74
P4+Gefocust bureauwerk	-1,29	0,35
P4+Sociaal	5,18	0,11
P4+Interactief bureauwerk	-5,59	0,11
P4+Meeting	3,58	0,16
P4+Bellen	4,67	0,19
P4+Ongeplande meeting	0,53	0,90
P3+Bellen	3,72	0,57
P3+Gefocust bureauwerk	2,78	0,14
P3+Interactief bureauwerk	-3,75	0,07
P3+Anders	0,28	0,89
P3+Ongeplande meeting	-0,55	0,94
P3+Normaal bureauwerk	-4,72	0,25
P3+Meeting	8,06	0,03
P3+Sociaal	-0,89	0,86

The following values are significant:

- P1 + Other (+)
- P2 + Undisturbed Desk Work (-)
- P2 + Social (+)
- P3 + Planned Meeting (+)

Activities & Mobility Profiles

ANOVA

	sum_sq	df	F	PR(>F)
C(MP)	262,42	3,00	0,45	0,72
C(AC)	4639,43	7,00	3,40	<0,01
C(MP):C(AC)	9470,83	21,00	2,31	<0,01
Residual	602085,38	3086,00		

	sum_sq	df	F	PR(>F)
C(MP)	262,42	3,00	0,45	0,72
C(AC)	4639,43	7,00	3,40	<0,01
C(MP):C(AC)	9470,83	21,00	2,31	<0,01
Residual	602085,38	3086,00		

The combination of the variables Activities & Mobility Profiles is significant with a p value of less than 0,05. In the next section, the T-tests are displayed to show which nominal values are significantly different from the mean.

T-test

Value	Mean	p(T)
Camper+Meeting	-3,81	0,03
Camper+Normaal bureauwerk	-1,22	0,11
Camper+Sociaal	5,20	<0,01
Camper+Bellen	1,51	0,38
Camper+Gefocust bureauwerk	0,69	0,34
Camper+Interactief bureauwerk	5,35	0,02
Camper+Ongeplande meeting	-3,09	0,44
Camper+Anders	-0,07	0,96
Nomad+Anders	-8,52	0,02
Nomad+Gefocust bureauwerk	-0,07	0,92
Nomad+Bellen	0,95	0,79
Nomad+Interactief bureauwerk	2,05	0,54
Nomad+Sociaal	0,24	0,88
Nomad+Normaal bureauwerk	-1,75	0,33
Nomad+Meeting	1,03	0,48
Nomad+Ongeplande meeting	-3,63	
Timid Traveller+Normaal bureauwerk	-0,13	0,85
Timid Traveller+Anders	2,67	0,06
Timid Traveller+Gefocust bureauwerk	-1,83	0,03
Timid Traveller+Sociaal	0,36	0,81
Timid Traveller+Interactief bureauwerk	-1,78	0,27
Timid Traveller+Meeting	3,17	<0,01
Timid Traveller+Bellen	0,92	0,63
Timid Traveller+Ongeplande meeting	-4,16	0,14
Explorer+Bellen	-4,42	0,21
Explorer+Gefocust bureauwerk	-5,30	<0,01
Explorer+Interactief bureauwerk	-1,33	0,39
Explorer+Anders	1,90	0,09
Explorer+Ongeplande meeting	-0,10	0,96
Explorer+Normaal bureauwerk	0,73	0,54
Explorer+Meeting	1,45	0,21
Explorer+Sociaal	3,24	0,15

The following values are significant:

- Camper + Planned Meeting (-)
- Camper + Social (+)
- Camper + Interactive Desk Work (+)
- Nomad + Other (-)
- Timid Traveller
  + Undisturbed Desk Work (-)
- Timid Traveller + Planned Meeting (+)
- Explorer + Undisturbed Desk Work (-)

Workplace characteristics

Overview of workplace characteristics codes

V1. Size of room
V2. Openness of room
V3. Audio privacy (how many people can hear you)
V4. Visual division (office partitions, facing a wall)
V5. Power socket
V6. Extra monitor
V7. Type of chair
V8. Type of desk (sitting, standing, walking etc)
V9. Presentation hardware (screen & sound)
V10. Desk space (able to use papers conveniently)
V11. Storage
V12. Department based or free use
V13. Flex use or assigned desk
V14. Out loud speaking or silence
V15. Calling
V16. Multiple person meeting
V17. Bookable – temporarily use
V18. Purpose (focus)
V19. Purpose (Collaborate)
V20. Purpose (Social)
V21. Purpose (Learn)

ANOVA

IndepVar	DepVar: Stress Score Minus Mean			
	sum_sq	df	F	PR(>F)
C(V1)	7707,84	5,00	7,88	<0,01
Residual	608487,80	3112,00		

IndepVar	Dependent variable: Stress Deviation			
	sum_sq	df	F	PR(>F)
C(V1)	260,58	5,00	0,30	0,91
Residual	545943,47	3112,00		

	sum_sq	df	F	PR(>F)
C(V2)	4982,00	7,00	3,62	<0,01
Residual	611213,64	3110,00		

	sum_sq	df	F	PR(>F)
C(V2)	996,13	7,00	0,81	0,58
Residual	545207,92	3110,00		

	sum_sq	df	F	PR(>F)
C(V3)	855,97	2,00	2,17	0,11
Residual	615339,68	3115,00		

	sum_sq	df	F	PR(>F)
C(V3)	257,59	2,00	0,73	0,48
Residual	545946,47	3115,00		

	sum_sq	df	F	PR(>F)
C(V4)	1183,77	4,00	1,50	0,20
Residual	615011,87	3113,00		

	sum_sq	df	F	PR(>F)
C(V4)	504,44	4,00	0,72	0,58
Residual	545699,61	3113,00		

	sum_sq	df	F	PR(>F)
C(V5)	225,97	1,00	1,14	0,29
Residual	615969,67	3116,00		

	sum_sq	df	F	PR(>F)
C(V5)	7,57	1,00	0,04	0,84
Residual	546196,49	3116,00		

	sum_sq	df	F	PR(>F)
C(V6)	75,55	1,00	0,38	0,54
Residual	616120,09	3116,00		

	sum_sq	df	F	PR(>F)
C(V6)	22,96	1,00	0,13	0,72
Residual	546181,09	3116,00		

	sum_sq	df	F	PR(>F)
C(V7)	7645,03	2,00	19,57	<0,01
Residual	608550,61	3115,00		

	sum_sq	df	F	PR(>F)
C(V7)	1,16	2,00	0,00	1,00
Residual	546202,90	3115,00		

	sum_sq	df	F	PR(>F)
C(V8)	515,84	3,00	0,87	0,46
Residual	615679,80	3114,00		

	sum_sq	df	F	PR(>F)
C(V8)	114,11	3,00	0,22	0,88
Residual	546089,95	3114,00		

	sum_sq	df	F	PR(>F)
C(V9)	1850,72	1,00	9,39	<0,01
Residual	614344,93	3116,00		

	sum_sq	df	F	PR(>F)
C(V9)	120,77	1,00	0,69	0,41
Residual	546083,29	3116,00		

	sum_sq	df	F	PR(>F)
C(V10)	182,10	2,00	0,46	0,63
Residual	616013,54	3115,00		

	sum_sq	df	F	PR(>F)
C(V10)	52,52	2,00	0,15	0,86
Residual	546151,54	3115,00		

	sum_sq	df	F	PR(>F)
C(V11)	11,39	1,00	0,06	0,81
Residual	616184,25	3116,00		

	sum_sq	df	F	PR(>F)
C(V11)	22,46	1,00	0,13	0,72
Residual	546181,59	3116,00		

	sum_sq	df	F	PR(>F)
C(V12)	2,52	1,00	0,01	0,91
Residual	616193,13	3116,00		

	sum_sq	df	F	PR(>F)
C(V12)	0,90	1,00	0,01	0,94
Residual	546203,16	3116,00		

	sum_sq	df	F	PR(>F)
C(V13)	116,79	1,00	0,59	0,44
Residual	616078,86	3116,00		

	sum_sq	df	F	PR(>F)
C(V13)	22,21	1,00	0,13	0,72
Residual	546181,85	3116,00		

	sum_sq	df	F	PR(>F)
C(V14)	530,15	1,00	2,68	0,10
Residual	615665,49	3116,00		

	sum_sq	df	F	PR(>F)
C(V14)	1,87	1,00	0,01	0,92
Residual	546202,19	3116,00		

	sum_sq	df	F	PR(>F)
C(V15)	25,33	1,00	0,13	0,72
Residual	616170,32	3116,00		

	sum_sq	df	F	PR(>F)
C(V15)	14,12	1,00	0,08	0,78
Residual	546189,94	3116,00		

	sum_sq	df	F	PR(>F)
C(V16)	132,76	1,00	0,67	0,41
Residual	616062,88	3116,00		

	sum_sq	df	F	PR(>F)
C(V16)	39,59	1,00	0,23	0,63
Residual	546164,47	3116,00		

	sum_sq	df	F	PR(>F)
C(V17)	1143,88	1,00	5,80	0,02
Residual	615051,76	3116,00		

	sum_sq	df	F	PR(>F)
C(V17)	166,69	1,00	0,95	0,33
Residual	546037,36	3116,00		

	sum_sq	df	F	PR(>F)
C(V18)	990,99	1,00	5,02	0,03
Residual	615204,65	3116,00		

	sum_sq	df	F	PR(>F)
C(V18)	17,39	1,00	0,10	0,75
Residual	546186,67	3116,00		

	sum_sq	df	F	PR(>F)
C(V19)	74,42	1,00	0,38	0,54
Residual	616121,22	3116,00		

	sum_sq	df	F	PR(>F)
C(V19)	26,85	1,00	0,15	0,70
Residual	546177,21	3116,00		

	sum_sq	df	F	PR(>F)
C(V20)	5716,99	1,00	29,18	<0,01
Residual	610478,65	3116,00		

	sum_sq	df	F	PR(>F)
C(V20)	6,83	1,00	0,04	0,84
Residual	546197,23	3116,00		

	sum_sq	df	F	PR(>F)
C(V21)	453,41	1,00	2,29	0,13
Residual	615742,24	3116,00		

	sum_sq	df	F	PR(>F)
C(V21)	22,10	1,00	0,13	0,72
Residual	546181,96	3116,00		

The following characteristics are significant with a p value of less than 0,05.

- V1. Size of room
- V2. Openness of room
- V7. Type of chair
- V9. Presentation hardware
- V17. Bookable
- V18. Purpose (Focus)
- V20. Purpose (Social)

In the next section, the T-tests are displayed to show which nominal values of the variables are significantly different from the mean.

T-tests

V1. Size of room

Value	Mean	p(T)
(1, 'open 10+')	0,78	0,01
(1, 'cellular 2-4 person')	-0,83	0,23
(1, 'cellular 5-10')	-4,05	<0,01
(1, 'open 5-10')	0,72	0,32
(1, 'cellullar 1 person')	-5,96	0,02
(1, 'open 2-4 person')	-0,68	0,77

The following values are significant:

- Open 10+ (+)
- Cellular 5-10 person (-)
- Cellular 1 person (-)

V2. Openness of room

Value	Mean	p(T)
(2, 'open')	0,78	0,01
(2, 'glass walls')	-2,11	0,12
(2, 'walls & windows')	-2,04	<0,01
(2, 'curtains')	12,58	0,60
(2, 'open with 1 wall')	0,70	0,28
(2, 'walls & no windows')	-9,91	0,12
(2, 'walls & open')	3,60	0,32
(2, 'glass walls with curtains')	-0,26	0,79

The following values are significant:

- Open (+)
- Walls & windows (-)

V7. Type of chair

Value	Mean	p(T)
(7, 'Deskchair')	-0,61	0,02
(7, 'Barstool')	3,23	<0,01
(7, 'Regular chair')	4,42	<0,01

The following values are significant:

- Deskchair (-)
- Barstool (+)
- Regular chair (+)

V9. Presentation hardware

Value	Mean	p(T)
(9, 'No')	0,29	0,26
(9, 'Yes')	-2,06	0,02

The following values are significant:

- Yes (-)

V17. Bookable

Value	Mean	p(T)
(17, 'No')	0,26	0,32
(17, 'Yes')	-1,41	0,06

No values appear to be significant.

V18. Purpose (Focus)

Value	Mean	p(T)
(18, 'Yes')	-0,27	0,31
(18, 'No')	1,18	0,09

No values appear to be significant

V20. Purpose (Social)

Value	Mean	p(T)
(20, 'No')	-0,53	0,05
(20, 'Yes')	3,46	<0,01

The following values are significant:

- No (-)
- Yes (+)

Activity + Workplace Characteristics

ANOVA

Variable **SSMM** **SD**

Activity (AC) Size of room (V1)

	sum_sq	df	F	PR(>F)
C(AC)	4068,86	7,00	3,07	0,08
C(V1)	449,13	5,00	0,47	0,75
C(AC):C(V1)	24978,57	35,00	3,77	<0,01
Residual	583732,13	3080,00		

	sum_sq	df	F	PR(>F)
C(AC)	1258,81	7,00	1,02	0,31
C(V1)	-29,00	5,00	-0,03	1,00
C(AC):C(V1)	3491,35	35,00	0,57	0,96
Residual	542540,19	3080,00		

Activity (AC) Openness of room (V2)

	sum_sq	df	F	PR(>F)
C(AC)	54,42	7,00	0,04	1,00
C(V2)	14086,47	7,00	10,62	<0,01
C(AC):C(V2)	1847,06	49,00	0,20	0,66
Residual	582651,19	3074,00		

	sum_sq	df	F	PR(>F)
C(AC)	-444,19	7,00	-0,36	1,00
C(V2)	-5101,27	7,00	-4,13	1,00
C(AC):C(V2)	5592,12	49,00	0,65	0,42
Residual	542592,37	3074,00		

Activity (AC) Audio privacy (V3)

	sum_sq	df	F	PR(>F)
C(AC)	4471,81	7,00	3,26	<0,01
C(V3)	736,77	2,00	1,88	0,15
C(AC):C(V3)	4699,33	14,00	1,71	0,05
Residual	606807,37	3095,00		

	sum_sq	df	F	PR(>F)
C(AC)	614,39	7,00	0,50	0,81
C(V3)	222,82	2,00	0,63	0,53
C(AC):C(V3)	1260,88	14,00	0,51	0,93
Residual	544158,97	3095,00		

Activity (AC) Visual division (V4)

	sum_sq	df	F	PR(>F)
C(AC)	4801,65	7,00	3,53	<0,01
C(V4)	2111,58	4,00	2,72	0,03
C(AC):C(V4)	12326,85	28,00	2,27	<0,01
Residual	598646,49	3080,00		

	sum_sq	df	F	PR(>F)
C(AC)	685,43	7,00	0,56	0,77
C(V4)	277,46	4,00	0,39	0,81
C(AC):C(V4)	3315,22	28,00	0,67	0,90
Residual	542050,03	3080,00		

Activity (AC) Power socket (V5)	sum_sq	df	F	PR(>F)
C(AC)	4138,18	7,00	3,00	0,01
C(V5)	16,87	1,00	0,09	0,77
C(AC):C(V5)	2338,74	7,00	1,70	0,10
Residual	610675,09	3104,00		

	sum_sq	df	F	PR(>F)
C(AC)	786,36	7,00	0,64	0,67
C(V5)	33,59	1,00	0,19	0,66
C(AC):C(V5)	1208,59	7,00	0,98	0,44
Residual	544426,21	3104,00		

Activity (AC) Extra monitor (V6)	sum_sq	df	F	PR(>F)
C(AC)	4828,31	7,00	3,54	<0,01
C(V6)	526,86	1,00	2,70	0,10
C(AC):C(V6)	6934,63	7,00	5,08	<0,01
Residual	604357,15	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	973,83	7,00	0,79	0,59
C(V6)	157,24	1,00	0,90	0,34
C(AC):C(V6)	292,45	7,00	0,24	0,98
Residual	544914,81	3102,00		

Activity (AC) Type of chair (V7)	sum_sq	df	F	PR(>F)
C(AC)	1563,87	7,00	1,15	0,33
C(V7)	5033,45	2,00	12,94	<0,01
C(AC):C(V7)	5359,70	14,00	1,97	0,02
Residual	601850,32	3095,00		

	sum_sq	df	F	PR(>F)
C(AC)	719,55	7,00	0,58	0,74
C(V7)	56,51	2,00	0,16	0,85
C(AC):C(V7)	1262,61	14,00	0,51	0,93
Residual	544323,55	3095,00		

Activity (AC) Type of desk (V8)	sum_sq	df	F	PR(>F)
C(AC)	5019,26	7,00	3,68	<0,01
C(V8)	751,16	3,00	1,28	0,28
C(AC):C(V8)	9921,95	21,00	2,42	<0,01
Residual	601853,83	3087,00		

	sum_sq	df	F	PR(>F)
C(AC)	1026,38	7,00	0,83	0,54
C(V8)	380,17	3,00	0,72	0,49
C(AC):C(V8)	1445,51	21,00	0,39	0,99
Residual	543711,86	3087,00		

Activity (AC) Presentation hardware (V9)	sum_sq	df	F	PR(>F)
C(AC)	7204,10	7,00	5,39	<0,01
C(V9)	4677,81	1,00	24,48	<0,01
C(AC):C(V9)	14310,86	7,00	10,70	<0,01
Residual	592829,97	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	832,96	7,00	0,68	0,69
C(V9)	114,18	1,00	0,65	0,42
C(AC):C(V9)	1243,08	7,00	1,01	0,42
Residual	544007,25	3102,00		

Activity (AC)
Desk space (V10)

	sum_sq	df	F	PR(>F)
C(AC)	4657,99	7,00	3,42	<0,01
C(V10)	463,09	2,00	1,19	0,30
C(AC):C(V10)	10082,20	14,00	3,71	<0,01
Residual	601273,34	3094,00		

	sum_sq	df	F	PR(>F)
C(AC)	1009,05	7,00	0,82	0,57
C(V10)	222,01	2,00	0,63	0,53
C(AC):C(V10)	638,92	14,00	0,26	1,00
Residual	544503,57	3094,00		

Activity (AC)
Storage (V11)

	sum_sq	df	F	PR(>F)
C(AC)	4417,60	7,00	3,22	<0,01
C(V11)	51,99	1,00	0,27	0,61
C(AC):C(V11)	4693,55	7,00	3,43	<0,01
Residual	607073,10	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	860,22	7,00	0,70	0,67
C(V11)	43,13	1,00	0,25	0,62
C(AC):C(V11)	669,53	7,00	0,54	0,80
Residual	544651,84	3102,00		

Activity (AC)
Department base (V12)

	sum_sq	df	F	PR(>F)
C(AC)	4513,29	7,00	3,29	<0,01
C(V12)	138,80	1,00	0,71	0,40
C(AC):C(V12)	3368,63	7,00	2,45	0,02
Residual	608311,21	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	850,16	7,00	0,69	0,68
C(V12)	11,51	1,00	0,07	0,80
C(AC):C(V12)	321,88	7,00	0,26	0,97
Residual	545031,12	3102,00		

Activity (AC)
Flex use (V13)

	sum_sq	df	F	PR(>F)
C(AC)	0,00	7,00	0,00	1,00
C(V13)	0,00	1,00	0,00	1,00
C(AC):C(V13)	891,86	7,00	0,65	0,52
Residual	611845,34	3107,00		

	sum_sq	df	F	PR(>F)
C(AC)	0,00	7,00	0,00	1,00
C(V13)	0,00	1,00	0,00	1,00
C(AC):C(V13)	1314,55	7,00	1,07	0,34
Residual	545725,39	3107,00		

Activity (AC)
Silence (V14)

	sum_sq	df	F	PR(>F)
C(AC)	4225,16	7,00	3,07	<0,01
C(V14)	378,32	1,00	1,92	0,17
C(AC):C(V14)	1307,27	7,00	0,95	0,47
Residual	610133,06	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	837,74	7,00	0,68	0,69
C(V14)	0,06	1,00	0,00	0,99
C(AC):C(V14)	1482,91	7,00	1,21	0,29
Residual	543881,53	3102,00		

Activity (AC) Calling (V15	sum_sq	df	F	PR(>F)
C(AC)	4352,10	7,00	3,16	<0,01
C(V15)	0,43	1,00	0,00	0,96
C(AC):C(V15)	1072,90	7,00	0,78	0,61
Residual	610745,31	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	832,21	7,00	0,68	0,69
C(V15)	6,78	1,00	0,04	0,84
C(AC):C(V15)	1153,29	7,00	0,94	0,47
Residual	544204,44	3102,00		

Activity (AC) Possible meeting (V16)	sum_sq	df	F	PR(>F)
C(AC)	4933,81	7,00	3,63	<0,01
C(V16)	689,57	1,00	3,55	0,06
C(AC):C(V16)	8704,67	7,00	6,40	<0,01
Residual	602424,39	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	862,79	7,00	0,70	0,67
C(V16)	62,82	1,00	0,36	0,55
C(AC):C(V16)	530,47	7,00	0,43	0,88
Residual	544771,20	3102,00		

Activity (AC) Bookable (V17)	sum_sq	df	F	PR(>F)
C(AC)	6709,31	7,00	4,94	<0,01
C(V17)	3476,19	1,00	17,91	<0,01
C(AC):C(V17)	6281,88	7,00	4,62	<0,01
Residual	602060,57	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	905,57	7,00	0,74	0,64
C(V17)	232,71	1,00	1,33	0,25
C(AC):C(V17)	857,23	7,00	0,70	0,67
Residual	544274,56	3102,00		

Activity (AC) Focus purpose (V18)	sum_sq	df	F	PR(>F)
C(AC)	3386,03	7,00	2,49	0,02
C(V18)	0,02	1,00	0,00	0,99
C(AC):C(V18)	8154,90	7,00	5,99	<0,01
Residual	603663,73	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	831,43	7,00	0,68	0,69
C(V18)	9,27	1,00	0,05	0,82
C(AC):C(V18)	920,80	7,00	0,75	0,63
Residual	544434,43	3102,00		

Activity (AC) Collaborate purpose (V19)	sum_sq	df	F	PR(>F)
C(AC)	4335,92	7,00	3,15	<0,01
C(V19)	33,34	1,00	0,17	0,68
C(AC):C(V19)	2504,51	7,00	1,82	0,08
Residual	609280,79	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	828,91	7,00	0,67	0,69
C(V19)	16,21	1,00	0,09	0,76
C(AC):C(V19)	759,60	7,00	0,62	0,74
Residual	544588,69	3102,00		

Activity (AC) Social purpose (V20)	sum_sq	df	F	PR(>F)
C(AC)	1582,79	7,00	1,16	0,32
C(V20)	2922,78	1,00	15,00	<0,01
C(AC):C(V20)	4497,31	7,00	3,30	<0,01
Residual	604398,54	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	894,91	7,00	0,73	0,65
C(V20)	62,18	1,00	0,35	0,55
C(AC):C(V20)	266,50	7,00	0,22	0,98
Residual	545035,82	3102,00		

Activity (AC) Learn purpose (V21)	sum_sq	df	F	PR(>F)
C(AC)	4018,08	7,00	2,95	<0,01
C(V21)	94,49	1,00	0,49	0,49
C(AC):C(V21)	8709,16	7,00	6,40	<0,01
Residual	603014,99	3102,00		

	sum_sq	df	F	PR(>F)
C(AC)	935,87	7,00	0,76	0,62
C(V21)	118,41	1,00	0,68	0,41
C(AC):C(V21)	1356,62	7,00	1,11	0,36
Residual	543889,47	3102,00		

Only significance is found for the SSMM variable. The SD appear to not result significant results. Significant variable combinations are:

- Activity (AC) & Size of room (V1)
- Activity (AC) & Audio privacy (V3)
- Activity (AC) & Visual division (V4)
- Activity (AC) & Extra monitor (V6)
- Activity (AC) & Type of chair (V7)
- Activity (AC) & Type of desk (V8)
- Activity (AC) & Presentation hardware (V9)
- Activity (AC) & Desk space (V10)
- Activity (AC) & Storage (V11)
- Activity (AC) & Department base (V12)
- Activity (AC) & Possible meeting (V16)
- Activity (AC) & Bookable (V17)
- Activity (AC) & Focus purpose (V18)
- Activity (AC) & Social purpose (V20)
- Activity (AC) & Learn purpose (V21)

T-tests

Activity (AC) & Size of room (V1)

Value	Mean	p(T)
Meeting+(1, 'open 10+')	2,18	0,07
Meeting+(1, 'cellular 5-10')	-0,68	0,56
Meeting+(1, 'cellular 2-4 person')	0,38	0,89
Meeting+(1, 'cellular 1 person')	1,31	0,38
Meeting+(1, 'open 2-4 person')	1,03	0,60
Meeting+(1, 'open 5-10')	3,22	0,03
Normaal bureauwerk+(1, 'open 10+')	-0,52	0,29
Normaal bureauwerk+(1, 'cellular 2-4 person')	-2,48	0,41
Normaal bureauwerk+(1, 'cellular 5-10')	6,82	0,02
Normaal bureauwerk+(1, 'open 5-10')	-0,66	0,62
Normaal bureauwerk+(1, 'cellular 1 person')	-11,82	0,24
Sociaal+(1, 'open 10+')	2,40	0,02
Sociaal+(1, 'cellular 2-4 person')	0,52	0,79
Sociaal+(1, 'cellular 5-10')	2,54	0,74
Sociaal+(1, 'open 5-10')	0,75	0,85
Bellen+(1, 'open 10+')	5,01	0,00
Bellen+(1, 'cellular 2-4 person')	1,14	0,65
Bellen+(1, 'cellular 5-10')	-18,17	0,00
Bellen+(1, 'open 5-10')	-5,90	0,12
Bellen+(1, 'cellular 1 person')	-2,11	0,68
Gefocust bureauwerk+(1, 'open 10+')	-0,28	0,62
Gefocust bureauwerk+(1, 'cellular 2-4 person')	-0,90	0,38
Gefocust bureauwerk+(1, 'cellular 5-10')	-10,25	0,00
Gefocust bureauwerk+(1, 'open 5-10')	-0,52	0,58
Gefocust bureauwerk+(1, 'cellular 1 person')	-12,41	0,00
Interactief bureauwerk+(1, 'open 10+')	-0,31	0,78
Interactief bureauwerk+(1, 'cellular 2-4 person')	0,34	0,88
Interactief bureauwerk+(1, 'open 5-10')	10,08	0,43
Interactief bureauwerk+(1, 'cellular 5-10')	0,28	0,98
Ongeplande meeting+(1, 'open 10+')	-2,10	0,37
Ongeplande meeting+(1, 'cellular 2-4 person')	-2,96	0,38
Ongeplande meeting+(1, 'cellular 5-10')	-1,16	0,63
Ongeplande meeting+(1, 'open 5-10')	-3,32	0,59
Ongeplande meeting+(1, 'open 2-4 person')	-7,55	
Anders+(1, 'open 10+')	3,34	0,00
Anders+(1, 'cellular 2-4 person')	-1,59	0,36
Anders+(1, 'open 5-10')	6,80	0,12
Anders+(1, 'cellular 5-10')	-13,12	0,01

The following values are significant:

- Planned Meeting + Open 5-10 (+)
- General Desk Work + Cellular 5-10 (+)
- Social + Open 10+ (+)
- Calling + (Open 10+ (+)
- Calling + Cellular 5-10 (-)
- Undisturbed Desk Work + Cellular 5-10 (-)
- Undisturbed Desk Work + Cellular 1 person (-)
- Other + Open 10+ (+)
- Other + Cellular 5-10 (-)

Activity (AC) & Audio privacy (V3)

Value	Mean	p(T)
Meeting+(3, '2+')	1,32	0,10
Meeting+(3, '1 or 2')	-0,51	0,86
Meeting+(3, 0)	1,03	0,52
Normaal bureauwerk+(3, '2+')	-0,41	0,37
Normaal bureauwerk+(3, '1 or 2')	-2,48	0,41
Normaal bureauwerk+(3, 0)	4,74	0,30
Sociaal+(3, '2+')	2,19	0,03
Sociaal+(3, '1 or 2')	-0,32	0,88
Sociaal+(3, 0)	19,71	0,32
Bellen+(3, '2+')	1,03	0,49
Bellen+(3, '1 or 2')	-1,12	0,67
Bellen+(3, 0)	-6,48	0,10
Gefocust bureauwerk+(3, '2+')	-1,06	0,05
Gefocust bureauwerk+(3, '1 or 2')	-1,06	0,31
Gefocust bureauwerk+(3, 0)	-7,63	0,02
Interactief bureauwerk+(3, '2+')	-0,36	0,73
Interactief bureauwerk+(3, '1 or 2')	2,31	0,32
Ongeplande meeting+(3, '2+')	-1,95	0,28
Ongeplande meeting+(3, '1 or 2')	-0,09	0,98
Ongeplande meeting+(3, 0)	-6,83	0,04
Anders+(3, '2+')	2,35	0,00
Anders+(3, '1 or 2')	-1,59	0,36
Anders+(3, 0)	-13,57	0,78

The following values are significant:

- Social + 2+ (+)
- Undisturbed Desk Work + 2+ (-)
- Undisturbed Desk Work + 0 (-)
- Unplanned Meeting + 0 (-)
- Other + 2+ (+)

Activity (AC) & Visual division (V4)

Value	Mean	p(T)
Meeting+(4, 'office partition')	0,65	0,51
Meeting+(4, 'non')	2,49	0,03
Meeting+(4, 'wall')	4,01	0,09
Meeting+(4, 'hallway')	-5,10	0,05
Meeting+(4, 'window')	-2,57	0,68
Normaal bureauwerk+(4, 'office partition')	-0,64	0,17
Normaal bureauwerk+(4, 'wall')	-0,61	0,81
Normaal bureauwerk+(4, 'non')	0,37	0,88
Normaal bureauwerk+(4, 'hallway')	5,29	0,26
Normaal bureauwerk+(4, 'window')	14,33	0,05
Sociaal+(4, 'office partition')	2,18	0,17
Sociaal+(4, 'non')	2,10	0,06
Sociaal+(4, 'wall')	-1,03	0,73
Sociaal+(4, 'hallway')	30,59	
Sociaal+(4, 'window')	11,63	
Bellen+(4, 'office partition')	3,42	0,02
Bellen+(4, 'non')	-5,64	0,07
Bellen+(4, 'window')	-8,66	0,28
Bellen+(4, 'wall')	0,34	0,92
Bellen+(4, 'hallway')	-4,56	0,35
Gefocust bureauwerk+(4, 'office partition')	-0,57	0,27
Gefocust bureauwerk+(4, 'window')	-2,97	0,46
Gefocust bureauwerk+(4, 'non')	-4,48	0,00
Gefocust bureauwerk+(4, 'wall')	-5,23	0,03
Gefocust bureauwerk+(4, 'hallway')	11,61	0,05
Interactief bureauwerk+(4, 'office partition')	1,00	0,42
Interactief bureauwerk+(4, 'non')	2,13	0,45
Interactief bureauwerk+(4, 'window')	-10,32	0,00
Interactief bureauwerk+(4, 'wall')	-1,76	0,35
Ongeplande meeting+(4, 'office partition')	-3,38	0,19
Ongeplande meeting+(4, 'non')	-0,92	0,66
Ongeplande meeting+(4, 'wall')	-0,15	0,96
Ongeplande meeting+(4, 'hallway')	-7,37	0,06
Ongeplande meeting+(4, 'window')	12,68	0,08
Anders+(4, 'office partition')	1,51	0,27
Anders+(4, 'wall')	0,91	0,46
Anders+(4, 'non')	2,44	0,05
Anders+(4, 'window')	-1,76	0,62

The following values are significant:

- Planned Meeting + Non (+)
- Planned Meeting + Hallway (-)
- General Desk Work + Window (+)
- Calling + Office Partition (+)
- Undisturbed Desk Work + Non (-)
- Undisturbed Desk Work + Wall (-)
- Undisturbed Desk Work + Hallway (+)
- Interactive Desk Work + Window (-)
- Other + Non (+)

Activity (AC) & Extra monitor (V6)

Value	Mean	p(T)
Meeting+(6, 'Yes')	0,57	0,59
Meeting+(6, 'No')	1,54	0,09
Normaal bureauwerk+(6, 'Yes')	-0,57	0,22
Normaal bureauwerk+(6, 'No')	1,45	0,47
Sociaal+(6, 'Yes')	1,98	0,14
Sociaal+(6, 'No')	2,10	0,09
Bellen+(6, 'Yes')	2,68	0,04
Bellen+(6, 'No')	-5,78	0,04
Gefocust bureauwerk+(6, 'Yes')	-0,63	0,18
Gefocust bureauwerk+(6, 'No')	-8,96	0,00
Interactief bureauwerk+(6, 'Yes')	0,30	0,77
Interactief bureauwerk+(6, 'No')	-5,07	0,20
Ongeplande meeting+(6, 'Yes')	-1,59	0,41
Ongeplande meeting+(6, 'No')	-3,62	0,08
Anders+(6, 'Yes')	0,94	0,35
Anders+(6, 'No')	2,45	0,03

The following values are significant:

- Calling + Yes (+)
- Calling + No (-)
- Undisturbed Desk Work + No (-)
- Other + No (+)

Activity (AC) & Type of chair (V7)

Value	Mean	p(T)
Meeting+(7, 'Deskchair')	-0,02	0,98
Meeting+(7, 'Regular chair')	7,74	0,02
Meeting+(7, 'Barstool')	6,06	0,00
Normaal bureauwerk+(7, 'Deskchair')	-0,33	0,47
Normaal bureauwerk+(7, 'Barstool')	-2,74	0,65
Normaal bureauwerk+(7, 'Regular chair')	-3,89	0,42
Sociaal+(7, 'Deskchair')	1,97	0,14
Sociaal+(7, 'Regular chair')	1,63	0,33
Sociaal+(7, 'Barstool')	2,65	0,14
Bellen+(7, 'Deskchair')	-0,99	0,48
Bellen+(7, 'Regular chair')	6,72	0,03
Bellen+(7, 'Barstool')	-7,32	0,53
Gefocust bureauwerk+(7, 'Deskchair')	-1,31	0,01
Gefocust bureauwerk+(7, 'Regular chair')	7,16	0,15
Gefocust bureauwerk+(7, 'Barstool')	-1,58	0,59
Interactief bureauwerk+(7, 'Deskchair')	0,30	0,77
Interactief bureauwerk+(7, 'Regular chair')	-8,89	0,00
Ongeplande meeting+(7, 'Deskchair')	-1,86	0,24
Ongeplande meeting+(7, 'Regular chair')	-5,61	0,30
Ongeplande meeting+(7, 'Barstool')	-3,63	
Anders+(7, 'Deskchair')	-0,87	0,40
Anders+(7, 'Barstool')	2,45	0,12
Anders+(7, 'Regular chair')	6,38	0,00

The following values are significant:

- Planned Meeting + Regular Chair (+)
- Planned Meeting + Barstool (+)
- Calling + Regular Chair (+)
- Undisturbed Desk Work + Deskchair (-)
- Interactive Desk Work + Regular Chair (-)
- Other + Regular Chair (+)

Activity (AC) & Type of desk (V8)

Value	Mean	p(T)
Meeting+(8, 'Individual desk, adjustable')	0,54	0,62
Meeting+(8, 'Shared table')	1,55	0,10
Meeting+(8, 'Individual desk')	1,48	0,31
Normaal bureauwerk+(8, 'Individual desk, adjustable')	-0,67	0,16
Normaal bureauwerk+(8, 'Shared table')	2,11	0,30
Normaal bureauwerk+(8, 'Individual desk')	-0,24	0,93
Normaal bureauwerk+(8, 'Special desk ')	7,93	0,25
Sociaal+(8, 'Individual desk, adjustable')	2,53	0,07
Sociaal+(8, 'Shared table')	1,83	0,23
Sociaal+(8, 'Individual desk')	-5,30	0,25
Sociaal+(8, 'Special desk ')	3,00	0,14
Bellen+(8, 'Individual desk, adjustable')	2,95	0,03
Bellen+(8, 'Shared table')	-6,23	0,04
Bellen+(8, 'Special desk ')	0,20	0,98
Bellen+(8, 'Individual desk')	-1,88	0,66
Gefocust bureauwerk+(8, 'Individual desk, adjustable')	-0,57	0,27
Gefocust bureauwerk+(8, 'Special desk ')	2,17	0,56
Gefocust bureauwerk+(8, 'Shared table')	-8,29	0,01
Gefocust bureauwerk+(8, 'Individual desk')	-2,68	0,01
Interactief bureauwerk+(8, 'Individual desk, adjustable')	1,03	0,41
Interactief bureauwerk+(8, 'Individual desk')	1,50	0,41
Interactief bureauwerk+(8, 'Shared table')	-2,55	0,54
Interactief bureauwerk+(8, 'Special desk ')	-10,32	0,00
Ongeplande meeting+(8, 'Individual desk, adjustable')	-2,93	0,22
Ongeplande meeting+(8, 'Shared table')	-3,62	0,08
Ongeplande meeting+(8, 'Individual desk')	0,79	0,81
Ongeplande meeting+(8, 'Special desk ')	12,68	0,08
Anders+(8, 'Individual desk, adjustable')	1,23	0,32
Anders+(8, 'Shared table')	2,45	0,03
Anders+(8, 'Individual desk')	-0,85	0,68
Anders+(8, 'Special desk ')	1,34	0,44

The following values are significant:

- Calling + Individual Desk, adjustable (+)
- Calling + Shared Table (-)
- Undisturbed Desk Work + Shared Table (-)
- Undisturbed Desk Work + Individual desk (-)
- Interactive Desk Work + Special Desk (-)
- Other + Shared Table (+)

Activity (AC) & Presentation hardware (V9)

Value	Mean	p(T)
Meeting+(9, 'No')	1,18	0,22
Meeting+(9, 'Yes')	1,08	0,28
Normaal bureauwerk+(9, 'No')	-0,58	0,21
Normaal bureauwerk+(9, 'Yes')	5,94	0,10
Sociaal+(9, 'No')	2,01	0,03
Sociaal+(9, 'Yes')	2,37	0,52
Bellen+(9, 'No')	2,92	0,01
Bellen+(9, 'Yes')	-16,87	0,00
Gefocust bureauwerk+(9, 'No')	-0,74	0,11
Gefocust bureauwerk+(9, 'Yes')	-18,14	0,00
Interactief bureauwerk+(9, 'No')	-0,19	0,85
Interactief bureauwerk+(9, 'Yes')	3,79	0,62
Ongeplande meeting+(9, 'No')	-1,99	0,27
Ongeplande meeting+(9, 'Yes')	-2,88	0,19
Anders+(9, 'No')	2,82	0,00
Anders+(9, 'Yes')	-3,51	0,12

The following values are significant:

- Social + No (+)
- Calling + No (+)
- Calling + Yes (-)
- Undisturbed Desk Work + Yes (-)
- Other + No (+)

Activity (AC) & Desk space (V10)

Value	Mean	p(T)
Meeting+(10, 'regular')	1,64	0,08
Meeting+(10, 'spacious')	0,54	0,61
Meeting+(10, 'small')	-2,96	0,17
Normaal bureauwerk+(10, 'regular')	-0,49	0,29
Normaal bureauwerk+(10, 'spacious')	0,23	0,94
Normaal bureauwerk+(10, 'small')	7,93	0,25
Sociaal+(10, 'regular')	2,13	0,10
Sociaal+(10, 'spacious')	1,82	0,15
Sociaal+(10, 'small')	11,63	
Bellen+(10, 'regular')	1,82	0,16
Bellen+(10, 'spacious')	-7,91	0,03
Bellen+(10, 'small')	0,20	0,98
Gefocust bureauwerk+(10, 'regular')	-0,92	0,05
Gefocust bureauwerk+(10, 'small')	2,17	0,56
Gefocust bureauwerk+(10, 'spacious')	-16,14	0,01
Interactief bureauwerk+(10, 'regular')	0,98	0,35
Interactief bureauwerk+(10, 'small')	-10,32	0,00
Interactief bureauwerk+(10, 'spacious')	-2,11	0,70
Ongeplande meeting+(10, 'regular')	-2,67	0,16
Ongeplande meeting+(10, 'spacious')	-2,30	0,25
Ongeplande meeting+(10, 'small')	12,68	0,08
Anders+(10, 'regular')	0,54	0,60
Anders+(10, 'spacious')	2,98	0,01
Anders+(10, 'small')	1,34	0,44

The following values are significant:

- Calling + Spacious (-)
- Undisturbed Desk Work + Regular (-)
- Undisturbed Desk Work + Spacious (-)
- Interactive Desk Work + Small (-)
- Other + Spacious (+)

Activity (AC) & Storage (V11)

Value	Mean	p(T)
Meeting+(11, 'No')	0,21	0,79
Meeting+(11, 'Yes')	3,95	0,00
Normaal bureauwerk+(11, 'No')	-0,69	0,30
Normaal bureauwerk+(11, 'Yes')	-0,15	0,81
Sociaal+(11, 'No')	2,33	0,02
Sociaal+(11, 'Yes')	1,16	0,54
Bellen+(11, 'No')	-2,58	0,12
Bellen+(11, 'Yes')	4,87	0,01
Gefocust bureauwerk+(11, 'No')	-0,59	0,32
Gefocust bureauwerk+(11, 'Yes')	-2,12	0,01
Interactief bureauwerk+(11, 'No')	-1,24	0,27
Interactief bureauwerk+(11, 'Yes')	2,53	0,18
Ongeplande meeting+(11, 'No')	-0,57	0,73
Ongeplande meeting+(11, 'Yes')	-5,10	0,08
Anders+(11, 'No')	2,21	0,01
Anders+(11, 'Yes')	0,34	0,83

The following values are significant:

- Meeting + Yes (+)
- Social + No (+)
- Calling + Yes (+)
- Undisturbed Desk Work + Yes (-)
- Other + No (+)

Activity (AC) & Department base (V12)

Value	Mean	p(T)
Meeting+(12, 'Department')	0,65	0,66
Meeting+(12, 'Free use')	1,30	0,09
Normaal bureauwerk+(12, 'Department')	-1,03	0,13
Normaal bureauwerk+(12, 'Free use')	0,13	0,83
Sociaal+(12, 'Department')	2,61	0,15
Sociaal+(12, 'Free use')	1,81	0,08
Bellen+(12, 'Department')	4,06	0,03
Bellen+(12, 'Free use')	-1,87	0,25
Gefocust bureauwerk+(12, 'Department')	-0,03	0,97
Gefocust bureauwerk+(12, 'Free use')	-2,71	0,00
Interactief bureauwerk+(12, 'Department')	-1,13	0,52
Interactief bureauwerk+(12, 'Free use')	0,54	0,64
Ongeplande meeting+(12, 'Department')	-5,76	0,09
Ongeplande meeting+(12, 'Free use')	-0,63	0,69
Anders+(12, 'Department')	1,58	0,27
Anders+(12, 'Free use')	1,79	0,05

The following values are significant:

- Calling + Department (+)
- Undisturbed Desk Work + Free Use (-)
- Other + Free Use (+)

Activity (AC) & Possible meeting (V16)

Value	Mean	p(T)
Meeting+(16, 'No')	2,40	0,02
Meeting+(16, 'Yes')	-0,04	0,97
Normaal bureauwerk+(16, 'No')	-0,82	0,10
Normaal bureauwerk+(16, 'Yes')	1,60	0,16
Sociaal+(16, 'No')	2,41	0,02
Sociaal+(16, 'Yes')	0,63	0,73
Bellen+(16, 'No')	3,44	0,01
Bellen+(16, 'Yes')	-10,62	0,00
Gefocust bureauwerk+(16, 'No')	-0,62	0,23
Gefocust bureauwerk+(16, 'Yes')	-4,20	0,00
Interactief bureauwerk+(16, 'No')	-0,08	0,94
Interactief bureauwerk+(16, 'Yes')	1,07	0,88
Ongeplande meeting+(16, 'No')	-2,41	0,17
Ongeplande meeting+(16, 'Yes')	-1,39	0,61
Anders+(16, 'No')	0,92	0,27
Anders+(16, 'Yes')	3,08	0,04

The following values are significant:

- Meeting + No (+)
- Social + No (+)
- Calling + No (+)
- Calling + Yes (-)
- Undisturbed Desk Work + Yes (-)
- Other + Yes (+)

Activity (AC) & Bookable (V17)

Value	Mean	p(T)
Meeting+(17, 'No')	0,99	0,30
Meeting+(17, 'Yes')	1,25	0,21
Normaal bureauwerk+(17, 'No')	-0,49	0,29
Normaal bureauwerk+(17, 'Yes')	1,49	0,65
Sociaal+(17, 'No')	1,85	0,06
Sociaal+(17, 'Yes')	2,82	0,21
Bellen+(17, 'No')	2,57	0,04
Bellen+(17, 'Yes')	-8,13	0,01
Gefocust bureauwerk+(17, 'No')	-0,81	0,08
Gefocust bureauwerk+(17, 'Yes')	-11,81	0,01
Interactief bureauwerk+(17, 'No')	0,16	0,87
Interactief bureauwerk+(17, 'Yes')	-2,55	0,54
Ongeplande meeting+(17, 'No')	-1,59	0,41
Ongeplande meeting+(17, 'Yes')	-3,62	0,08
Anders+(17, 'No')	2,98	0,00
Anders+(17, 'Yes')	-2,09	0,22

The following values are significant:

- Calling + No (+)
- Calling + Yes (-)
- Undisturbed Desk Work + Yes (-)
- Other + No (+)

Activity (AC) & Focus purpose (V18)

Value	Mean	p(T)
Meeting+(18, 'Yes')	-0,36	0,70
Meeting+(18, 'No')	2,86	0,01
Normaal bureauwerk+(18, 'Yes')	-0,38	0,41
Normaal bureauwerk+(18, 'No')	-1,52	0,67
Sociaal+(18, 'Yes')	2,32	0,09
Sociaal+(18, 'No')	1,76	0,14
Bellen+(18, 'Yes')	1,55	0,22
Bellen+(18, 'No')	-8,01	0,04
Gefocust bureauwerk+(18, 'Yes')	-0,85	0,07
Gefocust bureauwerk+(18, 'No')	-14,19	0,01
Interactief bureauwerk+(18, 'Yes')	0,05	0,96
Interactief bureauwerk+(18, 'No')	-1,58	0,76
Ongeplande meeting+(18, 'Yes')	-2,15	0,19
Ongeplande meeting+(18, 'No')	-2,38	0,52
Anders+(18, 'Yes')	0,50	0,61
Anders+(18, 'No')	3,07	0,01

The following values are significant:

- Meeting + No (+)
- Calling + No (-)
- Undisturbed Desk Work + No (-)
- Other + No (+)

Activity (AC) & Social purpose (V20)

Value	Mean	p(T)
Meeting+(20, 'No')	0,05	0,94
Meeting+(20, 'Yes')	6,14	0,00
Normaal bureauwerk+(20, 'No')	-0,29	0,52
Normaal bureauwerk+(20, 'Yes')	-4,73	0,19
Sociaal+(20, 'No')	2,15	0,10
Sociaal+(20, 'Yes')	1,91	0,12
Bellen+(20, 'No')	-0,47	0,74
Bellen+(20, 'Yes')	1,48	0,64
Gefocust bureauwerk+(20, 'No')	-1,13	0,02
Gefocust bureauwerk+(20, 'Yes')	-6,00	0,05
Interactief bureauwerk+(20, 'No')	-0,08	0,94
Interactief bureauwerk+(20, 'Yes')	1,38	0,86
Ongeplande meeting+(20, 'No')	-2,26	0,15
Ongeplande meeting+(20, 'Yes')	-0,65	0,82
Anders+(20, 'No')	-0,87	0,40
Anders+(20, 'Yes')	5,34	0,00

The following values are significant:

- Meeting + Yes (+)
- Undisturbed Desk Work + No (-)
- Undisturbed Desk Work + Yes (-)
- Other + Yes (+)

Activity (AC) & Learn purpose (V21)

Value	Mean	p(T)
Meeting+(21, 'No')	0,58	0,55
Meeting+(21, 'Yes')	1,63	0,10
Normaal bureauwerk+(21, 'No')	-0,44	0,34
Normaal bureauwerk+(21, 'Yes')	0,23	0,94
Sociaal+(21, 'No')	2,29	0,04
Sociaal+(21, 'Yes')	1,52	0,34
Bellen+(21, 'No')	2,11	0,10
Bellen+(21, 'Yes')	-10,94	0,00
Gefocust bureauwerk+(21, 'No')	-0,86	0,06
Gefocust bureauwerk+(21, 'Yes')	-13,71	0,01
Interactief bureauwerk+(21, 'No')	-0,19	0,85
Interactief bureauwerk+(21, 'Yes')	3,79	0,62
Ongeplande meeting+(21, 'No')	-2,10	0,23
Ongeplande meeting+(21, 'Yes')	-2,57	0,30
Anders+(21, 'No')	0,50	0,61
Anders+(21, 'Yes')	3,07	0,01

The following values are significant:

- Social + No (+)
- Calling + Yes (-)
- Undisturbed Desk Work + Yes (-)
- Other + Yes (+)

Activity + Workplace + Activity Profile

ANOVA

AP – AC – V1	sum_sq	df	F	PR(>F)
C(AP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V1)	0,00	5,00	0,00	1,00
C(AP):C(AC)	-129,46	21,00	-0,03	1,00
C(AP):C(V1)	36459,17	15,00	13,01	0,00
C(AC):C(V1)	20463,51	35,00	3,13	0,00
C(AP):C(AC):C(V1)	187,26	105,00	0,01	0,92
Residual	565879,61	3030,00		

AP-AC-V2	sum_sq	df	F	PR(>F)
C(AP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V2)	0,00	7,00	0,00	1,00
C(AP):C(AC)	0,00	21,00	0,00	1,00
C(AP):C(V2)	0,00	21,00	0,00	1,00
C(AC):C(V2)	0,00	49,00	0,00	1,00
C(AP):C(AC):C(V2)	5196,95	147,00	0,19	0,90
Residual	560382,29	3021,00		

AP-AC-V3	sum_sq	df	F	PR(>F)
C(AP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V3)	0,00	2,00	0,00	1,00
C(AP):C(AC)	0,00	21,00	0,00	1,00
C(AP):C(V3)	0,00	6,00	0,00	1,00
C(AC):C(V3)	0,00	14,00	0,00	1,00
C(AP):C(AC):C(V3)	490,16	42,00	0,06	0,81
Residual	596370,94	3061,00		

AP-AC-V4	sum_sq	df	F	PR(>F)
C(AP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V4)	-0,02	4,00	0,00	1,00
C(AP):C(AC)	0,04	21,00	0,00	1,00
C(AP):C(V4)	0,00	12,00	0,00	1,00
C(AC):C(V4)	0,00	28,00	0,00	1,00
C(AP):C(AC):C(V4)	4884,24	84,00	0,30	0,74
Residual	578507,02	3024,00		

AP-AC-V5	sum_sq	df	F	PR(>F)
C(AP)	70,40	3,00	0,12	0,95
C(AC)	1568,35	7,00	1,14	0,33
C(V5)	7,19	1,00	0,04	0,85
C(AP):C(AC)	11476,64	21,00	2,79	0,00
C(AP):C(V5)	72,70	3,00	0,12	0,95
C(AC):C(V5)	2491,81	7,00	1,82	0,08
C(AP):C(AC):C(V5)	3765,49	21,00	0,92	0,57
Residual	601140,37	3068,00		

AP-AC-V6	sum_sq	df	F	PR(>F)
C(AP)	101,26	3,00	0,18	0,91
C(AC)	1550,41	7,00	1,15	0,33
C(V6)	422,45	1,00	2,19	0,14
C(AP):C(AC)	15100,07	21,00	3,73	0,00
C(AP):C(V6)	3148,68	3,00	5,44	0,00
C(AC):C(V6)	3546,18	7,00	2,63	0,01
C(AP):C(AC):C(V6)	7485,12	21,00	1,85	0,01
Residual	590366,45	3061,00		

AP-AC-V7	sum_sq	df	F	PR(>F)
C(AP)	325541,48	3,00	564,01	0,00
C(AC)	-4558833,70	7,00	-3384,99	1,00
C(V7)	0,00	2,00	0,00	1,00
C(AP):C(AC)	-0,08	21,00	0,00	1,00
C(AP):C(V7)	-1998977,37	6,00	-1731,64	1,00
C(AC):C(V7)	0,00	14,00	0,00	1,00
C(AP):C(AC):C(V7)	12338,03	42,00	1,53	0,22
Residual	587002,58	3051,00		

AP-AC-V8	sum_sq	df	F	PR(>F)
C(AP)	0,00	3,00	0,00	1,00
C(AC)	692,60	7,00	0,51	0,47
C(V8)	0,00	3,00	0,00	1,00
C(AP):C(AC)	0,05	21,00	0,00	1,00
C(AP):C(V8)	-460411,16	9,00	-265,14	1,00
C(AC):C(V8)	0,79	21,00	0,00	1,00
C(AP):C(AC):C(V8)	1610,71	63,00	0,13	0,88
Residual	585573,59	3035,00		

AP-AC-V9

	sum_sq	df	F	PR(>F)
C(AP)	358,30	3,00	0,63	0,43
C(AC)	7980,96	7,00	6,03	0,00
C(V9)		1,00		
C(AP):C(AC)	12905,84	21,00	3,25	0,00
C(AP):C(V9)	12,58	3,00	0,02	0,88
C(AC):C(V9)	2255,52	7,00	1,70	0,16
C(AP):C(AC):C(V9)	10790,20	21,00	2,72	<0,01
Residual	580196,81	3067,00		

AP-AC-V10

	sum_sq	df	F	PR(>F)
C(AP)	31,18	3,00	0,05	0,98
C(AC)	4502,80	7,00	3,35	0,01
C(V10)	0,00	2,00	0,00	1,00
C(AP):C(AC)	8957,68	21,00	2,22	0,04
C(AP):C(V10)	1146,10	6,00	1,00	0,41
C(AC):C(V10)	1950,84	14,00	0,73	0,60
C(AP):C(AC):C(V10)	26647,73	42,00	3,31	<0,01
Residual	585632,63	3052,00		

AP-AC-V11

	sum_sq	df	F	PR(>F)
C(AP)	92,23	3,00	0,16	0,69
C(AC)	5759,26	7,00	4,25	0,00
C(V11)		1,00		
C(AP):C(AC)	9128,35	21,00	2,24	0,00
C(AP):C(V11)	1382,93	3,00	2,38	0,09
C(AC):C(V11)	707,57	7,00	0,52	0,67
C(AP):C(AC):C(V11)	8231,00	21,00	2,02	0,01
Residual	593432,64	3064,00		

AP-AC-V12

	sum_sq	df	F	PR(>F)
C(AP)	320,47	3,00	0,55	0,57
C(AC)	5368,16	7,00	3,97	0,00
C(V12)	292,87	1,00	1,52	0,22
C(AP):C(AC)	6704,01	21,00	1,65	0,04
C(AP):C(V12)	67,08	3,00	0,12	0,89
C(AC):C(V12)	2814,48	7,00	2,08	0,05
C(AP):C(AC):C(V12)	12419,97	21,00	3,06	<0,01
Residual	589906,98	3057,00		

AP-AC-V13

	sum_sq	df	F	PR(>F)
C(AP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V13)	0,00	1,00	0,00	1,00
C(AP):C(AC)	0,00	21,00	0,00	1,00
C(AP):C(V13)	0,00	3,00	0,00	1,00
C(AC):C(V13)	0,00	7,00	0,00	1,00
C(AP):C(AC):C(V13)	1749,71	21,00	0,43	0,83
Residual	603809,80	3082,00		

AP-AC-V14

	sum_sq	df	F	PR(>F)
C(AP)	176,81	3,00	0,30	0,58
C(AC)	3899,63	7,00	2,86	0,04
C(V14)		1,00		
C(AP):C(AC)	10128,37	21,00	2,48	0,01
C(AP):C(V14)	0,00	3,00	0,00	1,00
C(AC):C(V14)	1236,16	7,00	0,91	0,44
C(AP):C(AC):C(V14)	8215,47	21,00	2,01	0,03
Residual	597031,46	3068,00		

AP-AC-V15

	sum_sq	df	F	PR(>F)
C(AP)	0,00	3,00	0,00	1,00
C(AC)	12577,97	7,00	9,21	0,00
C(V15)	0,00	1,00	0,00	1,00
C(AP):C(AC)	-762,39	21,00	-0,19	1,00
C(AP):C(V15)	0,00	3,00	0,00	1,00
C(AC):C(V15)	130,74	7,00	0,10	1,00
C(AP):C(AC):C(V15)	535,24	21,00	0,13	0,88
Residual	599055,29	3071,00		

AP-AC-V16

	sum_sq	df	F	PR(>F)
C(AP)	0,00	3,00	0,00	1,00
C(AC)	10048,72	7,00	7,48	0,00
C(V16)		1,00		
C(AP):C(AC)	9825,28	21,00	2,44	0,01
C(AP):C(V16)	0,00	3,00	0,00	1,00
C(AC):C(V16)	5568,96	7,00	4,15	0,02
C(AP):C(AC):C(V16)	12676,24	21,00	3,15	<0,01
Residual	588329,22	3067,00		

AP-AC-V17

	sum_sq	df	F	PR(>F)
C(AP)	248,67	3,00	0,43	0,73
C(AC)	8415,61	7,00	6,26	0,00
C(V17)	1262,40	1,00	6,57	0,01
C(AP):C(AC)	8215,64	21,00	2,04	0,01
C(AP):C(V17)	1499,42	3,00	2,60	0,05
C(AC):C(V17)	856,61	7,00	0,64	0,42
C(AP):C(AC):C(V17)	7188,76	21,00	1,78	0,03
Residual	588100,02	3061,00		

AP-AC-V20

	sum_sq	df	F	PR(>F)
C(AP)	59,88	3,00	0,10	0,96
C(AC)	1223,01	7,00	0,90	0,41
C(V20)	2407,07	1,00	12,45	0,00
C(AP):C(AC)	7492,38	21,00	1,84	0,03
C(AP):C(V20)	558,52	3,00	0,96	0,41
C(AC):C(V20)	2039,65	7,00	1,51	0,20
C(AP):C(AC):C(V20)	6311,40	21,00	1,55	0,09
Residual	592568,66	3064,00		

AP-AC-V18

	sum_sq	df	F	PR(>F)
C(AP)	24,52	3,00	0,04	0,99
C(AC)	1093,14	7,00	0,81	0,58
C(V18)	4,49	1,00	0,02	0,88
C(AP):C(AC)	14692,19	21,00	3,62	0,00
C(AP):C(V18)	1821,00	3,00	3,14	0,02
C(AC):C(V18)	4156,47	7,00	3,07	0,00
C(AP):C(AC):C(V18)	7084,72	21,00	1,75	0,02
Residual	591815,18	3062,00		

AP-AC-V21

	sum_sq	df	F	PR(>F)
C(AP)	188,10	3,00	0,33	0,81
C(AC)	5762,14	7,00	4,27	0,01
C(V21)	0,00	1,00	0,00	1,00
C(AP):C(AC)	8848,82	21,00	2,18	0,01
C(AP):C(V21)	1427,46	3,00	2,47	0,06
C(AC):C(V21)	1352,01	7,00	1,00	0,37
C(AP):C(AC):C(V21)	10753,03	21,00	2,65	<0,01
Residual	590892,98	3063,00		

AP-AC-V19

	sum_sq	df	F	PR(>F)
C(AP)	0,05	3,00	0,00	1,00
C(AC)	-20664,90	7,00	-15,15	1,00
C(V19)	0,46	1,00	0,00	0,96
C(AP):C(AC)	296549,17	21,00	72,46	0,00
C(AP):C(V19)	0,04	3,00	0,00	1,00
C(AC):C(V19)	-2628,52	7,00	-1,93	1,00
C(AP):C(AC):C(V19)	595,10	21,00	0,15	0,70
Residual	598110,83	3069,00		

Significant variable combinations are:

- Activity Profile (AP) & Activity (AC) & Extra Monitor (V6)
- Activity Profile (AP) & Activity (AC) & Presentation Hardware (V9)
- Activity Profile (AP) & Activity (AC) & Desk Space (V10)
- Activity Profile (AP) & Activity (AC) & Storage (V11)
- Activity Profile (AP) & Activity (AC) & Department Based or Free Use (V12)
- Activity Profile (AP) & Activity (AC) & Multiple Person Meeting (V16)
- Activity Profile (AP) & Activity (AC) & Bookable (V17)
- Activity Profile (AP) & Activity (AC) & Focus Purpose (V18)
- Activity Profile (AP) & Activity (AC) & Learn Purpose (V21)

Activity Profile (AP) & Activity (AC) & Extra Monitor (V6)

Value	Mean	p(T)
P1+Meeting+6, Yes	-10,42	<0,01
P1+Meeting+6, No	3,28	0,09
P1+Normaal bureauwerk+6, Yes	-1,51	0,09
P1+Normaal bureauwerk+6, No	0,36	0,94
P1+Sociaal+6, Yes	0,69	0,75
P1+Sociaal+6, No	0,01	1,00
P1+Bellen+6, Yes	-0,93	0,73
P1+Bellen+6, No	8,00	0,15
P1+Gefocust bureauwerk+6, Yes	0,92	0,32
P1+Interactief bureauwerk+6, Yes	1,94	0,32
P1+Interactief bureauwerk+6, No	-6,09	0,02
P1+Ongeplande meeting+6, Yes	-1,11	0,74
P1+Ongeplande meeting+6, No	-0,33	0,92
P1+Anders+6, Yes	4,40	0,05
P1+Anders+6, No	6,23	0,17
P2+Anders+6, No	2,39	0,07
P2+Anders+6, Yes	0,30	0,80
P2+Gefocust bureauwerk+6, Yes	-1,54	0,01
P2+Gefocust bureauwerk+6, No	-8,96	<0,01
P2+Bellen+6, No	-7,36	0,02
P2+Bellen+6, Yes	3,20	0,06
P2+Interactief bureauwerk+6, Yes	3,22	0,03
P2+Interactief bureauwerk+6, No	-10,98	0,02
P2+Sociaal+6, No	2,95	0,03
P2+Sociaal+6, Yes	0,74	0,69
P2+Normaal bureauwerk+6, Yes	0,84	0,45
P2+Normaal bureauwerk+6, No	1,67	0,46
P2+Meeting+6, No	0,43	0,71
P2+Meeting+6, Yes	2,73	0,02
P2+Ongeplande meeting+6, Yes	-3,16	0,25
P2+Ongeplande meeting+6, No	-3,85	0,12
P4+Normaal bureauwerk+6, Yes	-0,36	0,56
P4+Normaal bureauwerk+6, No	-0,60	
P4+Anders+6, No	1,44	0,65
P4+Anders+6, Yes	0,00	1,00
P4+Gefocust bureauwerk+6, Yes	-1,29	0,35
P4+Sociaal+6, No	1,27	0,82
P4+Sociaal+6, Yes	6,06	0,12
P4+Interactief bureauwerk+6, Yes	-8,03	0,02
P4+Interactief bureauwerk+6, No	0,28	0,98
P4+Meeting+6, No	4,03	0,16
P4+Meeting+6, Yes	0,73	0,89
P4+Bellen+6, Yes	6,23	0,08
P4+Bellen+6, No	-14,02	
P4+Ongeplande meeting+6, Yes	0,53	0,90
P3+Bellen+6, Yes	3,72	0,57
P3+Gefocust bureauwerk+6, Yes	2,78	0,14
P3+Interactief bureauwerk+6, Yes	-3,75	0,07
P3+Anders+6, No	0,92	0,67
P3+Anders+6, Yes	-2,92	0,78
P3+Ongeplande meeting+6, No	-11,56	0,30
P3+Ongeplande meeting+6, Yes	10,46	0,19
P3+Normaal bureauwerk+6, Yes	-4,72	0,25
P3+Meeting+6, Yes	10,43	0,10
P3+Meeting+6, No	7,53	0,09
P3+Sociaal+6, Yes	2,17	0,72
P3+Sociaal+6, No	-11,58	0,06

The following values are significant:

- P1 + Interactive Desk Work + No (-)
- P1 + Other + Yes (+)
- P2 + Undisturbed Desk Work + Yes (-)
- P2 + Undisturbed Desk Work + No (-)
- P2 + Calling + No (-)
- P2 + Calling + Yes (+)
- P2 + Interactive Desk Work + Yes (+)
- P2 + Interactive Desk Work + No (-)
- P2 + Social + No (+)
- P2 + Planned Meeting + Yes (+)
- P4 + Interactive Desk Work + Yes (-)

Activity Profile (AP) & Activity (AC) & Presentation Hardware (V9)

Value	Mean	p(T)
P1+Meeting+9, No	-6,33	0,01
P1+Meeting+9, Yes	2,48	0,23
P1+Normaal bureauwerk+9, No	-1,37	0,12
P1+Normaal bureauwerk+9, Yes	-10,63	0,26
P1+Sociaal+9, No	0,62	0,76
P1+Sociaal+9, Yes	0,09	0,98
P1+Bellen+9, No	1,18	0,64
P1+Bellen+9, Yes	-2,62	0,75
P1+Gefocust bureauwerk+9, No	0,92	0,32
P1+Interactief bureauwerk+9, No	1,40	0,45
P1+Ongeplande meeting+9, No	-1,11	0,74
P1+Ongeplande meeting+9, Yes	-0,33	0,92
P1+Anders+9, No	4,87	0,02
P2+Anders+9, Yes	-6,04	0,02
P2+Anders+9, No	3,03	<0,01
P2+Gefocust bureauwerk+9, No	-1,64	0,01
P2+Gefocust bureauwerk+9, Yes	-18,14	<0,01
P2+Bellen+9, No	3,13	0,03
P2+Bellen+9, Yes	-18,11	<0,01
P2+Interactief bureauwerk+9, No	2,26	0,13
P2+Interactief bureauwerk+9, Yes	12,58	0,60
P2+Sociaal+9, No	1,98	0,07
P2+Sociaal+9, Yes	6,95	0,36
P2+Normaal bureauwerk+9, No	0,37	0,71
P2+Normaal bureauwerk+9, Yes	8,14	0,05
P2+Meeting+9, Yes	0,13	0,91
P2+Meeting+9, No	2,82	0,01
P2+Ongeplande meeting+9, No	-2,86	0,26
P2+Ongeplande meeting+9, Yes	-5,43	0,09
P4+Normaal bureauwerk+9, No	-0,36	0,56
P4+Normaal bureauwerk+9, Yes	-0,60	
P4+Anders+9, No	-2,21	0,44
P4+Anders+9, Yes	7,49	0,06
P4+Gefocust bureauwerk+9, No	-1,29	0,35
P4+Sociaal+9, No	5,18	0,11
P4+Interactief bureauwerk+9, No	-8,03	0,02
P4+Interactief bureauwerk+9, Yes	0,28	0,98
P4+Meeting+9, No	4,68	0,17
P4+Meeting+9, Yes	3,17	0,35
P4+Bellen+9, No	4,67	0,19
P4+Ongeplande meeting+9, No	0,53	0,90
P3+Bellen+9, No	3,72	0,57
P3+Gefocust bureauwerk+9, No	2,78	0,14
P3+Interactief bureauwerk+9, No	-3,75	0,07
P3+Anders+9, Yes	1,23	0,63
P3+Anders+9, No	-0,19	0,95
P3+Ongeplande meeting+9, No	-0,55	0,94
P3+Normaal bureauwerk+9, No	-4,72	0,25
P3+Meeting+9, No	10,43	0,10
P3+Meeting+9, Yes	7,53	0,09
P3+Sociaal+9, No	-0,89	0,86

The following values are significant:

- P1 + Planned Meeting + No (-)
- P1 + Other + No (+)
- P2 + Other + Yes (-)
- P2 + Other + No (+)
- P2 + Undisturbed Desk Work + No (-)
- P2 + Undisturbed Desk Work + Yes (-)
- P2 + Calling + No (+)
- P2 + Calling + Yes (-)
- P2 + General Desk Work + Yes (+)
- P2 + Planned Meeting + No (+)
- P4 + Other + Yes (+)
- P4 + Interactive Desk Work + No (-)

Activity Profile (AP) & Activity (AC) & Desk Space (V10)

Value	Mean	p(T)
P1+Meeting+10, regular	-8,74	<0,01
P1+Meeting+10, spacious	5,46	0,02
P1+Meeting+10, small	-2,96	0,17
P1+Normaal bureauwerk+10, regular	-1,45	0,10
P1+Normaal bureauwerk+10, small	18,84	
P1+Normaal bureauwerk+10, spacious	-10,63	0,26
P1+Sociaal+10, regular	0,69	0,75
P1+Sociaal+10, spacious	0,01	1,00
P1+Bellen+10, regular	-0,93	0,73
P1+Bellen+10, spacious	8,00	0,15
P1+Gefocust bureauwerk+10, regular	0,96	0,32
P1+Gefocust bureauwerk+10, small	0,16	0,97
P1+Interactief bureauwerk+10, regular	1,94	0,32
P1+Interactief bureauwerk+10, spacious	-6,09	0,02
P1+Ongeplande meeting+10, regular	-1,11	0,74
P1+Ongeplande meeting+10, spacious	-0,33	0,92
P1+Anders+10, regular	4,40	0,05
P1+Anders+10, spacious	6,23	0,17
P2+Anders+10, spacious	3,06	0,03
P2+Anders+10, regular	-0,21	0,87
P2+Anders+10, small	1,34	0,44
P2+Gefocust bureauwerk+10, regular	-1,83	<0,01
P2+Gefocust bureauwerk+10, spacious	-16,14	0,01
P2+Gefocust bureauwerk+10, small	-5,04	0,15
P2+Bellen+10, regular	1,66	0,32
P2+Bellen+10, spacious	-11,48	0,01
P2+Interactief bureauwerk+10, regular	2,52	0,09
P2+Sociaal+10, spacious	2,64	0,06
P2+Sociaal+10, regular	1,24	0,47
P2+Sociaal+10, small	11,63	
P2+Normaal bureauwerk+10, regular	1,02	0,33
P2+Normaal bureauwerk+10, spacious	0,94	0,77
P2+Normaal bureauwerk+10, small	4,29	0,55
P2+Meeting+10, spacious	-1,45	0,27
P2+Meeting+10, regular	3,55	<0,01
P2+Ongeplande meeting+10, regular	-4,20	0,13
P2+Ongeplande meeting+10, spacious	-3,88	0,15
P2+Ongeplande meeting+10, small	12,68	0,08
P4+Normaal bureauwerk+10, regular	-0,36	0,56
P4+Normaal bureauwerk+10, spacious	-0,60	
P4+Anders+10, spacious	1,44	0,65
P4+Anders+10, regular	0,00	1,00
P4+Gefocust bureauwerk+10, regular	-1,29	0,35
P4+Sociaal+10, spacious	1,27	0,82
P4+Sociaal+10, regular	6,06	0,12
P4+Interactief bureauwerk+10, regular	-8,03	0,02
P4+Interactief bureauwerk+10, spacious	0,28	0,98
P4+Meeting+10, spacious	2,42	0,47
P4+Meeting+10, regular	5,61	0,19
P4+Bellen+10, regular	6,23	0,08
P4+Bellen+10, spacious	-14,02	
P4+Ongeplande meeting+10, regular	0,53	0,90
P3+Bellen+10, small	0,20	0,98
P3+Bellen+10, regular	9,58	0,20
P3+Gefocust bureauwerk+10, small	19,39	0,33
P3+Gefocust bureauwerk+10, regular	2,04	0,27
P3+Interactief bureauwerk+10, small	-10,32	<0,01
P3+Interactief bureauwerk+10, regular	-0,76	0,78
P3+Anders+10, spacious	0,92	0,67
P3+Anders+10, regular	-2,92	0,78
P3+Ongeplande meeting+10, regular	-0,55	0,94
P3+Normaal bureauwerk+10, regular	-4,72	0,25
P3+Meeting+10, regular	10,43	0,10
P3+Meeting+10, spacious	7,53	0,09
P3+Sociaal+10, regular	2,17	0,72
P3+Sociaal+10, spacious	-11,58	0,06

The following values are significant:

- P1 + Planned Meeting + Regular (-)
- P1 + Planned Meeting + Spacious (+)
- P1 + Interactive Desk Work + Spacious (-)
- P1 + Other + Regular (+)
- P2 + Other + Spacious (+)
- P2 + Undisturbed Desk Work + Regular (-)
- P2 + Undisturbed Desk Work + Spacious (-)
- P2 + Calling + Spacious (-)
- P2 + Planned Meeting + Regular (+)
- P4 + Interactive Desk Work + Regular (-)
- P3 + Interactive Desk Work + Small (-)

Activity Profile (AP) & Activity (AC) & Storage (V11)

Value	Mean	p(T)
P1+Meeting+11, No	-2,32	0,15
P1+Normaal bureauwerk+11, No	-1,87	0,03
P1+Normaal bureauwerk+11, Yes	19,64	0,03
P1+Sociaal+11, No	0,49	0,79
P1+Bellen+11, No	0,92	0,70
P1+Gefocust bureauwerk+11, No	1,00	0,30
P1+Gefocust bureauwerk+11, Yes	-1,97	0,26
P1+Interactief bureauwerk+11, No	-0,03	0,99
P1+Interactief bureauwerk+11, Yes	12,85	0,04
P1+Ongeplande meeting+11, No	-0,37	0,89
P1+Ongeplande meeting+11, Yes	-4,25	0,49
P1+Anders+11, No	4,27	0,04
P1+Anders+11, Yes	14,40	0,25
P2+Anders+11, No	1,88	0,07
P2+Anders+11, Yes	0,33	0,85
P2+Gefocust bureauwerk+11, Yes	-2,26	0,01
P2+Gefocust bureauwerk+11, No	-2,51	<0,01
P2+Bellen+11, No	-4,58	0,04
P2+Bellen+11, Yes	4,45	0,05
P2+Interactief bureauwerk+11, Yes	3,14	0,23
P2+Interactief bureauwerk+11, No	2,02	0,24
P2+Sociaal+11, No	2,92	0,02
P2+Sociaal+11, Yes	0,37	0,86
P2+Normaal bureauwerk+11, Yes	-1,09	0,53
P2+Normaal bureauwerk+11, No	2,40	0,05
P2+Meeting+11, No	0,36	0,71
P2+Meeting+11, Yes	3,91	0,01
P2+Ongeplande meeting+11, Yes	-6,03	0,11
P2+Ongeplande meeting+11, No	-0,77	0,72
P4+Normaal bureauwerk+11, Yes	-0,27	0,68
P4+Normaal bureauwerk+11, No	-1,98	0,30
P4+Anders+11, No	2,64	0,36
P4+Anders+11, Yes	-2,21	0,59
P4+Gefocust bureauwerk+11, Yes	-1,29	0,35
P4+Sociaal+11, No	10,90	0,10
P4+Sociaal+11, Yes	2,52	0,51
P4+Interactief bureauwerk+11, Yes	-7,29	0,05
P4+Interactief bureauwerk+11, No	-2,46	0,76
P4+Meeting+11, No	4,03	0,16
P4+Meeting+11, Yes	0,73	0,89
P4+Bellen+11, Yes	6,23	0,08
P4+Bellen+11, No	-14,02	
P4+Ongeplande meeting+11, Yes	0,53	0,90
P3+Bellen+11, No	3,72	0,57
P3+Gefocust bureauwerk+11, No	2,78	0,14
P3+Interactief bureauwerk+11, No	-6,07	0,01
P3+Interactief bureauwerk+11, Yes	6,35	0,19
P3+Anders+11, No	0,28	0,89
P3+Ongeplande meeting+11, No	-0,55	0,94
P3+Normaal bureauwerk+11, Yes	7,10	0,22
P3+Normaal bureauwerk+11, No	-6,87	0,14
P3+Meeting+11, Yes	10,43	0,10
P3+Meeting+11, No	7,53	0,09
P3+Sociaal+11, No	-0,89	0,86

The following values are significant:

- P1 + General Desk Work + No (-)
- P1 + General Desk Work + Yes (+)
- P1 + Interactive Desk Work + Yes (+)
- P1 + Other + No (+)
- P2 + Undisturbed Desk Work + Yes (-)
- P2 + Undisturbed Desk Work + No (-)
- P2 + Calling + No (-)
- P2 + Calling + Yes (+)
- P2 + Social + No (+)
- P2 + General Desk Work + No (+)
- P2 + Planned Meeting + Yes (+)
- P4 + Interactive Desk Work + Yes (-)
- P3 + Interactive Desk Work + No (-)

Activity Profile (AP) & Activity (AC) & Department Based or Free Use (V12)

Value	Mean	p(T)
P1+Meeting+12, Department	-10,42	<0,01
P1+Meeting+12, Free use	3,28	0,09
P1+Normaal bureauwerk+12, Department	-1,28	0,32
P1+Normaal bureauwerk+12, Free use	-1,65	0,14
P1+Sociaal+12, Department	5,48	0,18
P1+Sociaal+12, Free use	-1,17	0,57
P1+Bellen+12, Department	3,58	0,39
P1+Bellen+12, Free use	-0,09	0,97
P1+Gefocust bureauwerk+12, Department	2,17	0,11
P1+Gefocust bureauwerk+12, Free use	-0,42	0,74
P1+Interactief bureauwerk+12, Department	3,94	0,28
P1+Interactief bureauwerk+12, Free use	0,00	1,00
P1+Ongeplande meeting+12, Department	-3,08	0,48
P1+Ongeplande meeting+12, Free use	0,74	0,80
P1+Anders+12, Department	2,45	0,24
P1+Anders+12, Free use	10,16	0,03
P2+Anders+12, Free use	1,52	0,13
P2+Anders+12, Department	1,21	0,56
P2+Gefocust bureauwerk+12, Free use	-3,53	<0,01
P2+Gefocust bureauwerk+12, Department	-1,27	0,19
P2+Bellen+12, Free use	-3,35	0,10
P2+Bellen+12, Department	3,69	0,14
P2+Interactief bureauwerk+12, Free use	2,86	0,08
P2+Interactief bureauwerk+12, Department	1,03	0,79
P2+Sociaal+12, Free use	3,33	0,01
P2+Sociaal+12, Department	-1,25	0,55
P2+Normaal bureauwerk+12, Free use	1,73	0,09
P2+Normaal bureauwerk+12, Department	-2,11	0,51
P2+Meeting+12, Free use	0,33	0,72
P2+Meeting+12, Department	4,75	0,01
P2+Ongeplande meeting+12, Department	-19,24	0,02
P2+Ongeplande meeting+12, Free use	-0,24	0,89
P4+Normaal bureauwerk+12, Department	-0,33	0,65
P4+Normaal bureauwerk+12, Free use	-0,40	0,71
P4+Anders+12, Free use	0,25	0,93
P4+Anders+12, Department	2,51	0,48
P4+Gefocust bureauwerk+12, Department	0,63	0,59
P4+Gefocust bureauwerk+12, Free use	-6,09	0,12
P4+Sociaal+12, Free use	2,14	0,59
P4+Sociaal+12, Department	10,51	0,07
P4+Interactief bureauwerk+12, Department	-7,31	0,05
P4+Interactief bureauwerk+12, Free use	-3,13	0,65
P4+Meeting+12, Free use	3,58	0,16
P4+Bellen+12, Free use	4,99	0,28
P4+Bellen+12, Department	3,63	0,37
P4+Ongeplande meeting+12, Department	0,53	0,90
P3+Bellen+12, Free use	0,20	0,98
P3+Bellen+12, Department	9,58	0,20
P3+Gefocust bureauwerk+12, Free use	19,39	0,33
P3+Gefocust bureauwerk+12, Department	2,04	0,27
P3+Interactief bureauwerk+12, Free use	-4,33	0,13
P3+Interactief bureauwerk+12, Department	-3,21	0,29
P3+Anders+12, Free use	0,92	0,67
P3+Anders+12, Department	-2,92	0,78
P3+Ongeplande meeting+12, Free use	-11,56	0,30
P3+Ongeplande meeting+12, Department	10,46	0,19
P3+Normaal bureauwerk+12, Free use	7,10	0,22
P3+Normaal bureauwerk+12, Department	-6,87	0,14
P3+Meeting+12, Free use	8,06	0,03
P3+Sociaal+12, Department	2,17	0,72
P3+Sociaal+12, Free use	-11,58	0,06

The following values are significant:

- P1 + Planned Meeting + Department (-)
- P1 + Other + Free use (+)
- P2 + Undisturbed Desk Work + Free use (-)
- P2 + Social + Free use (+)
- P2 + Planned Meeting + Department (-)
- P2 + Unplanned Meeting + Department (+)
- P4 + Interactive Desk Work + Department (-)
- P3 + Planned Meeting + Free use (+)

Activity Profile (AP) & Activity (AC) & Out Loud Speaking or Silence (V14)

Value	Mean	p(T)
P1+Meeting+14, out loud speaking	-2,32	0,15
P1+Normaal bureauwerk+14, out loud speaking	-1,13	0,25
P1+Normaal bureauwerk+14, silence	-2,83	0,14
P1+Sociaal+14, out loud speaking	1,82	0,38
P1+Sociaal+14, silence	-3,50	0,38
P1+Bellen+14, out loud speaking	5,23	0,04
P1+Bellen+14, silence	-8,67	0,06
P1+Gefocust bureauwerk+14, out loud speaking	2,03	0,04
P1+Gefocust bureauwerk+14, silence	-4,18	0,08
P1+Interactief bureauwerk+14, out loud speaking	1,57	0,42
P1+Interactief bureauwerk+14, silence	-2,23	0,04
P1+Ongeplande meeting+14, out loud speaking	-1,74	0,60
P1+Ongeplande meeting+14, silence	0,39	0,92
P1+Anders+14, out loud speaking	3,48	0,07
P1+Anders+14, silence	27,15	0,05
P2+Anders+14, out loud speaking	1,65	0,10
P2+Anders+14, silence	0,02	0,99
P2+Gefocust bureauwerk+14, out loud speaking	-2,71	<0,01
P2+Gefocust bureauwerk+14, silence	-0,94	0,28
P2+Bellen+14, out loud speaking	-1,00	0,60
P2+Bellen+14, silence	-2,75	0,37
P2+Interactief bureauwerk+14, out loud speaking	2,86	0,10
P2+Interactief bureauwerk+14, silence	0,89	0,71
P2+Sociaal+14, out loud speaking	2,01	0,07
P2+Sociaal+14, silence	6,43	0,40
P2+Normaal bureauwerk+14, out loud speaking	0,27	0,84
P2+Normaal bureauwerk+14, silence	2,51	0,07
P2+Meeting+14, out loud speaking	2,69	0,01
P2+Meeting+14, silence	-1,84	0,18
P2+Ongeplande meeting+14, out loud speaking	-2,62	0,31
P2+Ongeplande meeting+14, silence	-5,72	0,12
P4+Normaal bureauwerk+14, out loud speaking	-0,37	0,56
P4+Normaal bureauwerk+14, silence	0,00	1,00
P4+Anders+14, out loud speaking	0,79	0,74
P4+Gefocust bureauwerk+14, out loud speaking	-1,29	0,35
P4+Sociaal+14, out loud speaking	5,18	0,11
P4+Interactief bureauwerk+14, out loud speaking	-5,59	0,11
P4+Meeting+14, out loud speaking	3,58	0,16
P4+Bellen+14, out loud speaking	5,15	0,22
P4+Bellen+14, silence	2,04	0,74
P4+Ongeplande meeting+14, out loud speaking	0,53	0,90
P3+Bellen+14, out loud speaking	3,72	0,57
P3+Gefocust bureauwerk+14, out loud speaking	2,78	0,14
P3+Interactief bureauwerk+14, out loud speaking	-3,48	0,10
P3+Interactief bureauwerk+14, silence	-9,91	0,12
P3+Anders+14, out loud speaking	0,28	0,89
P3+Ongeplande meeting+14, out loud speaking	-0,55	0,94
P3+Normaal bureauwerk+14, out loud speaking	-4,72	0,25
P3+Meeting+14, out loud speaking	8,06	0,03
P3+Sociaal+14, out loud speaking	-0,89	0,86

The following values are significant:

- P1 + Calling + Out loud speaking (+)
- P1 + Undisturbed Desk Work + Out loud speaking (+)
- P1 + Interactive Desk Work + Silence (-)
- P1 + Anders + Silence (+)
- P2 + Undisturbed Desk Work + Out loud speaking (-)
- P2 + Planned Meeting + Out loud speaking (+)
- P3 + Planned Meeting + Out loud speaking (+)

Activity Profile (AP) & Activity (AC) & Multiple Person Meeting (V16)

Value	Mean	p(T)
P1+Meeting+16, No	-7,54	<0,01
P1+Meeting+16, Yes	6,24	0,01
P1+Normaal bureauwerk+16, No	-1,32	0,17
P1+Normaal bureauwerk+16, Yes	-2,03	0,31
P1+Sociaal+16, No	1,01	0,62
P1+Sociaal+16, Yes	-1,96	0,67
P1+Bellen+16, No	5,08	0,05
P1+Bellen+16, Yes	-10,00	0,03
P1+Gefocust bureauwerk+16, No	1,56	0,10
P1+Gefocust bureauwerk+16, Yes	-7,66	0,08
P1+Interactief bureauwerk+16, No	1,40	0,45
P1+Ongeplande meeting+16, No	-2,75	0,33
P1+Ongeplande meeting+16, Yes	4,85	0,31
P1+Anders+16, No	3,77	0,06
P1+Anders+16, Yes	10,02	0,14
P2+Anders+16, No	0,39	0,71
P2+Anders+16, Yes	2,71	0,08
P2+Gefocust bureauwerk+16, No	-1,92	0,01
P2+Gefocust bureauwerk+16, Yes	-3,83	<0,01
P2+Bellen+16, No	2,74	0,08
P2+Bellen+16, Yes	-10,78	0,01
P2+Interactief bureauwerk+16, No	2,49	0,10
P2+Interactief bureauwerk+16, Yes	5,06	
P2+Sociaal+16, No	2,63	0,04
P2+Sociaal+16, Yes	1,28	0,54
P2+Normaal bureauwerk+16, No	-0,83	0,56
P2+Normaal bureauwerk+16, Yes	3,47	0,01
P2+Meeting+16, Yes	-1,11	0,30
P2+Meeting+16, No	4,88	<0,01
P2+Ongeplande meeting+16, No	-2,83	0,28
P2+Ongeplande meeting+16, Yes	-4,80	0,15
P4+Normaal bureauwerk+16, No	-0,37	0,56
P4+Normaal bureauwerk+16, Yes	0,00	1,00
P4+Anders+16, No	0,79	0,74
P4+Gefocust bureauwerk+16, No	-1,29	0,35
P4+Sociaal+16, No	5,18	0,11
P4+Interactief bureauwerk+16, No	-8,03	0,02
P4+Interactief bureauwerk+16, Yes	0,28	0,98
P4+Meeting+16, No	6,43	0,05
P4+Meeting+16, Yes	0,73	0,86
P4+Bellen+16, No	4,67	0,19
P4+Ongeplande meeting+16, No	0,53	0,90
P3+Bellen+16, No	3,72	0,57
P3+Gefocust bureauwerk+16, No	2,78	0,14
P3+Interactief bureauwerk+16, No	-3,75	0,07
P3+Anders+16, No	0,28	0,89
P3+Ongeplande meeting+16, No	-0,55	0,94
P3+Normaal bureauwerk+16, No	-4,72	0,25
P3+Meeting+16, No	10,44	0,02
P3+Meeting+16, Yes	1,71	0,84
P3+Sociaal+16, No	-0,89	0,86

The following values are significant:

- P1 + Planned Meeting + No (-)
- P1 + Planned Meeting + Yes (+)
- P1 + Calling + No (+)
- P1 + Calling + Yes (-)
- P2 + Undisturbed Desk Work + No (-)
- P2 + Undisturbed Desk Work + Yes (-)
- P2 + Calling + Yes (-)
- P2 + Social + No (+)
- P2 + General Desk Work + Yes (+)
- P2 + Planned Meeting + No (+)
- P4 + Interactive Desk Work + No (-)
- P4 + Planned Meeting + No (+)
- P3 + Planned Meeting + No (+)

Activity Profile (AP) & Activity (AC) & Bookable (V17)

Value	Mean	p(T)
P1+Meeting+17, No	-6,18	0,01
P1+Meeting+17, Yes	2,03	0,32
P1+Normaal bureauwerk+17, No	-1,37	0,12
P1+Normaal bureauwerk+17, Yes	-10,63	0,26
P1+Sociaal+17, No	0,93	0,65
P1+Sociaal+17, Yes	-0,67	0,87
P1+Bellen+17, No	-0,93	0,73
P1+Bellen+17, Yes	8,00	0,15
P1+Gefocust bureauwerk+17, No	0,92	0,32
P1+Interactief bureauwerk+17, No	1,94	0,32
P1+Interactief bureauwerk+17, Yes	-6,09	0,02
P1+Ongeplande meeting+17, No	-1,11	0,74
P1+Ongeplande meeting+17, Yes	-0,33	0,92
P1+Anders+17, No	4,77	0,03
P1+Anders+17, Yes	5,61	0,23
P2+Anders+17, Yes	-4,14	0,08
P2+Anders+17, No	2,93	<0,01
P2+Gefocust bureauwerk+17, No	-1,78	<0,01
P2+Gefocust bureauwerk+17, Yes	-11,81	0,01
P2+Bellen+17, Yes	-10,81	<0,01
P2+Bellen+17, No	2,93	0,07
P2+Interactief bureauwerk+17, No	2,97	0,05
P2+Interactief bureauwerk+17, Yes	-3,13	0,67
P2+Sociaal+17, Yes	7,41	0,03
P2+Sociaal+17, No	1,22	0,28
P2+Normaal bureauwerk+17, No	0,84	0,41
P2+Normaal bureauwerk+17, Yes	2,47	0,50
P2+Meeting+17, Yes	0,29	0,82
P2+Meeting+17, No	2,63	0,01
P2+Ongeplande meeting+17, No	-3,16	0,25
P2+Ongeplande meeting+17, Yes	-3,85	0,12
P4+Normaal bureauwerk+17, No	-0,36	0,56
P4+Normaal bureauwerk+17, Yes	-0,60	
P4+Anders+17, Yes	1,44	0,65
P4+Anders+17, No	0,00	1,00
P4+Gefocust bureauwerk+17, No	-1,29	0,35
P4+Sociaal+17, Yes	1,27	0,82
P4+Sociaal+17, No	6,06	0,12
P4+Interactief bureauwerk+17, No	-8,03	0,02
P4+Interactief bureauwerk+17, Yes	0,28	0,98
P4+Meeting+17, Yes	4,03	0,16
P4+Meeting+17, No	0,73	0,89
P4+Bellen+17, No	6,23	0,08
P4+Bellen+17, Yes	-14,02	
P4+Ongeplande meeting+17, No	0,53	0,90
P3+Bellen+17, No	3,72	0,57
P3+Gefocust bureauwerk+17, No	2,78	0,14
P3+Interactief bureauwerk+17, No	-3,75	0,07
P3+Anders+17, Yes	0,92	0,67
P3+Anders+17, No	-2,92	0,78
P3+Ongeplande meeting+17, Yes	-11,56	0,30
P3+Ongeplande meeting+17, No	10,46	0,19
P3+Normaal bureauwerk+17, No	-4,72	0,25
P3+Meeting+17, No	10,43	0,10
P3+Meeting+17, Yes	7,53	0,09
P3+Sociaal+17, No	2,17	0,72
P3+Sociaal+17, Yes	-11,58	0,06

The following values are significant:

- P1 + Planned Meeting + No (-)
- P1 + Interactive Desk Work + Yes (-)
- P1 + Other + No (+)
- P2 + Other + No (+)
- P2 + Undisturbed Desk Work + No (-)
- P2 + Undisturbed Desk Work + Yes (-)
- P2 + Calling + Yes (-)
- P2 + Interactive Desk Work + No (+)
- P2 + Social + Yes (+)
- P2 + Planned Meeting + No (+)
- P4 + Interactive Desk Work + No (-)

Activity Profile (AP) & Activity (AC) & Collaboration Purpose (V18)

Value	Mean	p(T)
P1+Meeting+18, Yes	-9,91	<0,01
P1+Meeting+18, No	3,62	0,07
P1+Normaal bureauwerk+18, Yes	-1,37	0,12
P1+Normaal bureauwerk+18, No	-10,63	0,26
P1+Sociaal+18, Yes	0,69	0,75
P1+Sociaal+18, No	0,01	1,00
P1+Bellen+18, Yes	1,18	0,64
P1+Bellen+18, No	-2,62	0,75
P1+Gefocust bureauwerk+18, Yes	0,92	0,32
P1+Interactief bureauwerk+18, Yes	1,40	0,45
P1+Ongeplande meeting+18, Yes	-1,61	0,58
P1+Ongeplande meeting+18, No	2,02	0,63
P1+Anders+18, Yes	4,40	0,05
P1+Anders+18, No	6,23	0,17
P2+Anders+18, No	3,18	0,02
P2+Anders+18, Yes	-0,21	0,86
P2+Gefocust bureauwerk+18, Yes	-1,83	<0,01
P2+Gefocust bureauwerk+18, No	-14,19	0,01
P2+Bellen+18, No	-8,20	0,06
P2+Bellen+18, Yes	0,79	0,63
P2+Interactief bureauwerk+18, Yes	2,97	0,05
P2+Interactief bureauwerk+18, No	-3,13	0,67
P2+Sociaal+18, No	2,52	0,05
P2+Sociaal+18, Yes	1,67	0,41
P2+Normaal bureauwerk+18, Yes	1,29	0,20
P2+Normaal bureauwerk+18, No	-0,77	0,85
P2+Meeting+18, No	2,03	0,14
P2+Meeting+18, Yes	1,12	0,27
P2+Ongeplande meeting+18, Yes	-3,52	0,11
P2+Ongeplande meeting+18, No	0,39	0,94
P4+Normaal bureauwerk+18, Yes	-0,36	0,56
P4+Normaal bureauwerk+18, No	-0,60	
P4+Anders+18, No	1,44	0,65
P4+Anders+18, Yes	0,00	1,00
P4+Gefocust bureauwerk+18, Yes	-1,29	0,35
P4+Sociaal+18, No	1,27	0,82
P4+Sociaal+18, Yes	6,06	0,12
P4+Interactief bureauwerk+18, Yes	-8,03	0,02
P4+Interactief bureauwerk+18, No	0,28	0,98
P4+Meeting+18, No	4,03	0,16
P4+Meeting+18, Yes	0,73	0,89
P4+Bellen+18, Yes	6,23	0,08
P4+Bellen+18, No	-14,02	
P4+Ongeplande meeting+18, Yes	0,53	0,90
P3+Bellen+18, Yes	3,72	0,57
P3+Gefocust bureauwerk+18, Yes	2,78	0,14
P3+Interactief bureauwerk+18, Yes	-3,75	0,07
P3+Anders+18, No	0,92	0,67
P3+Anders+18, Yes	-2,92	0,78
P3+Ongeplande meeting+18, No	-11,56	0,30
P3+Ongeplande meeting+18, Yes	10,46	0,19
P3+Normaal bureauwerk+18, Yes	-4,72	0,25
P3+Meeting+18, Yes	10,43	0,10
P3+Meeting+18, No	7,53	0,09
P3+Sociaal+18, Yes	2,17	0,72
P3+Sociaal+18, No	-11,58	0,06

The following values are significant:

- P1 + Planned Meeting + Yes (-)
- P1 + Other + Yes (+)
- P2 + Other + No (+)
- P2 + Undisturbed Desk Work + Yes (-)
- P2 + Undisturbed Desk Work + No (-)
- P2 + Interactive Desk Work + Yes (+)
- P2 + Social + No (+)
- P4 + Interactive Desk Work + Yes (-)

Activity Profile (AP) & Activity (AC) & Learn Purpose (V21)

Value	Mean	p(T)
P1+Meeting+21, No	-9,91	<0,01
P1+Meeting+21, Yes	3,62	0,07
P1+Normaal bureauwerk+21, No	-1,37	0,12
P1+Normaal bureauwerk+21, Yes	-10,63	0,26
P1+Sociaal+21, No	0,69	0,75
P1+Sociaal+21, Yes	0,01	1,00
P1+Bellen+21, No	1,18	0,64
P1+Bellen+21, Yes	-2,62	0,75
P1+Gefocust bureauwerk+21, No	0,92	0,32
P1+Interactief bureauwerk+21, No	1,40	0,45
P1+Ongeplande meeting+21, No	-1,61	0,58
P1+Ongeplande meeting+21, Yes	2,02	0,63
P1+Anders+21, No	4,40	0,05
P1+Anders+21, Yes	6,23	0,17
P2+Anders+21, Yes	3,18	0,02
P2+Anders+21, No	-0,21	0,86
P2+Gefocust bureauwerk+21, No	-1,85	<0,01
P2+Gefocust bureauwerk+21, Yes	-13,71	0,01
P2+Bellen+21, No	1,66	0,32
P2+Bellen+21, Yes	-11,48	0,01
P2+Interactief bureauwerk+21, No	2,26	0,13
P2+Interactief bureauwerk+21, Yes	12,58	0,60
P2+Sociaal+21, Yes	2,78	0,16
P2+Sociaal+21, No	1,92	0,14
P2+Normaal bureauwerk+21, No	1,08	0,30
P2+Normaal bureauwerk+21, Yes	0,94	0,77
P2+Meeting+21, Yes	0,34	0,79
P2+Meeting+21, No	2,51	0,02
P2+Ongeplande meeting+21, No	-2,86	0,26
P2+Ongeplande meeting+21, Yes	-5,43	0,09
P4+Normaal bureauwerk+21, No	-0,36	0,56
P4+Normaal bureauwerk+21, Yes	-0,60	
P4+Anders+21, Yes	1,44	0,65
P4+Anders+21, No	0,00	1,00
P4+Gefocust bureauwerk+21, No	-1,29	0,35
P4+Sociaal+21, Yes	1,27	0,82
P4+Sociaal+21, No	6,06	0,12
P4+Interactief bureauwerk+21, No	-8,03	0,02
P4+Interactief bureauwerk+21, Yes	0,28	0,98
P4+Meeting+21, Yes	4,03	0,16
P4+Meeting+21, No	0,73	0,89
P4+Bellen+21, No	6,23	0,08
P4+Bellen+21, Yes	-14,02	
P4+Ongeplande meeting+21, No	0,53	0,90
P3+Bellen+21, No	3,72	0,57
P3+Gefocust bureauwerk+21, No	2,78	0,14
P3+Interactief bureauwerk+21, No	-3,75	0,07
P3+Anders+21, Yes	0,92	0,67
P3+Anders+21, No	-2,92	0,78
P3+Ongeplande meeting+21, No	-0,55	0,94
P3+Normaal bureauwerk+21, No	-4,72	0,25
P3+Meeting+21, No	10,43	0,10
P3+Meeting+21, Yes	7,53	0,09
P3+Sociaal+21, No	2,17	0,72
P3+Sociaal+21, Yes	-11,58	0,06

The following values are significant:

- P1 + Planned Meeting + No (-)
- P1 + Other + No (+)
- P2 + Other + Yes (+)
- P2 + Undisturbed Desk Work + No (-)
- P2 + Undisturbed Desk Work + Yes (-)
- P2 + Calling + Yes (-)
- P2 + Planned Meeting + No (+)
- P4 + Interactive Desk Work + No (-)

Activity + Workplace + Mobility Profile

ANOVA

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V1)	0,00	5,00	0,00	1,00
C(MP):C(AC)	286173,02	21,00	74,44	0,00
C(MP):C(V1)	-21130,95	15,00	-7,70	1,00
C(AC):C(V1)	0,00	35,00	0,00	1,00
C(MP):C(AC):C(V1)	598,13	105,00	0,03	0,86
Residual	552873,64	3020,00		

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V2)	0,00	7,00	0,00	1,00
C(MP):C(AC)	-13285,11	21,00	-3,42	1,00
C(MP):C(V2)	-23835,56	21,00	-6,14	1,00
C(AC):C(V2)	0,00	49,00	0,00	1,00
C(MP):C(AC):C(V2)	29297,48	147,00	1,08	0,36
Residual	555600,62	3005,00		

	sum_sq	df	F	PR(>F)
C(MP)	2536,60	3,00	4,41	0,00
C(AC)	-2551,75	7,00	-1,90	1,00
C(V3)	0,05	2,00	0,00	1,00
C(MP):C(AC)	-0,01	21,00	0,00	1,00
C(MP):C(V3)	59,99	6,00	0,05	1,00
C(AC):C(V3)	0,00	14,00	0,00	1,00
C(MP):C(AC):C(V3)	19,59	42,00	0,00	0,96
Residual	584511,97	3049,00		

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V4)	0,00	4,00	0,00	1,00
C(MP):C(AC)	0,00	21,00	0,00	1,00
C(MP):C(V4)	0,00	12,00	0,00	1,00
C(AC):C(V4)	0,00	28,00	0,00	1,00
C(MP):C(AC):C(V4)	12663,88	84,00	0,80	0,45
Residual	568981,87	3016,00		

	sum_sq	df	F	PR(>F)
C(MP)	276,70	3,00	0,47	0,70
C(AC)	-94,91	7,00	-0,07	1,00
C(V5)	0,02	1,00	0,00	0,99
C(MP):C(AC)	-558,63	21,00	-0,14	1,00
C(MP):C(V5)	18,88	3,00	0,03	0,99
C(AC):C(V5)	28,71	7,00	0,02	1,00
C(MP):C(AC):C(V5)	8942,80	21,00	2,18	0,14
Residual	599661,14	3070,00		

	sum_sq	df	F	PR(>F)
C(MP)	33,82	3,00	0,06	0,81
C(AC)	753,71	7,00	0,56	0,73
C(V6)	372,93	1,00	1,93	0,16
C(MP):C(AC)	13480,97	21,00	3,33	0,00
C(MP):C(V6)	124,43	3,00	0,22	0,64
C(AC):C(V6)	3254,97	7,00	2,41	0,03
C(MP):C(AC):C(V6)	9205,30	21,00	2,27	<0,01
Residual	590489,75	3062,00		

	sum_sq	df	F	PR(>F)
C(MP)	-1,36	3,00	0,00	1,00
C(AC)	848945,64	7,00	628,80	0,00
C(V8)	-3,78	3,00	-0,01	1,00
C(MP):C(AC)	-8,94	21,00	0,00	1,00
C(MP):C(V8)	4,44	9,00	0,00	1,00
C(AC):C(V8)	41,57	21,00	0,01	1,00
C(MP):C(AC):C(V8)	294,55	63,00	0,02	0,88
Residual	584977,81	3033,00		

	sum_sq	df	F	PR(>F)
C(MP)	69,17	3,00	0,12	0,88
C(AC)	6207,31	7,00	4,74	0,00
C(V9)		1,00		
C(MP):C(AC)	12377,16	21,00	3,15	0,00
C(MP):C(V9)	8226,24	3,00	14,67	0,00
C(AC):C(V9)	0,00	7,00	0,00	1,00
C(MP):C(AC):C(V9)	21753,95	21,00	5,54	<0,01
Residual	572909,18	3065,00		

	sum_sq	df	F	PR(>F)
C(MP)	2153,81	3,00	3,77	0,01
C(AC)	9465,09	7,00	7,09	0,00
C(V10)	0,00	2,00	0,00	1,00
C(MP):C(AC)	15840,23	21,00	3,96	0,00
C(MP):C(V10)	5812,26	6,00	5,08	0,00
C(AC):C(V10)	0,00	14,00	0,00	1,00
C(MP):C(AC):C(V10)	25734,39	42,00	3,21	<0,01
Residual	581784,11	3052,00		

	sum_sq	df	F	PR(>F)
C(MP)	325,83	3,00	0,57	0,45
C(AC)	6100,09	7,00	4,54	0,00
C(V11)	122,77	1,00	0,64	0,42
C(MP):C(AC)	11714,68	21,00	2,91	0,00
C(MP):C(V11)	2633,73	3,00	4,58	0,01
C(AC):C(V11)	7465,54	7,00	5,56	0,00
C(MP):C(AC):C(V11)	9055,44	21,00	2,25	<0,01
Residual	586635,01	3058,00		

	sum_sq	df	F	PR(>F)
C(MP)	-12,12	3,00	-0,02	1,00
C(AC)	4729,08	7,00	3,49	0,00
C(V12)	-0,06	1,00	0,00	1,00
C(MP):C(AC)	10138,52	21,00	2,49	0,00
C(MP):C(V12)	22,12	3,00	0,04	0,99
C(AC):C(V12)	1879,34	7,00	1,39	0,21
C(MP):C(AC):C(V12)	163,59	21,00	0,04	0,84
Residual	593362,22	3063,00		

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V13)	0,00	1,00	0,00	1,00
C(MP):C(AC)	0,00	21,00	0,00	1,00
C(MP):C(V13)	0,00	3,00	0,00	1,00
C(AC):C(V13)	0,00	7,00	0,00	1,00
C(MP):C(AC):C(V13)	725,92	21,00	0,18	0,91
Residual	601965,58	3082,00		

	sum_sq	df	F	PR(>F)
C(MP)	308,81	3,00	0,53	0,59
C(AC)	3805,59	7,00	2,79	0,01
C(V14)	0,00	1,00	0,00	1,00
C(MP):C(AC)	9757,83	21,00	2,39	0,00
C(MP):C(V14)	702,68	3,00	1,20	0,30
C(AC):C(V14)	623,70	7,00	0,46	0,77
C(MP):C(AC):C(V14)	4728,01	21,00	1,16	0,29
Residual	596239,67	3062,00		

	sum_sq	df	F	PR(>F)
C(MP)	0,00	3,00	0,00	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V15)	0,00	1,00	0,00	1,00
C(MP):C(AC)	-0,01	21,00	0,00	1,00
C(MP):C(V15)	0,00	3,00	0,00	1,00
C(AC):C(V15)	0,00	7,00	0,00	1,00
C(MP):C(AC):C(V15)	2049,67	21,00	0,50	0,48
Residual	599081,78	3069,00		

	sum_sq	df	F	PR(>F)
C(MP)	70,13	3,00	0,12	0,88
C(AC)	4294,90	7,00	3,22	0,00
C(V16)	0,00	1,00	0,00	1,00
C(MP):C(AC)	11499,21	21,00	2,87	0,00
C(MP):C(V16)	1474,26	3,00	2,58	0,08
C(AC):C(V16)	2633,83	7,00	1,97	0,10
C(MP):C(AC):C(V16)	15511,08	21,00	3,87	<0,01
Residual	583995,37	3062,00		

	sum_sq	df	F	PR(>F)
C(MP)	451,61	3,00	0,80	0,37
C(AC)	7174,51	7,00	5,42	0,00
C(V17)	0,00	1,00	0,00	1,00
C(MP):C(AC)	11985,17	21,00	3,02	0,00
C(MP):C(V17)	8141,15	3,00	14,34	0,00
C(AC):C(V17)	2100,87	7,00	1,59	0,18
C(MP):C(AC):C(V17)	12674,06	21,00	3,19	<0,01
Residual	579256,83	3061,00		

	sum_sq	df	F	PR(>F)
C(MP)	544,85	3,00	0,96	0,38
C(AC)	952,11	7,00	0,72	0,61
C(V18)	3,95	1,00	0,02	0,89
C(MP):C(AC)	13468,15	21,00	3,38	0,00
C(MP):C(V18)	714,24	3,00	1,25	0,29
C(AC):C(V18)	7640,78	7,00	5,75	0,00
C(MP):C(AC):C(V18)	16692,21	21,00	4,19	<0,01
Residual	581121,72	3061,00		

	sum_sq	df	F	PR(>F)
C(MP)	-60,39	3,00	-0,10	1,00
C(AC)	0,00	7,00	0,00	1,00
C(V19)	0,00	1,00	0,00	1,00
C(MP):C(AC)	2401,06	21,00	0,59	0,91
C(MP):C(V19)	0,00	3,00	0,00	1,00
C(AC):C(V19)	4265,58	7,00	3,12	0,00
C(MP):C(AC):C(V19)	3089,43	21,00	0,75	0,39
Residual	598097,72	3065,00		

	sum_sq	df	F	PR(>F)
C(MP)	1614,29	3,00	2,81	0,09
C(AC)	1707,80	7,00	1,27	0,27
C(V20)	0,00	1,00	0,00	1,00
C(MP):C(AC)	10698,93	21,00	2,66	0,00
C(MP):C(V20)	4069,26	3,00	7,07	0,01
C(AC):C(V20)	5,76	7,00	0,00	1,00
C(MP):C(AC):C(V20)	10811,34	21,00	2,69	<0,01
Residual	587266,84	3063,00		

	sum_sq	df	F	PR(>F)
C(MP)	94,23	3,00	0,17	0,68
C(AC)	1375,91	7,00	1,04	0,39
C(V21)	0,00	1,00	0,00	1,00
C(MP):C(AC)	10428,96	21,00	2,62	0,00
C(MP):C(V21)	1488,37	3,00	2,62	0,11
C(AC):C(V21)	1908,67	7,00	1,44	0,23
C(MP):C(AC):C(V21)	19123,38	21,00	4,80	<0,01
Residual	580179,78	3061,00		

T-tests

Activity Profile & Activity & Extra Monitor

Value	Mean	p(T)
Camper+Meeting+6, Yes	-4,84	0,01
Camper+Meeting+6, No	8,53	0,19
Camper+Normaal bureauwerk+6, Yes	-1,22	0,11
Camper+Sociaal+6, Yes	6,89	0,00
Camper+Sociaal+6, No	1,68	0,56
Camper+Bellen+6, Yes	1,97	0,25
Camper+Bellen+6, No	-14,02	
Camper+Gefocust bureauwerk+6, Yes	0,69	0,34
Camper+Interactief bureauwerk+6, Yes	5,35	0,02
Camper+Ongeplande meeting+6, Yes	-3,09	0,44
Camper+Anders+6, Yes	0,15	0,92
Camper+Anders+6, No	-18,85	
Nomad+Anders+6, No	-9,56	0,05
Nomad+Anders+6, Yes	-6,44	
Nomad+Gefocust bureauwerk+6, Yes	-0,15	0,84
Nomad+Gefocust bureauwerk+6, No	1,01	0,71
Nomad+Bellen+6, No	-0,19	0,97
Nomad+Bellen+6, Yes	5,50	0,02
Nomad+Interactief bureauwerk+6, Yes	4,94	0,19
Nomad+Interactief bureauwerk+6, No	-10,98	0,02
Nomad+Sociaal+6, No	-0,29	0,86
Nomad+Sociaal+6, Yes	3,00	0,67
Nomad+Normaal bureauwerk+6, Yes	-1,75	0,33
Nomad+Meeting+6, No	1,03	0,48
Nomad+Ongeplande meeting+6, No	-3,63	
Timid Traveller+Normaal bureauwerk+6, Yes	-0,37	0,59
Timid Traveller+Normaal bureauwerk+6, No	3,77	0,33
Timid Traveller+Anders+6, No	2,37	0,21
Timid Traveller+Anders+6, Yes	2,91	0,15
Timid Traveller+Gefocust bureauwerk+6, Yes	-1,93	0,02
Timid Traveller+Gefocust bureauwerk+6, No	0,54	0,92
Timid Traveller+Sociaal+6, No	1,70	0,47
Timid Traveller+Sociaal+6, Yes	-0,51	0,79
Timid Traveller+Interactief bureauwerk+6, Yes	-1,74	0,31
Timid Traveller+Interactief bureauwerk+6, No	-2,11	0,70
Timid Traveller+Meeting+6, No	1,19	0,40
Timid Traveller+Meeting+6, Yes	5,11	0,00
Timid Traveller+Bellen+6, Yes	3,15	0,12
Timid Traveller+Bellen+6, No	-5,30	0,22
Timid Traveller+Ongeplande meeting+6, Yes	-6,27	0,22
Timid Traveller+Ongeplande meeting+6, No	-1,88	0,35
Explorer+Bellen+6, Yes	2,09	0,60
Explorer+Bellen+6, No	-8,86	0,09
Explorer+Gefocust bureauwerk+6, Yes	-0,60	0,67
Explorer+Gefocust bureauwerk+6, No	-13,66	0,00
Explorer+Interactief bureauwerk+6, Yes	-1,33	0,39
Explorer+Anders+6, No	2,74	0,05
Explorer+Anders+6, Yes	-0,77	0,57
Explorer+Ongeplande meeting+6, No	-6,45	0,19
Explorer+Ongeplande meeting+6, Yes	1,93	0,34
Explorer+Normaal bureauwerk+6, Yes	1,00	0,48
Explorer+Normaal bureauwerk+6, No	0,12	0,96
Explorer+Meeting+6, Yes	1,04	0,45
Explorer+Meeting+6, No	1,55	0,27
Explorer+Sociaal+6, No	5,15	0,07
Explorer+Sociaal+6, Yes	-0,95	0,80

Activity Profile & Activity & Presentation Hardware

Value	Mean	p(T)
Camper+Meeting+9, No	-4,84	0,01
Camper+Meeting+9, Yes	8,53	0,19
Camper+Normaal bureauwerk+9, No	-1,22	0,11
Camper+Sociaal+9, No	5,20	0,00
Camper+Bellen+9, No	1,51	0,38
Camper+Gefocust bureauwerk+9, No	0,69	0,34
Camper+Interactief bureauwerk+9, No	5,35	0,02
Camper+Ongeplande meeting+9, No	-3,09	0,44
Camper+Anders+9, No	-0,07	0,96
Nomad+Anders+9, Yes	-10,29	
Nomad+Anders+9, No	-7,63	0,10
Nomad+Gefocust bureauwerk+9, No	-0,15	0,84
Nomad+Gefocust bureauwerk+9, Yes	1,01	0,71
Nomad+Bellen+9, No	6,30	0,14
Nomad+Bellen+9, Yes	-9,76	0,08
Nomad+Interactief bureauwerk+9, No	0,99	0,77
Nomad+Interactief bureauwerk+9, Yes	12,58	0,60
Nomad+Sociaal+9, No	0,24	0,88
Nomad+Normaal bureauwerk+9, No	-1,75	0,33
Nomad+Meeting+9, Yes	0,94	0,62
Nomad+Meeting+9, No	1,31	0,38
Nomad+Ongeplande meeting+9, Yes	-3,63	
Timid Traveller+Normaal bureauwerk+9, No	-0,41	0,55
Timid Traveller+Normaal bureauwerk+9, Yes	9,93	0,04
Timid Traveller+Anders+9, No	2,35	0,13
Timid Traveller+Anders+9, Yes	4,39	0,19
Timid Traveller+Gefocust bureauwerk+9, No	-1,71	0,04
Timid Traveller+Gefocust bureauwerk+9, Yes	-8,29	0,42
Timid Traveller+Sociaal+9, No	0,37	0,81
Timid Traveller+Sociaal+9, Yes	0,26	0,98
Timid Traveller+Interactief bureauwerk+9, No	-1,92	0,25
Timid Traveller+Interactief bureauwerk+9, Yes	0,28	0,98
Timid Traveller+Meeting+9, No	5,61	0,00
Timid Traveller+Meeting+9, Yes	-0,99	0,53
Timid Traveller+Bellen+9, No	3,48	0,06
Timid Traveller+Bellen+9, Yes	-11,89	0,05
Timid Traveller+Ongeplande meeting+9, No	-6,27	0,22
Timid Traveller+Ongeplande meeting+9, Yes	-1,88	0,35
Explorer+Bellen+9, No	2,30	0,44
Explorer+Bellen+9, Yes	-28,79	0,00
Explorer+Gefocust bureauwerk+9, No	-2,08	0,10
Explorer+Gefocust bureauwerk+9, Yes	-32,63	0,00
Explorer+Interactief bureauwerk+9, No	-1,33	0,39
Explorer+Anders+9, Yes	-6,78	0,02
Explorer+Anders+9, No	4,70	0,00
Explorer+Ongeplande meeting+9, No	0,47	0,81
Explorer+Ongeplande meeting+9, Yes	-8,98	0,62
Explorer+Normaal bureauwerk+9, No	0,66	0,59
Explorer+Normaal bureauwerk+9, Yes	1,55	0,79
Explorer+Meeting+9, No	0,66	0,63
Explorer+Meeting+9, Yes	1,66	0,24
Explorer+Sociaal+9, No	3,15	0,26
Explorer+Sociaal+9, Yes	3,43	0,40

Activity Profile & Activity & Deskspace

Value	Mean	p(T)
Camper+Meeting+10, regular	-3,81	0,03
Camper+Normaal bureauwerk+10, regular	-1,22	0,11
Camper+Sociaal+10, regular	6,89	0,00
Camper+Sociaal+10, spacious	1,68	0,56
Camper+Bellen+10, regular	1,97	0,25
Camper+Bellen+10, spacious	-14,02	
Camper+Gefocust bureauwerk+10, regular	0,70	0,33
Camper+Gefocust bureauwerk+10, small	-3,85	
Camper+Interactief bureauwerk+10, regular	5,35	0,02
Camper+Ongeplande meeting+10, regular	-3,09	0,44
Camper+Anders+10, regular	0,15	0,92
Camper+Anders+10, spacious	-18,85	
Nomad+Anders+10, spacious	-9,56	0,05
Nomad+Anders+10, regular	-6,44	
Nomad+Gefocust bureauwerk+10, regular	-0,22	0,76
Nomad+Gefocust bureauwerk+10, spacious	6,17	0,37
Nomad+Bellen+10, regular	5,58	0,15
Nomad+Bellen+10, spacious	-11,78	0,09
Nomad+Interactief bureauwerk+10, regular	2,05	0,54
Nomad+Sociaal+10, spacious	-1,55	0,35
Nomad+Sociaal+10, regular	4,84	0,23
Nomad+Normaal bureauwerk+10, regular	-1,75	0,33
Nomad+Meeting+10, spacious	0,94	0,62
Nomad+Meeting+10, regular	1,31	0,38
Nomad+Ongeplande meeting+10, regular	-3,63	
Timid Traveller+Normaal bureauwerk+10, regular	-0,27	0,69
Timid Traveller+Normaal bureauwerk+10, spacious	1,54	0,69
Timid Traveller+Normaal bureauwerk+10, small	18,84	
Timid Traveller+Anders+10, spacious	3,16	0,07
Timid Traveller+Anders+10, regular	2,28	0,28
Timid Traveller+Gefocust bureauwerk+10, regular	-2,09	0,01
Timid Traveller+Gefocust bureauwerk+10, spacious	9,42	0,08
Timid Traveller+Gefocust bureauwerk+10, small	0,16	0,97
Timid Traveller+Sociaal+10, spacious	1,70	0,47
Timid Traveller+Sociaal+10, regular	-0,51	0,79
Timid Traveller+Interactief bureauwerk+10, regular	-1,74	0,31
Timid Traveller+Interactief bureauwerk+10, spacious	-2,11	0,70
Timid Traveller+Meeting+10, spacious	1,40	0,36
Timid Traveller+Meeting+10, regular	4,61	0,00
Timid Traveller+Meeting+10, small	-2,96	0,17
Timid Traveller+Bellen+10, regular	1,42	0,52
Timid Traveller+Bellen+10, spacious	-0,98	0,78
Timid Traveller+Ongeplande meeting+10, regular	-6,27	0,22
Timid Traveller+Ongeplande meeting+10, spacious	-1,88	0,35
Explorer+Bellen+10, small	0,20	0,98
Explorer+Bellen+10, regular	0,63	0,86
Explorer+Bellen+10, spacious	-14,76	0,08
Explorer+Gefocust bureauwerk+10, small	10,85	0,42
Explorer+Gefocust bureauwerk+10, regular	-2,47	0,05
Explorer+Gefocust bureauwerk+10, spacious	-32,63	0,00
Explorer+Interactief bureauwerk+10, small	-10,32	0,00
Explorer+Interactief bureauwerk+10, regular	1,60	0,37
Explorer+Anders+10, spacious	3,20	0,04
Explorer+Anders+10, regular	-1,29	0,40
Explorer+Anders+10, small	1,34	0,44
Explorer+Ongeplande meeting+10, regular	-0,45	0,83
Explorer+Ongeplande meeting+10, spacious	-3,39	0,55
Explorer+Ongeplande meeting+10, small	12,68	0,08
Explorer+Normaal bureauwerk+10, regular	0,94	0,46
Explorer+Normaal bureauwerk+10, spacious	-1,73	0,70
Explorer+Normaal bureauwerk+10, small	4,29	0,55
Explorer+Meeting+10, regular	3,72	0,01
Explorer+Meeting+10, spacious	-0,06	0,97
Explorer+Sociaal+10, spacious	4,97	0,10
Explorer+Sociaal+10, regular	-1,23	0,74
Explorer+Sociaal+10, small	11,63	

Activity Profile & Activity & Storage

Value	Mean	p(T)
Camper+Meeting+11, No	-7,46	0,00
Camper+Meeting+11, Yes	-0,27	0,91
Camper+Normaal bureauwerk+11, No	-2,01	0,12
Camper+Normaal bureauwerk+11, Yes	-0,55	0,54
Camper+Sociaal+11, No	2,89	0,25
Camper+Sociaal+11, Yes	7,75	0,00
Camper+Bellen+11, No	1,62	0,69
Camper+Bellen+11, Yes	1,48	0,44
Camper+Gefocust bureauwerk+11, No	0,83	0,39
Camper+Gefocust bureauwerk+11, Yes	0,55	0,61
Camper+Interactief bureauwerk+11, No	5,84	0,03
Camper+Interactief bureauwerk+11, Yes	4,34	0,30
Camper+Ongeplande meeting+11, No	-3,75	0,60
Camper+Ongeplande meeting+11, Yes	-2,65	0,61
Camper+Anders+11, No	3,30	0,15
Camper+Anders+11, Yes	-1,82	0,37
Nomad+Anders+11, No	-8,52	0,02
Nomad+Gefocust bureauwerk+11, Yes	-14,67	0,06
Nomad+Gefocust bureauwerk+11, No	0,43	0,52
Nomad+Bellen+11, No	0,53	0,89
Nomad+Bellen+11, Yes	6,74	
Nomad+Interactief bureauwerk+11, Yes	7,15	0,13
Nomad+Interactief bureauwerk+11, No	-4,08	0,38
Nomad+Sociaal+11, No	-0,64	0,66
Nomad+Sociaal+11, Yes	21,29	
Nomad+Normaal bureauwerk+11, Yes	-2,62	0,27
Nomad+Normaal bureauwerk+11, No	0,17	0,94
Nomad+Meeting+11, No	1,03	0,55
Nomad+Meeting+11, Yes	1,03	0,60
Nomad+Ongeplande meeting+11, No	-3,63	
Timid Traveller+Normaal bureauwerk+11, Yes	-0,28	0,76
Timid Traveller+Normaal bureauwerk+11, No	0,08	0,94
Timid Traveller+Anders+11, No	3,05	0,07
Timid Traveller+Anders+11, Yes	2,17	0,36
Timid Traveller+Gefocust bureauwerk+11, Yes	-4,51	0,00
Timid Traveller+Gefocust bureauwerk+11, No	0,86	0,39
Timid Traveller+Sociaal+11, No	2,93	0,11
Timid Traveller+Sociaal+11, Yes	-5,77	0,01
Timid Traveller+Interactief bureauwerk+11, Yes	-2,04	0,55
Timid Traveller+Interactief bureauwerk+11, No	-1,69	0,37
Timid Traveller+Meeting+11, No	0,76	0,56
Timid Traveller+Meeting+11, Yes	7,39	0,00
Timid Traveller+Bellen+11, Yes	8,79	0,01
Timid Traveller+Bellen+11, No	-2,32	0,28
Timid Traveller+Ongeplande meeting+11, Yes	-12,46	0,01
Timid Traveller+Ongeplande meeting+11, No	2,48	0,32
Explorer+Bellen+11, No	-5,35	0,15
Explorer+Bellen+11, Yes	6,18	0,64
Explorer+Gefocust bureauwerk+11, No	-7,08	0,00
Explorer+Gefocust bureauwerk+11, Yes	-0,30	0,77
Explorer+Interactief bureauwerk+11, No	-3,50	0,03
Explorer+Interactief bureauwerk+11, Yes	3,46	0,32
Explorer+Anders+11, No	1,90	0,09
Explorer+Ongeplande meeting+11, No	-1,44	0,53
Explorer+Ongeplande meeting+11, Yes	5,94	0,00
Explorer+Normaal bureauwerk+11, Yes	8,78	0,02
Explorer+Normaal bureauwerk+11, No	-0,42	0,73
Explorer+Meeting+11, Yes	1,41	0,65
Explorer+Meeting+11, No	1,45	0,23
Explorer+Sociaal+11, No	3,24	0,15

Activity Profile & Activity & Multiple Person Meeting

Value	Mean	p(T)
Camper+Meeting+16, No	-3,81	0,03
Camper+Normaal bureauwerk+16, No	-1,23	0,11
Camper+Normaal bureauwerk+16, Yes	0,00	1,00
Camper+Sociaal+16, No	6,13	0,00
Camper+Sociaal+16, Yes	-3,15	0,63
Camper+Bellen+16, No	1,51	0,38
Camper+Gefocust bureauwerk+16, No	0,69	0,34
Camper+Interactief bureauwerk+16, No	5,35	0,02
Camper+Ongeplande meeting+16, No	-3,09	0,44
Camper+Anders+16, No	-0,07	0,96
Nomad+Anders+16, No	-10,29	
Nomad+Anders+16, Yes	-7,63	0,10
Nomad+Gefocust bureauwerk+16, No	-7,19	0,08
Nomad+Gefocust bureauwerk+16, Yes	0,53	0,44
Nomad+Bellen+16, No	6,30	0,14
Nomad+Bellen+16, Yes	-9,76	0,08
Nomad+Interactief bureauwerk+16, No	1,90	0,59
Nomad+Interactief bureauwerk+16, Yes	5,06	
Nomad+Sociaal+16, No	4,37	0,16
Nomad+Sociaal+16, Yes	-3,01	0,05
Nomad+Normaal bureauwerk+16, No	-2,62	0,27
Nomad+Normaal bureauwerk+16, Yes	0,17	0,94
Nomad+Meeting+16, Yes	0,94	0,62
Nomad+Meeting+16, No	1,31	0,38
Nomad+Ongeplande meeting+16, No	-3,63	
Timid Traveller+Normaal bureauwerk+16, No	-0,75	0,31
Timid Traveller+Normaal bureauwerk+16, Yes	2,54	0,13
Timid Traveller+Anders+16, No	2,52	0,10
Timid Traveller+Anders+16, Yes	3,18	0,32
Timid Traveller+Gefocust bureauwerk+16, No	-1,39	0,10
Timid Traveller+Gefocust bureauwerk+16, Yes	-7,11	0,04
Timid Traveller+Sociaal+16, No	-0,16	0,92
Timid Traveller+Sociaal+16, Yes	2,88	0,46
Timid Traveller+Interactief bureauwerk+16, No	-1,92	0,25
Timid Traveller+Interactief bureauwerk+16, Yes	0,28	0,98
Timid Traveller+Meeting+16, No	6,91	0,00
Timid Traveller+Meeting+16, Yes	0,17	0,91
Timid Traveller+Bellen+16, No	4,91	0,02
Timid Traveller+Bellen+16, Yes	-5,74	0,09
Timid Traveller+Ongeplande meeting+16, No	-7,47	0,08
Timid Traveller+Ongeplande meeting+16, Yes	0,66	0,81
Explorer+Bellen+16, No	2,44	0,41
Explorer+Bellen+16, Yes	-25,75	0,01
Explorer+Gefocust bureauwerk+16, No	-1,80	0,20
Explorer+Gefocust bureauwerk+16, Yes	-13,52	0,00
Explorer+Interactief bureauwerk+16, No	-1,33	0,39
Explorer+Anders+16, No	-0,10	0,92
Explorer+Anders+16, Yes	3,21	0,06
Explorer+Ongeplande meeting+16, No	1,02	0,61
Explorer+Ongeplande meeting+16, Yes	-5,16	0,42
Explorer+Normaal bureauwerk+16, No	0,84	0,60
Explorer+Normaal bureauwerk+16, Yes	0,53	0,76
Explorer+Meeting+16, No	5,21	0,00
Explorer+Meeting+16, Yes	-0,38	0,79
Explorer+Sociaal+16, No	2,28	0,34
Explorer+Sociaal+16, Yes	8,44	0,26

Activity Profile & Activity & Bookable Room

Value	Mean	p(T)
Camper+Meeting+17, No	-4,84	0,01
Camper+Meeting+17, Yes	8,53	0,19
Camper+Normaal bureauwerk+17, No	-1,22	0,11
Camper+Sociaal+17, No	4,69	0,02
Camper+Sociaal+17, Yes	8,75	0,01
Camper+Bellen+17, No	1,97	0,25
Camper+Bellen+17, Yes	-14,02	
Camper+Gefocust bureauwerk+17, No	0,69	0,34
Camper+Interactief bureauwerk+17, No	5,35	0,02
Camper+Ongeplande meeting+17, No	-3,09	0,44
Camper+Anders+17, No	0,15	0,92
Camper+Anders+17, Yes	-18,85	
Nomad+Anders+17, Yes	-10,29	
Nomad+Anders+17, No	-7,63	0,10
Nomad+Gefocust bureauwerk+17, No	-0,15	0,84
Nomad+Gefocust bureauwerk+17, Yes	1,01	0,71
Nomad+Bellen+17, Yes	-0,19	0,97
Nomad+Bellen+17, No	5,50	0,02
Nomad+Interactief bureauwerk+17, No	3,99	0,30
Nomad+Interactief bureauwerk+17, Yes	-3,13	0,67
Nomad+Sociaal+17, Yes	3,73	0,38
Nomad+Sociaal+17, No	-0,64	0,72
Nomad+Normaal bureauwerk+17, No	-1,75	0,33
Nomad+Meeting+17, Yes	0,92	0,70
Nomad+Meeting+17, No	1,20	0,27
Nomad+Ongeplande meeting+17, Yes	-3,63	
Timid Traveller+Normaal bureauwerk+17, No	-0,21	0,76
Timid Traveller+Normaal bureauwerk+17, Yes	1,46	0,73
Timid Traveller+Anders+17, Yes	2,85	0,17
Timid Traveller+Anders+17, No	2,58	0,16
Timid Traveller+Gefocust bureauwerk+17, No	-1,93	0,02
Timid Traveller+Gefocust bureauwerk+17, Yes	0,54	0,92
Timid Traveller+Sociaal+17, Yes	-4,48	0,43
Timid Traveller+Sociaal+17, No	0,97	0,52
Timid Traveller+Interactief bureauwerk+17, No	-1,74	0,31
Timid Traveller+Interactief bureauwerk+17, Yes	-2,11	0,70
Timid Traveller+Meeting+17, Yes	0,03	0,98
Timid Traveller+Meeting+17, No	5,32	0,00
Timid Traveller+Bellen+17, No	3,68	0,06
Timid Traveller+Bellen+17, Yes	-8,76	0,06
Timid Traveller+Ongeplande meeting+17, No	-6,27	0,22
Timid Traveller+Ongeplande meeting+17, Yes	-1,88	0,35
Explorer+Bellen+17, No	0,54	0,87
Explorer+Bellen+17, Yes	-14,76	0,08
Explorer+Gefocust bureauwerk+17, No	-2,08	0,10
Explorer+Gefocust bureauwerk+17, Yes	-32,63	0,00
Explorer+Interactief bureauwerk+17, No	-1,33	0,39
Explorer+Anders+17, Yes	-6,12	0,02
Explorer+Anders+17, No	4,74	0,00
Explorer+Ongeplande meeting+17, Yes	-6,45	0,19
Explorer+Ongeplande meeting+17, No	1,93	0,34
Explorer+Normaal bureauwerk+17, No	0,66	0,59
Explorer+Normaal bureauwerk+17, Yes	1,55	0,79
Explorer+Meeting+17, No	1,04	0,45
Explorer+Meeting+17, Yes	1,55	0,27
Explorer+Sociaal+17, Yes	4,43	0,22
Explorer+Sociaal+17, No	2,20	0,47

Activity Profile & Activity & Focus Purpose

Value	Mean	p(T)
Camper+Meeting+18, Yes	-4,84	0,01
Camper+Meeting+18, No	8,53	0,19
Camper+Normaal bureauwerk+18, Yes	-1,22	0,11
Camper+Sociaal+18, Yes	6,89	0,00
Camper+Sociaal+18, No	1,68	0,56
Camper+Bellen+18, Yes	1,97	0,25
Camper+Bellen+18, No	-14,02	
Camper+Gefocust bureauwerk+18, Yes	0,69	0,34
Camper+Interactief bureauwerk+18, Yes	5,35	0,02
Camper+Ongeplande meeting+18, Yes	-3,09	0,44
Camper+Anders+18, Yes	0,15	0,92
Camper+Anders+18, No	-18,85	
Nomad+Anders+18, No	-9,56	0,05
Nomad+Anders+18, Yes	-6,44	
Nomad+Gefocust bureauwerk+18, Yes	0,00	0,99
Nomad+Gefocust bureauwerk+18, No	-1,58	0,59
Nomad+Bellen+18, No	0,09	0,99
Nomad+Bellen+18, Yes	2,66	0,21
Nomad+Interactief bureauwerk+18, Yes	3,99	0,30
Nomad+Interactief bureauwerk+18, No	-3,13	0,67
Nomad+Sociaal+18, No	-0,29	0,86
Nomad+Sociaal+18, Yes	3,00	0,67
Nomad+Normaal bureauwerk+18, Yes	-1,75	0,33
Nomad+Meeting+18, No	0,94	0,62
Nomad+Meeting+18, Yes	1,31	0,38
Nomad+Ongeplande meeting+18, No	-3,63	
Timid Traveller+Normaal bureauwerk+18, Yes	-0,08	0,91
Timid Traveller+Normaal bureauwerk+18, No	-1,78	0,75
Timid Traveller+Anders+18, No	3,16	0,07
Timid Traveller+Anders+18, Yes	2,28	0,28
Timid Traveller+Gefocust bureauwerk+18, Yes	-2,04	0,01
Timid Traveller+Gefocust bureauwerk+18, No	7,16	0,15
Timid Traveller+Sociaal+18, No	0,63	0,77
Timid Traveller+Sociaal+18, Yes	0,19	0,92
Timid Traveller+Interactief bureauwerk+18, Yes	-1,92	0,25
Timid Traveller+Interactief bureauwerk+18, No	0,28	0,98
Timid Traveller+Meeting+18, No	4,73	0,01
Timid Traveller+Meeting+18, Yes	2,43	0,08
Timid Traveller+Bellen+18, Yes	1,42	0,50
Timid Traveller+Bellen+18, No	-1,60	0,70
Timid Traveller+Ongeplande meeting+18, Yes	-5,56	0,09
Timid Traveller+Ongeplande meeting+18, No	2,02	0,63
Explorer+Bellen+18, Yes	1,18	0,68
Explorer+Bellen+18, No	-33,34	0,01
Explorer+Gefocust bureauwerk+18, Yes	-2,08	0,10
Explorer+Gefocust bureauwerk+18, No	-32,63	0,00
Explorer+Interactief bureauwerk+18, Yes	-1,33	0,39
Explorer+Anders+18, No	3,34	0,03
Explorer+Anders+18, Yes	-1,07	0,39
Explorer+Ongeplande meeting+18, No	-7,57	0,37
Explorer+Ongeplande meeting+18, Yes	0,93	0,64
Explorer+Normaal bureauwerk+18, Yes	0,95	0,44
Explorer+Normaal bureauwerk+18, No	-1,26	0,80
Explorer+Meeting+18, Yes	-0,32	0,85
Explorer+Meeting+18, No	2,21	0,14
Explorer+Sociaal+18, No	5,15	0,07
Explorer+Sociaal+18, Yes	-0,95	0,80

Activity Profile & Activity & Social Purpose

Value	Mean	p(T)
Camper+Meeting+20, No	-4,84	0,01
Camper+Meeting+20, Yes	8,53	0,19
Camper+Normaal bureauwerk+20, No	-1,22	0,11
Camper+Sociaal+20, No	6,89	0,00
Camper+Sociaal+20, Yes	1,68	0,56
Camper+Bellen+20, No	1,97	0,25
Camper+Bellen+20, Yes	-14,02	
Camper+Gefocust bureauwerk+20, No	0,69	0,34
Camper+Interactief bureauwerk+20, No	5,35	0,02
Camper+Ongeplande meeting+20, No	-3,09	0,44
Camper+Anders+20, No	0,15	0,92
Camper+Anders+20, Yes	-18,85	
Nomad+Anders+20, Yes	-9,56	0,05
Nomad+Anders+20, No	-6,44	
Nomad+Gefocust bureauwerk+20, No	0,00	0,99
Nomad+Gefocust bureauwerk+20, Yes	-1,58	0,59
Nomad+Bellen+20, No	0,95	0,79
Nomad+Interactief bureauwerk+20, No	0,99	0,77
Nomad+Interactief bureauwerk+20, Yes	12,58	0,60
Nomad+Sociaal+20, Yes	-1,55	0,35
Nomad+Sociaal+20, No	4,84	0,23
Nomad+Normaal bureauwerk+20, No	-1,75	0,33
Nomad+Meeting+20, No	0,94	0,62
Nomad+Meeting+20, Yes	1,31	0,38
Nomad+Ongeplande meeting+20, Yes	-3,63	
Timid Traveller+Normaal bureauwerk+20, No	-0,08	0,91
Timid Traveller+Normaal bureauwerk+20, Yes	-1,78	0,75
Timid Traveller+Anders+20, Yes	2,75	0,13
Timid Traveller+Anders+20, No	2,62	0,19
Timid Traveller+Gefocust bureauwerk+20, No	-1,91	0,02
Timid Traveller+Gefocust bureauwerk+20, Yes	5,60	0,38
Timid Traveller+Sociaal+20, Yes	1,68	0,47
Timid Traveller+Sociaal+20, No	-0,32	0,87
Timid Traveller+Interactief bureauwerk+20, No	-1,61	0,34
Timid Traveller+Interactief bureauwerk+20, Yes	-6,09	0,02
Timid Traveller+Meeting+20, Yes	8,46	0,02
Timid Traveller+Meeting+20, No	2,60	0,03
Timid Traveller+Bellen+20, No	0,87	0,67
Timid Traveller+Bellen+20, Yes	1,24	0,79
Timid Traveller+Ongeplande meeting+20, No	-4,16	0,14
Explorer+Bellen+20, No	-8,35	0,08
Explorer+Bellen+20, Yes	2,84	0,54
Explorer+Gefocust bureauwerk+20, No	-4,61	0,01
Explorer+Gefocust bureauwerk+20, Yes	-12,41	0,00
Explorer+Interactief bureauwerk+20, No	-1,33	0,39
Explorer+Anders+20, Yes	7,04	0,00
Explorer+Anders+20, No	-4,85	0,01
Explorer+Ongeplande meeting+20, No	-0,15	0,94
Explorer+Ongeplande meeting+20, Yes	0,35	0,93
Explorer+Normaal bureauwerk+20, No	1,51	0,22
Explorer+Normaal bureauwerk+20, Yes	-8,56	0,05
Explorer+Meeting+20, No	-0,27	0,85
Explorer+Meeting+20, Yes	5,83	0,01
Explorer+Sociaal+20, Yes	5,15	0,07
Explorer+Sociaal+20, No	-0,95	0,80

Activity Profile & Activity & Learn Purpose

Value	Mean	p(T)
Camper+Meeting+21, No	-4,84	0,01
Camper+Meeting+21, Yes	8,53	0,19
Camper+Normaal bureauwerk+21, No	-1,22	0,11
Camper+Sociaal+21, No	5,70	0,01
Camper+Sociaal+21, Yes	3,46	0,33
Camper+Bellen+21, No	1,97	0,25
Camper+Bellen+21, Yes	-14,02	
Camper+Gefocust bureauwerk+21, No	0,69	0,34
Camper+Interactief bureauwerk+21, No	5,35	0,02
Camper+Ongeplande meeting+21, No	-3,09	0,44
Camper+Anders+21, No	0,15	0,92
Camper+Anders+21, Yes	-18,85	
Nomad+Anders+21, Yes	-9,56	0,05
Nomad+Anders+21, No	-6,44	
Nomad+Gefocust bureauwerk+21, No	-0,15	0,84
Nomad+Gefocust bureauwerk+21, Yes	1,01	0,71
Nomad+Bellen+21, No	5,58	0,15
Nomad+Bellen+21, Yes	-11,78	0,09
Nomad+Interactief bureauwerk+21, No	0,99	0,77
Nomad+Interactief bureauwerk+21, Yes	12,58	0,60
Nomad+Sociaal+21, Yes	-2,77	0,14
Nomad+Sociaal+21, No	3,50	0,20
Nomad+Normaal bureauwerk+21, No	-1,75	0,33
Nomad+Meeting+21, Yes	0,92	0,70
Nomad+Meeting+21, No	1,20	0,27
Nomad+Ongeplande meeting+21, Yes	-3,63	
Timid Traveller+Normaal bureauwerk+21, No	-0,22	0,75
Timid Traveller+Normaal bureauwerk+21, Yes	1,54	0,69
Timid Traveller+Anders+21, Yes	3,16	0,07
Timid Traveller+Anders+21, No	2,28	0,28
Timid Traveller+Gefocust bureauwerk+21, No	-2,03	0,02
Timid Traveller+Gefocust bureauwerk+21, Yes	9,42	0,08
Timid Traveller+Sociaal+21, Yes	-1,78	0,64
Timid Traveller+Sociaal+21, No	0,79	0,62
Timid Traveller+Interactief bureauwerk+21, No	-1,92	0,25
Timid Traveller+Interactief bureauwerk+21, Yes	0,28	0,98
Timid Traveller+Meeting+21, Yes	1,40	0,36
Timid Traveller+Meeting+21, No	4,42	0,00
Timid Traveller+Bellen+21, No	1,42	0,52
Timid Traveller+Bellen+21, Yes	-0,98	0,78
Timid Traveller+Ongeplande meeting+21, No	-5,91	0,17
Timid Traveller+Ongeplande meeting+21, Yes	-1,18	0,60
Explorer+Bellen+21, No	2,30	0,44
Explorer+Bellen+21, Yes	-28,79	0,00
Explorer+Gefocust bureauwerk+21, No	-2,08	0,10
Explorer+Gefocust bureauwerk+21, Yes	-32,63	0,00
Explorer+Interactief bureauwerk+21, No	-1,33	0,39
Explorer+Anders+21, Yes	3,34	0,03
Explorer+Anders+21, No	-1,07	0,39
Explorer+Ongeplande meeting+21, No	0,47	0,81
Explorer+Ongeplande meeting+21, Yes	-8,98	0,62
Explorer+Normaal bureauwerk+21, No	1,03	0,40
Explorer+Normaal bureauwerk+21, Yes	-1,73	0,70
Explorer+Meeting+21, No	1,04	0,45
Explorer+Meeting+21, Yes	1,55	0,27
Explorer+Sociaal+21, Yes	5,43	0,08
Explorer+Sociaal+21, No	-0,41	0,90

Significant combinations are:

- Camper+Meeting+21, No
- Timid Traveller+Meeting+21, No
- Timid Traveller + Gefocust bureauwerk+21, No
- Nomad+Ongeplande meeting+21, Yes
- Nomad+Anders+21, Yes
- Nomad+Anders+21, No
- Explorer+Gefocust bureauwerk+21, Yes
- Explorer+Bellen+21, Yes
- Explorer+Anders+21, Yes
- Camper+Sociaal+21, No
- Camper+Interactief bureauwerk+21, No
- Camper+Bellen+21, Yes
- Camper+Anders+21, Yes

ANALYSIS OF VARIANCE

In order to check if a variable in itself or even a combination of multiple variables differ from each other's mean, the analysis of variance (ANOVA) is conducted. As described in section ***Error! Reference source*** not found. of the main text, an ANOVA can be performed as an one-way ANOVA, where it is similar to the t-test, or in a multiple-way ANOVA (or MANOVA), where also the possible interaction between variables is researched. The different ANOVA's are divided in sections, that each focus on a different variable or a combination of them. The first section explores relationship between employee profiles and stress. The second section investigates the relationship between stress and activity. The third section is on the relationship between stress and workplace. The last section combines the previous sections and investigates the relationship between stress, activity and workplace.

The ANOVA tables in this part have three columns. The most left column contains the variable (or combination of variables) the for which the (M)ANOVA is performed. The middle column contains the outcome of that, denoted as F(*degrees of freedom, sum of squares*)=F-value. When the F-value is greater than 1 and has a significant p-value of p(F)<0,05 an asterix (*) is added. For *p-values* that are p(F)<0,01, two asterixis (**) are added. The third column, on the right, contains all nominal values of the variable that are significant after performed a Student's t-test with mean deviation contrasts, using the *SSMM*. Either a (+) or a (-) indicates if the mean of that value was respectively below or above zero. Therefore, values with a (+) are relatively more stressed measurements and (-) less stressed measurements.

Employee characteristics and stress

As discussed previously, it is not possibly to compare groups of persons by their means. The SS score gives a distorted image due to the calibration bias and both SD and SSMM have a mean that should be (approximately) 0. When performing an analysis of variance, the F value therefore becomes 0, indicating no variation. This goes for the variables *Age, Gender, Mobility Profile* and *Activity Profile.* An example for *Gender* and *Age* is given in Figure 36, Table 49, Table 50 & Table 53.

	sum_sq	*df*	*F*	*PR(>F)*
C(Age)	0,00	4	0,00	1
Residual	616195,6	3113		

Table A1. ANOVA for the variable Age (own ill.)

Value	*Mean*	*p(T)*
<25	0,00	1
25-34	0,00	1
35-44	0,00	1
45-54	0,00	1
55-65	0,00	1

Table A2. Overview of Student's t-tests for ordinal values of Age (own ill.)

	sum_sq	*df*	*F*	*PR(>F)*
C(Gender)	0,00	1	0,00	1
Residual	616195,6	3116		

Table A3. ANOVA for the variable Gender (own ill.)

Value	*Mean*	*p(T)*
Vrouw	0,00	1
Man	0,00	1

Table A4. Overview of Student's t-tests for dichotomous values of Gender (own ill.)

All test result in a *p-value of 1*, indicating no variance within the variables. While there might be variation between the groups when the actual stress level could be determined, for the purpose of this research it is preferable to regard the employee profiles (*activity profile* and *mobility profile*) as having the same mean, since the focus of this research is not on the difference between the profiles itself, but how they react to different workplace characteristics and activities.

In terms of *Gender* and *Age* it would have been interesting to investigate the relationship to stress. With this information, the measurements could have been adjusted, creating better understandings in general. Using the SSMM score adjusts for a lot of deviations, but also removes the potential for revealing difference between groups.

Relationship between stress and activity

For the relation of *activity type* and the *SSMM*, three ANOVAs have been performed: a one-way ANOVA for *activity type*, and two two-way ANOVAs for both *activity profile* and *mobility profile*. The results of these ANOVAs can be seen in Table 52, which indicate that all of them have significant variances within the groups.

Variable	***F significant p(F)<0,05***	***Significant values p(T)<0,05***
Activity (AC)	F(7, 4377)=3,18 **	• Undisturbed Desk Work (-) • Social (+) • Other (+)
Activity Profile (AP) & Activity (AC)	F(21, 8270)=2,01 **	• P1 + Other (+) • P2 + Undisturbed Desk Work (-) • P2 + Social (+) • P3 + Planned Meeting (+)
Mobility Profile (MP) & Activity (AC)	F(21, 9470)=2,31 **	• Camper + Planned Meeting (-) • Camper + Social (+) • Camper + Interactive Desk Work (+) • Nomad + Other (-) • Timid Traveller + Undisturbed Desk Work (-) • Timid Traveller + Planned Meeting (+) • Explorer + Undisturbed Desk Work (-)

*Table A5. ANOVA results for Activity & Activity Profile and Activity & Mobility Profile. *P<0,05, **p<0,01 (own ill.)*

Activity

Different activities result in different stress scores. This is in line with findings from literature, where the mismatch between skill and ability of an employee and the demands of a certain task can become a stressor. When looking at which activities have significant deviation from the sample mean, the results show the following:

1. *Undisturbed Desk Work* results in less stress

   This could be reasoned that employee perform UDW on their core job activities, in which they are relatively skilled and confident, as is stated in the Person Environment Fit theory.
2. *Social results* in more stress

   This is in line with literature, since social interactions could result in public embarrassment and are therefore a stressor.

The last activity that appears significant, is *Other*. However, since it is not known what actions the employees are performing exactly during this time, no explanation could be reasoned for this.

Looking at the results for *activity* divided by *activity profile*, one would expect in a balanced work environment with acceptable work load, based on the Person Environment Fit theory, that employees generate less stress performing activities that they perform most, and more stress for activities that they do not perform often.

The t-test results show the following:

1. *Activity Profile 2* in combination with Undisturbed Desk Work result in less stress
2. *Activity Profile 2* in combination with Social result in more stress
3. *Activity Profile 3* in combination with Planned Meeting result in more stress

AP2 has a more or less equal division between GDW, UDW and IDW (50% in total) and more than average meetings (PMT and UPM, 25% in total). AP3 has mainly UDW (50%) and meetings (15%)

It is hard to draw conclusions out of these results because of the inability to tell if the result is *causal* or *circumstantial*. With *causality*, the concept of one variable being the cause of influence on the outcome of another. Eating a lot of food is causal to gaining weight. A *circumstantial* relation occurs when one variable is not the direct cause of another but is somehow linked to it due to it.

Example: the number of visits per week to a McDonalds could be linear with increased weight, but it is not the cause of that increased weight. Eating fast-food would be the cause. For instance, an employee of the McDonalds also frequently visits a McDonalds, but might not have an increased weight, thus the number of visits is circumstantial.

In the context of this research, *causal* and *circumstantial* are very important, yet hard to proof. It is mostly not possible to conclude *causal* relationships, because the variables could be circumstantially linked to other variables or even confounding factors.

In the case of the combination AP2 and UDW resulting in less stress, this could be because employees that are in AP2 can handle UDW very well due to hardiness and coping skills (*causal*), but it could also be that employees in AP2 only perform UDW work when almost no people are around to distract them and wear noise cancelling headphones to block out sound. In this case the number of people present, and lack of noise distraction would be the *causal* relationship and employees being AP2 is *circumstantial*.

Relationship between stress and workplace

For the relationship between stress and the workplace, the both stress variables *SD* and *SSMM* have been analysed, however the variable *SD* resulted in no significant results. If there would have been significant results for *SD*, this would have indicated that certain workplace characteristics would on average resulted into increasing or decreasing stress levels, marking them either as malefactor or benefactor in the context of the current use of these workplaces. An example for this would be that if employees are very stressed, they would go to a certain room to 'cool down'. The *SSMM* score of this workplace would be very high, but the *SD* score would be negative, since their stress levels would decrease during their stay. No such results have been found.

In Table 54 an overview of the Workplace Characteristics that yield a significant ANOVA result is given.

Variable	***F significant p(F)<0,05***	***Significant values p(T)<0,05***
Size of Room (V1)	F(5, 7707)=7,88**	• Open 10+ (+) • Cellular 5-10 person (-) • Cellular 1 person (-)
Openness of Room (V2)	F(7, 4982)=3,62**	• Open (+) • Walls & windows (-)
Type of Chair (V7)	F(2, 7645)=19,57**	• Deskchair (-) • Barstool (+) • Regular chair (+)
Presentation Hardware (V9)	F(1, 1850)=9,39**	• Yes (-)
Bookable (V17)	F(1, 1143)=5,80*	No significant values
Focus Purpose (V18)	F(1, 990)=5,02*	No significant values
Social Purpose (V20)	F(1, 5716)=29,18**	• No (-) • Yes (+)

Table A6. ***ANOVA results for Workplace Characteristics (V1 – V21). *P<0,05, **p<0,01 (own ill.)***

Relationship between stress, activity and workplace

Activity & Workplace characteristics

Variable	*F significant p(F)<0,05*	*Significant values p(T)<0,05*
Activity (AC) & Size of Room (V1)	F(35, 24978)=3,77**	• Planned Meeting + Open 5-10 (+) • General Desk Work + Cellular 5-10 (+) • Social + Open 10+ (+) • Calling + (Open 10+ (+) • Calling + Cellular 5-10 (-) • Undisturbed Desk Work + Cellular 5-10 (-) • Undisturbed Desk Work + Cellular 1 person (-) • Other + Open 10+ (+) • Other + Cellular 5-10 (-)
Activity (AC) & Audio Privacy (V3)	F(14, 4699)=1,71*	• Social + 2+ (+) • Undisturbed Desk Work + 2+ (-) • Undisturbed Desk Work + 0 (-) • Unplanned Meeting + 0 (-) • Other + 2+ (+)
Activity (AC) & Visual Division (V4)	F(28, 12326)=2,27**	• Planned Meeting + Non (+) • Planned Meeting + Hallway (-) • General Desk Work + Window (+) • Calling + Office Partition (+) • Undisturbed Desk Work + Non (-) • Undisturbed Desk Work + Wall (-) • Undisturbed Desk Work + Hallway (+) • Interactive Desk Work + Window (-) • Other + Non (+)
Activity (AC) & Extra Monitor (V6)	F(7, 6934)=5,08**	• Calling + Yes (+) • Calling + No (-) • Undisturbed Desk Work + No (-) • Other + No (+)
Activity (AC) & Type of Chair (V7)	F(14, 5559)=1,97*	• Planned Meeting + Regular Chair (+) • Planned Meeting + Barstool (+) • Calling + Regular Chair (+) • Undisturbed Desk Work + Deskchair (-) • Interactive Desk Work + Regular Chair (-) • Other + Regular Chair (+)
Activity (AC) & Type of Desk (V8)	F(21, 9921)=2,42**	• Calling + Individual Desk, adjustable (+) • Calling + Shared Table (-) • Undisturbed Desk Work + Shared Table (-) • Undisturbed Desk Work + Individual desk (-) • Interactive Desk Work + Special Desk (-) • Other + Shared Table (+)
Activity (AC) & Presentation Hardware (V9)	F(7, 14310)=10,70**	• Social + No (+) • Calling + No (+) • Calling + Yes (-) • Undisturbed Desk Work + Yes (-) • Other + No (+)
V10. Desk Space	F(14, 10082)=3,71**	• Calling + Spacious (-) • Undisturbed Desk Work + Regular (-) • Undisturbed Desk Work + Spacious (-) • Interactive Desk Work + Small (-) • Other + Spacious (+)
Activity (AC) & Storage (V11)	F(7, 2693)=3,43**	• Meeting + Yes (+) • Social + No (+) • Calling + Yes (+) • Undisturbed Desk Work + Yes (-) • Other + No (+)
Activity (AC) & Department based (V12)	F(7, 3368)=2,45*	• Calling + Department (+) • Undisturbed Desk Work + Free Use (-) • Other + Free Use (+)
Activity (AC) & Multiple Person Meeting (V16)	F(7, 8704)=6,40**	• Meeting + No (+) • Social + No (+) • Calling + No (+) • Calling + Yes (-) • Undisturbed Desk Work + Yes (-) • Other + Yes (+)

Activity (AC) & Bookable (V17)	F(7, 6281)=4,62**	• Calling + No (+) • Calling + Yes (-) • Undisturbed Desk Work + Yes (-) • Other + No (+)
Activity (AC) & Focus Purpose (V18)	F(7, 8154)=5,99**	• Meeting + No (+) • Calling + No (-) • Undisturbed Desk Work + No (-) • Other + No (+)
Activity (AC) & Social Purpose (V20)	F(7, 4497)=3,30**	• Meeting + Yes (+) • Undisturbed Desk Work + No (-) • Undisturbed Desk Work + Yes (-) • Other + Yes (+)
Activity (AC) & Learn Purpose (V21)	F(7, 8709)=6,40**	• Social + No (+) • Calling + Yes (-) • Undisturbed Desk Work + Yes (-) • Other + Yes (+)

Activity Profile & Activity & Workplace characteristics

Variable	*F significant p(F)<0,05*	*Significant values p(T)<0,05*
Activity Profile (AP) & Activity (AC) & Extra Monitor (V6)	F(21, 7485)=1,85**	• P1 + Interactive Desk Work + No (-) • P1 + Other + Yes (+) • P2 + Undisturbed Desk Work + Yes (-) • P2 + Undisturbed Desk Work + No (-) • P2 + Calling + No (-) • P2 + Calling + Yes (+) • P2 + Interactive Desk Work + Yes (+) • P2 + Interactive Desk Work + No (-) • P2 + Social + No (+) • P2 + Planned Meeting + Yes (+) • P4 + Interactive Desk Work + Yes (-)
Activity Profile (AP) & Activity (AC) & Presentation Hardware (V9)	F(21, 10790)=2,72**	• P1 + Planned Meeting + No (-) • P1 + Other + No (+) • P2 + Other + Yes (-) • P2 + Other + No (+) • P2 + Undisturbed Desk Work + No (-) • P2 + Undisturbed Desk Work + Yes (-) • P2 + Calling + No (+) • P2 + Calling + Yes (-) • P2 + General Desk Work + Yes (+) • P2 + Planned Meeting + No (+) • P4 + Other + Yes (+) • P4 + Interactive Desk Work + No (-)
Activity Profile (AP) & Activity (AC) & Desk Space (V10)	F(42, 26647)=3,31**	• P1 + Planned Meeting + Regular (-) • P1 + Planned Meeting + Spacious (+) • P1 + Interactive Desk Work + Spacious (-) • P1 + Other + Regular (+) • P2 + Other + Spacious (+) • P2 + Undisturbed Desk Work + Regular (-) • P2 + Undisturbed Desk Work + Spacious (-) • P2 + Calling + Spacious (-) • P2 + Planned Meeting + Regular (+) • P4 + Interactive Desk Work + Regular (-) • P3 + Interactive Desk Work + Small (-)
Activity Profile (AP) & Activity (AC) & Storage (V11)	F(21, 8231)=2,02**	• P1 + General Desk Work + No (-) • P1 + General Desk Work + Yes (+) • P1 + Interactive Desk Work + Yes (+) • P1 + Other + No (+) • P2 + Undisturbed Desk Work + Yes (-) • P2 + Undisturbed Desk Work + No (-) • P2 + Calling + No (-) • P2 + Calling + Yes (+) • P2 + Social + No (+) • P2 + General Desk Work + No (+) • P2 + Planned Meeting + Yes (+) • P4 + Interactive Desk Work + Yes (-) • P3 + Interactive Desk Work + No (-)

Activity Profile (AP) & Activity (AC) & Department based (V12)	F(21, 12419)=3,06**	• P1 + Planned Meeting + Department (-) • P1 + Other + Free use (+) • P2 + Undisturbed Desk Work + Free use (-) • P2 + Social + Free use (+) • P2 + Planned Meeting + Department (-) • P2 + Unplanned Meeting + Department (+) • P4 + Interactive Desk Work + Department (-) • P3 + Planned Meeting + Free use (+)
Activity Profile (AP) & Activity (AC) & Out loud Speaking or Silence (V14)	F(21, 8215)=2,01*	• P1 + Calling + Out loud speaking (+) • P1 + Undisturbed Desk Work + Out loud speaking (+) • P1 + Interactive Desk Work + Silence (-) • P1 + Anders + Silence (+) • P2 + Undisturbed Desk Work + Out loud speaking (-) • P2 + Planned Meeting + Out loud speaking (+) P3 + Planned Meeting + Out loud speaking (+)
Activity Profile (AP) & Activity (AC) & Multiple Person Meeting (V16)	F(21, 12676)=3,15**	• P1 + Planned Meeting + No (-) • P1 + Planned Meeting + Yes (+) • P1 + Calling + No (+) • P1 + Calling + Yes (-) • P2 + Undisturbed Desk Work + No (-) • P2 + Undisturbed Desk Work + Yes (-) • P2 + Calling + Yes (-) • P2 + Social + No (+) • P2 + General Desk Work + Yes (+) • P2 + Planned Meeting + No (+) • P4 + Interactive Desk Work + No (-) • P4 + Planned Meeting + No (+) • P3 + Planned Meeting + No (+)
Activity Profile (AP) & Activity (AC) & Bookable (V17)	F(21, 7188)=1,78*	• P1 + Planned Meeting + No (-) • P1 + Interactive Desk Work + Yes (-) • P1 + Other + No (+) • P2 + Other + No (+) • P2 + Undisturbed Desk Work + No (-) • P2 + Undisturbed Desk Work + Yes (-) • P2 + Calling + Yes (-) • P2 + Interactive Desk Work + No (+) • P2 + Social + Yes (+) • P2 + Planned Meeting + No (+) P4 + Interactive Desk Work + No (-)
Activity Profile (AP) & Activity (AC) & Focus Purpose (V18)	F(21, 7084)=1,75*	• P1 + Planned Meeting + Yes (-) • P1 + Other + Yes (+) • P2 + Other + No (+) • P2 + Undisturbed Desk Work + Yes (-) • P2 + Undisturbed Desk Work + No (-) • P2 + Interactive Desk Work + Yes (+) • P2 + Social + No (+) • P4 + Interactive Desk Work + Yes (-)
Activity Profile (AP) & Activity (AC) & Social Purpose (V20)		
Activity Profile (AP) & Activity (AC) & Learn Purpose (V21)	F(21, 10753)=2,65**	• P1 + Planned Meeting + No (-) • P1 + Other + No (+) • P2 + Other + Yes (+) • P2 + Undisturbed Desk Work + No (-) • P2 + Undisturbed Desk Work + Yes (-) • P2 + Calling + Yes (-) • P2 + Planned Meeting + No (+) • P4 + Interactive Desk Work + No (-)

Mobility Profile & Activity & Workplace characteristics

Variable	*F significant p(F)<0,05*	*Significant values p(T)<0,05*
Mobility Profile (AP) & Activity (AC) & Extra Monitor (V6)	F(21, 9205)=2,27**	• Camper + Planned Meeting + Yes • Timid Traveller + Planned Meeting + Yes • Timid Traveller + Undisturbed Desk Work + Yes • Nomad + Undisturbed Desk Work + No • Nomad+ Interactive Desk Work + No • Nomad + Calling + Yes • Nomad + Other + Yes • Nomad + Other + No • Explorer + Undisturbed Desk Work + No • Camper + Social + Yes • Camper + Interactive Desk Work + Yes • Camper + Calling + No • Camper + Other + No
Mobility Profile (AP) & Activity (AC) & Presentation Hardware (V9)	F(21, 21753)=5,54**	• Timid Traveller + General Desk Work + Yes (+) • Timid Traveller + Planned Meeting + No (+) • Timid Traveller + Undisturbed Desk Work + No (-) • Timid Traveller + Calling + Yes (-) • Nomad + Unplanned Meeting + Yes (-) • Nomad + Other + Yes (-) • Explorer + Undisturbed Desk Work + Yes (-) • Explorer + Calling + Yes (-) • Explorer + Other + Yes (-) • Explorer + Other + No (+) • Camper + Social + No (+) • Camper + Planned Meeting + No (-) • Camper + Interactive Desk Work + No (+)
Mobility Profile (AP) & Activity (AC) & Desk Space (V10)	F(42, 25734)=3,21**	• Camper + Other + Spacious (-) • Camper+ Calling + Spacious (-) • Camper + Undisturbed Desk Work + Small (-) • Camper + Interactive Desk Work + Regular (+) • Camper + Planned Meeting + Regular (-) • Camper + Social + Regular (+) • Explorer + Other + Spacious (+) • Explorer + Undisturbed Desk Work + Regular (-) • Explorer + Undisturbed Desk Work + Spacious (-) • Explorer + Interactive Desk Work + Small (-) • Explorer + Planned Meeting + Regular (+) • Explorer + Social + Small (+) • Nomad + Other + Regular (-) • Nomad + Other + Spacious (-) • Nomad + Unplanned Meeting + Regular (-) • Timid Traveller + Undisturbed Desk Work + Regular (-) • Timid Traveller + Planned Meeting + Regular (+) • Timid Traveller + General Desk Work + Small (+)
Mobility Profile (AP) & Activity (AC) & Storage (V11)	F(21, 9055)=2,25**	• Camper + Interactive Desk Work + No (+) • Camper + Planned Meeting + No (-) • Camper + Social + Yes (+) • Explorer + Undisturbed Desk Work + No (-) • Explorer + Interactive Desk Work + No (-) • Explorer + General Desk Work + Yes (+) • Explorer + Unplanned Meeting + Yes (+) • Nomad + Other + No (-) • Nomad + Calling + Yes (+) • Nomad + Unplanned Meeting + No (-) • Nomad + Social + Yes (+) • Timid Traveller + Calling + Yes (+) • Timid Traveller + Undisturbed Desk Work + Yes (-) • Timid Traveller + Planned Meeting + Yes (+) • Timid Traveller + Unplanned Meeting + Yes (-) • Timid Traveller + Social + Yes (-)
Mobility Profile (AP) & Activity (AC) & Multiple Person Meeting	F(21, 15511)=3,87**	• Camper + Interactive Desk Work + No (+) • Camper + Planned Meeting + No (-)

(V16)		• Camper + Social + No (+) • Explorer + Calling + Yes (-) • Explorer + Undisturbed Desk Work + Yes (-) • Explorer + Planned Meeting + No (+) • Nomad + Other + No (-) • Nomad + Interactive Desk Work + Yes (+) • Nomad + Unplanned Meeting + No (-) • Nomad + Social + Yes (-) • Timid Traveller + Calling + No (+) • Timid Traveller + Undisturbed Desk Work + Yes (-) • Timid Traveller + Planned Meeting + No (+)
Mobility Profile (AP) & Activity (AC) & Bookable (V17)	F(21, 12674)=3,19**	• Camper + Other + Yes (-) • Camper + Calling + Yes (-) • Camper + Interactive Desk Work + No (+) • Camper + Planned Meeting + No (-) • Camper + Social + No (+) • Camper + Social + Yes (+) • Explorer + Other + No (+) • Explorer + Other + Yes (-) • Explorer + Undisturbed Desk Work + Yes (-) • Nomad + Other + Yes (-) • Nomad + Calling + No (+) • Nomad + Unplanned Meeting + Yes (-) • Timid Traveller + Undisturbed Desk Work + No (-) • Timid Traveller + Planned Meeting + No (+)
Mobility Profile (AP) & Activity (AC) & Focus Purpose (V18)	F(21, 16692)=4,19**	• Camper + Other + No (-) • Camper + Calling + No (-) • Camper + Interactive Desk Work + Yes (+) • Camper + Planned Meeting + Yes (-) • Camper + Social + Yes (+) • Explorer + Other + No (+) • Explorer + Calling + No (-) • Explorer + Undisturbed Desk Work + No (-) • Nomad + Other + No (-) • Nomad + Other + Yes (-) • Nomad + Unplanned Meeting + No (-) • Timid Traveller + Undisturbed Desk Work + Yes (-) • Timid Traveller + Planned Meeting + No (+)
Mobility Profile (AP) & Activity (AC) & Social Purpose (V20)	F(21, 10811)=2,69**	• Camper + Other + Yes (-) • Camper + Calling + Yes (-) • Camper + Interactive Desk Work + No (+) • Camper + Planned Meeting + No (-) • Camper + Social + No (+) • Explorer + Other + No (-) • Explorer + Other + Yes (+) • Explorer + Undisturbed Desk Work + No (-) • Explorer + Undisturbed Desk Work + Yes (-) • Explorer + Planned Meeting + Yes (+) • Explorer + General Desk Work + Yes (-) • Nomad + Other + No (-) • Nomad + Other + Yes (-) • Nomad + Unplanned Meeting + Yes (-) • Timid Traveller + Undisturbed Desk Work + No (-) • Timid Traveller + Interactive Desk Work + Yes (-) • Timid Traveller + Planned Meeting + No (+) • Timid Traveller + Planned Meeting + Yes (+)
Mobility Profile (AP) & Activity (AC) & Learn Purpose (V21)	F(21, 19123)=4,80**	• Camper + Other + Yes (-) • Camper + Calling + Yes (-) • Camper + Interactive Desk Work + No (+) • Camper + Planned Meeting + No (-) • Camper + Social + No (+) • Explorer + Other + Yes (+) • Explorer + Calling + Yes (-) • Explorer + Undisturbed Desk Work + Yes (-) • Nomad + Other + No (-) • Nomad + Other+ Yes (-) • Nomad + Unplanned Meeting + Yes (-) • Timid Traveller + Undisturbed Desk Work + No (-) • Timid Traveller + Planned Meeting + No (+)

OVERVIEW OF THE RESULTS

On the following pages, overviews of the gathered data are given. Different thresholds of the significance value have been used, to allow more information to be present in the overview.

Note: the tables are very large and not readable well from paper. To see the result, use the digital document and zoom in.

Workplace characteristics	Value	Average	Average	Average	Average	Average	UDW	UDW	UDW	UDW	UDW	GDW	GDW	GDW	GDW	GDW	IDW	IDW	IDW	IDW	IDW
Privacy:		Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
V1		cellular 1 person	-5,96	0,00	-6,55	0,00	0,00	-12,41	0,00	-12,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		cellular 2-4 person	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V1	Size of room	cellular 5-10	-4,05	0,00	-5,75	0,00	0,00	-10,25	0,00	-10,36	0,00	0,00	6,82	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 2-4 person	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 5-10	0,00	-5,74	2,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 10+	0,78	0,00	1,59	0,00	0,00	0,00	2,03	-2,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
			-5,96	-5,74	-6,55	0,00	0,00	-12,41	0,00	-12,41	0,00	0,00	0,00	-6,05	0,00	0,00	0,00	-2,23	0,00	0,00	-8,03
V2		walls & no windows	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V2		walls & windows	-2,04	0,00	-3,37	0,00	0,00	-8,41	0,00	-12,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V2		walls & open	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-6,09	0,00	0,00	0,00
V2	Openness of room	glass walls with curtains	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V2		glass walls	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,98	0,00	-10,98	0,00	0,00
V2		curtains	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V2		open with 1 wall	0,00	10,88	0,00	0,00	0,00	-3,23	0,00	-6,67	0,00	0,00	0,00	19,64	0,00	0,00	0,00	12,85	0,00	0,00	0,00
V2		open	0,78	0,00	1,80	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,19	-2,17	0,00	0,00	0,00	0,00	4,26	0,00	0,00
			-2,04	0,00	-3,37	0,00	0,00	-8,41	0,00	-12,10	0,00	0,00	-1,19	-2,17	0,00	0,00	-10,98	-6,09	-10,98	0,00	0,00
V3		0	0,00	0,00	0,00	0,00	0,00	-7,63	0,00	-7,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V3	Audio privacy (how many people can hear you)	1 or 2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V3		2+	0,00	0,00	0,00	0,00	0,00	-1,06	0,00	-3,03	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-7,63	0,00	-7,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V4		wall	0,00	0,00	0,00	0,00	0,00	-5,23	0,00	-12,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,55	0,00	0,00	0,00
V4	Visual division (office partitions, facing a wall)	window	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-15,65	0,00	0,00	14,33	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00
V4		office partition	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,55	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V4		hallway	0,00	0,00	0,00	0,00	0,00	11,61	0,00	11,61	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V4		non	0,00	0,00	0,00	0,00	0,00	-4,48	0,00	-4,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-5,23	0,00	-15,65	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	-4,55	0,00	-10,32	0,00
Facilities:																					
V5	Power socket	No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V5		Yes	0,00	0,00	0,00	0,00	0,00	-1,26	0,00	-2,43	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-1,26	0,00	-2,43	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V6	Extra monitor	No	0,00	2,66	0,00	0,00	0,00	-8,96	0,00	-8,96	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-10,98	0,00	0,00
V6		Yes	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,54	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,22	0,00	-8,03
			0,00	0,00	0,00	0,00	0,00	-8,96	0,00	-8,96	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-10,98	0,00	-8,03
V7		No chair/standing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V7		Deskchair	-0,61	0,00	-0,96	0,00	0,00	-1,31	0,00	-2,52	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,22	0,00	0,00
V7	Type of chair	Barstool	3,23	0,00	2,84	0,00	7,34	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V7		Regular chair	4,42	6,03	5,32	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,89	-6,09	-10,98	0,00	0,00
			-0,61	0,00	-0,96	0,00	0,00	-1,31	0,00	-2,52	0,00	0,00	0,00	0,00	0,00	0,00	-8,89	-6,09	-10,98	0,00	0,00
V8		No desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V8		Shared table	0,00	2,66	0,00	0,00	0,00	-8,29	0,00	-8,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00
V8	Type of desk (sitting, standing, walking etc)	Individual desk	0,00	0,00	0,00	0,00	0,00	-2,68	0,00	-2,90	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V8		Individual desk, adjustable	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,55	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V8		Special desk	0,00	0,00	2,62	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00
			0,00	0,00	0,00	0,00	0,00	-8,29	0,00	-8,29	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	-6,09	0,00	-10,32	-8,03
V9		Yes	-2,06	0,00	-3,72	0,00	0,00	-18,14	0,00	-18,14	0,00	0,00	0,00	0,00	8,14	0,00	0,00	0,00	0,00	0,00	0,00
V9	Presentation hardware (screen & sound)	No	0,00	0,00	0,73	0,00	0,00	0,00	0,00	-1,64	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
			-2,06	0,00	-3,72	0,00	0,00	-18,14	0,00	-18,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V10		no desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V10		small	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00
V10	Desk space (able to use papers conveniently)	regular	0,00	0,00	0,00	0,00	0,00	-0,92	0,00	-1,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V10		spacious	0,00	3,36	0,00	0,00	0,00	-16,14	0,00	-16,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-16,14	0,00	-16,14	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	-6,09	0,00	-10,32	-8,03
V11		Yes	0,00	8,71	0,00	7,09	0,00	-2,12	0,00	-2,26	0,00	0,00	0,00	19,64	0,00	0,00	0,00	12,85	0,00	0,00	-7,29
V11	Storage	No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,51	0,00	0,00	0,00	-1,87	2,40	0,00	0,00	0,00	0,00	-6,07	0,00
			0,00	0,00	0,00	0,00	0,00	-2,12	0,00	-2,51	0,00	0,00	0,00	-1,87	0,00	0,00	0,00	0,00	0,00	-6,07	-7,29
Access:																					
V12	Department based or free use	Free use	0,00	0,00	0,00	0,00	0,00	-2,71	0,00	-3,53	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V12		Department	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-2,71	0,00	-3,53	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V13	Flex use or assigned desk	Flex use	0,00	0,00	0,00	0,00	0,00	-1,23	0,00	-2,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V13		Assigned	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-1,23	0,00	-2,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Use agreements:																					
V14	Out loud speaking or silence	out loud speaking	0,00	0,00	0,00	0,00	0,00	-1,12	2,03	-2,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V14		silence	0,00	-2,70	0,00	0,00	0,00	-1,77	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
			0,00	-2,70	0,00	0,00	0,00	-1,77	0,00	-2,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	0,00	0,00
V15	Calling	no	0,00	-3,65	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V15		yes	0,00	0,00	0,00	0,00	0,00	-1,23	0,00	-2,80	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	-3,65	0,00	0,00	0,00	-1,23	0,00	-2,80	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V16	Multiple person meeting	No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,92	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V16		Yes	0,00	0,00	0,00	0,00	0,00	-4,20	0,00	-3,83	0,00	0,00	0,00	0,00	3,47	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-4,20	0,00	-3,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V17	Bookable – temporarily use	No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V17		Yes	0,00	0,00	-2,64	0,00	0,00	-11,81	0,00	-11,81	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00
			0,00	0,00	-2,64	0,00	0,00	-11,81	0,00	-11,81	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	-8,03
V18	focus	Yes	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
V18		No						-14,19		-14,19											
V19	collaborate	Yes	0,00	0,00	0,00	0,00	0,00	-1,37	0,00	-2,70	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V19		No		-4,61										-5,19				-9,42		-10,27	
V20	social	Yes	3,46	0,00	3,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00
V20		No	-0,53		-0,79			-1,13		-2,25											
V21	learn	Yes	0,00	0,00	0,00	0,00	0,00	-13,71	0,00	-13,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V21		No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-1,85	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,03
			-0,53	-4,61	-0,79	0,00	0,00	-14,19	0,00	-14,19	0,00	0,00	0,00	-5,19	0,00	0,00	0,00	-9,42	-6,09	0,00	-10,27	-8,03

Figure A3. ***Model Input overview with p<0,05 (own ill.)***

PMT	PMT	PMT	PMT	PMT	UPM	UPM	UPM	UPM	UPM	CL	CL	CL	CL	CL	SCL	SCL	SCL	SCL	SCL	OTH	OTH	OTH	OTH	OTH
Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-18,17	0,00	-19,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3,22	0,00	3,62	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-5,48	5,38	10,44	0,00	0,00	0,00	0,00	0,00	0,00	5,01	6,11	4,80	0,00	0,00	2,40	0,00	0,00	0,00	0,00	3,34	0,00	3,88	0,00	0,00
0,00	-5,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-18,17	-12,46	-19,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,95	0,00	-10,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,31	0,00	-5,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
6,95	0,00	10,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-8,77	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
8,01	0,00	8,01	0,00	0,00	-26,16	0,00	-26,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-9,69	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-5,48	0,00	10,44	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,77	0,00	2,66	0,00	0,00	4,09	0,00	4,70	0,00	0,00
0,00	-5,48	0,00	0,00	0,00	-26,16	0,00	-26,16	0,00	0,00	-5,95	0,00	-10,16	0,00	0,00	0,00	0,00	-9,69	0,00	0,00	-4,31	0,00	-5,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-6,83	0,00	-6,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	1,95	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,19	0,00	0,00	0,00	0,00	2,35	4,20	2,34	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-6,83	0,00	-6,83	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-9,22	3,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,42	0,00	4,03	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-5,10	0,00	-5,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2,49	0,00	0,00	0,00	7,98	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,01	0,00	0,00	2,44	0,00	2,70	0,00	0,00
-5,10	-9,22	-5,10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,01	0,00	0,00	0,00	0,00	1,74	4,77	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,78	0,00	-7,36	0,00	0,00	0,00	0,00	2,95	0,00	0,00	2,45	0,00	0,00	0,00	0,00
0,00	-10,42	2,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,68	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-10,42	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,78	0,00	-7,36	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-4,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
6,06	0,00	7,39	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
7,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,72	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,38	0,00	7,79	0,00	0,00
0,00	-4,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,23	0,00	-8,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,45	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-10,42	2,76	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,95	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-10,42	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,23	0,00	-8,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-16,87	0,00	-18,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,04	0,00	0,00
0,00	-6,33	2,82	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,92	0,00	3,13	0,00	0,00	2,01	0,00	0,00	0,00	0,00	2,82	4,87	3,03	0,00	0,00
0,00	-6,33	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-16,87	0,00	-18,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-8,74	3,55	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	5,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-7,91	0,00	-11,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,98	0,00	3,06	0,00	0,00
0,00	-8,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-7,91	0,00	-11,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3,95	0,00	3,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,87	0,00	4,45	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,58	0,00	0,00	2,33	0,00	2,92	0,00	0,00	2,21	4,27	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,58	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,33	0,00	0,00	1,79	10,16	0,00	0,00	0,00
0,00	-10,42	4,75	0,00	0,00	0,00	0,00	-19,24	0,00	0,00	4,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-10,42	0,00	0,00	0,00	0,00	0,00	-19,24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,04	0,00	2,24	0,00	0,00	1,73	4,87	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1,86	0,00	2,69	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5,23	0,00	0,00	0,00	2,26	0,00	0,00	0,00	0,00	1,73	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	27,15	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,11	0,00	2,32	0,00	0,00	1,55	4,19	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2,40	-7,54	4,88	10,44	6,43	0,00	0,00	0,00	0,00	0,00	3,44	0,00	0,00	0,00	0,00	2,41	0,00	2,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	6,24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,62	-10,00	-10,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,08	0,00	0,00	0,00	0,00
0,00	-7,54	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,62	-10,00	-10,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-6,18	2,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,57	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,98	4,77	2,93	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,13	0,00	-10,81	0,00	0,00	0,00	0,00	7,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-6,18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,13	0,00	-10,81	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2,86										-8,01										3,07		3,18		
0,00	0,00	0,00	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,07	0,00	0,00	0,00	0,00	1,60	4,48	0,00	0,00	0,00
											-12,46													
6,14	0,00	6,60	0,00	8,57	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5,34	0,00	6,15	0,00	0,00
	-4,22																							
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,94	0,00	-11,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,07	0,00	3,18	0,00	0,00
0,00	-9,91	2,51	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,94	-12,46	-11,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Workplace charact	Value	Average	Average	Average	Average	Average	UDW	UDW	UDW	UDW	UDW	GDW	GDW	GDW	GDW	GDW	IDW	IDW	IDW	IDW	IDW	PMT	PMT
Privacy:		Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1
V1	Size of room	cellular 1 person	-5,96	0,00	-6,55	0,00	0,00	-12,41	0,00	-12,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		cellular 2-4 person	0,00	0,00	0,00	-10,90	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	0,00	-9,91	0,00	0,00	0,00
V1		cellular 5-10	-4,05	0,00	-5,75	0,00	0,00	-10,25	0,00	-10,36	0,00	0,00	6,82	0,00	7,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,47
V1		open 2-4 person	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 5-10	0,00	-5,74	2,10	0,00	5,33	0,00	0,00	0,00	0,00	0,00	0,00	-6,05	2,39	0,00	0,00	0,00	0,00	0,00	0,00	3,22	0,00
V1		open 10+	0,78	0,00	1,59	0,00	0,00	0,00	2,03	-2,74	2,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,55	-3,48	-8,03	2,18	-5,48
			-5,96	-5,74	-6,55	-10,90	0,00	-12,41	0,00	-12,41	0,00	0,00	0,00	-6,05	0,00	0,00	0,00	-2,23	0,00	-9,91	-8,03	0,00	-5,48
V2	Openness of room	walls & no windows	-9,91	0,00	0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-9,91	0,00	0,00	-9,91	0,00	0,00	0,00
V2		walls & windows	-2,04	0,00	-3,37	0,00	0,00	-8,41	-3,80	-12,10	0,00	-6,09	0,00	0,00	4,82	0,00	0,00	-2,23	0,00	0,00	0,00	0,00	4,47
V2		walls & open	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-6,09	0,00	0,00	0,00	0,00	0,00
V2		glass walls with curtains	0,00	0,00	0,00	6,68	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	11,69	0,00	11,69	0,00	0,00	6,95	0,00
V2		glass walls	-2,11	0,00	-1,84	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,98	0,00	-10,98	0,00	0,00	-3,10	0,00
V2		curtains	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V2		open with 1 wall	0,00	10,88	0,00	0,00	0,00	-3,23	0,00	-6,67	0,00	0,00	0,00	19,64	0,00	0,00	0,00	12,85	-6,07	0,00	-6,33	8,01	0,00
V2		open	0,78	0,00	1,80	0,00	0,00	0,00	1,83	-0,98	2,78	0,00	-1,19	-2,17	0,00	0,00	0,00	0,00	4,26	-3,48	-13,15	0,00	-5,48
			-9,91	0,00	-3,37	-9,91	0,00	-8,41	-3,80	-12,10	0,00	-6,09	-1,19	-2,17	0,00	0,00	-10,98	-6,09	-10,98	-9,91	-13,15	-3,10	-5,48
V3	Audio priva	0,00	0,00	0,00	0,00	0,00	6,68	-7,63	0,00	-7,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V3		1 or 2	-0,98	0,00	0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	4,08	-9,91	0,00	0,00	0,00
V3		2+	0,00	0,00	0,00	0,00	0,00	-1,06	1,28	-3,03	2,78	0,00	0,00	-1,42	1,33	0,00	0,00	0,00	0,00	-3,48	-5,59	1,32	0,00
			-0,98	0,00	0,00	-9,91	0,00	-7,63	0,00	-7,63	0,00	0,00	0,00	-1,42	0,00	0,00	0,00	-2,23	0,00	-9,91	-5,59	0,00	0,00
V4	Visual division (offic	wall	0,00	0,00	-1,61	0,00	6,30	-5,23	0,00	-12,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-4,55	0,00	-9,91	0,00	4,01	0,00
V4		window	-2,89	0,00	0,00	-5,23	0,00	0,00	0,00	-15,65	0,00	0,00	14,33	0,00	13,43	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	0,00
V4		office partition	0,00	0,00	0,00	0,00	0,00	0,00	1,34	-1,55	0,00	0,00	-0,64	-1,58	0,00	0,00	0,00	0,00	0,00	0,00	-5,59	0,00	-9,22
V4		hallway	0,00	0,00	0,00	0,00	0,00	11,61	0,00	11,61	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,10	0,00
V4		non	0,00	2,72	0,00	-6,27	0,00	-4,48	0,00	-4,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,49	4,11
			-2,89	0,00	-1,61	-6,27	0,00	-5,23	0,00	-15,65	0,00	0,00	-0,64	-1,58	0,00	0,00	0,00	-10,32	-4,55	0,00	-10,32	-5,59	-5,10	-9,22
Facilities:																							
V5	Power socket	No	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,99	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,87	0,00
V5		Yes	0,00	0,00	0,00	0,00	0,00	-1,26	0,00	-2,43	2,78	0,00	0,00	-1,37	1,47	0,00	0,00	0,00	0,00	2,52	-3,75	-5,59	0,95	-2,52
			0,00	0,00	0,00	0,00	0,00	-1,26	0,00	-2,43	0,00	0,00	-6,99	-1,37	0,00	0,00	0,00	0,00	0,00	-3,75	-5,59	0,95	-2,52
V6	Extra monitor	No	0,00	2,66	0,00	0,00	0,00	-8,96	0,00	-8,96	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-10,98	0,00	0,00	1,54	3,28
V6		Yes	0,00	0,00	0,00	0,00	0,00	-0,63	0,00	-1,54	2,78	0,00	0,00	-1,51	0,00	0,00	0,00	0,00	3,22	-3,75	-8,03	0,00	-10,42
			0,00	0,00	0,00	0,00	0,00	-8,96	0,00	-8,96	0,00	0,00	0,00	-1,51	0,00	0,00	0,00	-6,09	-10,98	-3,75	-8,03	0,00	-10,42
V7	Type of chair	No chair/standing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V7		Deskchair	-0,61	0,00	-0,96	0,00	0,00	-1,31	0,00	-2,52	2,78	0,00	0,00	-1,37	1,43	0,00	0,00	0,00	3,22	-3,75	-5,59	0,00	-4,22
V7		Barstool	3,23	0,00	2,84	6,75	7,34	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,06	0,00
V7		Regular chair	4,42	6,03	5,32	-4,87	0,00	7,16	0,00	7,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-8,89	-6,09	-10,98	0,00	0,00	7,74	8,50
			-0,61	0,00	-0,96	-4,87	0,00	-1,31	0,00	-2,52	0,00	0,00	0,00	-1,37	0,00	0,00	0,00	-8,89	-6,09	-10,98	-3,75	-5,59	0,00	-4,22
V8	Type of desk (sitting,	No desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V8		Shared table	0,00	2,66	0,00	0,00	0,00	-8,29	0,00	-8,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00	1,55	3,28
V8		Individual desk	-1,22	0,00	0,00	-13,83	0,00	-2,68	0,00	-2,90	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,23	3,34	-13,83	0,00	0,00	0,00
V8		Individual desk, adjustable	0,00	0,00	0,00	0,00	0,00	0,00	1,34	-1,55	0,00	0,00	-0,67	-1,58	0,00	0,00	0,00	0,00	0,00	0,00	-8,03	0,00	-10,42
V8		Special desk	0,00	0,00	2,62	-5,23	0,00	0,00	0,00	-5,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	0,00	0,00
			-1,22	0,00	0,00	-13,83	0,00	-8,29	0,00	-8,29	0,00	0,00	-0,67	-1,58	0,00	0,00	0,00	-10,32	-6,09	0,00	-13,83	-8,03	0,00	-10,42
V9	Presentation	Yes	-2,06	0,00	-3,72	5,59	4,25	-18,14	0,00	-18,14	0,00	0,00	5,94	0,00	8,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V9		No	0,00	0,00	0,73	0,00	0,00	-0,74	0,00	-1,64	2,78	0,00	0,00	-1,37	0,00	0,00	0,00	0,00	2,26	-3,75	-8,03	0,00	-6,33
			-2,06	0,00	-3,72	0,00	0,00	-18,14	0,00	-18,14	0,00	0,00	0,00	-1,37	0,00	0,00	0,00	0,00	0,00	-3,75	-8,03	0,00	-6,33
V10	Desk space (able to	no desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V10		small	0,00	0,00	2,55	-5,23	0,00	0,00	0,00	-5,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	-2,96	-2,96
V10		regular	0,00	0,00	0,00	0,00	0,00	-0,92	0,00	-1,83	0,00	0,00	0,00	-1,45	0,00	0,00	0,00	0,00	2,52	0,00	-8,03	1,64	-8,74
V10		spacious	0,00	3,36	0,00	0,00	0,00	-16,14	0,00	-16,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00	0,00	5,46
			0,00	0,00	0,00	-5,23	0,00	-16,14	0,00	-16,14	0,00	0,00	0,00	-1,45	0,00	0,00	0,00	-10,32	-6,09	0,00	-10,32	-8,03	-2,96	-8,74
V11	Storage	Yes	0,00	8,71	0,00	7,09	0,00	-2,12	0,00	-2,26	0,00	0,00	0,00	19,64	0,00	0,00	0,00	2,53	12,85	0,00	6,35	-7,29	3,95	0,00
V11		No	0,00	0,00	0,00	0,00	1,94	0,00	0,00	-2,51	2,78	0,00	0,00	-1,87	2,40	-6,87	0,00	0,00	0,00	0,00	-6,07	0,00	0,00	-2,32
			0,00	0,00	0,00	0,00	0,00	-2,12	0,00	-2,51	0,00	0,00	0,00	-1,87	0,00	-6,87	0,00	0,00	0,00	0,00	-6,07	-7,29	0,00	-2,32
Access:																							
V12	Department based	Free use	0,00	0,00	0,00	0,00	0,00	-2,71	0,00	-3,53	0,00	-6,09	0,00	-1,65	1,73	0,00	0,00	0,00	0,00	2,86	-4,33	0,00	1,30	3,28
V12		Department	0,00	0,00	0,00	0,00	0,00	0,00	2,17	-1,27	0,00	0,00	-1,03	0,00	0,00	-6,87	0,00	0,00	0,00	0,00	0,00	7,31	0,00	-10,42
			0,00	0,00	0,00	0,00	0,00	-2,71	0,00	-3,53	0,00	-6,09	-1,03	-1,65	0,00	-6,87	0,00	0,00	0,00	0,00	-4,33	-7,31	0,00	-10,42
V13	Flex user	Flex use	0,00	0,00	0,00	0,00	0,00	-1,23	0,00	-2,37	2,78	0,00	0,00	-1,45	0,00	0,00	0,00	0,00	2,52	-3,48	-5,59	1,13	-2,32
V13		Assigned	-3,60	0,00	0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-9,91	0,00	0,00	-9,91	0,00	0,00	0,00
			-3,60	0,00	0,00	-9,91	0,00	-1,23	0,00	-2,37	0,00	0,00	0,00	-1,45	0,00	0,00	0,00	-9,91	0,00	0,00	-9,91	-5,59	0,00	-2,32
Use agreements:																							
V14	Out loud	out loud speaking	0,00	0,00	0,00	0,00	0,00	-1,12	2,03	-2,71	2,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,86	-3,48	-5,59	1,86	-2,32
V14		silence	-0,98	-2,70	0,00	-9,91	0,00	-1,77	-4,18	0,00	0,00	0,00	0,00	-2,83	2,51	0,00	0,00	0,00	0,00	0,00	-9,91	0,00	-1,84	0,00
			-0,98	-2,70	0,00	-9,91	0,00	-1,77	-4,18	-2,71	0,00	0,00	0,00	-2,83	0,00	0,00	0,00	0,00	0,00	0,00	-9,91	-5,59	-1,84	-2,32
V15	Calling	no	0,00	-3,65	0,00	0,00	0,00	-1,22	-7,66	0,00	0,00	0,00	0,00	-3,05	2,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V15		yes	0,00	0,00	0,00	0,00	0,00	-1,23	1,56	-2,80	2,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,49	-3,75	-5,59	1,26	-2,32
			0,00	-3,65	0,00	0,00	0,00	-1,23	-7,66	-2,80	0,00	0,00	0,00	-3,05	0,00	0,00	0,00	0,00	0,00	-3,75	-5,59	0,00	-2,32
V16	Multiple person	No	0,00	0,00	0,00	0,00	0,00	0,00	1,56	-1,92	2,78	0,00	-0,82	-1,32	0,00	0,00	0,00	0,00	0,00	2,49	-3,75	-8,03	2,40	-7,54
V16		Yes	0,00	0,00	0,00	0,00	0,00	-4,20	-7,66	-3,83	0,00	0,00	1,60	0,00	3,47	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,24
			0,00	0,00	0,00	0,00	0,00	-4,20	-7,66	-3,83	0,00	0,00	-0,82	-1,32	0,00	0,00	0,00	0,00	0,00	-3,75	-8,03	0,00	-7,54
V17	Bookable –	No	0,00	0,00	0,65	0,00	0,00	-0,81	0,00	-1,78	2,78	0,00	0,00	-1,37	0,00	0,00	0,00	0,00	2,97	-3,75	-8,03	0,00	-6,18
V17		Yes	-1,41	0,00	-2,64	0,00	0,00	-11,81	0,00	-11,81	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00	0,00
			-1,41	0,00	-2,64	0,00	0,00	-11,81	0,00	-11,81	0,00	0,00	0,00	-1,37	0,00	0,00	0,00	0,00	-6,09	0,00	-3,75	-8,03	0,00	-6,18
V18		focus	Yes	0,00	0,00	0,00	0,00	0,00	-0,85	0,00	-1,83	2,78	0,00	0,00	-1,37	0,00	0,00	0,00	0,00	0,00	2,97	-3,75	-8,03	0,00	-9,91
V18			No	1,18	2,80			-14,19		-14,19												2,86	3,62
V19		collaborate	Yes	0,00	0,00	0,00	0,00	0,00	-1,37	0,00	-2,70	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,49	0,00	-5,59	1,26	-2,32
V19			No		-4,61	1,18	-5,62							-5,19	2,50			-9,42			-10,27			
V20		social	Yes	3,46	3,41	3,63	0,00	0,00	-6,00	0,00	-6,00	0,00	0,00	-4,73	0,00	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00	6,14	0,00
V20			No	-0,53		-0,79			-1,13		-2,25	2,78			-1,37	1,64				2,26	-3,75	-5,59		-4,22
V21		learn	Yes	0,00	2,80	0,00	0,00	0,00	-13,71	0,00	-13,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,63	3,62
V21			No	0,00	0,00	0,00	0,00	0,00	-0,86	0,00	-1,85	2,78	0,00	0,00	-1,37	0,00	0,00	0,00	0,00	2,26	-3,75	-8,03	0,00	-9,91
			-0,53	-4,61	-0,79	-5,62	0,00	-14,19	0,00	-14,19	0,00	0,00	-4,73	-5,19	0,00	0,00	0,00	-9,42	-6,09	0,00	-10,27	-8,03	0,00	-9,91

Figure A4. **Model Input overview with p<0,20 (own ill.)**

PMT	PMT	PMT	UPM	UPM	UPM	UPM	UPM	CL	CL	CL	CL	CL	SCL	SCL	SCL	SCL	SCL	OTH	OTH	OTH	OTH	OTH
AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,20	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-4,52	0,00	0,00	-18,17	0,00	-19,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3,62	0,00	8,53	0,00	0,00	0,00	0,00	0,00	-5,90	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,80	0,00	0,00	0,00	0,00
5,38	10,44	4,68	0,00	0,00	0,00	10,46	0,00	5,01	6,11	4,80	0,00	0,00	2,40	2,89	1,76	0,00	5,18	3,34	3,48	3,88	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-4,52	0,00	0,00	-18,17	-12,46	-19,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,95	0,00	-10,16	0,00	7,10	0,00	0,00	4,38	0,00	0,00	-4,31	0,00	-5,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	13,32	13,32	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
10,40	0,00	8,53	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-3,10	0,00	0,00	-8,77	0,00	-7,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	13,12	0,00	13,12	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
8,01	0,00	0,00	-26,16	0,00	-26,16	0,00	0,00	9,18	0,00	9,41	0,00	0,00	0,00	0,00	-9,69	0,00	8,69	3,52	0,00	0,00	0,00	0,00
0,00	10,44	8,63	0,00	0,00	0,00	10,46	0,00	0,00	0,00	0,00	0,00	0,00	2,77	0,00	2,66	0,00	10,90	4,09	3,22	4,70	0,00	0,00
-3,10	0,00	0,00	-26,16	0,00	-26,16	0,00	0,00	-5,95	0,00	-10,16	0,00	0,00	0,00	0,00	-9,69	0,00	0,00	-4,31	0,00	-5,04	0,00	0,00
0,00	0,00	8,53	-6,83	0,00	-6,83	0,00	0,00	-6,48	0,00	-7,38	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,20	0,00	0,00
1,95	8,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,19	0,00	1,90	0,00	5,18	2,35	4,20	2,34	0,00	0,00
0,00	0,00	0,00	-6,83	0,00	-6,83	0,00	0,00	-6,48	0,00	-7,38	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,20	0,00	0,00
0,00	10,44	0,00	0,00	0,00	0,00	0,00	0,00	0,00	7,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	7,49
0,00	0,00	0,00	12,68	0,00	12,68	0,00	0,00	0,00	0,00	-17,52	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3,48	0,00	0,00	-3,38	0,00	-6,06	10,46	0,00	3,42	0,00	4,03	9,58	7,07	2,18	0,00	0,00	0,00	6,06	0,00	3,48	0,00	0,00	0,00
-5,10	0,00	0,00	-7,37	0,00	-7,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	7,98	0,00	0,00	5,31	0,00	0,00	-5,64	0,00	-5,57	0,00	0,00	2,10	0,00	3,01	-11,58	0,00	2,44	6,23	2,70	0,00	-6,42
-5,10	0,00	0,00	-7,37	0,00	-7,37	0,00	0,00	-5,64	0,00	-17,52	0,00	0,00	0,00	0,00	0,00	-11,58	0,00	0,00	0,00	0,00	0,00	-6,42
0,00	10,44	8,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	5,20	-11,58	0,00	0,00	0,00	0,00	0,00	0,00
1,53	0,00	0,00	-2,18	0,00	-3,34	0,00	0,00	0,00	0,00	0,00	0,00	6,23	2,01	0,00	1,86	0,00	6,06	1,74	4,77	1,44	0,00	0,00
0,00	0,00	0,00	-2,18	0,00	-3,34	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,86	-11,58	0,00	0,00	0,00	0,00	0,00	0,00
0,00	7,53	4,03	-3,62	0,00	-3,85	0,00	0,00	-5,78	8,00	-7,36	0,00	0,00	2,10	0,00	2,95	-11,58	0,00	2,45	6,23	2,39	0,00	0,00
2,73	10,43	0,00	0,00	0,00	0,00	10,46	0,00	2,68	0,00	3,20	0,00	6,23	1,98	0,00	0,00	0,00	6,06	0,00	4,40	0,00	0,00	0,00
0,00	7,53	0,00	-3,62	0,00	-3,85	0,00	0,00	-5,78	0,00	-7,36	0,00	0,00	1,98	0,00	0,00	-11,58	0,00	0,00	4,40	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-3,61	10,46	0,00	0,00	0,00	0,00	0,00	6,23	1,97	0,00	0,00	0,00	6,06	0,00	4,40	-1,86	0,00	0,00
7,39	10,44	8,53	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,65	0,00	2,47	0,00	0,00	2,45	0,00	0,00	0,00	7,49
0,00	0,00	8,63	0,00	0,00	0,00	0,00	0,00	6,72	13,32	6,32	0,00	0,00	0,00	0,00	2,57	-11,58	0,00	6,38	6,23	7,79	0,00	-6,42
0,00	0,00	0,00	0,00	0,00	-3,61	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-11,58	0,00	0,00	0,00	-1,86	0,00	-6,42
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	7,53	4,03	-3,62	0,00	-3,85	0,00	0,00	-6,23	8,00	-8,22	0,00	0,00	0,00	0,00	3,13	-11,58	0,00	2,45	6,23	2,39	0,00	0,00
0,00	0,00	0,00	0,00	0,00	9,15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2,76	10,43	0,00	0,00	0,00	-5,70	10,46	0,00	2,95	0,00	3,20	9,58	7,07	2,53	0,00	0,00	0,00	6,06	0,00	3,48	0,00	0,00	0,00
0,00	0,00	0,00	12,68	0,00	12,68	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,00	0,00	3,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	-3,62	0,00	-5,70	0,00	0,00	-6,23	0,00	-8,22	0,00	0,00	0,00	0,00	0,00	-11,58	0,00	0,00	0,00	0,00	0,00	0,00
0,00	7,53	0,00	-2,88	0,00	-5,43	0,00	0,00	-16,87	0,00	-18,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-3,51	0,00	-6,04	0,00	7,49
2,82	10,43	4,68	0,00	0,00	0,00	0,00	0,00	2,92	0,00	3,13	0,00	4,67	2,01	0,00	1,98	0,00	5,18	2,82	4,87	3,03	0,00	0,00
0,00	7,53	0,00	-2,88	0,00	-5,43	0,00	0,00	-16,87	0,00	-18,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-3,51	0,00	-6,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	12,68	0,00	12,68	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3,55	10,43	5,61	-2,67	0,00	-4,20	0,00	0,00	1,82	0,00	0,00	9,58	6,23	2,13	0,00	0,00	0,00	6,06	0,00	4,40	0,00	0,00	0,00
0,00	7,53	0,00	0,00	0,00	-3,88	0,00	0,00	-7,91	8,00	-11,48	0,00	0,00	1,82	0,00	2,64	-11,58	0,00	2,98	6,23	3,06	0,00	0,00
0,00	0,00	0,00	-2,67	0,00	-4,20	0,00	0,00	-7,91	0,00	-11,48	0,00	0,00	0,00	0,00	0,00	-11,58	0,00	0,00	0,00	0,00	0,00	0,00
3,91	10,43	0,00	-5,10	0,00	-6,03	0,00	0,00	4,87	0,00	4,45	0,00	6,23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	7,53	4,03	0,00	0,00	0,00	0,00	0,00	-2,58	0,00	-4,58	0,00	0,00	2,33	0,00	2,92	0,00	10,90	2,21	4,27	1,88	0,00	0,00
0,00	7,53	0,00	-5,10	0,00	-6,03	0,00	0,00	-2,58	0,00	-4,58	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	8,06	3,58	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-3,35	0,00	0,00	1,81	0,00	3,33	-11,58	0,00	1,79	10,16	1,52	0,00	0,00
4,75	0,00	0,00	-5,76	0,00	-19,24	10,46	0,00	4,06	0,00	3,69	9,58	0,00	2,61	5,48	0,00	0,00	10,51	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	-5,76	0,00	-19,24	0,00	0,00	0,00	0,00	-3,35	0,00	0,00	1,81	0,00	0,00	-11,58	0,00	0,00	0,00	0,00	0,00	0,00
1,48	8,06	3,58	-2,10	0,00	-3,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,04	0,00	2,24	0,00	5,18	1,73	4,87	1,45	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	-2,10	0,00	-3,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2,69	8,06	3,58	0,00	0,00	0,00	0,00	0,00	0,00	5,23	0,00	0,00	0,00	2,26	0,00	2,01	0,00	5,18	1,73	3,48	1,65	0,00	0,00
-1,84	0,00	0,00	0,00	0,00	-5,72	0,00	0,00	-4,07	-8,67	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	27,15	0,00	0,00	0,00
-1,84	0,00	0,00	0,00	0,00	-5,72	0,00	0,00	-4,07	-8,67	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,48	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,90	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,47	21,42	0,00	0,00	0,00
1,72	8,06	3,58	-2,42	0,00	-3,35	0,00	0,00	0,00	4,41	0,00	0,00	4,67	2,11	0,00	2,32	0,00	5,18	1,55	4,19	1,32	0,00	0,00
0,00	0,00	0,00	-2,42	0,00	-3,35	0,00	0,00	-5,90	-12,46	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,55	4,19	0,00	0,00	0,00
4,88	10,44	6,43	-2,41	0,00	0,00	0,00	0,00	3,44	5,08	2,74	0,00	4,67	2,41	0,00	2,63	0,00	5,18	0,00	3,77	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	-4,80	0,00	0,00	-10,62	-10,00	-10,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,08	10,02	2,71	0,00	0,00
0,00	0,00	0,00	-2,41	0,00	-4,80	0,00	0,00	-10,62	-10,00	-10,78	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	3,77	0,00	0,00	0,00
2,63	10,43	0,00	0,00	0,00	0,00	10,46	0,00	2,57	0,00	2,93	0,00	6,23	1,85	0,00	0,00	0,00	6,06	2,98	4,77	2,93	0,00	0,00
0,00	7,53	4,03	-3,62	0,00	-3,85	0,00	0,00	-8,13	8,00	-10,81	0,00	0,00	0,00	0,00	7,41	-11,58	0,00	0,00	0,00	-4,14	0,00	0,00
0,00	7,53	0,00	-3,62	0,00	-3,85	0,00	0,00	-8,13	0,00	-10,81	0,00	0,00	0,00	0,00	0,00	-11,58	0,00	0,00	0,00	-4,14	0,00	0,00
0,00	10,43	0,00	-2,15	0,00	-3,52	10,46	0,00	0,00	0,00	0,00	0,00	6,23	2,32	0,00	0,00	0,00	6,06	0,00	4,40	0,00	0,00	0,00
2,03	7,53	4,03						-8,01		-8,20			1,76		2,52	-11,58		3,07	6,23	3,18		
1,72	8,06	3,58	-2,54	0,00	-4,21	0,00	0,00	0,00	4,41	0,00	9,58	4,67	2,07	0,00	2,11	0,00	5,18	1,60	4,48	1,32	0,00	0,00
									-12,46									3,53				
6,60	10,44	8,57	0,00	0,00	0,00	0,00	0,00	0,00	13,32	0,00	0,00	0,00	1,91	0,00	2,29	-11,58	0,00	5,34	6,23	6,15	0,00	0,00
			-2,26		-3,61							6,23	2,15				6,06		4,40	-1,86		
0,00	7,53	4,03	0,00	0,00	-5,43	0,00	0,00	-10,94	0,00	-11,48	0,00	0,00	0,00	0,00	2,78	-11,58	0,00	3,07	6,23	3,18	0,00	0,00
2,51	10,43	0,00	0,00	0,00	0,00	0,00	0,00	2,11	0,00	0,00	0,00	6,23	2,29	0,00	1,92	0,00	6,06	0,00	4,40	0,00	0,00	0,00
0,00	7,53	0,00	-2,54	0,00	-5,43	0,00	0,00	-10,94	-12,46	-11,48	0,00	0,00	0,00	0,00	0,00	-11,58	0,00	0,00	4,40	-1,86	0,00	0,00

Workplace characte	Value		Average	Average	Average	Average	Average	UDW	UDW	UDW	UDW	UDW	GDW	GDW	GDW	GDW	GDW	IDW	IDW	IDW	IDW	IDW	PMT
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average
V1	Size of room	cellular 1 person	-5,96	0,00	-6,55	0,00	0,00	-12,41	0,00	-12,41	0,00	0,00	-11,82	0,00	-11,82	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,31
V1		cellular 2-4 person	-0,83	-1,41	-0,64	-10,90	0,00	-0,90	-1,97	-0,79	0,00	0,00	-2,48	0,00	-2,66	0,00	0,00	0,00	-2,23	0,00	-9,91	0,00	0,00
V1		cellular 5-10	-4,05	1,81	-5,75	0,00	0,00	-10,25	-9,57	-10,36	0,00	0,00	6,82	5,35	7,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 2-4 person	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V1		open 5-10	0,72	-5,74	2,10	0,00	5,33	0,00	-5,74	0,00	0,00	0,00	0,00	-6,05	2,39	0,00	0,00	10,08	0,00	10,08	0,00	0,00	3,22
V1		open 10+	0,78	0,50	1,59	0,00	0,00	0,00	2,03	-2,74	2,78	-1,29	-0,52	-1,13	0,00	-4,72	0,00	0,00	1,57	2,55	-3,48	-8,03	2,18
			-5,96	-5,74	-6,55	-10,90	0,00	-12,41	-9,57	-12,41	0,00	-1,29	-11,82	-6,05	-11,82	-4,72	0,00	0,00	-2,23	0,00	-9,91	-8,03	0,00
V2	Openness of room	walls & no windows	-9,91	0,00	0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-9,91	0,00	0,00	-9,91	0,00	0,00
V2		walls & windows	-2,04	0,00	-3,37	0,00	0,00	-8,41	-3,80	-12,10	0,00	-6,09	1,27	0,00	4,82	0,00	0,00	0,00	-2,23	0,00	0,00	0,00	0,00
V2		walls & open	3,60	5,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-6,09	0,00	0,00	0,00	0,00
V2		glass walls with curtains	0,00	-3,07	0,00	0,00	6,68	-0,98	0,00	-0,98	0,00	0,00	-6,69	0,00	-6,69	0,00	0,00	11,69	0,00	11,69	0,00	0,00	6,95
V2		glass walls	-2,11	0,00	-1,84	-11,56	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-10,98	0,00	-10,98	0,00	0,00	-3,10
V2		curtains	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V2		open with 1 wall	0,70	10,88	0,00	0,00	0,00	-3,23	-1,97	-6,67	0,00	0,00	0,00	19,64	0,00	0,00	0,00	-2,06	12,85	-6,07	0,00	-6,33	8,01
V2		open	0,78	-0,40	1,80	0,00	0,00	0,53	1,83	-0,98	2,78	0,00	-1,19	-2,17	0,96	-4,72	-1,15	0,00	0,00	4,26	-3,48	-13,15	-0,87
			-9,91	-3,07	-3,37	-11,56	0,00	-8,41	-3,80	-12,10	0,00	-6,09	-6,69	-2,17	-6,69	-4,72	-1,15	-10,98	-6,09	-10,98	-9,91	-13,15	-3,10
V3	Audio privacy	0	-1,35	-3,07	-1,68	0,00	6,68	-7,63	0,00	-7,63	0,00	0,00	4,74	0,00	4,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V3		1 or 2	-0,98	-1,41	-0,89	-9,91	0,00	-1,06	-1,97	-0,96	0,00	0,00	-2,48	0,00	-2,66	0,00	0,00	2,31	-2,23	4,08	-9,91	0,00	0,00
V3		2+	0,25	0,00	0,47	0,00	0,00	-1,06	1,28	-3,03	2,78	-1,29	-0,41	-1,42	1,33	-4,72	0,00	0,00	1,57	2,04	-3,48	-5,59	1,32
			-1,35	-3,07	-1,68	-9,91	0,00	-7,63	-1,97	-7,63	0,00	-1,29	-2,48	-1,42	-2,66	-4,72	0,00	0,00	-2,23	0,00	-9,91	-5,59	0,00
V4	Visual division (offic	wall	0,00	0,00	-1,61	3,98	6,30	-5,23	-1,97	-12,41	0,00	0,00	0,00	-3,46	0,00	0,00	0,00	-1,76	-4,55	0,00	-9,91	0,00	4,01
V4		window	-2,89	0,00	-2,91	-5,23	0,00	-2,97	0,00	-15,65	19,39	0,00	14,33	0,00	13,43	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	0,00
V4		office partition	0,00	0,00	0,00	1,32	0,00	-0,57	1,34	-1,55	2,04	-1,29	-0,64	-1,58	0,00	-4,72	0,00	1,00	2,15	2,74	0,00	-5,59	0,00
V4		hallway	-1,73	0,00	-1,73	0,00	0,00	11,61	0,00	11,61	0,00	0,00	5,29	0,00	5,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,10
V4		non	0,70	2,72	0,62	-6,27	0,00	-4,48	0,00	-4,48	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,13	0,00	3,21	0,00	0,00	2,49
			-2,89	0,00	-2,91	-6,27	0,00	-5,23	-1,97	-15,65	0,00	-1,29	-0,64	-3,46	0,00	-4,72	0,00	-10,32	-4,55	0,00	-10,32	-5,59	-5,10
Facilities:																							
V5	Power socket	No	1,19	0,00	0,00	2,70	0,00	5,60	0,00	5,60	0,00	0,00	-6,99	-10,63	-6,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,87
V5		Yes	0,00	0,00	0,00	0,00	0,00	-1,26	0,92	-2,43	2,78	-1,29	-0,31	-1,37	1,47	-4,72	0,00	0,00	1,40	2,52	-3,75	-5,59	0,95
			0,00	0,00	0,00	0,00	0,00	-1,26	0,00	-2,43	0,00	-1,29	-6,99	-10,63	-6,91	-4,72	0,00	0,00	0,00	0,00	-3,75	-5,59	0,95
V6	Extra monitor	No	0,00	2,66	0,00	0,00	1,92	-8,96	0,00	-8,96	0,00	0,00	1,45	0,00	1,67	0,00	0,00	-5,07	-6,09	-10,98	0,00	0,00	1,54
V6		Yes	0,00	-0,38	0,00	0,00	0,00	-0,63	0,92	-1,54	2,78	-1,29	-0,57	-1,51	0,84	-4,72	0,00	0,00	1,94	3,22	-3,75	-8,03	0,00
			0,00	-0,38	0,00	0,00	0,00	-8,96	0,00	-8,96	0,00	-1,29	-0,57	-1,51	0,84	-4,72	0,00	-5,07	-6,09	-10,98	-3,75	-8,03	0,00
V7	Type of chair	No chair/standing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V7		Deskchair	-0,61	0,00	-0,96	0,00	0,00	-1,31	0,92	-2,52	2,78	-1,29	-0,33	-1,37	1,43	-4,72	0,00	0,00	1,94	3,22	-3,75	-5,59	0,00
V7		Barstool	3,23	0,00	2,84	6,75	7,34	0,00	0,00	0,00	0,00	0,00	0,00	-10,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,06
V7		Regular chair	4,42	6,03	5,32	-4,87	-2,63	7,16	0,00	7,16	0,00	0,00	-3,89	0,00	-3,89	0,00	0,00	-8,89	-6,09	-10,98	0,00	0,00	7,74
			-0,61	0,00	-0,96	-4,87	-2,63	-1,31	0,00	-2,52	0,00	-1,29	-3,89	-10,63	-3,89	-4,72	0,00	-8,89	-6,09	-10,98	-3,75	-5,59	0,00
V8	Type of desk (sitting,	No desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V8		Shared table	0,48	2,66	0,00	0,00	1,92	-8,29	0,00	-8,29	0,00	0,00	2,11	0,00	2,48	0,00	0,00	0,00	-6,09	0,00	0,00	0,00	1,55
V8		Individual desk	-1,22	-1,67	-0,88	-13,83	0,00	-2,68	-1,97	-2,90	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,50	-2,23	3,34	-13,83	0,00	1,48
V8		Individual desk, adjustable	0,00	0,00	0,00	1,31	0,00	-0,57	1,34	-1,55	2,04	-1,29	-0,67	-1,58	0,00	-4,72	0,00	1,03	2,15	2,74	0,00	-8,03	0,00
V8		Special desk	0,00	0,00	2,62	-5,23	0,00	0,00	0,00	-5,04	19,39	0,00	7,93	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	0,00
			-1,22	-1,67	-0,88	-13,83	0,00	-8,29	-1,97	-8,29	0,00	-1,29	-0,67	-1,58	0,00	-4,72	0,00	-10,32	-6,09	0,00	-13,83	-8,03	0,00
V9	Presentation	Yes	-2,06	0,00	-3,72	5,59	4,25	-18,14	0,00	-18,14	0,00	0,00	5,94	-10,63	8,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,08
V9		No	0,29	0,00	0,73	0,00	0,00	-0,74	0,92	-1,64	2,78	-1,29	-0,58	-1,37	0,00	-4,72	0,00	0,00	1,40	2,26	-3,75	-8,03	1,18
			-2,06	0,00	-3,72	0,00	0,00	-18,14	0,00	-18,14	0,00	-1,29	-0,58	-10,63	0,00	-4,72	0,00	0,00	0,00	0,00	-3,75	-8,03	1,08
V10	Desk space (able to	no desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V10		small	0,00	0,00	2,55	-5,23	0,00	0,00	0,00	-5,04	19,39	0,00	7,93	0,00	0,00	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	-2,96
V10		regular	0,00	-0,41	0,00	0,00	0,00	-0,92	0,96	-1,83	2,04	-1,29	-0,49	-1,45	1,02	-4,72	0,00	0,98	1,94	2,52	0,00	-8,03	1,64
V10		spacious	0,48	3,36	0,00	2,56	0,00	-16,14	0,00	-16,14	0,00	0,00	0,00	-10,63	0,00	0,00	0,00	0,00	-6,09	0,00	0,00	0,00	0,00
			0,00	-0,41	0,00	-5,23	0,00	-16,14	0,00	-16,14	0,00	-1,29	-0,49	-10,63	0,00	-4,72	0,00	-10,32	-6,09	0,00	-10,32	-8,03	-2,96
V11	Storage	Yes	0,00	8,71	0,00	7,09	0,00	-2,12	-1,97	-2,26	0,00	-1,29	0,00	19,64	0,00	7,10	0,00	2,53	12,85	3,14	6,35	-7,29	3,95
V11		No	0,00	0,00	0,00	0,00	1,94	-0,59	1,00	-2,51	2,78	0,00	-0,69	-1,87	2,40	-6,87	-1,98	-1,24	0,00	2,02	-6,07	0,00	0,00
			0,00	0,00	0,00	0,00	0,00	-2,12	-1,97	-2,51	0,00	-1,29	-0,69	-1,87	0,00	-6,87	-1,98	-1,24	0,00	2,02	-6,07	-7,29	0,00
Access:																							
V12	Department based	Free use	0,00	0,00	0,00	0,00	0,00	-2,71	0,00	-3,53	19,39	-6,09	0,00	-1,65	1,73	7,10	0,00	0,00	0,00	2,86	-4,33	0,00	1,30
V12		Department	0,00	0,00	0,00	0,00	0,00	0,00	2,17	-1,27	2,04	0,00	-1,03	-1,28	0,00	-6,87	0,00	0,00	3,94	0,00	-3,21	-7,31	0,00
			0,00	0,00	0,00	0,00	0,00	-2,71	0,00	-3,53	2,04	-6,09	-1,03	-1,65	0,00	-6,87	0,00	0,00	0,00	0,00	-4,33	-7,31	0,00
V13	Flex use or	Flex use	0,00	0,00	0,00	0,00	0,00	-1,23	0,92	-2,37	2,78	-1,29	-0,41	-1,45	1,06	-4,72	0,00	0,00	1,40	2,52	-3,48	-5,59	1,13
V13		Assigned	-3,60	-4,25	0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-9,91	0,00	0,00	-9,91	0,00	0,00
			-3,60	-4,25	0,00	-9,91	0,00	-1,23	0,00	-2,37	0,00	-1,29	-0,41	-1,45	0,00	-4,72	0,00	-9,91	0,00	0,00	-9,91	-5,59	0,00
Use agreements:																							
V14	Out loud	out loud speaking	0,00	0,54	0,00	0,00	0,00	-1,12	2,03	-2,71	2,78	-1,29	-0,55	-1,13	0,00	-4,72	0,00	0,00	1,57	2,86	-3,48	-5,59	1,86
V14		silence	-0,98	-2,70	0,00	-9,91	0,00	-1,77	-4,18	-0,94	0,00	0,00	0,00	-2,83	2,51	0,00	0,00	0,00	-2,23	0,00	-9,91	0,00	-1,84
			-0,98	-2,70	0,00	-9,91	0,00	-1,77	-4,18	-2,71	0,00	-1,29	-0,55	-2,83	0,00	-4,72	0,00	0,00	-2,23	0,00	-9,91	-5,59	-1,84
V15	Calling	no	0,00	-3,65	0,72	0,00	0,00	-1,22	-7,66	0,00	0,00	0,00	0,00	-3,05	2,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V15		yes	0,00	0,36	0,00	0,00	0,00	-1,23	1,56	-2,80	2,78	-1,29	-0,47	-1,17	0,00	-4,72	0,00	0,00	1,40	2,49	-3,75	-5,59	1,26
			0,00	-3,65	0,00	0,00	0,00	-1,23	-7,66	-2,80	0,00	-1,29	-0,47	-3,05	0,00	-4,72	0,00	0,00	0,00	0,00	-3,75	-5,59	0,00
V16	Multiple person	No	0,00	0,00	0,00	0,00	0,00	-0,62	1,56	-1,92	2,78	-1,29	-0,82	-1,32	0,00	-4,72	0,00	0,00	1,40	2,49	-3,75	-8,03	2,40
V16		Yes	0,00	0,00	-0,44	0,00	0,00	-4,20	-7,66	-3,83	0,00	0,00	1,60	-2,03	3,47	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
			0,00	0,00	-0,44	0,00	0,00	-4,20	-7,66	-3,83	0,00	-1,29	-0,82	-2,03	0,00	-4,72	0,00	0,00	0,00	0,00	-3,75	-8,03	0,00
V17	Bookable –	No	0,26	0,00	0,65	0,00	0,00	-0,81	0,92	-1,78	2,78	-1,29	-0,49	-1,37	0,84	-4,72	0,00	0,00	1,94	2,97	-3,75	-8,03	0,99
V17		Yes	-1,41	1,42	-2,64	0,00	1,92	-11,81	0,00	-11,81	0,00	0,00	0,00	-10,63	2,47	0,00	0,00	0,00	-6,09	0,00	0,00	0,00	1,25
			-1,41	0,00	-2,64	0,00	0,00	-11,81	0,00	-11,81	0,00	-1,29	-0,49	-10,63	0,84	-4,72	0,00	0,00	-6,09	0,00	-3,75	-8,03	0,99
V18	focus	Yes	-0,27	0,00	-0,28	0,00	0,00	-0,85	0,92	-1,83	2,78	-1,29	-0,38	-1,37	1,29	-4,72	0,00	0,00	1,40	2,97	-3,75	-8,03	0,00
V18		No	1,18	2,80	0,84		1,92	-14,19		-14,19				-10,63									2,86
V19	collaborate	Yes	0,00	0,39	0,00	1,04	0,00	-1,37	1,22	-2,70	2,04	-1,29	-0,43	-0,97	0,00	-4,72	0,00	0,94	1,40	2,49	0,00	-5,59	1,26
V19		No	-0,48	-4,61	1,18	-5,62			-2,27		19,39			-5,19	2,50			-9,42			-10,27		
V20	social	Yes	3,46	3,41	3,63	2,70	2,49	-6,00	0,00	-6,00	0,00	0,00	-4,73	-10,63	-4,34	0,00	0,00	0,00	-6,09	0,00	0,00	0,00	6,14
V20		No	-0,53		-0,79			-1,13	0,92	-2,25	2,78	-1,29		-1,37	1,64	-4,72			1,94	2,26	-3,75	-5,59	
V21	learn	Yes	0,79	2,80	0,00	2,56	1,92	-13,71	0,00	-13,71	0,00	0,00	0,00	-10,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,63
V21		No	-0,18	0,00	0,00	0,00	0,00	-0,86	0,92	-1,85	2,78	-1,29	-0,44	-1,37	1,08	-4,72	0,00	0,00	1,40	2,26	-3,75	-8,03	0,00
			-0,53	-4,61	-0,79	-5,62	0,00	-14,19	-2,27	-14,19	0,00	-1,29	-4,73	-10,63	-4,34	-4,72	0,00	-9,42	-6,09	0,00	-10,27	-8,03	0,00

Figure A5. ***Model Input overview with p<0,50***

PMT	PMT	PMT	PMT
AP1	AP2	AP3	AP4
0,00	1,31	0,00	0,00
0,00	0,00	0,00	0,00
4,47	-1,76	0,00	0,00
0,00	0,00	0,00	0,00
-3,07	3,62	0,00	8,53
-5,48	5,38	10,44	4,68
-5,48	-1,76	0,00	0,00
0,00	0,00	0,00	0,00
4,47	0,00	0,00	0,00
0,00	0,00	0,00	0,00
-3,07	10,40	0,00	8,53
0,00	-3,10	0,00	0,00
0,00	0,00	0,00	0,00
0,00	8,01	0,00	0,00
-5,48	0,00	10,44	8,63
-5,48	-3,10	0,00	0,00
-3,07	0,00	0,00	8,53
0,00	0,00	0,00	0,00
-2,22	1,95	8,06	2,12
-3,07	0,00	0,00	0,00
0,00	0,00	10,44	0,00
0,00	0,00	0,00	0,00
-9,22	3,48	5,20	0,00
0,00	-5,10	0,00	0,00
4,11	1,60	0,00	7,98
-9,22	-5,10	0,00	0,00
0,00	0,00	10,44	8,63
-2,52	1,53	5,20	2,78
-2,52	0,00	5,20	2,78
3,28	0,00	7,53	4,03
-10,42	2,73	10,43	0,00
-10,42	0,00	7,53	0,00
0,00	0,00	0,00	0,00
-4,22	0,66	5,20	0,00
0,00	7,39	10,44	8,53
8,50	6,43	0,00	8,63
-4,22	0,00	0,00	0,00
0,00	0,00	0,00	0,00
3,28	0,00	7,53	4,03
0,00	1,48	0,00	0,00
-10,42	2,76	10,43	0,00
0,00	0,00	0,00	0,00
-10,42	0,00	0,00	0,00
2,48	0,00	7,53	3,17
-6,33	2,82	10,43	4,68
-6,33	0,00	7,53	3,17
0,00	0,00	0,00	0,00
-2,96	0,00	0,00	0,00
-8,74	3,55	10,43	5,61
5,46	-1,45	7,53	2,42
-8,74	-1,45	0,00	0,00
0,00	3,91	10,43	0,00
-2,32	0,00	7,53	4,03
-2,32	0,00	7,53	0,00
3,28	0,00	8,06	3,58
-10,42	4,75	0,00	0,00
-10,42	0,00	0,00	0,00
-2,32	1,48	8,06	3,58
0,00	0,00	0,00	0,00
-2,32	0,00	0,00	0,00
-2,32	2,69	8,06	3,58
0,00	-1,84	0,00	0,00
-2,32	-1,84	0,00	0,00
0,00	0,00	0,00	0,00
-2,32	1,72	8,06	3,58
-2,32	0,00	0,00	0,00
-7,54	4,88	10,44	6,43
6,24	-1,11	0,00	0,00
-7,54	-1,11	0,00	0,00
-6,18	2,63	10,43	0,00
2,03	0,00	7,53	4,03
-6,18	0,00	7,53	0,00
-9,91	1,12	10,43	0,00
3,62	2,03	7,53	4,03
-2,32	1,72	8,06	3,58
2,72	6,60	10,44	8,57
-4,22	0,75	5,20	
3,62	0,00	7,53	4,03
-9,91	2,51	10,43	0,00
-9,91	0,00	5,20	0,00

UPM	UPM	UPM	UPM	UPM
Average	AP1	AP2	AP3	AP4
0,00	0,00	0,00	0,00	0,00
-2,96	0,00	0,00	-11,56	0,00
0,00	0,00	-4,52	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-2,10	-3,83	-2,87	10,46	0,00
-2,96	-3,83	-4,52	-11,56	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-8,77	0,00	-7,37	-11,56	0,00
0,00	0,00	0,00	0,00	0,00
-26,16	0,00	-26,16	0,00	0,00
1,62	-3,83	2,94	10,46	0,00
-26,16	-3,83	-26,16	-11,56	0,00
-6,83	0,00	-6,83	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-1,95	0,00	-2,66	0,00	0,00
-6,83	0,00	-6,83	0,00	0,00
0,00	0,00	0,00	0,00	0,00
12,68	0,00	12,68	0,00	0,00
-3,38	0,00	-6,06	10,46	0,00
-7,37	0,00	-7,37	0,00	0,00
-1,95	0,00	5,31	-11,56	0,00
-7,37	0,00	-7,37	-11,56	0,00
0,00	0,00	0,00	0,00	0,00
-2,18	0,00	-3,34	0,00	0,00
-2,18	0,00	-3,34	0,00	0,00
-3,62	0,00	-3,85	-11,56	0,00
-1,59	0,00	-3,16	10,46	0,00
-3,62	0,00	-3,85	-11,56	0,00
0,00	0,00	0,00	0,00	0,00
-1,86	0,00	-3,61	10,46	0,00
0,00	0,00	0,00	0,00	0,00
-5,61	0,00	0,00	-11,56	0,00
-5,61	0,00	-3,61	-11,56	0,00
0,00	0,00	0,00	0,00	0,00
-3,62	0,00	-3,85	-11,56	0,00
0,00	0,00	9,15	0,00	0,00
-2,93	0,00	-5,70	10,46	0,00
12,68	0,00	12,68	0,00	0,00
-3,62	0,00	-5,70	-11,56	0,00
-2,88	0,00	-5,43	0,00	0,00
-1,99	0,00	-2,86	0,00	0,00
-2,88	0,00	-5,43	0,00	0,00
0,00	0,00	0,00	0,00	0,00
12,68	0,00	12,68	0,00	0,00
-2,93	0,00	-5,70	10,46	0,00
0,00	0,00	0,00	0,00	0,00
-5,10	-4,25	-6,03	0,00	0,00
0,00	0,00	0,00	-11,56	0,00
-5,76	-3,08	-19,24	10,46	0,00
-2,10	0,00	-3,40	0,00	0,00
-3,33	-4,25	0,00	0,00	0,00
-3,33	-4,25	-3,40	0,00	0,00
-2,01	0,00	-2,62	0,00	0,00
-2,67	0,00	-5,72	0,00	0,00
-2,67	0,00	-5,72	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-2,42	-1,72	-3,35	0,00	0,00
-2,42	-1,72	-3,35	0,00	0,00
-2,41	-2,75	-2,83	0,00	0,00
0,00	4,85	-4,80	0,00	0,00
-2,41	-2,75	-4,80	0,00	0,00
-1,59	0,00	-3,16	10,46	0,00
-3,62	0,00	-3,85	-11,56	0,00
-3,62	0,00	-3,85	-11,56	0,00
-2,15	0,00	-3,52	10,46	0,00
			-11,56	
-2,54	0,00	-4,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-2,26		-3,61		
-2,57	0,00	-5,43	0,00	0,00
-2,10	0,00	-2,86	0,00	0,00
-2,57	0,00	-5,43	-11,56	0,00

CL	CL	CL	CL	CL
Average	AP1	AP2	AP3	AP4
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-18,17	0,00	-19,73	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-5,90	-12,46	0,00	0,00	0,00
5,01	6,11	4,80	0,00	5,15
-18,17	-12,46	-19,73	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-5,95	0,00	-10,16	0,00	7,10
13,32	13,32	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
9,18	0,00	9,41	0,00	0,00
1,46	0,00	2,54	0,00	0,00
-5,95	0,00	-10,16	0,00	0,00
-6,48	0,00	-7,38	0,00	0,00
0,00	0,00	0,00	0,00	0,00
1,03	0,00	0,00	0,00	5,15
-6,48	0,00	-7,38	0,00	0,00
0,00	7,14	-4,29	0,00	0,00
-8,66	0,00	-17,52	0,00	0,00
3,42	0,00	4,03	9,58	7,07
-4,56	0,00	-4,56	0,00	0,00
-5,64	0,00	-5,57	0,00	0,00
-8,66	0,00	-17,52	0,00	0,00
-4,18	0,00	0,00	0,00	0,00
0,00	0,00	-1,25	0,00	6,23
-6,18	0,00	-1,25	0,00	0,00
-5,78	8,00	-7,36	0,00	0,00
2,68	0,00	3,20	0,00	6,23
-5,78	0,00	-7,36	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-0,99	0,00	-2,32	0,00	6,23
0,00	0,00	0,00	0,00	0,00
6,72	13,32	6,32	0,00	0,00
-0,99	0,00	-2,32	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-6,23	8,00	-8,22	0,00	0,00
0,00	0,00	0,00	0,00	0,00
2,95	0,00	3,20	9,58	7,07
0,00	0,00	0,00	0,00	0,00
-6,23	0,00	-8,22	0,00	0,00
-16,87	0,00	-18,11	0,00	0,00
2,92	0,00	3,13	0,00	4,67
-16,87	0,00	-18,11	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
1,82	0,00	1,66	9,58	6,23
-7,91	8,00	-11,48	0,00	0,00
-7,91	0,00	-11,48	0,00	0,00
4,87	0,00	4,45	0,00	6,23
-2,58	0,00	-4,58	0,00	0,00
-2,58	0,00	-4,58	0,00	0,00
-1,87	0,00	-3,35	0,00	4,99
4,06	3,58	3,69	9,58	3,63
-1,87	0,00	-3,35	0,00	3,63
0,00	0,00	-1,35	0,00	5,15
0,00	0,00	0,00	0,00	0,00
0,00	0,00	-1,35	0,00	0,00
0,00	5,23	0,00	0,00	5,15
-4,07	-8,67	-2,75	0,00	0,00
-4,07	-8,67	-2,75	0,00	0,00
-5,90	-12,46	0,00	0,00	0,00
0,00	4,41	-1,38	0,00	4,67
-5,90	-12,46	-1,38	0,00	0,00
3,44	5,08	2,74	0,00	4,67
-10,62	-10,00	-10,78	0,00	0,00
-10,62	-10,00	-10,78	0,00	0,00
2,57	0,00	2,93	0,00	6,23
-8,13	8,00	-10,81	0,00	0,00
-8,13	0,00	-10,81	0,00	0,00
1,55	0,00	0,00	0,00	6,23
-8,01		-8,20		
0,00	4,41	-1,38	9,58	4,67
-4,30	-12,46			
0,00	13,32	0,00	0,00	0,00
		-1,56		6,23
-10,94	0,00	-11,48	0,00	0,00
2,11	0,00	1,66	0,00	6,23
-10,94	-12,46	-11,48	0,00	0,00

SCL	SCL	SCL	SCL	SCL	SCL
	Average	AP1	AP2	AP3	AP4
0,00	0,00	0,00	0,00	0,00	0,00
0,00	-5,30	2,56	0,00	0,00	
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	4,66	0,00	0,00	0,00
2,40	2,89	1,76	0,00	5,18	
0,00	-5,30	0,00	0,00	0,00	
0,00	0,00	0,00	0,00	0,00	0,00
0,00	-4,02	4,38	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
13,12	0,00	13,12	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	-9,69	0,00	8,69	
2,77	2,20	2,66	0,00	10,90	
0,00	-4,02	-9,69	0,00	0,00	0,00
19,71	0,00	19,71	0,00	0,00	0,00
0,00	-5,30	1,73	0,00	0,00	0,00
2,19	1,72	1,90	0,00	5,18	
0,00	-5,30	1,73	0,00	0,00	
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
2,18	2,69	-1,84	0,00	6,06	
0,00	0,00	0,00	0,00	0,00	0,00
2,10	-4,82	3,01	-11,58	0,00	
0,00	-4,82	-1,84	-11,58	0,00	
2,20	0,00	5,20	-11,58	0,00	
2,01	0,00	1,86	0,00	6,06	
2,01	0,00	1,86	-11,58	0,00	
2,10	0,00	2,95	-11,58	0,00	
1,98	0,00	0,00	0,00	6,06	
1,98	0,00	0,00	-11,58	0,00	
0,00	0,00	0,00	0,00	0,00	0,00
1,97	0,00	1,67	0,00	6,06	
2,65	0,00	2,47	0,00	0,00	0,00
1,63	0,00	2,57	-11,58	0,00	
0,00	0,00	0,00	-11,58	0,00	
0,00	0,00	0,00	0,00	0,00	0,00
1,83	0,00	3,13	-11,58	0,00	
-5,30	-5,30	0,00	0,00	0,00	0,00
2,53	2,69	0,00	0,00	6,06	
3,00	0,00	3,00	0,00	0,00	0,00
-5,30	-5,30	0,00	-11,58	0,00	
0,00	0,00	6,95	0,00	0,00	
2,01	0,00	1,98	0,00	5,18	
0,00	0,00	1,98	0,00	0,00	
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
2,61	5,48	0,00	0,00	10,51	
1,81	0,00	0,00	-11,58	0,00	
2,04	0,00	2,24	0,00	5,18	
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
2,26	1,82	2,01	0,00	5,18	
0,00	-3,50	6,43	0,00	0,00	
0,00	-3,50	2,01	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
2,11	0,00	2,32	0,00	5,18	
0,00	0,00	0,00	0,00	0,00	0,00
2,41	0,00	2,63	0,00	5,18	
0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00
1,85	0,00	1,22	0,00	6,06	
2,82	0,00	7,41	-11,58	0,00	
1,85	0,00	1,22	-11,58	0,00	
2,32	0,00	1,67	0,00	6,06	
1,76		2,52	-11,58		
2,07	0,00	2,11	0,00	5,18	
		5,36			
1,91	0,00	2,29	-11,58	0,00	
2,15		2,15		6,06	
1,52	0,00	2,78	-11,58	0,00	
2,29	0,00	1,92	0,00	6,06	
1,52	0,00	1,67	-11,58	0,00	

OTH	OTH	OTH	OTH	OTH
Average	AP1	AP2	AP3	AP4
0,00	0,00	0,00	0,00	0,00
-1,59	0,00	-2,20	0,00	0,00
-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00
6,80	0,00	5,71	0,00	0,00
3,34	3,48	3,88	0,00	0,00
-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-4,31	28,58	-5,04	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-9,86	0,00	-9,86	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
3,52	14,40	3,57	0,00	0,00
4,09	3,22	4,70	0,00	2,64
-9,86	0,00	-9,86	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-1,59	0,00	-2,20	0,00	0,00
2,35	4,20	2,34	0,00	0,00
-1,59	0,00	-2,20	0,00	0,00
0,91	0,00	-1,00	0,00	7,49
0,00	0,00	0,00	0,00	0,00
1,51	3,48	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
2,44	6,23	2,70	0,00	-6,42
0,00	0,00	-1,00	0,00	-6,42
1,69	5,61	1,48	0,00	0,00
1,74	4,77	1,44	0,00	0,00
1,69	4,77	1,44	0,00	0,00
2,45	6,23	2,39	0,00	0,00
0,94	4,40	0,00	0,00	0,00
0,94	4,40	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
-0,87	4,40	-1,86	0,00	0,00
2,45	0,00	0,00	0,00	7,49
6,38	6,23	7,79	0,00	-6,42
-0,87	0,00	-1,86	0,00	-6,42
0,00	0,00	0,00	0,00	0,00
2,45	6,23	2,39	0,00	0,00
0,00	0,00	-2,13	0,00	0,00
1,23	3,48	0,00	0,00	0,00
1,34	0,00	1,34	0,00	0,00
0,00	0,00	-2,13	0,00	0,00
-3,51	0,00	-6,04	0,00	7,49
2,82	4,87	3,03	0,00	-2,21
-3,51	0,00	-6,04	0,00	-2,21
0,00	0,00	0,00	0,00	0,00
1,34	0,00	1,34	0,00	0,00
0,00	4,40	0,00	0,00	0,00
2,98	6,23	3,06	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	14,40	0,00	0,00	0,00
2,21	4,27	1,88	0,00	2,64
0,00	4,27	0,00	0,00	0,00
1,79	10,16	1,52	0,00	0,00
1,58	2,45	0,00	0,00	2,51
1,58	2,45	0,00	0,00	0,00
1,73	4,87	1,45	0,00	0,00
0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00
1,73	3,48	1,65	0,00	0,00
1,69	27,15	0,00	0,00	0,00
1,69	3,48	0,00	0,00	0,00
6,47	21,42	4,47	0,00	0,00
1,55	4,19	1,32	0,00	0,00
1,55	4,19	1,32	0,00	0,00
0,92	3,77	0,00	0,00	0,00
3,08	10,02	2,71	0,00	0,00
0,92	3,77	0,00	0,00	0,00
2,98	4,77	2,93	0,00	0,00
-2,09	5,61	-4,14	0,00	0,00
-2,09	4,77	-4,14	0,00	0,00
0,00	4,40	0,00	0,00	0,00
3,07	6,23	3,18		
1,60	4,48	1,32	0,00	0,00
3,53		2,86		
5,34	6,23	6,15	0,00	0,00
-0,87	4,40	-1,86		
3,07	6,23	3,18	0,00	0,00
0,00	4,40	0,00	0,00	0,00
-0,87	4,40	-1,86	0,00	0,00

Workplace characte	Value		Average	Average	Average	Average	Average	UDW	UDW	UDW	UDW	UDW	GDW	GDW	GDW	GDW	GDW	IDW	IDW	IDW	IDW	IDW	PMT
Privacy:			Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average
V1	Size of room	Cellular 1 person	-5,96	0,00	-6,55	0,00	2,04	-12,41	0,00	-12,41	0,00	0,00	-11,82	0,00	-11,82	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,31
V1		Cellular 2-4 person	-0,83	-1,41	-0,64	-10,90	0,53	-0,90	-1,97	-0,79	0,00	0,00	-2,48	-2,02	-2,66	0,00	0,00	0,34	-2,23	1,46	-9,91	0,00	0,38
V1		Cellular 5-10	-4,05	1,81	-5,75	1,71	0,59	-10,25	-9,57	-10,36	0,00	0,00	6,82	5,35	7,63	0,00	0,00	0,28	0,00	0,00	0,00	0,28	-0,68
V1		Open 2-4 person	-0,68	0,00	-0,68	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,03
V1		Open 5-10	0,72	-5,74	2,10	0,00	5,33	-0,52	-5,74	0,01	0,00	0,00	-0,66	-6,05	2,39	0,00	0,00	10,08	0,00	10,08	0,00	0,00	3,22
V1		Open 10+	0,78	0,50	1,59	0,34	-0,12	-0,28	2,03	-2,74	2,78	-1,29	-0,52	-1,13	0,61	-4,72	-0,37	-0,31	1,57	2,55	-3,48	-8,03	2,18
			-5,96	-5,74	-6,55	-10,90	-0,12	-12,41	-9,57	-12,41	0,00	-1,29	-11,82	-6,05	-11,82	-4,72	-0,37	-0,31	-2,23	0,00	-9,91	-8,03	-0,68
V2	Openness of room	Walls & no windows	-9,91	0,00	0,00	-9,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-9,91	0,00	0,00	-9,91	0,00	0,00
V2		Walls & windows	-2,04	0,21	-3,37	1,71	-0,43	-8,41	-3,80	-12,10	0,00	-6,09	1,27	1,67	4,82	0,00	-0,12	0,21	-2,23	0,56	0,00	0,28	0,29
V2		Walls & open	3,60	5,00	0,35	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-6,09	-6,09	0,00	0,00	0,00	0,00
V2		Glass walls with curtains	-0,26	-3,07	-0,35	0,00	6,68	-0,98	0,00	-0,98	0,00	0,00	-6,69	0,00	-6,69	0,00	0,00	11,69	0,00	11,69	0,00	0,00	6,95
V2		Glass walls	-2,11	0,00	-1,84	-11,56	0,00	-2,38	0,00	-2,38	0,00	0,00	1,01	0,00	1,01	0,00	0,00	-10,98	0,00	-10,98	0,00	0,00	-3,10
V2		Curtains	12,58	0,00	12,58	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	12,58	0,00	12,58	0,00	0,00	0,00
V2		Open with 1 walt	0,70	10,88	0,70	0,00	-0,04	-3,23	-1,97	-6,67	0,00	0,63	0,37	19,64	0,66	0,00	-0,17	-2,06	12,85	-6,07	0,00	-6,33	8,01
V2		Open	0,78	-0,40	1,80	0,34	0,27	0,53	1,83	-0,98	2,78	0,00	-1,19	-2,17	0,96	-4,72	-1,15	0,17	0,62	4,26	-3,48	-13,15	-0,87
			-9,91	-3,07	-3,37	-11,56	-0,43	-8,41	-3,80	-12,10	0,00	-6,09	-6,69	-2,17	-6,69	-4,72	-1,15	-10,98	-6,09	-10,98	-9,91	-13,15	-3,10
V3	Audio priva	0	-1,35	-3,07	-1,68	0,00	6,68	-7,63	0,00	-7,63	0,00	0,00	4,74	0,00	4,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,03
V3		1 or 2	-0,98	-1,41	-0,89	-9,91	0,53	-1,06	-1,97	-0,96	0,00	0,00	-2,48	-2,02	-2,66	0,00	0,00	2,31	-2,23	4,08	-9,91	0,00	-0,51
V3		2+	0,25	0,15	0,47	0,13	-0,09	-1,06	1,28	-3,03	2,78	-1,29	-0,41	-1,42	1,33	-4,72	-0,36	-0,36	1,57	2,04	-3,48	-5,59	1,32
			-1,35	-3,07	-1,68	-9,91	-0,09	-7,63	-1,97	-7,63	0,00	-1,29	-2,48	-2,02	-2,66	-4,72	-0,36	-0,36	-2,23	0,00	-9,91	-5,59	-0,51
V4	Visual divisi on (offic	Wall	-0,35	-0,29	-1,61	3,98	6,30	-5,23	-1,97	-12,41	0,00	0,00	-0,61	-3,46	1,83	0,00	0,00	-1,76	-4,55	0,56	-9,91	0,00	4,01
V4		Window	-2,89	1,86	-2,91	-5,23	0,00	-2,97	0,16	-15,65	19,39	0,00	14,33	0,00	13,43	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	-2,57
V4		Office partition	-0,05	-0,33	0,06	1,32	-0,24	-0,57	1,34	-1,55	2,04	-1,29	-0,64	-1,58	0,61	-4,72	-0,36	1,00	2,15	2,74	0,55	-5,59	0,65
V4		Hallway	-1,73	0,00	-1,73	0,00	0,00	11,61	0,00	11,61	0,00	0,00	5,29	0,00	5,29	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-5,10
V4		Open	0,70	2,72	0,62	-6,27	0,56	-4,48	0,00	-4,48	0,00	0,00	0,37	3,51	-0,19	0,00	0,00	2,13	0,00	3,21	0,00	0,00	2,49
			-2,89	-0,33	-2,91	-6,27	-0,24	-5,23	-1,97	-15,65	0,00	-1,29	-0,64	-3,46	-0,19	-4,72	-0,36	-10,32	-4,55	0,00	-10,32	-5,59	-5,10
Facilities:																							
V5	Power socket	No	1,19	1,55	0,63	2,70	1,55	5,60	0,00	5,60	0,00	0,00	-6,99	-10,63	-6,91	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,87
V5		Yes	-0,06	-0,04	-0,03	-0,36	-0,10	-1,26	0,92	-2,43	2,78	-1,29	-0,31	-1,37	1,47	-4,72	-0,36	-0,04	1,40	2,52	-3,75	-5,59	0,95
			-0,06	-0,04	-0,03	-0,36	-0,10	-1,26	0,00	-2,43	0,00	-1,29	-6,99	-10,63	-6,91	-4,72	-0,36	-0,04	0,00	0,00	-3,75	-5,59	0,95
V6	Extra monitor	No	0,27	2,66	-0,26	0,80	1,92	-8,96	0,00	-8,96	0,00	0,00	1,45	0,36	1,67	0,00	0,00	-5,07	-6,09	-10,98	0,00	0,28	1,54
V6		Yes	-0,09	-0,38	0,13	-0,15	-0,21	-0,63	0,92	-1,54	2,78	-1,29	-0,57	-1,51	0,84	-4,72	-0,36	0,30	1,94	3,22	-3,75	-8,03	0,57
			-0,09	-0,38	-0,26	-0,15	-0,21	-8,96	0,00	-8,96	0,00	-1,29	-0,57	-1,51	0,84	-4,72	-0,36	-5,07	-6,09	-10,98	-3,75	-8,03	0,57
V7	Type of chair	No chair/standing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V7		Deskchair	-0,61	-0,25	-0,96	-0,11	-0,19	-1,31	0,92	-2,52	2,78	-1,29	-0,33	-1,37	1,43	-4,72	-0,36	0,30	1,94	3,22	-3,75	-5,59	-0,02
V7		Barstool	3,23	-0,37	2,84	6,75	7,34	-1,58	0,00	-1,58	0,00	0,00	-2,74	-10,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	6,06
V7		Regular chair	4,42	6,03	5,32	-4,87	-2,63	7,16	0,00	7,16	0,00	0,00	-3,89	0,00	-3,89	0,00	0,00	-8,89	-6,09	-10,98	0,00	0,00	7,74
			-0,61	-0,37	-0,96	-4,87	-2,63	-1,58	0,00	-2,52	0,00	-1,29	-3,89	-10,63	-3,89	-4,72	-0,36	-8,89	-6,09	-10,98	-3,75	-5,59	-0,02
V8	Type of desk (sitting,	No desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V8		Shared table	0,48	2,66	-0,04	0,80	1,92	-8,29	0,00	-8,29	0,00	0,00	2,11	0,36	2,48	0,00	0,00	-2,55	-6,09	-3,13	0,00	0,28	1,55
V8		Individual desk	-1,22	-1,67	-0,88	-13,83	2,04	-2,68	-1,97	-2,90	0,00	0,00	-0,24	-2,02	1,13	0,00	0,00	1,50	-2,23	3,34	-13,83	0,00	1,48
V8		Individual desk, adjustable	-0,05	-0,31	0,04	1,31	-0,22	-0,57	1,34	-1,55	2,04	-1,29	-0,67	-1,58	0,47	-4,72	-0,36	1,03	2,15	2,74	0,55	-8,03	0,54
V8		special desk	0,46	1,86	2,62	-5,23	0,00	2,17	0,16	-5,04	19,39	0,00	7,93	0,00	4,29	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	0,00
			-1,22	-1,67	-0,88	-13,83	-0,22	-8,29	-1,97	-8,29	0,00	-1,29	-0,67	-2,02	0,00	-4,72	-0,36	-10,32	-6,09	-3,13	-13,83	-8,03	0,00
V9	Presentation	Yes	-2,06	0,89	-3,72	5,59	4,25	-18,14	0,00	-18,14	0,00	0,00	5,94	-10,63	8,14	0,00	0,00	3,79	0,00	12,58	0,00	0,28	1,08
V9		No	0,29	-0,07	0,73	-0,52	-0,30	-0,74	0,92	-1,64	2,78	-1,29	-0,58	-1,37	0,37	-4,72	-0,36	-0,19	1,40	2,26	-3,75	-8,03	1,18
			-2,06	-0,07	-3,72	-0,52	-0,30	-18,14	0,00	-18,14	0,00	-1,29	-0,58	-10,63	0,37	-4,72	-0,36	-0,19	0,00	2,26	-3,75	-8,03	1,08
V10	Desk space (able to	No desk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
V10		Small	-0,66	1,12	2,55	-5,23	0,00	2,17	0,16	-5,04	19,39	0,00	7,93	0,00	4,29	0,00	0,00	-10,32	0,00	0,00	-10,32	0,00	-2,96
V10		Regular	-0,10	-0,41	0,01	0,55	-0,12	-0,92	0,96	-1,83	2,04	-1,29	-0,49	-1,45	1,02	-4,72	-0,36	0,98	1,94	2,52	-0,76	-8,03	1,64
V10		Spacious	0,48	3,36	-0,18	2,56	1,23	-16,14	0,00	-16,14	0,00	0,00	0,23	-10,63	0,94	0,00	0,00	-2,11	-6,09	0,00	0,00	0,28	0,54
			-0,66	-0,41	-0,18	-5,23	-0,12	-16,14	0,00	-16,14	0,00	-1,29	-0,49	-10,63	0,00	-4,72	-0,36	-10,32	-6,09	0,00	-10,32	-8,03	-2,96
V11	Storage	Yes	-0,08	8,71	-0,31	7,09	-0,34	-2,12	-1,97	-2,26	0,00	-1,29	-0,15	19,64	-1,09	7,10	-0,27	2,53	12,85	3,14	6,35	-7,29	3,95
V11		No	0,05	-0,26	0,21	-0,65	1,94	-0,59	1,00	-2,51	2,78	0,00	-0,69	-1,87	2,40	-6,87	-1,98	-1,24	-0,03	2,02	-6,07	-2,46	0,21
			-0,08	-0,26	-0,31	-0,65	-0,34	-2,12	-1,97	-2,51	0,00	-1,29	-0,69	-1,87	-1,09	-6,87	-1,98	-1,24	-0,03	2,02	-6,07	-7,29	0,21
Access:																							
V12	Department based	Free use	0,02	0,10	0,01	-0,09	-0,01	-2,71	-0,42	-3,53	19,39	-6,09	0,13	-1,65	1,73	7,10	-0,40	0,54	0,00	2,86	-4,33	-3,13	1,30
V12		Department	-0,03	-0,10	-0,03	0,06	0,01	-0,03	2,17	-1,27	2,04	0,63	-1,03	-1,28	-2,11	-6,87	-0,33	-1,13	3,94	1,03	-3,21	-7,31	0,65
			-0,03	-0,10	-0,03	-0,09	-0,01	-2,71	-0,42	-3,53	2,04	-6,09	-1,03	-1,65	-2,11	-6,87	-0,40	-1,13	0,00	1,03	-4,33	-7,31	0,65
V13	Flex user	Flex use	0,01	0,02	0,00	0,13	-0,01	-1,23	0,92	-2,37	2,78	-1,29	-0,41	-1,45	1,06	-4,72	-0,36	0,06	1,40	2,52	-3,48	-5,59	1,13
V13		Assigned	-3,60	-4,25	-1,95	-9,91	2,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-9,91	0,00	0,00	-9,91	0,00	0,00
			-3,60	-4,25	-1,95	-9,91	-0,01	-1,23	0,00	-2,37	0,00	-1,29	-0,41	-1,45	0,00	-4,72	-0,36	-9,91	0,00	0,00	-9,91	-5,59	0,00
Use agreements:																							
V14	Out loud	Out loud speaking	0,17	0,54	0,09	0,13	-0,01	-1,12	2,03	-2,71	2,78	-1,29	-0,55	-1,13	0,27	-4,72	-0,37	0,03	1,57	2,86	-3,48	-5,59	1,86
V14		Silence	-0,98	-2,70	-0,36	-9,91	0,82	-1,77	-4,18	-0,94	0,00	0,00	0,37	-2,83	2,51	0,00	0,00	-0,66	-2,23	0,89	-9,91	0,00	-1,84
			-0,98	-2,70	-0,36	-9,91	-0,01	-1,77	-4,18	-2,71	0,00	-1,29	-0,55	-2,83	0,27	-4,72	-0,37	-0,66	-2,23	0,89	-9,91	-5,59	-1,84
V15	Calling	no	-0,29	-3,65	0,72	0,00	0,00	-1,22	-7,66	-0,22	0,00	0,00	0,03	-3,05	2,37	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05
V15		yes	0,03	0,36	-0,10	0,00	0,00	-1,23	1,56	-2,80	2,78	-1,29	-0,47	-1,17	0,63	-4,72	-0,37	-0,07	1,40	2,49	-3,75	-5,59	1,26
			-0,29	-3,65	-0,10	0,00	0,00	-1,23	-7,66	-2,80	0,00	-1,29	-0,47	-3,05	0,63	-4,72	-0,37	-0,07	0,00	0,00	-3,75	-5,59	0,05
V16	Multiple person	No	0,12	0,03	0,25	-0,03	-0,02	-0,62	1,56	-1,92	2,78	-1,29	-0,82	-1,32	-0,83	-4,72	-0,37	-0,08	1,40	2,49	-3,75	-8,03	2,40
V16		Yes	-0,37	-0,15	-0,44	1,71	0,49	-4,20	-7,66	-3,83	0,00	0,00	1,60	-2,03	3,47	0,00	0,00	1,07	0,00	0,00	0,00	0,28	-0,04
			-0,37	-0,15	-0,44	-0,03	-0,02	-4,20	-7,66	-3,83	0,00	-1,29	-0,82	-2,03	-0,83	-4,72	-0,37	-0,08	0,00	0,00	-3,75	-8,03	-0,04
V17	Bookable –	No	0,26	-0,15	0,65	-0,15	-0,21	-0,81	0,92	-1,78	2,78	-1,29	-0,49	-1,37	0,84	-4,72	-0,36	0,16	1,94	2,97	-3,75	-8,03	0,99
V17		Yes	-1,41	1,42	-2,64	0,80	1,92	-11,81	0,00	-11,81	0,00	0,00	1,49	-10,63	2,47	0,00	0,00	-2,55	-6,09	-3,13	0,00	0,28	1,25
			-1,41	-0,15	-2,64	-0,15	-0,21	-11,81	0,00	-11,81	0,00	-1,29	-0,49	-10,63	0,84	-4,72	-0,36	-2,55	-6,09	-3,13	-3,75	-8,03	0,99
V18	focus	Yes	-0,27	-0,31	-0,28	-0,15	-0,21	-0,85	0,92	-1,83	2,78	-1,29	-0,38	-1,37	1,29	-4,72	-0,36	0,05	1,40	2,97	-3,75	-8,03	-0,36
V18		No	1,18	2,80	0,84	0,80	1,92	-14,19		-14,19			-1,52	-10,63	-0,77			-1,58		-3,13		0,28	2,86
V19	collaborate	Yes	0,05	0,39	-0,16	1,04	0,00	-1,37	1,22	-2,70	2,04	-1,29	-0,43	-0,97	0,57	-4,72	-0,37	0,94	1,40	2,49	-0,17	-5,59	1,26
V19		No	-0,48	-4,61	1,18	-5,62	0,00	-0,04	-2,27	-0,05	19,39		-0,25	-5,19	2,50		0,00	-9,42			-10,27		0,05
V20	social	Yes	3,46	3,41	3,63	2,70	2,49	-6,00	0,00	-6,00	0,00	0,00	-4,73	-10,63	-4,34	0,00	0,00	1,38	-6,09	12,58	0,00	0,00	6,14
V20		No	-0,53	-0,25	-0,79	-0,36	-0,19	-1,13	0,92	-2,25	2,78	-1,29	-0,29	-1,37	1,64	-4,72	-0,36	-0,08	1,94	2,26	-3,75	-5,59	0,05
V21	learn	Yes	0,79	2,80	0,25	2,56	1,92	-13,71	0,00	-13,71	0,00	0,00	0,23	-10,63	0,94	0,00	0,00	3,79	0,00	12,58	0,00	0,28	1,63
V21		No	-0,18	-0,31	-0,09	-0,40	-0,21	-0,86	0,92	-1,85	2,78	-1,29	-0,44	-1,37	1,08	-4,72	-0,36	-0,19	1,40	2,26	-3,75	-8,03	0,58
			-0,53	-4,61	-0,79	-5,62	-0,21	-14,19	-2,27	-14,19	0,00	-1,29	-4,73	-10,63	-4,34	-4,72	-0,37	-9,42	-6,09	-3,13	-10,27	-8,03	-0,36

Figure A6. ***Model Input overview without significance threshold (own ill.)***

PMT				UPM					CL					SCL					OTH				
AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4	Average	AP1	AP2	AP3	AP4
0,00	1,31	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-2,11	0,00	-3,15	0,00	2,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,38	0,00	0,00	-2,96	-0,40	0,00	-11,56	0,53	1,14	-1,10	1,46	0,00	0,00	0,52	-5,30	2,56	0,00	0,00	-1,59	0,00	-2,20	0,00	0,00
4,47	-1,76	1,71	0,73	-1,16	1,82	-4,52	0,00	0,00	-18,17	-2,62	-19,73	0,00	0,00	2,54	-1,79	11,19	0,00	0,00	-13,12	0,00	-14,21	0,00	0,00
0,00	1,03	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-3,07	3,62	0,00	8,53	-3,32	0,00	-3,32	0,00	0,00	-5,90	-12,46	-0,98	0,00	0,00	0,75	-7,08	4,66	0,00	0,00	6,80	0,00	5,71	0,00	0,00
-5,48	5,38	10,44	4,68	-2,10	-3,83	-2,87	10,46	0,00	5,01	6,11	4,80	3,72	5,15	2,40	2,89	1,76	-0,89	5,18	3,34	3,48	3,88	0,28	0,79
-5,48	-1,76	0,00	0,00	-3,32	-3,83	-4,52	-11,56	0,00	-18,17	-12,46	-19,73	0,00	0,00	0,00	-7,08	0,00	-0,89	0,00	-13,12	0,00	-14,21	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
4,47	-0,49	1,71	0,73	-0,01	0,93	-1,44	0,00	0,53	-5,95	-1,71	-10,16	0,00	7,10	-0,32	-4,02	4,38	0,00	-2,88	-4,31	28,58	-5,04	0,00	-2,79
0,00	0,00	0,00	0,00	0,35	0,00	0,35	0,00	0,00	13,32	13,32	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-3,07	10,40	0,00	8,53	0,00	0,00	0,00	0,00	0,00	-0,08	0,00	-1,14	0,00	2,04	-1,22	0,00	-1,22	0,00	0,00	-9,86	0,00	-9,86	0,00	0,00
0,00	-3,10	0,00	0,00	-8,77	0,00	-7,37	-11,56	0,00	-0,29	0,00	-0,29	0,00	0,00	13,12	0,00	13,12	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,00	8,01	0,00	0,00	-26,16	0,00	-26,16	0,00	0,00	9,18	0,00	9,41	0,00	0,00	0,20	0,00	-9,69	0,00	8,69	3,52	14,40	3,57	0,00	-1,47
-5,48	0,10	10,44	8,63	1,62	-3,83	2,94	10,46	0,00	1,46	-0,90	2,54	3,72	0,00	2,77	2,20	2,66	-0,89	10,90	4,09	3,22	4,70	0,28	2,64
-5,48	-3,10	0,00	0,00	-26,16	-3,83	-26,16	-11,56	0,00	-5,95	-1,71	-10,16	0,00	0,00	-1,22	-4,02	-9,69	-0,89	-2,88	-9,86	0,00	-9,86	0,00	-2,79
-3,07	0,96	0,00	8,53	-6,83	0,00	-6,83	0,00	0,00	-6,48	0,00	-7,38	0,00	2,04	19,71	0,00	19,71	0,00	0,00	-13,57	0,00	-13,57	0,00	0,00
0,00	-0,51	0,00	0,00	-0,09	-0,40	0,00	0,00	0,53	-1,12	-1,10	-1,13	0,00	0,00	-0,32	-5,30	1,73	0,00	0,00	-1,59	0,00	-2,20	0,00	0,00
-2,22	1,95	8,06	2,12	-1,95	-1,00	-2,66	-0,55	0,00	1,03	1,15	0,11	3,72	5,15	2,19	1,72	1,90	-0,89	5,18	2,35	4,20	2,34	0,28	0,79
-3,07	-0,51	0,00	0,00	-6,83	-1,00	-6,83	-0,55	0,00	-6,48	-1,10	-7,38	0,00	0,00	-0,32	-5,30	1,73	-0,89	0,00	-13,57	0,00	-13,57	0,00	0,00
4,68	-0,04	10,44	0,00	-0,15	-0,40	0,35	0,00	0,00	0,34	7,14	-4,29	0,00	2,04	-1,03	-0,92	-1,56	0,00	0,00	0,91	0,00	-1,00	1,23	7,49
0,00	-2,57	0,00	0,00	12,68	0,00	12,68	0,00	0,00	-8,66	0,00	-17,52	0,20	0,00	0,00	0,00	0,00	0,00	0,00	-1,76	0,00	-1,76	0,00	0,00
-9,22	3,48	5,20	-0,82	-3,38	0,13	-6,06	10,46	0,00	3,42	-0,90	4,03	9,58	7,07	2,18	2,69	-1,84	2,17	6,06	1,51	3,48	1,11	-2,92	0,00
0,00	-5,10	0,00	0,00	-7,37	0,00	-7,37	0,00	0,00	-4,56	0,00	-4,56	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
4,11	1,60	0,00	7,98	-0,92	-1,91	5,31	-11,56	0,53	-5,64	-2,62	-5,57	0,00	0,00	2,10	-4,82	3,01	-11,58	1,27	2,44	6,23	2,70	0,72	-6,42
-9,22	-5,10	0,00	-0,82	-7,37	-1,91	-7,37	-11,56	0,00	-8,66	-2,62	-17,52	0,00	0,00	-1,03	-4,82	-1,84	-11,58	0,00	-1,76	0,00	-1,76	-2,92	-6,42
0,65	-2,07	10,44	8,63	0,00	0,00	0,00	0,00	0,00	-4,18	0,00	-2,77	0,00	0,00	2,20	2,00	5,20	-11,58	1,27	1,69	5,61	1,48	0,92	1,44
-2,52	1,53	5,20	2,78	-2,18	-0,85	-3,34	-0,55	0,53	0,02	0,92	-1,25	3,72	6,23	2,01	0,11	1,86	2,17	6,06	1,74	4,77	1,44	-2,92	0,00
-2,52	**-2,07**	**5,20**	**2,78**	**-2,18**	**-0,85**	**-3,34**	**-0,55**	**0,00**	**-4,18**	**0,00**	**-2,77**	**0,00**	**0,00**	**2,01**	**0,11**	**1,86**	**-11,58**	**1,27**	**1,69**	**4,77**	**1,44**	**-2,92**	**0,00**
3,28	0,43	7,53	4,03	-3,62	-0,33	-3,85	-11,56	0,00	-5,78	8,00	-7,36	0,00	0,00	2,10	0,01	2,95	-11,58	1,27	2,45	6,23	2,39	0,92	1,44
-10,42	2,73	10,43	0,73	-1,59	-1,11	-3,16	10,46	0,53	2,68	-0,93	3,20	3,72	6,23	1,98	0,69	0,74	2,17	6,06	0,94	4,40	0,30	-2,92	0,00
-10,42	**0,43**	**7,53**	**0,73**	**-3,62**	**-1,11**	**-3,85**	**-11,56**	**0,00**	**-5,78**	**-0,93**	**-7,36**	**0,00**	**0,00**	**1,98**	**0,01**	**0,74**	**-11,58**	**1,27**	**0,94**	**4,40**	**0,30**	**-2,92**	**0,00**
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-4,22	0,66	5,20	0,73	-1,86	-0,85	-3,61	10,46	0,53	-0,99	-1,07	-2,32	3,72	6,23	1,97	-0,13	1,67	2,17	6,06	-0,87	4,40	-1,86	-2,92	0,00
-0,95	7,39	10,44	8,53	0,00	0,00	0,00	0,00	0,00	-7,32	0,00	-7,32	0,00	0,00	2,65	3,46	2,47	0,00	0,00	2,45	0,00	0,72	1,23	7,49
8,50	6,43	0,00	8,63	-5,61	0,00	0,35	-11,56	0,00	6,72	13,32	6,32	0,00	0,00	1,63	-0,34	2,57	-11,58	1,27	6,38	6,23	7,79	0,72	-6,42
-4,22	**0,00**	**0,00**	**0,00**	**-5,61**	**-0,85**	**-3,61**	**-11,56**	**0,00**	**-7,32**	**-1,07**	**-7,32**	**0,00**	**0,00**	**0,00**	**-0,34**	**0,00**	**-11,58**	**0,00**	**-0,87**	**0,00**	**-1,86**	**-2,92**	**-6,42**
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3,28	0,39	7,53	4,03	-3,62	-0,33	-3,85	-11,56	0,00	-6,23	8,00	-8,22	0,00	0,00	1,83	0,01	3,13	-11,58	1,27	2,45	6,23	2,39	0,92	1,44
0,00	1,48	0,00	0,00	0,79	-2,35	9,15	0,00	0,00	-1,88	-1,10	-3,15	0,00	2,04	-5,30	-5,30	0,00	0,00	0,00	-0,85	0,00	-2,13	0,00	0,00
-10,42	2,76	10,43	0,73	-2,93	0,13	-5,70	10,46	0,53	2,95	-0,90	3,20	9,58	7,07	2,53	2,69	0,38	2,17	6,06	1,23	3,48	0,80	-2,92	0,00
0,00	0,00	0,00	0,00	12,68	0,00	12,68	0,00	0,00	0,20	0,00	0,00	0,20	0,00	3,00	0,00	3,00	0,00	0,00	1,34	0,00	1,34	0,00	0,00
-10,42	**0,00**	**0,00**	**0,00**	**-3,62**	**-2,35**	**-5,70**	**-11,56**	**0,00**	**-6,23**	**-1,10**	**-8,22**	**0,00**	**0,00**	**-5,30**	**-5,30**	**0,00**	**-11,58**	**0,00**	**-0,85**	**0,00**	**-2,13**	**-2,92**	**0,00**
2,48	0,13	7,53	3,17	-2,88	-0,33	-5,43	0,00	0,00	-16,87	-2,62	-18,11	0,00	0,00	2,37	0,09	6,95	0,00	0,00	-3,51	0,00	-6,04	1,23	7,49
-6,33	2,82	10,43	4,68	-1,99	-1,11	-2,86	-0,55	0,53	2,92	1,18	3,13	3,72	4,67	2,01	0,62	1,98	-0,89	5,18	2,82	4,87	3,03	-0,19	-2,21
-6,33	**0,13**	**7,53**	**3,17**	**-2,88**	**-1,11**	**-5,43**	**-0,55**	**0,00**	**-16,87**	**-2,62**	**-18,11**	**0,00**	**0,00**	**2,01**	**0,09**	**1,98**	**-0,89**	**0,00**	**-3,51**	**0,00**	**-6,04**	**-0,19**	**-2,21**
0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-2,96	0,00	0,00	0,00	12,68	0,00	12,68	0,00	0,00	0,20	0,00	0,00	0,20	0,00	0,00	0,00	0,00	0,00	0,00	1,34	0,00	1,34	0,00	0,00
-8,74	3,55	10,43	5,61	-2,67	-1,11	-4,20	-0,55	0,53	1,82	-0,93	1,66	9,58	6,23	2,13	0,69	1,24	2,17	6,06	0,54	4,40	-0,21	-2,92	0,00
5,46	-1,45	7,53	2,42	-2,30	-0,33	-3,88	0,00	0,00	-7,91	8,00	-11,48	0,00	0,00	1,82	0,01	2,64	-11,58	1,27	2,98	6,23	3,06	0,92	1,44
-8,74	**-1,45**	**0,00**	**0,00**	**-2,67**	**-1,11**	**-4,20**	**-0,55**	**0,00**	**-7,91**	**-0,93**	**-11,48**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**-11,58**	**0,00**	**0,00**	**0,00**	**-0,21**	**-2,92**	**0,00**
0,00	3,91	10,43	0,73	-5,10	-4,25	-6,03	0,00	0,53	4,87	0,00	4,45	0,00	6,23	1,16	0,00	0,37	0,00	2,52	0,34	14,40	0,33	0,00	-2,21
-2,32	0,36	7,53	4,03	-0,57	-0,37	-0,77	-0,55	0,00	-2,58	0,92	-4,58	3,72	0,00	2,33	0,49	2,92	-0,89	10,90	2,21	4,27	1,88	0,28	2,64
-2,32	**0,36**	**7,53**	**0,73**	**-5,10**	**-4,25**	**-6,03**	**-0,55**	**0,00**	**-2,58**	**0,00**	**-4,58**	**0,00**	**0,00**	**1,16**	**0,00**	**0,37**	**-0,89**	**2,52**	**0,34**	**4,27**	**0,33**	**0,00**	**-2,21**
3,28	0,33	8,06	3,58	-0,63	0,74	-0,24	-11,56	0,00	-1,87	-0,09	-3,35	0,20	4,99	1,81	-1,17	3,33	-11,58	2,14	1,79	10,16	1,52	0,92	0,25
-10,42	4,75	0,00	0,00	-5,76	-3,08	-19,24	10,46	0,53	4,06	3,58	3,69	9,58	3,63	2,61	5,48	-1,25	2,17	10,51	1,58	2,45	1,21	-2,92	2,51
-10,42	**0,33**	**0,00**	**0,00**	**-5,76**	**-3,08**	**-19,24**	**-11,56**	**0,00**	**-1,87**	**-0,09**	**-3,35**	**0,20**	**3,63**	**1,81**	**-1,17**	**-1,25**	**-11,58**	**2,14**	**1,58**	**2,45**	**1,21**	**-2,92**	**0,25**
-2,32	1,48	8,06	3,58	-2,10	-0,37	-3,40	-0,55	0,53	-0,22	0,92	-1,35	3,72	5,15	2,04	0,49	2,24	-0,89	5,18	1,73	4,87	1,45	0,28	0,79
0,00	0,00	0,00	0,00	-3,33	-4,25	-1,95	0,00	0,00	2,04	0,00	0,00	0,00	2,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
-2,32	**0,00**	**0,00**	**0,00**	**-3,33**	**-4,25**	**-3,40**	**-0,55**	**0,00**	**-0,22**	**0,00**	**-1,35**	**0,00**	**2,04**	**0,00**	**0,00**	**0,00**	**-0,89**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
-2,32	2,69	8,06	3,58	-2,01	-1,74	-2,62	-0,55	0,53	0,83	5,23	-1,00	3,72	5,15	2,26	1,82	2,01	-0,89	5,18	1,73	3,48	1,65	0,28	0,79
0,00	-1,84	0,00	0,00	-2,67	0,39	-5,72	0,00	0,00	-4,07	-8,67	-2,75	0,00	2,04	-0,19	-3,50	6,43	0,00	0,00	1,69	27,15	0,02	0,00	0,00
-2,32	**-1,84**	**0,00**	**0,00**	**-2,67**	**-1,74**	**-5,72**	**-0,55**	**0,00**	**-4,07**	**-8,67**	**-2,75**	**0,00**	**2,04**	**-0,19**	**-3,50**	**2,01**	**-0,89**	**0,00**	**1,69**	**3,48**	**0,02**	**0,00**	**0,00**
0,00	0,05	0,00	0,00	1,21	0,00	-3,24	0,00	0,00	-5,90	-12,46	-0,98	0,00	0,00	0,52	0,69	0,39	0,00	0,00	6,47	21,42	4,47	0,00	0,00
-2,32	1,72	8,06	3,58	-2,42	-1,72	-3,35	-0,55	0,53	0,36	4,41	-1,38	3,72	4,67	2,11	0,47	2,32	-0,89	5,18	1,55	4,19	1,32	0,28	0,79
-2,32	**0,05**	**0,00**	**0,00**	**-2,42**	**-1,72**	**-3,35**	**-0,55**	**0,00**	**-5,90**	**-12,46**	**-1,38**	**0,00**	**0,00**	**0,52**	**0,47**	**0,39**	**-0,89**	**0,00**	**1,55**	**4,19**	**1,32**	**0,00**	**0,00**
-7,54	4,88	10,44	6,43	-2,41	-2,75	-2,83	-0,55	0,53	3,44	5,08	2,74	3,72	4,67	2,41	1,01	2,63	-0,89	5,18	0,92	3,77	0,39	0,28	0,79
6,24	-1,11	1,71	0,73	-1,39	4,85	-4,80	0,00	0,00	-10,62	-10,00	-10,78	0,00	0,00	0,63	-1,96	1,28	0,00	0,00	3,08	10,02	2,71	0,00	0,00
-7,54	**-1,11**	**1,71**	**0,73**	**-2,41**	**-2,75**	**-4,80**	**-0,55**	**0,00**	**-10,62**	**-10,00**	**-10,78**	**0,00**	**0,00**	**0,63**	**-1,96**	**1,28**	**-0,89**	**0,00**	**0,92**	**3,77**	**0,39**	**0,00**	**0,00**
-6,18	2,63	10,43	0,73	-1,59	-1,11	-3,16	10,46	0,53	2,57	-0,93	2,93	3,72	6,23	1,85	0,93	1,22	2,17	6,06	2,98	4,77	2,93	-2,92	0,00
2,03	0,29	7,53	4,03	-3,62	-0,33	-3,85	-11,56	0,00	-8,13	8,00	-10,81	0,00	0,00	2,82	-0,67	7,41	-11,58	1,27	-2,09	5,61	-4,14	0,92	1,44
-6,18	**0,29**	**7,53**	**0,73**	**-3,62**	**-1,11**	**-3,85**	**-11,56**	**0,00**	**-8,13**	**-0,93**	**-10,81**	**0,00**	**0,00**	**1,85**	**-0,67**	**1,22**	**-11,58**	**1,27**	**-2,09**	**4,77**	**-4,14**	**-2,92**	**0,00**
-9,91	1,12	10,43	0,73	-2,15	-1,61	-3,52	10,46	0,53	1,55	1,18	0,79	3,72	6,23	2,32	0,69	1,67	2,17	6,06	0,50	4,40	-0,21	-2,92	0,00
3,62	2,03	7,53	4,03	-2,38	2,02	0,39	-11,56		-8,01	-2,62	-8,20			1,76	0,01	2,52	-11,58	1,27	3,07	6,23	3,18	0,92	1,44
-2,32	1,72	8,06	3,58	-2,54	-0,85	-4,21	-0,55	0,53	0,37	4,41	-1,38	9,58	4,67	2,07	0,89	2,11	-0,89	5,18	1,60	4,48	1,32	0,28	0,79
	0,05			2,06		2,06			-4,30	-12,46	-0,98	0,20		1,21	-7,08	5,36			3,53		2,86		
2,72	6,60	10,44	8,57	-0,65	0,00	-0,65	0,00	0,00	1,48	13,32	-0,29	0,00	0,00	1,91	2,62	2,29	-11,58	1,27	5,34	6,23	6,15	0,92	1,44
-4,22	0,75	5,20	0,73	-2,26	-0,85	-3,61	-0,55	0,53	-0,47	-1,07	-1,56	3,72	6,23	2,15	-0,13	2,15	2,17	6,06	-0,87	4,40	-1,86	-2,92	0,00
3,62	0,34	7,53	4,03	-2,57	2,02	-5,43	0,00	0,00	-10,94	-2,62	-11,48	0,00	0,00	1,52	0,01	2,78	-11,58	1,27	3,07	6,23	3,18	0,92	1,44
-9,91	2,51	10,43	0,73	-2,10	-1,61	-2,86	-0,55	0,53	2,11	1,18	1,66	3,72	6,23	2,29	0,69	1,92	2,17	6,06	0,50	4,40	-0,21	-2,92	0,00
-9,91	**0,05**	**5,20**	**0,73**	**-2,57**	**-1,61**	**-5,43**	**-11,56**	**0,00**	**-10,94**	**-12,46**	**-11,48**	**0,00**	**0,00**	**1,21**	**-7,08**	**1,67**	**-11,58**	**1,27**	**-0,87**	**4,40**	**-1,86**	**-2,92**	**0,00**

RUBEN DEN UYL | 2019

TU Delft