

# Examining users' design preferences regarding the architectural design features of the office-type workplace

A quantitative approach of user participation applied to hospitals

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Chantal Pieterse

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### Student information

Student: Pieterse, Chantal

Student number: 950924653120

University: Wageningen University and Research Centre

Study: Management, Economics and Consumer Studies

Specialization: Management Studies

Profile: Facility Management

Course-code: MST-80436

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### Supervision information

Supervisor: dr. Kok, H.B.

First Examiner: dr. Kok, H.B.

Second Examiner: dr. Van der Velde, G.

Commissioner: EGM architecten

Commissioner supervisors: Brabers, M. and Eijkelenboom, A.

## Abstract

The purpose of this study is to examine users' design preferences regarding the architectural design features of the office-type workplace. The study is characterised by an explorative, cross-sectional design concentrated on staff making use of an office-type workplace in Dutch hospitals. Data was gathered by a full-profile conjoint experiment which was included in an e-mail survey. 107 respondents, working for 7 hospitals in the Netherlands completed the survey. The results, presented for two categories of activities, include two outcomes: 1) users' preferences regarding architectural design characteristics (number of workplaces in the room, assigned or flexible, and placement of windows) and 2) users' relative importance of these architectural design characteristics. The results indicate that in general users prefer an office-type workplace with the characteristics of a closed room with 2 workplaces which are assigned. The preference of having a window with or without view seems to depend on the performed type of activity. The originality of this study lies in the combination of applying a quantitative approach of user participation to come to workplaces and examining users' preferences for the office-type workplace within hospitals as these are both under-researched fields.

**Keywords:** user participation; office-type workplace; architectural design features; workplace design preferences.

## Executive summary

There has been a movement from the designer speaking for the user, towards designing with users (Sanders, 2002; Sanders & Stappers, 2008). With regard to designing the workplace, just a few studies focused on the application of a design approach in which user involvement is key. This is a missed opportunity as users of the workplace can be seen as “expert of their experiences”, for instance regarding their behaviour, values and preferences (Steen et al., 2011). It can be proposed that the more permanent or fixed a design feature is (Harris et al., 2002), the earlier in the design process user participation may become beneficial. These so-called architectural design features are not likely to change after realization and therefore receiving insights into users’ design preferences seems crucial. Despite the advantages of user involvement, the field deals with practical obstacles because of the required time and energy. However, the emerging field of ICT provided opportunities to easier involve large numbers of end-users in the design process of workplaces (Dewulf & Van Meel, 2002). Therefore, the aim of this study is to examine users’ design preferences regarding the architectural design features of the office-type workplace.

A literature study was conducted which focussed on the two main concepts of this study: the office-type workplace and workplace design preferences. Based on the framework of Harris et al. (2002), the architectural design features of the office-type workplace were identified as ‘office-layout’ and ‘placement of windows’. ‘Office layout’ includes the following characteristics: ‘degree of openness’, ‘number of workplaces’, and ‘assigned or flexible’. The characteristics of ‘placement of windows’ were distinguished as: ‘position’, ‘proportion’ and ‘controllability’. Adapted from the definitions of preferences by Rothe et al. (2012) and Scherer (2005), workplace design preferences were defined as: “the architectural design characteristics of the office-type workplace which are liked or preferred over other architectural design characteristics of the office-type workplace when users have the choice”. Literature indicated that users’ preferences are influenced by two main factors: demographic characteristics (Appel-Meulenbroek et al., 2015; Kotler, 2003) and goals (Warren et al., 2011). Demographic characteristics which seemed relevant for this study include age, gender, function and type of organisation. Goals were translated to users’ performed activities. Adopted from the studies of Brunia et al. (2012) and De Been & Beijer (2014), it was concluded that activities can be distinguished in two main categories: activities where users do not want to be disturbed (undisturbed desk work, reading), and activities where users might be disturbed, or which are performed together with colleagues (regular desk work, interactive desk work, planned meetings, unplanned meetings, calling and archiving).

The empirical study is an explorative cross-sectional design which concentrated on the office-type workplace within hospitals, since academic literature on this topic is still limited (Mroczek et al., 2005; Sadatsafavi et al., 2015; Ulrich et al., 2008). Users’ workplace design preferences were examined for two categories of activities by applying a full-profile conjoint experiment. The design characteristics as identified in the literature study were transformed into attributes and attribute levels in order to develop scenarios. The first attribute was defined as ‘number of workplaces in the room’ and included three levels: ‘closed room with 1 workplace’, ‘closed room with 2 workplaces’ and ‘closed room with 4 workplaces’. The second attribute was defined as ‘assigned or flexible’ and included the levels ‘assigned workplace’, ‘flexible workplace within the own department’ and ‘totally flexible workplace’. The third attribute was ‘placement of window’ and included three levels: ‘window with view’, ‘window without view’ and ‘no window’. With an orthogonal design, nine scenarios were developed which were all visually presented to Dutch hospital staff through an e-mail survey. The survey was completed by 107 people of 7 different hospitals. The respondents were divided into a sample and a control group based on their activity pattern. The sample includes respondents with the following functions: specialist, professor, teacher, AIOS, ANIOS, researcher and care managers. The control group include respondents with the function of secretary or other. The aim of the control group was to investigate if

the examined preferences are specifically for hospital staff with certain functions or might be common among office-type workplace users in general and therefore can be seen as universal preferences. The research has been conducted in collaboration with a commissioner: EGM architects.

The results indicated that for both categories of activities, users of the sample prefer an office-type workplace with the characteristics of a closed room with 2 workplaces which are assigned. When performing activities where they do not want to be disturbed, they prefer 'a window without view', while when performing activities where they might be disturbed, or which are performed together with colleagues, they prefer 'a window with view'. This variation in preference might be due to the relative importance of the design characteristic 'placement of windows'. When users are performing activities where they do not want to be disturbed, the relative importance of 'placement of windows' is lower (24,0%) than for activities where users might be disturbed, or which are performed together with colleagues (27,2%). 'Assigned or flexible' always had the highest relative importance: 40,0% when they might be disturbed and 40,9% for the other category of activity. The second most important characteristic is 'number of workplaces' with 35,9% and 31,9%.

In line with the general preferences, all user groups of the sample (males, females, <40 years, >40 years, medical functions and care managers) prefer an office-type workplace with the characteristics of a closed room with 2 workplaces which are assigned. Preferences regarding 'placement of windows' again varied. The characteristic 'assigned or flexible' had most of times the highest relative importance, however males and respondents with a medical function found the characteristic 'number of workplaces' more important when performing activities where they do not want to be disturbed. 'Placement of windows' was placed by all user groups as the least important characteristic for both categories of activities.

Lastly it was concluded that the examined relative importance's and preferences of the sample and the control group are in general comparable. However, for the control group the characteristic 'placement of windows' is the most important when performing activities where they might be disturbed or which are performed together with colleagues, while for the sample this is the least important characteristic. There are also some other small differences in the preferences and how explicit these are. As a result, the examined preferences and relative importance's of the sample can still be seen as unique. It is not conclusive yet if the examined preferences of the sample are universal for users of the office-type workplace in general.

Based on the conclusion, recommendations for EGM as architectural firm and further research were developed. Since EGM has their own R&D department, the recommendations for further research are also valuable for them. The managerial recommendations focus on two aspects. It is first of all recommended that EGM take the results of this study with them in future hospital projects in order to increase users' satisfaction with the realised office-type workplace and to strengthen their position as market leader in the care industry. The second recommendation for EGM is to conduct pilots with a quantitative approach of user participation in their future projects. However, it is recommended to apply in addition also other methods of user participation in the design process. Examples are more direct methods such as interviews or virtual reality. A recommendation for further research is to examine users' preferences for other architectural design characteristics as well as to include interior design features and ambient features since this study only includes architectural design characteristics which can be presented visually. Second, it is recommended to conduct a similar study with users of non-hospital environments. Third, it might be interesting to include other demographic characteristics like users' personality. As a final recommendation, it might be interesting to explore the possibilities of applying a quantitative method of user participation to examine users' preferences regarding other aspects of the work environment than the design features. For example, the offered facilities and services.

## Preface

This report presents my thesis as part of the master Management, Economics & Consumer Studies with the specialisation Facility Management at Wageningen University & Research. During the past years, I developed an interest in the relation between the physical environment and its users. Therefore, this research in which I examined users' design preferences through a quantitative approach of user participation really fits me.

First, I would like to express my gratitude to EGM architecten located at Dordrecht for providing me the opportunity to conduct my research in collaboration with their R&D department. Special thanks to Merel Brabers and AnneMarie Eijkelenboom for their enthusiasm in the topic, insights in the practice of designing, helpful feedback and their invested time to create the pictures of the office-type workplace to use in my survey. Of course, I also like to thank my supervisors Herman Kok and Gerben van der Velde for their feedback and guidance during this research project. The meetings were all very meaningful to me and helped to bring my thesis to a higher level. Furthermore, I would like to thank the hospitals willing to spread my survey among their staff and the respondents who actually filled in the survey. As it turned out to be quite hard to find hospitals willing to participate, I really appreciate this. Finally, I would like to thank my family and friends for their support and providing me a listening ear.

Utrecht, September 2018  
Chantal Pieterse

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# 1 Introduction

## 1.1 Background information

According to Sanders & Stappers (2008) there has been a shift from designing products or services to designing for users' purposes, an example is designing for experiencing. At the same time, there has been a move from design being the exclusive responsibility of design experts towards involving customers or users into the design team (Trischler et al., 2017; Witell et al., 2011). Design approaches like human-centred design, customer-centred design, user-centred design, participatory design and codesign derived. All these concepts are more or less related to each other (Miaskiewicz & Kozar, 2011; Sanders & Stappers, 2008; Trischler et al., 2017). In general, there has been a shift from user-centred design towards participatory design or codesign. In other words, there has been a movement from the designer speaking for the user towards designing with users (Sanders, 2002; Sanders & Stappers, 2008).

With regard to designing the workplace, just a few studies focused on the application of one of these design approaches in which user involvement is key. Before continuing, it is important to notice that the terms 'workplace' and 'workspace' are often mixed with little distinction between them (Wheeler, 2003). According to Davis et al. (2010), the concept of workspace refers to the physical environment an organisation provides for its employees to carry out their work activities. McGregor and Shiem-Shen Ten (1999) stated that workspace is broader than workplace since a workspace includes individual workstations, personal filling as well as meeting requirements while they defined a workplace as "the desk or workstation configuration provided to an individual member of staff, be it enclosed or open plan" (p.xvi). Vischer (2008) argued that "workspace" is broader than "office" because it includes also office-type workspace in places like hospitals, universities and other contexts. Concluded, the terms workplace and workspace are both common in literature and consistent definitions of these terms are missing. To avoid that both terms will be used interchangeably, from now on there will just be spoken of 'workplace'.

In the design process to come to workplaces, the focus is on the involvement of end-users. These are the people who ultimately use or occupy the workplace and therefore have knowledge and opinions about the performance of the building in relation to their own objectives (Pemsel et al., 2010). Users can also be seen as "experts of their experiences", for instance regarding their behaviour, values and preferences (Steen et al., 2011). Maarleveld (2008) stated that when designing workplaces, user participation provides the opportunity to utilise the knowledge and expertise of the end-users' needs and desires. According to Myerson & Ramster (2017), "it is not hard to see the value of codesign to the creation of office environments, but detailed evidence of practice in the workplace is relatively thin on the ground" (p.350). When people understand the reasons for and consequences of design decisions, they will be in general more involved and satisfied with their workplace (Perkins, 2013). Users become less reactive and critical about the workplace when they are involved in the design stage. As a result, those who are responsible for managing the space need to deal with less tensions (Kaya, 2004). In addition, it has been showed that user participation in workplace design can have a beneficial effect on wellbeing at work (Myerson & Ramster, 2017).

Despite the above stressed advantages of involving users when designing the workplace, the field deals with practical obstacles because of the required time and energy of user participation (Dewulf & Van Meel, 2002). In design projects, the present and future requirements as well as needs of the end-users need to be understood (Pemsel et al., 2010). There are multiple ways to gain insight into these end-users needs. The methods and tools can be a form of direct involvement, such as focus groups or workshops, or indirect involvement like experience (e.g. simulation games) and surveys. The disadvantages, of especially the direct involvement methods, are that they are time-consuming and costly as well as that not all the users can be involved. User involvement in the design process requires

a lot of planning, expensive consultants, workshops, interviews and presentations (Dewulf & Van Meel, 2002).

However, the emerging field of ICT provided opportunities to easier involve large numbers of end-users in the design process of workplaces. Examples are the possibilities of email, intranet and new design software (Dewulf & Van Meel, 2002). The importance of the used communication channel was also stressed by Mahr et al. (2014) with regard to cocreation. According to them, the most common distinction in channels is that of face-to-face communication (e.g. personal meetings, interviews and workshops) versus bit-to-bit communication (e.g. email). Just like Dewulf & Van Meel, (2002), they argued that new digital communication channels that can reach many customers at low costs provide opportunities to limit the financial investment of user participation.

Based on the framework of Harris et al. (2002) on design features, it can be proposed that the more permanent or fixed a design feature is, the earlier in the design process user participation may become beneficial. Their framework shows that each building, and thus also workplaces, consists of three categories of design features: architectural features, interior design features and ambient features. Architectural features are the more permanent aspects, so fixed elements, of a building and therefore not likely to change after realization. This category includes building layout, size and shape of rooms, and placement of windows. Interior design features are the less permanent aspects of the building and so more easily to change after realization. It includes furnishings, colours, finishes and artwork. The interior design features create the look and feel of the building. Ambient features include lighting, acoustics, indoor air quality, odor and temperature (Harris et al., 2002). Since ambient features highly influence users' comfort and health, modern buildings often have construction standards and respect building codes in order to realise a physically comfortable environment (Bluyssen, 2009; Vischer, 2007). All design features consist of various design characteristics. The interior design feature 'furniture' can for example be characterised by comfort, adjustability and colours and textures.

## 1.2 Conceptual research design

This chapter addresses the problem statement, scientific and social relevance, research objective and questions, research framework and lastly the research outline of this report.

### 1.2.1 Problem statement

Users of the workplace can be seen as "expert of their experiences", for instance regarding their behaviour, values and preferences (Steen et al., 2011). The more permanent or fixed a design feature of the workplace, the earlier in the design process user participation may become beneficial. As architectural features are not likely to change after realization, receiving insights into users' workplace design preferences seems crucial (Harris et al., 2002). The rise of ICT provided opportunities to easily involve large numbers of end-users in the design process at low costs (Dewulf & Van Meel, 2002; Mahr et al., 2014). Despite, so far, no studies have been conducted which examined users' workplace design preferences through an indirect method or so-called quantitative approach of user participation.

### 1.2.2 Scientific and societal relevance

The scientific relevance is to explore if it is possible to examine users' workplace design preferences through a quantitative method of user participation. Workplace design preferences can be identified as a scientific knowledge gap since most studies focus on post-design measures like users' satisfaction, productivity and health. The societal relevance is that when it seems possible to examine users' workplace design preferences with a quantitative approach, the designer is able to involve a larger number of users at lower costs and within relative less time. As a result, it is expected that the designer is able to reduce the chance of costly mistakes in the design of the workplace. Users of the workplace will be more satisfied with the design process as well as with their realised workplace.

### 1.2.3 Research objective

The purpose of this study is to examine users' design preferences regarding the architectural design features of the office-type workplace.

### 1.2.4 Research questions and sub-questions

Based on the research objective, the following main research question is formulated:

**What are users' design preferences regarding the architectural design features of the office-type workplace?**

To answer this main research question, four specific sub research questions are formulated. Within these, a distinction is made between theoretical and empirical sub-questions.

#### Theoretical sub-questions:

1. Which architectural design features and characteristics of the office-type workplace can be identified?
2. How can users' workplace design preferences be defined and how are they constructed?

#### Empirical sub-questions:

3. Which architectural design characteristics of the office-type workplace do users prefer?
4. To what extent is there a difference between the workplace design preferences of various user groups?

### 1.2.5 Research framework

To answer the above stated main research question and related sub-questions, a research framework was created which is presented in figure 1. According to Verschuren & Doorewaard (2010), a research framework represents the logic of a research project. It is a schematic representation of the research objective and include the appropriate steps that need to be taken in order to achieve it.

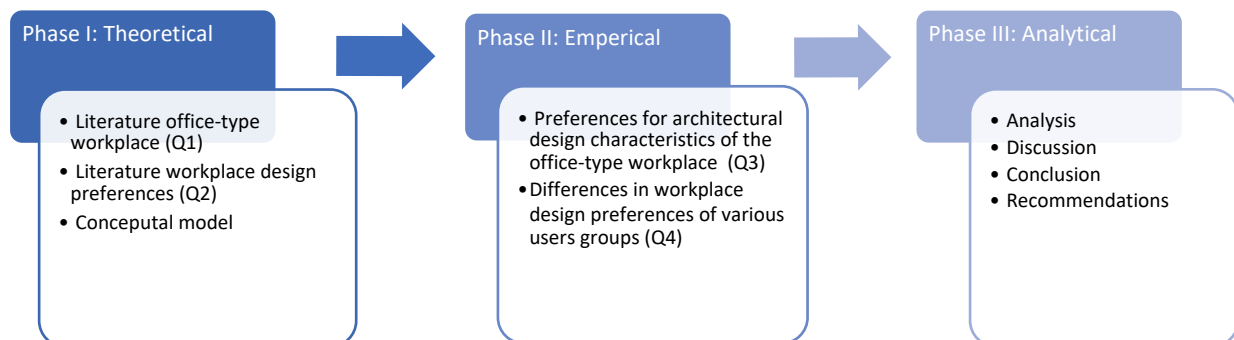


Figure 1: Research framework

### 1.2.6 Research outline

After this first chapter, the second chapter includes the theoretical framework regarding the two main concepts of this study: the office-type workplace and workplace design preferences. In the third chapter, the methodology of the empirical part of the study is described. Chapter four presents the results of the study. The fifth chapter provides the discussion and conclusion where after the managerial recommendations and suggestions for further research are described in the sixth chapter. Last, the references are presented. The appendices can be found at the end of this report.

## 2 Theoretical framework

In this chapter, literature on the two main concepts of this study, the office-type workplace and workplace design preferences, as well as the developed conceptual model are presented. This theoretical framework answers the two theoretical sub-questions: *“Which architectural design features and characteristics of the office-type workplace can be identified?”* and *“How can users’ workplace design preferences be defined and how are they constructed?”*. Before answering these two sub questions, the office-type workplace is shortly introduced.

### 2.1 Office-type workplace

#### 2.1.1 Introduction of the office-type workplace

Where at the start of the 19<sup>th</sup> century factories were the symbol of the industrialisation, in the 20<sup>th</sup> century the office building became the most important building due to the growing significance of knowledge and information in our society (Van Meel, 2000). However, in 2008, Vischer stated that until recently the design of office buildings was still connected to the model of work from the 19<sup>th</sup> century: “workers who are asked to perform rather than to think, who are brought together in space and time so that they can be supervised, so that they have access to necessary tools, and so that there is a clear barrier between work and other activities, occupy standardized and often uniform workspaces” (Vischer, 2008, p. 97).

In the 21<sup>st</sup> century, developments in information technology such as intranets, mobile technology and electronic archives facilitated employees to work anytime and anywhere (Van Meel, 2000; Vischer, 2008). As a result, new ways of working emerged which enabled employees to choose the space which suit the best with the task at hand (Dooley, 2017). The workplace became more virtual and teleworking came up (Van Meel, 2000; Perez et al., 2005). Teleworking can be defined as: “the organisation of work by using information and communication technologies that enable employees and managers to get access to their labour activities from remote locations” (Perez et al., 2005, p.1476). They distinguished three types of remote locations: home-based teleworking (employees and managers’ homes), mobile teleworking (airport, hotels and other remote locations), and telecentres or teleworking centres (offices on a location which is convenient to the employee to reduce commuting). According to Johnson (2003), a telecentre can accommodate employees of various organisations or be a decentralized office for employees of one organisation. As a result of working place and time independent, barriers between work and personal life were breaking down (Vischer, 2008).

Next to changes due to developments in information technology, Vischer (2008) argued that through the past century there has been a shift from acknowledging the workplace as a passive setting for work, to the concept of the workplace as an active support to and a tool for getting work done. An example is the growing interest in how workplace features affect the occupants. Van Meel (2000) stated that the workplace can also be seen as a tool to attract young talented people to the organisation. Consequently, it is important to design a more ‘human office environment’ in which users’ needs are considered. Next, Van Meel and Vos (2001) argued that for the future they expect office buildings will change even more in character. An example is that organisations will create a ‘fun’ office or choose for non-office typologies like a campus.

#### 2.1.2 Architectural design features of the office-type workplace

The previous section stressed the growing interest in how features of the office-type workplace affect users as well as the relevance of taking users’ needs into account (Van Meel, 2000; Vischer, 2008). As a next step, this section identifies and describes the architectural design features and characteristics of the office-type workplace. It was proposed it should be priority to receive insight in users’ preferences regarding these aspects as they are the more permanent aspects of the workplace and therefore not likely to change after realization. Harris et al. (2002) distinguished three architectural

design features of the building: building layout, size and shape of rooms, and placement of windows. When adapting these to the office-type workplace, building layout and size and shape of rooms can be combined. This resulted in two architectural design features: 1) office layout and (2) placement of windows. Underneath, both features are described and the corresponding characteristics are identified.

### Office layout

Various researchers made a distinction in types of workplaces based on the office layout. Danielsson and Bodin (2005) distinguished seven types of offices, see table 1.

Type of workplace	Description
<b>Cell-office</b>	Room office for a single person. The work is often highly concentrated and independent.
<b>Shared-room office</b>	Room shared by 2 or 3 people. The choice for this room can be to emphasize interaction within projects or because of lack of space.
<b>Small-open plan</b>	4 to 9 people per room
<b>Medium open-plan</b>	10 to 24 people per room
<b>Large open-plan</b>	More than 24 people per room
<b>Flex-office</b>	An open-plan layout where employees do not have a personal workstation, the capacity of the flex-office is designed for less than 70% of the workforce to be in office at the same time.
<b>Combi-office</b>	This office type does not have a strict spatial definition, but it is defined by teamwork and sharing common facilities. The work is characterised by independence and interactivity in teamwork. Furthermore, 25% of the time the work is executed at other places than the personal workstation.

Table 1: Types of offices according to Danielsson & Bodin (2005)

Some years later, De Been & Beijer (2014) acknowledged three office types which are most common in the Netherlands, see table 2.

Type of workplace	Description
<b>Individual and shared room office</b>	Assigned workspaces in small and enclosed rooms which can be reached by a hallway. This office is mostly used by one to three employees. In addition, there are enclosed meeting rooms and some other facilities for shared use.
<b>Combi-office</b>	Employees have an assigned workspace, mostly in an open or half-open office area. In addition, there are spaces for specific activities like concentration, informal and formal communication. This office type is characterised by openness and transparency.
<b>Flex-office</b>	In this office type, employees do not have an assigned workstation but work according to the concept of activity-based working. This means that they choose a workstation freely according to their daily activities and preferences. Next to this, the office is similar with the combi-office regarding office design and floor plan.

Table 2: Types of offices according to De Been & Beijer (2014)

The combi-office and flex-office are a response to the idea that cellular offices are a barrier for informal interaction and do not promote quick access to colleagues (Al Horr et al, 2016; Van Meel, 2000). Furthermore, also costs play a role. Open plan offices are less costly to construct and to rearrange than cellular offices with full height partitions (Bradley, 2003). However, the combi-office and flex-office also have disadvantages. Where in cellular offices the users' do have an assigned workstation which is mostly arranged in close proximity to team members, users in a flex-office choose a workstation that suits best with their task at hand. As a result, team members can be spread all over the floor or building which could make it harder for users to find each other (Wohlers & Hertel, 2017). Next, the flex-office might result in tensions regarding territoriality, personalisation, privacy and status which are all human needs (Van der Voordt & Van Meel, 2002). Territoriality, the expressing of feelings of ownership towards objects, is limited in the flex-office since non-assigned desks limits possibilities to personalise the office environment. Next, users in open-office environments often complain about noise,



interruptions and visual exposure to others which are all elements of privacy (Wohlers & Hertel, 2017). Van der Voordt (2004) concluded: “One of the main reasons for using combi-offices, with a mix of shared and activity-related workspaces, has been to overcome the disadvantages of office units (too closed, poor conditions for social interaction) and open-plan offices (too open, too many distractions)” (p. 146). However, it should be noticed that in comparison with a flex-office, the combi-office has higher costs (Van Meel, 2002).

Concluded, based on the various types of workplaces as distinguished above, the characteristics of the architectural design feature ‘office layout’ can be defined as: degree of openness, number of workplaces in the room or space, and assigned or flexible (figure 2). The characteristic ‘degree of openness’ refers to the variations in a cellular office or an (half)open office. ‘Number of workplaces in the room or space’ indicate the capacity of workplaces in the room or space. ‘Assigned or flexible’ refers to the form of use of the workplace, so if users have an assigned or not-assigned workplace. This last workplace is also called a shared or flexible workplace.

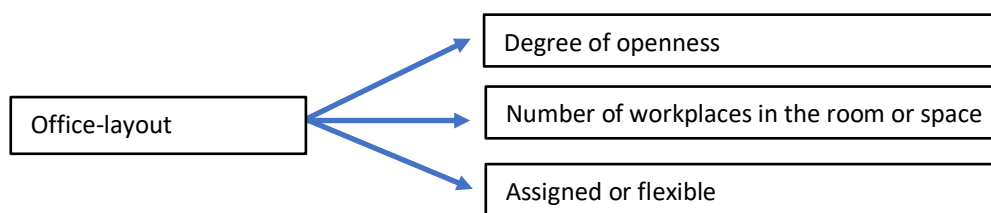


Figure 2: Characteristics of architectural design feature ‘office-layout’

### Placement of windows

It is important to decide on the position and proportions of windows in an early stage of the design because it affects both the energy consumption and visual comfort of the space (Ochoa et al., 2012). Regarding visual comfort, windows offer a view outdoors as well as access to daylight (Boyce et al., 2003; Galasiu & Veitch, 2006). Through the view outdoors, windows provide the opportunity for visual contact with the external environment and receiving general information like weather and seasonal changes (Al Horr et al., 2016; Boyce et al., 20023; McCoy, 2002). Having a window with a view is also considered as a status-symbol of the office-type workplace (McCoy, 2002). When the window is operable, ventilation is provided which influences users' thermal comfort (Brager et al., 2004; Huizenga et al., 2006). Thermal comfort is also affected by the presence of sun blinds (Franzetti et al., 2004).

Concluded, as presented in figure 3, the characteristics of the architectural design feature ‘placement of windows’ can be distinguished as: position, proportions and controllability. ‘Position’ refers to which area of the wall the window is positioned. ‘Proportions’ indicates the size of the window. ‘Controllability’ refers to if the window is operable or not and if the users have control over the sun blinds.

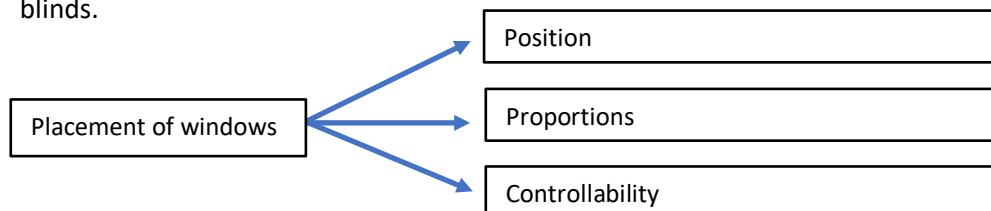


Figure 3: Characteristics of architectural design feature ‘placement of windows’

### Conclusion

The architectural design features of the office-type workplace are defined as: ‘office-layout’ and ‘placement of windows’. The feature ‘office-layout’ can be distinguished in the following characteristics: degree of openness, number of workplaces in the room or space, and assigned or flexible. For the feature ‘placement of windows’, the identified characteristics include: position, proportion and controllability.

## 2.2 Workplace design preferences

As presented in the introduction, user participation in the design process provides the opportunity to utilise end-user's knowledge and expertise about their needs and desires regarding the architectural design features and characteristics (Maarleveld, 2008; Pemsel et al., 2010; Steen et al., 2011). In this chapter, the concept of workplace design preferences is introduced through developing a definition and explaining how these preferences are constructed.

### 2.2.1 Defining workplace design preferences

According to Warren et al. (2011), the term preference is used in multiple ways. A distinction can be made in an expressed preference and an underlying preference. An expressed preference is commonly used by economists and behavioural decision theorists who consider a preference as a choice or willingness to pay, while an underlying preference is used by psychologists to denote a latent tendency to consider something desirable or undesirable. They stated that literature assumes both terms are the same despite differences in the way they are measured and inferred (Warren et al, 2011). The concept of preferences is especially popular in the field of marketing and consumer behaviour as “the purpose of marketing is to understand consumer preferences and to help design and deliver appropriate goods and services” (Allenby & Rossi, 1999, p.57).

In the light of the office-type workplace, Rothe et al. (2012) argued that users' needs, preferences and satisfaction are concepts which are all related to each other. They defined users' needs as “issues that are necessary for employees to perform well” (p.80). Needs often relates to work processes, activities and workplace settings, but it also means that basic psychological needs like comfort, safety, security and sense of belonging must be met. Preferences were defined as “issues that cause happiness and satisfaction, but which are not necessarily needed to perform a task. Preferences are the things end-users would like to have if they have the choice” (p.80). So, when users argue they need a private room, this is a preference instead of a need since users can in fact also perform in other office types like an open-plan or flex-office. However, it should be considered that a design feature of the office-type workplace can be a need and a preference at the same time. Furthermore, in reality, only a part of users' needs and preferences are established as requirements in the design process and finally implemented. This result in four types of situations: compromise, must have, necessity and bliss. The relation between needs, preferences and actual implementation on the one hand and these four situations on the other hand is visualised in figure 4.

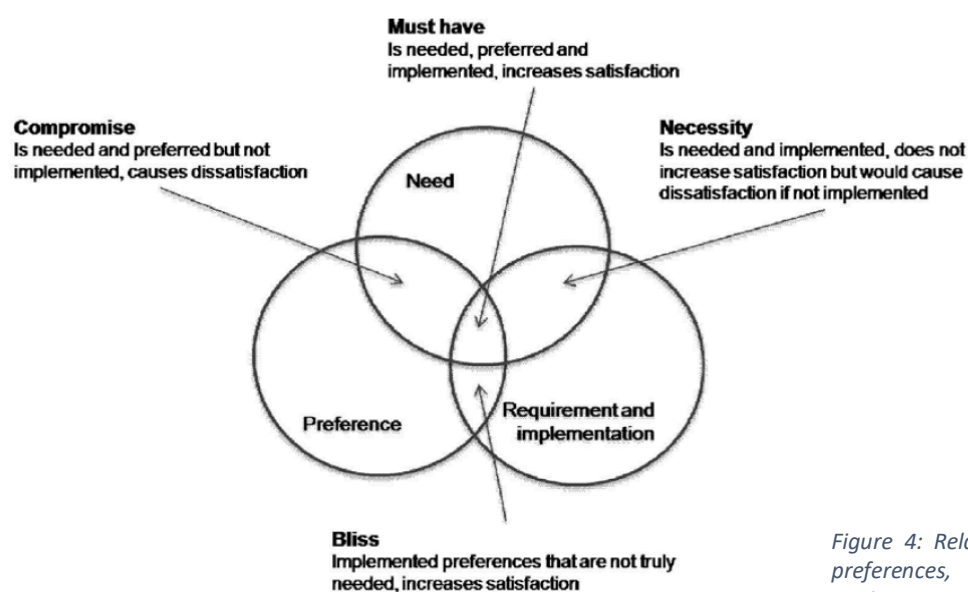


Figure 4: Relationship between needs, preferences, and requirements and implementation by Rothe et al. (2012)



Rothe et al. (2012) based these four types of situations on the so called dissatisfiers (hygiene factors) and satisfiers (motivators) developed by Herzberg et al. (1959): “Hygiene factors contribute to employee dissatisfaction if they are not met while the motivators increase satisfaction when they are fulfilled” (p. 80-81). As shown in figure 4, implemented preferences (bliss or must have) increase user satisfaction, while when something is needed and implemented but not preferred (necessity) this does not increase satisfaction but would cause dissatisfaction if not implemented (Rothe et al, 2012).

Pizam and Ellis (1990) stressed the difference between overall satisfaction and satisfaction with individual attributes. They explain this by non-compensatory and compensatory models. In non-compensatory models, users establish a minimum acceptable level for each attribute and are only satisfied when each attribute equals or exceeds this minimum level. In compensatory models, the overall satisfaction level depends on the relative importance of the various attributes. A weakness in one attribute can be compensated by strength in another. Based on this theory, it can be presumed that the higher users’ relative importance of a workplace design feature, the more crucial it is to realise users’ needs and preferences regarding these workplace design feature in order to contribute to users’ satisfaction.

As needs are crucial for an employee to perform their job, they are often realised in the design through for instance construction standards and building codes (Vischer, 2007). Although beyond the scope of this study, it should be noticed that there can still be a mismatch between these standards and users’ needs (Bluyssen, 2009). In the light of user participation in the design process, it seems especially interesting to receive insights into users’ preferences because when these are implemented in the design this will contribute to users’ satisfaction with the workplace. Therefore, from now on, the concept of preferences as defined by Rothe et al. (2012) will be adopted: “Preferences are issues that cause happiness and satisfaction, but which are not necessarily needed to perform a task. Preferences are the things end-users would like to have if they have the choice” (p.80). This definition of Rothe al. (2012) is very similar as that of Scherer (2005): “Preferences are relatively stable evaluative judgments in the sense of liking or disliking a stimulus or preferring it or not over other objects or stimuli” (p. 703). When combining these definitions, office-type workplace design preferences can be defined as: “the architectural design characteristics of the office-type workplace which are liked or preferred over other architectural design characteristics of the office-type workplace when users have the choice”.

Lastly, Rothe et al. (2012) stressed the importance of better understanding the variety of users and their preferences since office-type workplace users are not alike. This link to the concept of preference segmentation. Kotler (2003) stated that when preferences are known, preference segments can be identified through which market segments can be developed. Three different patterns of preferences can emerge. First, homogenous preferences, so a market where all the consumers have the same preferences. Second, diffused preferences in which consumers preferences vary greatly. Third, clustered preferences, so a market which reveal distinct preference clusters (Kotler, 2003). In addition, Allenby and Rossi (1999) argued that heterogeneity in preferences lead to differentiated product offerings, market segments and market niche.

### 2.2.2 Construction of workplace design preferences

Literature indicates that preferences are influenced by two main factors: demographic characteristics and goals. In this section, these factors will be described and translated to workplace design preferences.

#### Demographic characteristics

According to Kotler (2003), consumer preferences are often associated with demographic variables. Often included demographic variables in marketing are: age, family size, family life cycle, gender, income, occupant, education, religion, race, generation, nationality and social class. However, not all these demographic variables are relevant in the light of the office-type workplace. Appel-Meulenbroek et al. (2015) stressed the relevance of considering the personal characteristics of status (position), gender and age in studies about the office-type workplace. Furthermore, she expected that tenure will be more relevant as well in the future.

#### Performed activity

Warren et al. (2011) stated that preferences are also influenced by goals. They clarified this with the example of that a consumer may prefer soup when she wants to warm up but ice cream when she wants to cool down. When translating this to the office-type workplace, users' performed activities can be seen as goals. As mentioned by Dooley (2017), new ways of working emerged which enabled employees to choose the space which suit the best with the task at hand. Therefore, it is interesting to zoom in on the activity pattern of users of the office-type workplace. An activity pattern can be described as the amount of time employees spend on a certain type of task when they are present in the office-type workplace.

The Centre for People and Buildings conducted a study regarding the activity pattern of academic office workers in Dutch universities whereof the results are visualised in figure 5 (Brunia et al., 2012). They distinguish three types of desk work. 'Regular desk work' is defined as routine desk work. 'Undisturbed desk work' is defined as desk work where people do not want to be disturbed. 'Interactive desk work' refers to desk work where interaction/collaboration with a colleague is desired or required (Beijer,

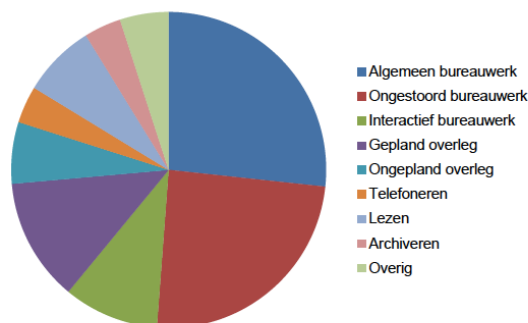


Figure 5: Average activity pattern of academics according to Brunia et al. (2012)

2011). Figure 5 shows that on average 60% of the time is spent on desk work, whereof most time is spent to regular desk work and undisturbed office work. Next, academic office workers spend around 20% of their time to meetings. Brunia et al. (2012) stated that in general, the activity pattern of non-academic and academic office workers is similar. Both spend around 60% of their time to desk work, however the proportions vary. Non-academic office workers spend for instance 10% less time to undisturbed desk work. Furthermore, they spend 6% less time to phone use.

In a later study of the Centre for People and Buildings (De Been & Beijer, 2014), the activities as presented in figure 3 were aggregated into three categories: centred work (deskwork that requires concentration, reading longer than 30 minutes consecutively), communication work (deskwork that requires interaction, formal and informal meetings and telephone calls) and other activities. Results showed that the 12.000 respondents spend 21,9% of their time to concentration activities, 38% to communication activities and the other 40,1% to unidentified activities (De Been & Beijer, 2014).

Adopted from the studies of Brunia et al. (2012) and De Been & Beijer (2014), it can be concluded that office-type workplace activities can be distinguished in two main categories:

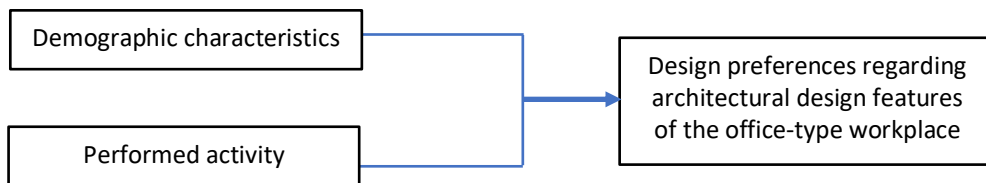
1. Activities where users do not want to be disturbed (undisturbed desk work and reading longer than 30 minutes consecutively).
2. Activities where users might be disturbed, or which are performed together with colleagues (regular desk work, interactive desk work, planned meetings, unplanned meetings, calling and archiving).

#### **Conclusion**

The concept of office-type workplace design preferences is defined as: “the architectural design characteristics of the office-type workplace which are liked or preferred over other architectural design characteristics of the office-type workplace when users have the choice”. Workplace design preferences are influenced by two main factors: demographic characteristics and goals. Demographic characteristics which seem relevant for the office-type workplace include age, gender, function and type of organisation. Goals can be translated to users’ performed activity. Literature indicates that the activities performed at the office-type workplace can be distinguished in two categories: (1) activities where users do not want to be disturbed, and (2) activities where users might be disturbed, or which are performed together with colleagues.

### **2.3 Conceptual model**

The theoretical framework is translated into a conceptual model as presented in figure 6. The included architectural design features are office layout and placement of windows. The expectation is that users’ performed activity and demographic characteristics affect their workplace design preferences.



*Figure 6: Conceptual model*

## 3 Methodology

### 3.1 Cross-sectional design

The study has an explorative, cross-sectional design. “This design is best suited to studies aimed at finding out the prevalence of a phenomenon, situation, problem, attitude or issue, by taking a cross-section of the population. They are useful in obtaining an overall ‘picture’ as it stands at the time of the study” (Kumar, 2014, p. 134). As there is only one contact with the study population, the design is relatively cheap to conduct and analyse (Kumar, 2014).

#### **Study population**

When defining the workplace, it became clear that this concept also includes office-type workplaces in hospitals, universities and other contexts (Vischer, 2008). Remarkably, when zooming in on hospitals, it appears that academic literature on this topic is still limited. A review of Ulrich et al. (2008) showed that research about the physical design of hospitals focus in general on three types of outcomes: patient safety issues, other patient outcomes and staff outcomes. Staff outcomes include injuries, stress, work effectiveness and satisfaction. In addition, Mroczek et al. (2005) argued that although various aspects of health care environments have been linked to patient outcomes, less studies focused on how the medical staff is affected by this environment. The most comprehensive study so far is that of Sadatsafavi et al. (2015). They investigated the level of association of multiple design features with employee’s overall satisfaction for three types of workplaces used by staff: patient areas, staff work spaces and staff areas. However, their results are not conclusive in the light of the office-type workplace in particular. Therefore, the study population of interest was defined as staff who make use of an office-type workplace in Dutch hospitals. In 2016, the Netherlands counted 91 hospitals whereof 61 regular hospitals, 22 categorical hospitals and 8 University Medical Centres (CBS, 2016). Hospital staff can be distinguished in employees working for a medical specialism and employees working for supporting departments like HR, Finance and Facilities. This last group is excluded from the study scope since it is assumed that their workplace design preferences are more similar with users of office-type workplaces in non-hospital settings. In 2016, Dutch hospitals offered 227.007 fulltime jobs (Nederlandse Vereniging van Ziekenhuizen, 2017). It is not clear how many of these jobs are related to a medical specialism. There is also a lack of insight in the number of hospital staff who make use of an office-type workplace. Consequently, it was impossible to identify the number of people in the study population.

#### **Sampling technique**

In consultation with the commissioner of this study (see subchapter 3.7), hospital staff with the following functions were invited to participate: specialist, professor, lecturer, AIOS, ANIOS and researcher. Employees with the function of care manager and secretary were also invited to participate in order to create a control group. The aim of the control group was to investigate if the examined preferences are specifically for hospital staff with certain functions or might be common among office-type workplace users in general and therefore can be seen as universal preferences. This is crucial because when the preferences seem universal, the external validity of the results increase.

The first step of sampling was to approach Dutch hospitals in consultation with the commissioner as well as via the network of the researcher. The explanation of the study as send to various hospitals is included in Appendix I. When a hospital or department of a hospital approved to participate in this study, the second step was that a contact person within the hospital approached the employees with the request to participate. Appendix II includes the invitation as send to the hospital staff. This applied method is also called the snowball sampling technique. The disadvantage is the lack of insight in the number of hospital employees which were approached to participate in this study. For example, when a hospital approved to participate, a contact person within the hospital send an email to all the head

of departments with the request to spread the invitation to participate among all the employees he or she is responsible for. As a result, it was not possible to define the response rate.

### 3.2 Conjoint experiment

A conjoint experiment was used to answer the empirical questions. The conjoint analysis became popular in marketing early 1970s (Wettink & Carlin, 1989) and represents a major set of techniques for measuring buyers' tradeoffs among multi attributed products and services (Green & Srinivasan, 1990; Green et al., 2001). In other words, it is a method to estimate the impact of selected product or service characteristics on customer's preferences regarding these products or services (Wettink & Carlin, 1989). The method is suited for situations in which a choice needs to be made about options that simultaneously vary across two or more attributes (Green et al., 2001) and helps to identify consumer segments with similar preferences (Koo et al., 1999).

When performing a conjoint analysis, multiple steps need to be taken (Green et al., 2001; Gustafsson et al., 2003; Ryan & Farrar, 2000). First, the architectural design features and characteristics of the office-type workplace as defined in literature were transformed into attributes and attribute levels to develop so called scenarios. In the conjoint experiment method, the scenarios can be seen as the independent variable and the preference judgement as the dependent variable (Green et al., 2001). Since this study is about design preferences, it is interesting to present the scenarios visually. The advantage is that marketplace conditions can be represented more realistic than in case of verbal presenting in which product information sheets, key words, descriptive sentences or a combination of these elements is used (Green & Srinivasan, 1990). With this in mind, the attributes and attributes levels are chosen for the conjoint experiment as described below.

#### Office layout

In the theoretical framework, three characteristics of the architectural design feature 'office layout' were identified: 'degree of openness', number of workplaces in the room or space' and 'assigned or flexible'. Because the explorative character of this study and the visual presentation, the characteristic 'degree of openness' is fixed to the 'cellular office'. When an open-plan office, combi-office or flex-office were also included, this would be hard to present visually because the amount of space within each type of office significantly differs and as a result also for instance the amount of furniture and the number of windows would vary. Therefore, the chosen attributes are 'number of workplaces in the room' and 'assigned or flexible'. The attribute levels, as presented in table 3, are based on the theoretical framework and chosen in consultation with the commissioner since they have the expertise which design options are most common in practice.

#### Placement of windows

Literature indicated that the feature 'placement of windows' includes three characteristics: 'position', 'proportions' and 'controllability'. Since in this study the attributes and levels are visually presented, the focus is on visual comfort and the characteristic 'controllability' was excluded from the study scope. The defined attribute levels as presented in table 3 reflects the characteristics 'position' and 'proportion' and makes it able to examine preferences regarding having a view outdoors as well as access to daylight.

Design characteristic 1: Number of workplaces in the room	Design characteristic 2: Assigned or flexible	Design characteristic 3: Placement of windows
Closed room with 1 workplace	Assigned workplace	Window with view
Closed room with 2 workplaces	Flexible workplace within the own department	Window without view
Closed room with 4 workplaces	Totally flexible workplace	No window

Table 3: Attribute and attribute levels of the conjoint experiment

As the study includes three attributes with three levels each, this would result in 27 possible scenarios ( $3 \times 3 \times 3$ ). To avoid information overload problems at respondents (Koo et al., 1999), a reduced design was made with SPSS 23. This so-called orthogonal design resulted in nine scenarios (see Appendix III).

When choosing for a conjoint analysis design, the researcher can choose between various methods (Wettink & Carlin, 1989). As this study includes three attributes, the full-profile method was applied since this method is recommended if the number of attributes can be kept down to six or fewer factors (Green & Srinivasan, 1990). In this method, each respondent ranks or scores a set of profiles according to their preference. On each profile, all attributes of interest are represented, and a different combination of levels is presented to the respondent (Koo et al., 1999). Because all factors are considered and evaluated at the same time this method comes close to a real-life situation (Gustafsson et al., 2001; Koo et al., 1999).

### 3.3 Survey

The conjoint experiment was incorporated into an e-mail survey which was designed in Qualtrics. A Dutch as well as English version was developed. The survey, see appendix IV, was active in the period of the 4<sup>th</sup> of June till the 20<sup>th</sup> of June. It started with an introduction text to shortly explain the goal of the study and to thank the participants in advance for their response. After this introduction, the survey consisted of four parts. The first part consisted of five questions regarding participants' current office-type workplace and their activity pattern. These questions aimed to make the participant familiar with the topic of the office-type workplace and to gain insight in the use of the office-type workplace within hospitals. The questions were a mix of single-choice, multiple-choice, open-ended and total sum questions. The second part of the survey included two questions in which the respondent was asked to rank the nine scenarios of the office-type workplace (appendix III) according to their own personal preference in the light of two categories of activities which were based on the theoretical framework. Calling and e-consultation were included to the category of activities where users do not want to be disturbed because in hospitals often patient confidentially information is discussed during these activities. The commissioner visualised the scenarios with the design software programmes Revit and Escape. In the last part of the survey, five questions were asked to identify respondent's demographic characteristics. These questions were a mix of multiple-choice and open-ended questions. Since these questions are the most personal, they were presented at the end. Rattray and Jones (2007) recommended to ask demographic questions at the end of the survey to engage participants and prevent boredom.

### 3.4 Pilot study

In the period of 27 May 2018 till 30 May 2018, the survey was tested in a pilot study. The sample of the pilot study consisted of ten participants, five people were asked to fill in the Dutch version and five to fill in the English version. The participants were approached via the network of the researcher. The aim was to test the understandability of the different parts of the survey and the questions and to identify possible errors. Furthermore, it was checked if the respondents were able to finish the survey in the proposed time frame of 5-10 minutes. Where the activity pattern was first measured through a slider question, this has been changed to a constant sum question to make sure that the percentages sum to 100%. Moreover, the size of the pictures of the conjoint experiment were made smaller in order to be able to present all nine scenarios at one page. This makes it easier and less time consuming for the participant to make the ranking. To compensate the smaller picture size, an option was added in which the respondent could increase the picture size by clicking on the picture. Furthermore, some small changes have been made in the survey as a result of founded errors and misunderstandings.

### 3.5 Data analysis

Only fully executed surveys were accounted as valid and analysed. The retrieved data was analysed in SPSS 23. Based on the activity pattern of the various functions, the respondents were divided into a

sample and a control group. After this, descriptives of the sample and control group were analysed. Through non-parametric tests (Mann Whitney U) it was measured if these results of the sample and control group significantly differ. Furthermore, a conjoint analysis has been performed to examine users' preferences. This output consists of two important elements: 1) utility of attribute and 2) relative importance of attribute. The utility is "a numerical expression of the value consumers places in an attribute level". Low utility indicates less value, high utility indicates more value". The relative importance can be calculated by "examining the difference between the lowest and highest utilities across the attribute levels". (Levy, 1995, in Koo et al., 1999, p.243). For this study, these outcomes were translated to: 1) the preferences for architectural design characteristics and 2) the relative importance of architectural design characteristics. The conjoint analysis has been performed for the total sample and control group as well as the various user groups (based on gender, age and function) within the sample and the control group. In order to distinguish user groups based on age, output was generated for respondents younger and older than 40 years as well as younger and older than 50 years. It was examined that when drawing the line on younger and older than 40 years, the outcomes are the most varying and therefore most interesting. The demographic characteristic 'medical specialism' was not used to distinguish user groups used since the respondents are working for more than fifteen different specialisms. Furthermore, type of hospital (regular, categorical, UMC) was also not considered because almost all respondents are working for a regular hospital.

### 3.6 Reliability and validity

Reliability refers to the extent in which the indicator consistently comes up with the same measurement (Vaus, 2011). First, a pilot study of the survey was performed to increase the reliability. Although the pilot study was performed with participants outside the study population, most of them were familiar with the office-type workplace within hospitals as a result of their function as architect or consultant in the care industry. Second, with the conjoint experiment the respondents were asked to rank the scenarios of the office-type workplace based on their personal preference, which is a reliable method according to Green and Srinivasan (1987). Last, reliability can be ensured by a certain number of respondents. According to Verschuren and Doorewaard (2010), a sample size should be at least between 60 and 80 units.

Next to reliability, also the internal and external validity of the study should be assessed. Vaus (2011) defined internal validity as "the extent to which the structure of a research design enables us to draw unambiguous conclusions from our results" (p.27). In this study, the developed conceptual model as starting point for the empirical study contribute to the internal validity. Next, the internal validity was increased by using a mix of visual and verbal presentation of the scenarios in the conjoint experiment. Under each picture, a description was included which attributes levels of the office-type workplace were presented. External validity means the extent to which results from a study could be generalized beyond the particular study, so the critical question is to what extent the results are likely to apply more widely (Vaus, 2011). For this study, it was impossible to identify the study population of interest and so the required sample size. Next, because the use of the snowball sampling technique, it was hard to calculate the response rate. However, by including a control group it can be measured if the examined design preferences are specifically for the sample or might be universal preferences for users of office-type workplaces in general. This is important in the light of external validity.

### 3.7 Commissioner

This research has been performed in collaboration with a commissioner: EGM. This organisation focusses on: "How to design excellent buildings? Buildings in which people can live, learn, heal, work and research". By asking questions, listening and designing, the aim of EGM is to come to buildings that meet users' needs (EGM, 2018a). The core business of the organisation can be seen as EGM architects, one of the most innovative and knowledge-intensive architectural firms in the Netherlands with a market leader position in the health care industry (EGM, 2018b).



## 4 Results

This chapter presents the results of the people who completed the survey, from now on called respondents. In total 107 people of 7 different hospitals finished the survey. All respondents filled in the Dutch version of the survey.

### 4.1 Introduction of sample and control group

The 107 respondents were divided into a sample group and a control group, see table 4. Based on respondents' activity pattern, which can be found in appendix IV, respondents with the function of care manager were added to the sample because their activity pattern is quite similar as the sample. Respondents with the function 'other' are mainly clinic assistants, doctor's assistants and nurses. Their activity pattern is most similar with respondents of secretary. Important to note is that respondents can have multiple functions.

Sample (n=60)		Control group (n=47)	
<b>Specialist</b>	21 (35,0%)	<b>Secretary</b>	22 (29,7%)
<b>Professor</b>	1 (1,7%)	<b>Other</b>	28 (37,8%)
<b>Teacher</b>	0 (0,0%)		
<b>AIOS</b>	6 (10,0%)		
<b>ANIOS</b>	6 (10,0%)		
<b>Researcher</b>	2 (3,3%)		
<b>Care manager</b>	25 (41,7%)		

Table 4: Overview of total respondents

### 4.2 Descriptives

This sub-chapter presents the samples' descriptives. At the end, it is described which results of the sample and control group are significantly different (table 5). Appendix VI includes the descriptives of the control group.

#### Demographic characteristics

Figure 7 shows the distribution of the sample's gender and figure 8 of the samples' age.

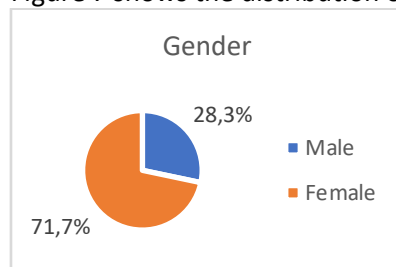


Figure 7: Gender of sample

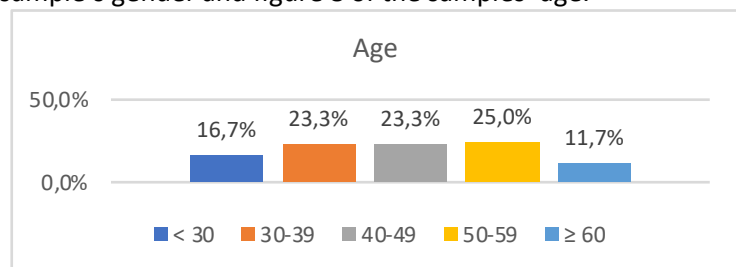


Figure 8: Age of sample

#### Current office-type workplace

Figure 9 presents the distribution of the sample's current office-type workplace. 66,7% of the respondents (n=40) work in a closed room, 23,4% of the respondents work in an open-plan (n=14). Furthermore, 5% of the respondents do not have a separate office-type workplace, instead they make use of a consultation room (n=3). Last, 5% of the respondents indicated their current office-type workplace is different (n=3).

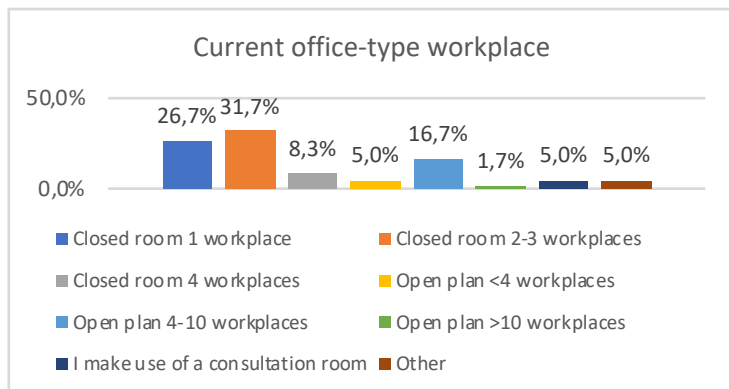


Figure 9: Current office-type workplace of sample



Since the respondents were asked which of the above-mentioned office-type workplaces matches the best with the office-type workplace they are currently working in most often, it is possible that they make use of more office-type workplaces during the day or week. Figure 10 shows whether the respondents of the sample have an assigned or flexible workplace. Figure 11 visualises if they have the possibility to make use of extra facilities in addition to their regular office-type workplace.

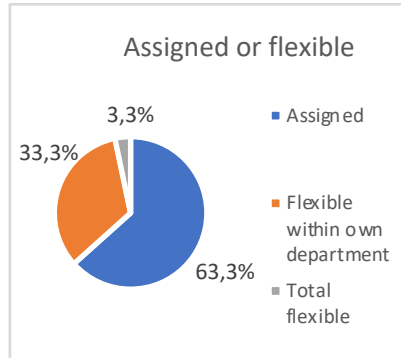


Figure 10: Assigned or flexible

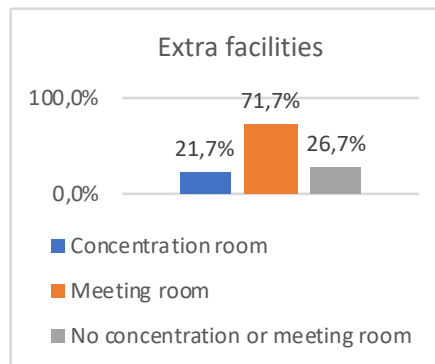


Figure 11: Extra facilities

### Activity pattern

The sample spend on average 22,4 hours at an office-type workplace with a minimum of 2 hours and a maximum of 48 hours. Figure 12 presents the overall distribution of the various categories of activities. Figure 13 and 14 zoom in on the time spend on the various activities within these two main categories.

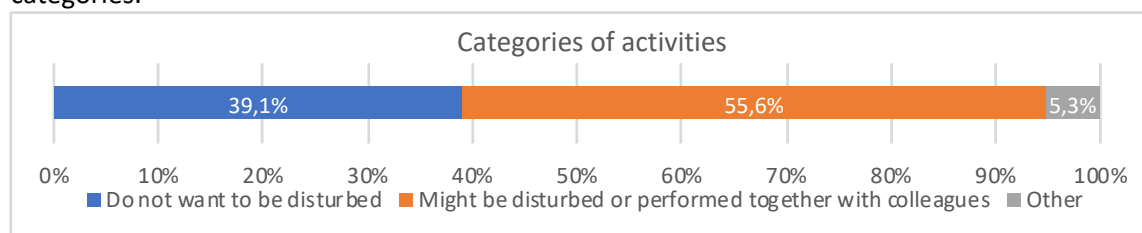


Figure 12: Distribution categories of activities of sample

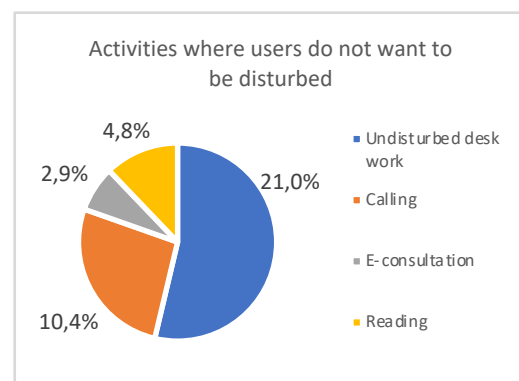


Figure 13: Breakdown of activities category 1 for sample

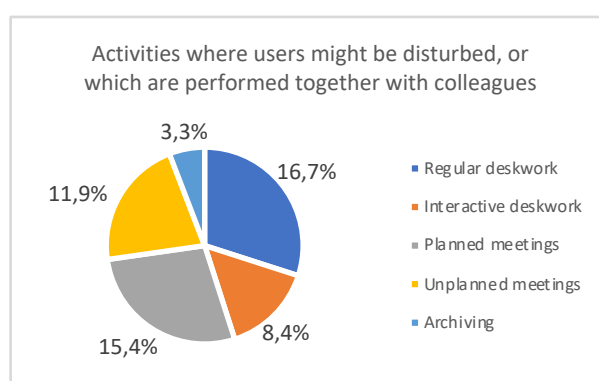


Figure 14: Breakdown of activities category 2 for sample

### Control group

Table 5 provides an overview of which variables are significantly different for the control group.

Variable	Sign.	Variable	Sign.
Gender	0,000	Reading	0,004
Current office-type workplace	0,001	Regular desk work	0,001
Assigned or flexible	0,003	Planned meetings	0,000
Undisturbed desk work	0,040	Unplanned meetings	0,002
Calling	0,001		

Table 5: Outcomes Mann Whitney U tests

### 4.3 Preferences for office-type workplace design characteristics

In this section, the third sub-question is answered: “Which architectural design characteristics of the office-type workplace do users prefer?” Users’ preferences are examined for two categories of activities: (1) activities where users do not want to be disturbed, and (2) activities where users might be disturbed, or which are performed together with colleagues.

Table 6 presents the relative importance of the architectural design characteristics for each category of activities. Per category, the importance’s sum up to 100. As shown, the order of relative importance is the same for both categories of activities. ‘Assigned or flexible’ is the most important, followed by ‘number of workplaces’ and lastly ‘placement of windows’. However, for the second category of activities, ‘number of workplaces’ is slightly less important while both ‘assigned or flexible’ and ‘placement of windows’ are more important.

Relative importance design characteristics (%)	1.Activities where users do not want to be disturbed	2. Activities where users might be disturbed or performed together with colleagues
<b>Number of workplaces</b>	35,9	31,9
<b>Assigned or flexible</b>	40,0	40,9
<b>Placement of windows</b>	24,0	27,2

Table 6: Relative importance architectural design characteristics

#### 4.3.1 Activities where users do not want to be disturbed

Figure 15a shows respondents’ preferences for the category of activities where they do not want to be disturbed by presenting the utility values per architectural design characteristic. A utility value of 0 can be interpreted as a neutral preference. A value above 0 indicates a characteristic’s level is preferred, a value under the 0 indicates it is not preferred. The higher the utility value (positive or negatively), the more pronounced a characteristic level is preferred or not preferred. Finally, the relative importance’s and preferences of the sample are compared with the control group which results can be found in appendix IV.

Based on figure 15a, it can be concluded that when respondents do not want to be disturbed, they prefer an office-type workplace with the following characteristics: 1) a closed room with 2 workplaces, 2) assigned and 3) a window without view. Furthermore, they also slightly prefer to have a flexible workplace which is shared with the own department. Having a window with view is remarkably not preferred. The preferences regarding ‘assigned or flexible’ are the most pronounced. An assigned workplace is clearly preferred while a totally flexible workplace is not preferred at all.

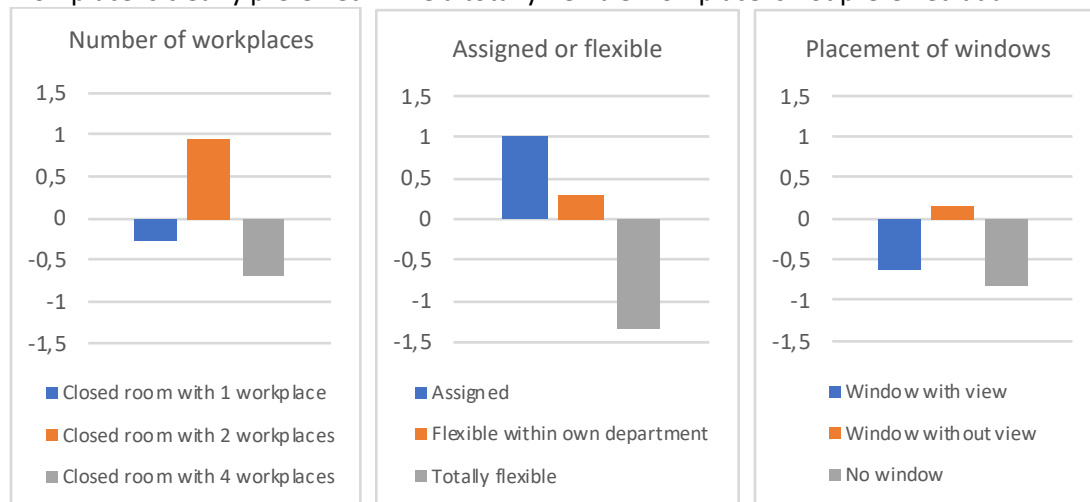


Figure 15a: Utility values per architectural design characteristic

### Control group

The preferences of the control group are in general comparable with the sample. They prefer an office type workplace with the same three characteristics. However, there are also some differences. For the control group, the relative importance of the design features 'number of workplaces' (33,4%) and 'assigned or flexible' (36,3%) are both lower, while the relative importance of the feature 'placement of windows' (30,3%) is higher than the sample. The preferences of the control group are a little less pronounced. Furthermore, the closed room with 1 workplace as well as a flexible workplace within the own department are both neutrally preferred by the control group. Remarkably, the control group also slightly prefer to have a window with view.

#### 4.3.2. Activities where users might be disturbed, or which are performed together with colleagues

Figure 15b shows that for activities where respondents might be disturbed, or which are performed together with colleagues, they prefer an office-type workplace with the following characteristics: 1) a closed room with 2 workplaces, 2) assigned and 3) a window with view. The closed room with 1 workplace, flexible workplace within the own department, and window without view are all neutrally preferred. Respondents' preferences for the characteristic 'assigned or flexible' are very explicit. They highly prefer an assigned workplace and strongly do not prefer the totally flexible workplace.

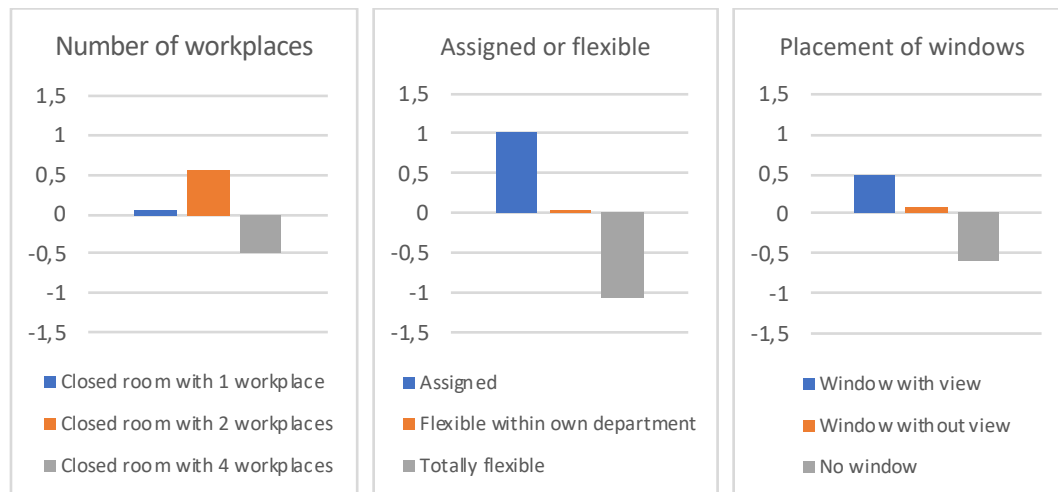


Figure 15b: Utility values per architectural design characteristic

### Control group

Also for this category of activities, the preferences of the control group are in general comparable with the sample. They prefer an office type workplace with the same three characteristics. However, the relative importance's of the design characteristics are not alike. For the control group, 'assigned or flexible' is the least important feature (30,8%) and placement of windows the most important (36,6%) which is the opposite of the sample. The control group slightly more prefer the closed room with 1 workplace. Furthermore, when zooming in on 'assigned or flexible', the control group especially does not prefer the flexible workplace within the own department, while for the sample the totally flexible workplace is the least preferred. The preferences of the control group regarding 'placement of windows' are somewhat less explicit.

## 4.4 Differences in workplace design preferences of various user groups

In this sub-chapter, the fourth sub-question is answered: *“To what extent is there a difference between the workplace design preferences of various user groups?”*. The various user groups are based on the demographic characteristics of gender, age and function and all presented in the next sections. When possible, the results of the sample were compared with the control group which results can be found in appendix IV.

### 4.4.1 Gender

Table 8 shows the relative importance of the architectural design characteristics for males and females. Remarkably, the order is not alike for the first category of activities. For males, ‘number of workplaces’ is the most important followed by ‘assigned or flexible’. For females, this is the opposite. For both categories of activities, ‘placement of windows’ is more important for females.

Male	N=17
Female	N=43

Table 7: User groups based on gender

Relative importance design characteristics (%)	Activity 1		Activity 2	
	Male	Female	Male	Female
Number of workplaces	40,0	34,4	31,9	31,9
Assigned or flexible	38,5	40,6	43,7	39,8
Placement of windows	21,5	25,0	24,4	28,3

Table 8: Relative important architectural design characteristics per gender

### Activities where users do not want to be disturbed

Figure 16a present the preferences of both males and females regarding the architectural design characteristics for the first category of activities. Males and females both prefer to have an office-type workplace in the form of a closed room with 2 workplaces and an assigned workplace. Strikingly, males prefer to have a window with view while females prefer a window without view. Despite, it should be noticed that males’ preferences regarding ‘placement of windows’ are really unpronounced. Their preferences can also be described as neutral. Another remarkable result is that males slightly prefer the closed room with 1 workplace, while females do not prefer this. Furthermore, males strongly do not prefer a closed room with 4 workplaces.

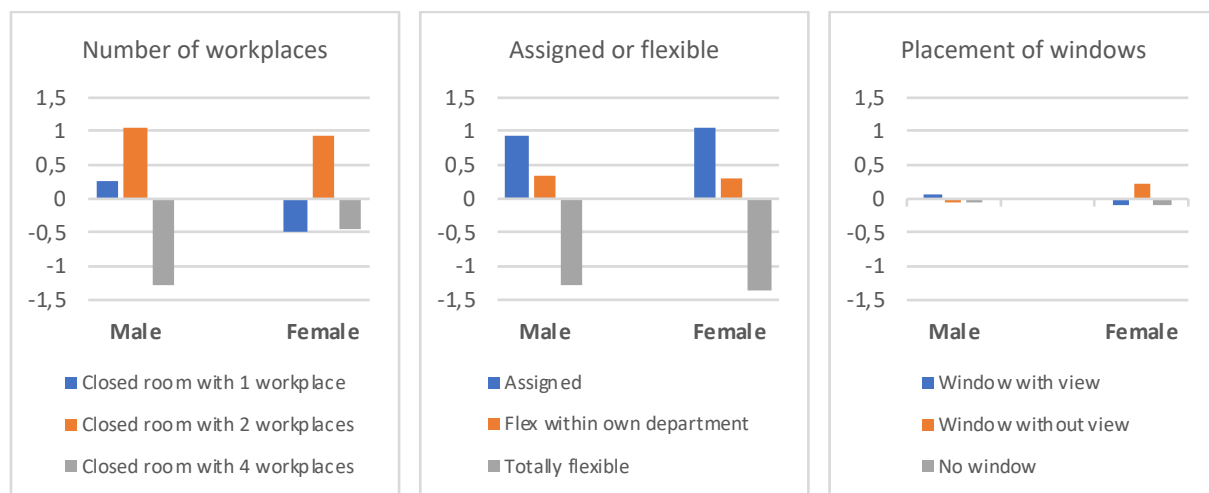


Figure 16a: Utility values per architectural design characteristic for gender

### Activities where users might be disturbed, or which are performed together with colleagues

Figure 16b present the preferences of both males and females for the second category of activities. They both prefer an office-type workplace with the same three characteristics: 1) closed room with 2 workplaces, 2) assigned, and 3) window with view. Also for this type of category, males' preferences regarding 'placement of windows' are unpronounced. Females strongly prefer to have a window, especially with view. On the other hand, males' preferences for the characteristic 'assigned or flexible' are more explicit.

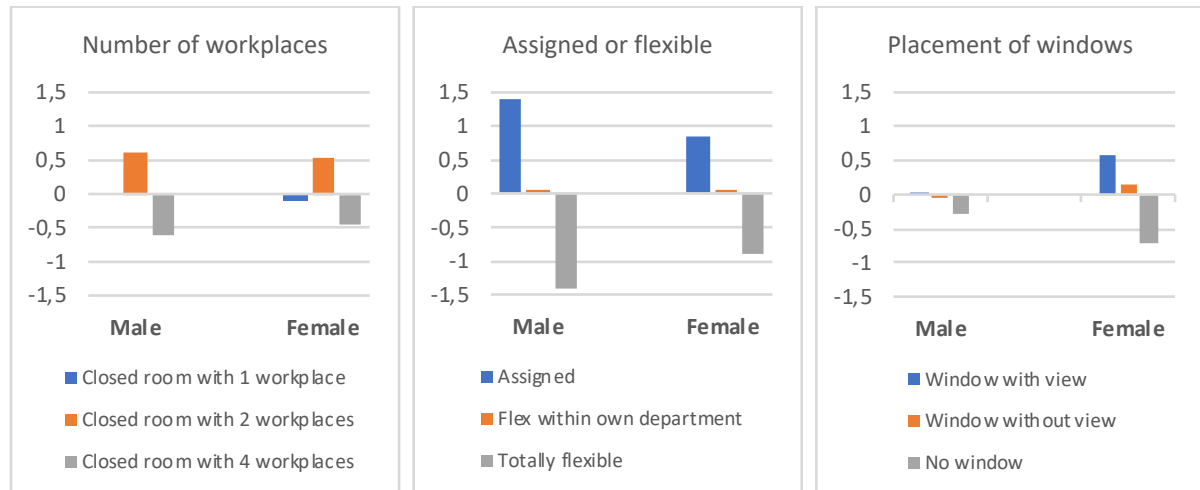


Figure 16b: Utility values per architectural design characteristic for gender

### Control group

As the control group only consists of females, the results of the sample's females were compared with the entire control group.

- **Relative importance:** For the control group, 'assigned or flexible' is quit less important and 'placement of windows' more important. For the second category of activities the order is not alike. The control group find 'placement of windows' the most important (36,6%), followed by 'number of workplaces' (32,6%) and 'assigned or flexible' (30,8%).
- **Preferences:** Most differences in preferences appear for the first category of activities. Where the control group neutrally prefer the closed room with 1 workplace, females of the sample do not prefer this. In addition, the control group neutrally prefers the flexible workplace within the own department while females of the sample slightly prefer this. Females of the control group also more strongly do not prefer to have no window. Remarkable for the second category of activities is that the control group do not prefer the flexible workplace within the own department, while females of the sample neutrally prefer this.

### 4.4.2 Age

Table 10 indicates that the order and distribution of the relative importance is comparable among the respondents younger than 40 years and the respondents older than 40 years.

<40 years	N=24
>40 years	N=36

Table 9: User groups based on age

Relative importance design characteristics (%)	Activity 1		Activity 2	
	<40 years	>40 years	<40 years	>40 years
Number of workplaces	37,7	34,8	32,9	31,2
Assigned or flexible	38,9	40,8	38,2	42,7
Placement of windows	23,4	24,5	28,9	26,1

Table 10: Relative importance architectural design characteristics per age

### Activities where users do not want to be disturbed

Figure 17a presents the preferences for respondents younger than 40 years and older than 40 years for the first category of activities. All respondents prefer to have a closed room with 2 workplaces and an assigned workplace. Regarding 'placement of windows', respondents <40 years prefer to have no window while respondents >40 years prefer to have window with view. However, respondents' preferences regarding this characteristic, especially when younger than 40 years, are really unpronounced. Furthermore, respondents <40 years do not prefer a closed room with 1 workplace, while respondents >40 years neutrally prefer this. Next, respondents >40 years have more pronounced preferences regarding 'assigned or flexible'. They highly prefer an assigned workplace and totally do not prefer the totally flexible workplace.

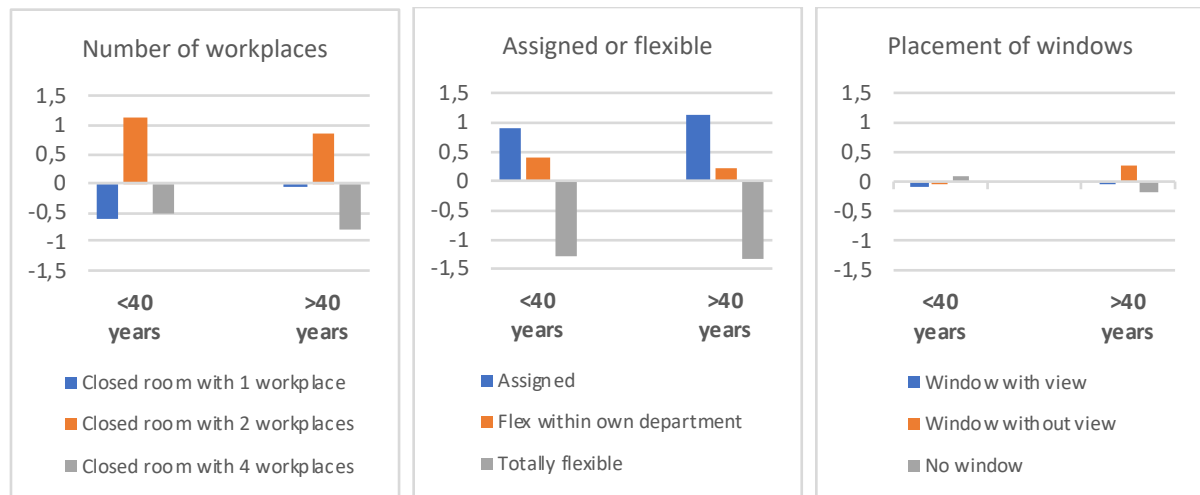


Figure 17a: Utility values per architectural design characteristic for age

### Activities where users might be disturbed, or which are performed together with colleagues

Figure 17b presents respondents' preferences for the second category of activities. Both user groups prefer a closed room with 2 workplaces and an assigned workplace. Respondents <40 years strongly prefer to have a window with view. The preferences of respondents >40 years are less prominent. They prefer to have a window, slightly more without view than with view. For the characteristics 'number of workplaces' and 'assigned or flexible', respondents >40 have more explicit preferences.

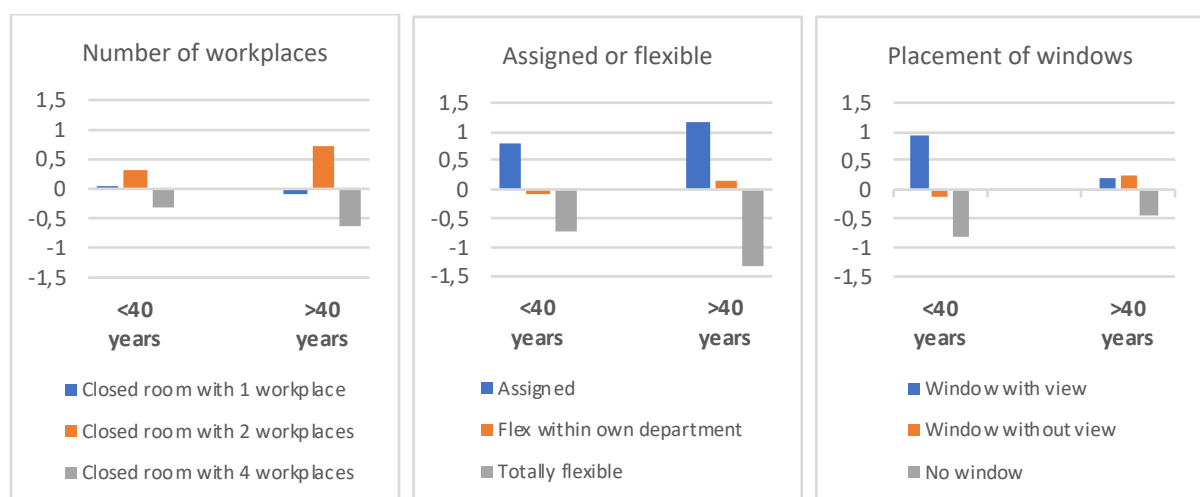


Figure 17b: Utility values per architectural design characteristic for age

## Control group

In appendix IV, the preferences of the control group were examined for respondents' younger than 40 years and respondents older than 40 years. The most important differences between the control group and the sample are:

- *Relative importance*: For the first category of activities, the order of relative importance is not alike for respondents <40 and similar for respondents >40 years. Respondents of the control group <40 years find 'placement of windows' the most important, while for the sample this is 'assigned or flexible'. For the second category of activities, the order of importance is different for both user groups. Most striking are the differences for the respondents >40 years. The order of importance for the control group is: 'placement of windows', 'number of workplaces' and 'assigned or not' which is the opposite as the sample.
- *Preferences*: For both categories of activities, there are some small differences in the examined preferences. Strikingly for the first category of activities is that respondents <40 year of the control group have less pronounced preferences for 'assigned or flexible' but more prominent preferences for 'placement of windows'. For the second category of activities, respondents of the control group <40 years slightly prefer the closed room with 1 workplace and the window without view. Respondents >40 years of the control group do not prefer the flexible workplace within the own department.

### 4.4.3 Function

This section compares the preferences of so called medical functions (specialist, professor, teacher, AIOS, ANIOS and researcher) and care managers, see table 11. Because the control group includes other functions, these results are not compared with the control group.

In table 12, the relative importance is presented. For the first category of activities, 'number of workplaces' and thereafter 'allocation' are the most important for respondents with a medical function. This is the opposite as for respondents with the function of care manager. For the second category of activities, the order of relative importance is the same among the two user groups.

<b>Medical</b>	N=36
<ul style="list-style-type: none"> <li>• Specialist</li> <li>• Professor</li> <li>• Teacher</li> <li>• AIOS</li> <li>• ANIOS</li> <li>• Researcher</li> </ul>	
<b>Care manager</b>	N=25

Table 11: User groups based on function

Relative importance design characteristics (%)	Activity 1		Activity 2	
	Medical	Supervisor	Medical	Supervisor
Number of workplaces	39,1	31,5	30,5	33,8
Assigned or flexible	36,8	44,5	40,8	41,0
Placement of windows	24,1	24,0	28,7	25,2

Table 12: Relative importance architectural design characteristics per function

### Activities where users do not want to be disturbed

Figure 18a shows that both user groups prefer an office-type workplace with the following three characteristics: 1) closed room with 2 workplaces, 2), assigned, 3) window without view. Remarkable is that the preferences regarding 'placement of windows', especially of the medical functions, are very unpronounced. Furthermore, medical staff have more prominent preferences for 'number of workplaces', while care managers have more pronounced preferences for 'assigned or flexible'.

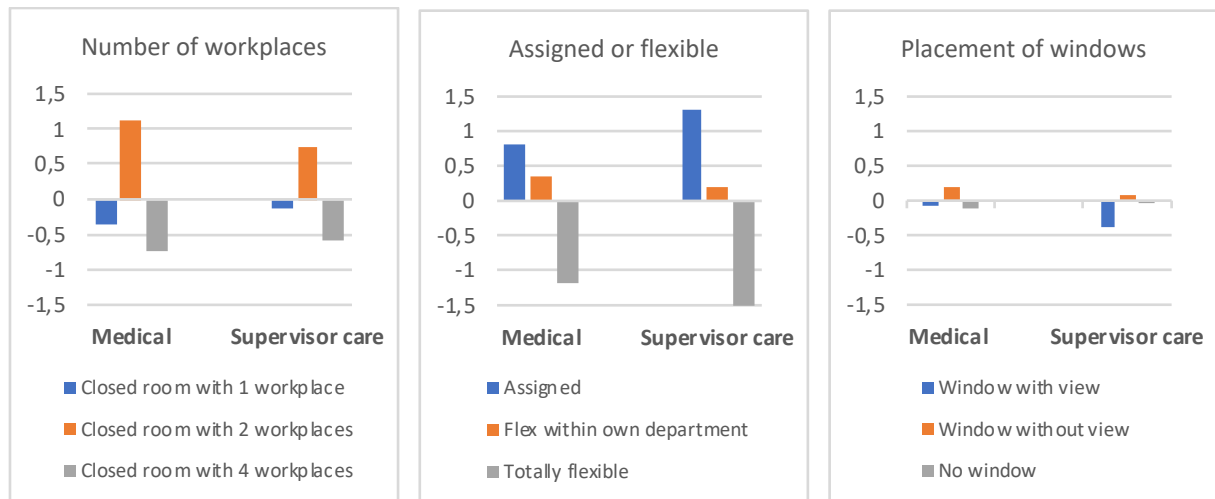


Figure 18a: Utility values per architectural design characteristic for function

### Activities where users might be disturbed, or which are performed together with colleagues

Figure 18b indicates that both function groups prefer to have a closed room with 2 workplaces and an assigned workplace. Respondents with a medical function clearly prefer to have a window with view. Supervisors' preferences for this characteristic are less pronounced, they slightly prefer a window with view as well as window without view. Another remarkable result is that supervisors' preferences regarding 'number of workplaces' are more explicit. They strongly prefer a closed room with 2 workplaces.

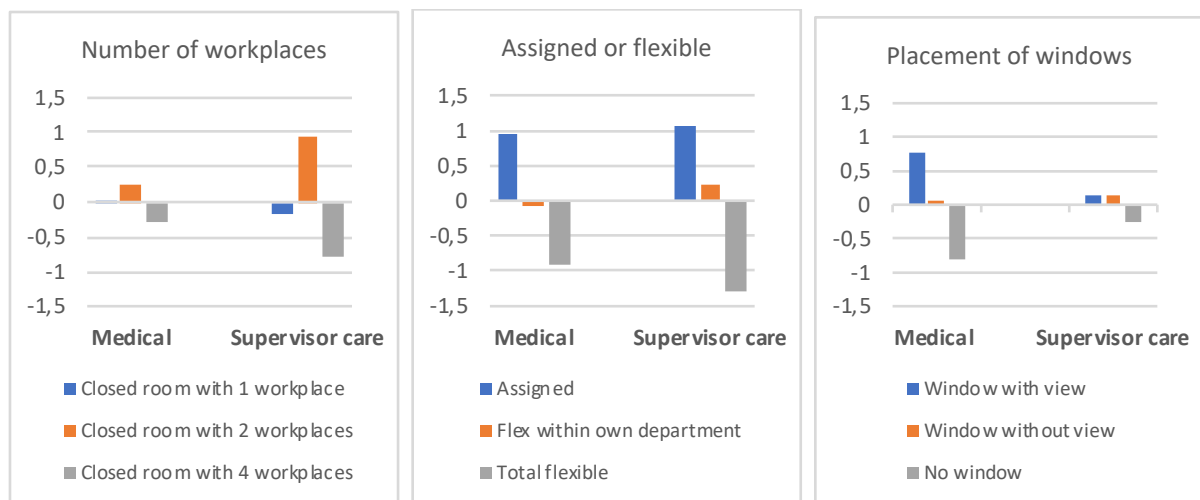


Figure 18b: Utility values per architectural design characteristic for function



## 5 Discussion and conclusion

The first section of this chapter presents the discussion where after the conclusion provides an answer to the main research question.

### 5.1 Discussion

This sub-chapter discusses the validity and generalizability of this study. Furthermore, the most important interpretations and clarifications concerning the presented results are discussed. Lastly, the limitations of the study are assessed.

#### 5.1.1 Validity and generalizability of this study

Various aspects ensured good internal validity. The developed conceptual model was used as starting point for the empirical study, which means that the survey questions and scenarios of the conjoint analysis were based on the theoretical framework. The visually as well as verbally presentation of the scenarios of the conjoint experiment also increased the internal validity. The generalizability of this study can be considered as limited as a result of the explorative character of the study and the lack of insight in the total study population which was defined as hospital staff of Dutch hospitals who make use of an office-type workplace. However, the introduction of the control group contributed to the external validity. Despite it is not totally conclusive yet if the examined preferences of the sample are universal for users of the office-type workplace, the preferences of the sample and the control group are in general comparable.

#### 5.1.2 Coherence of the empirical results with literature

In this section, the coherence of the results with previous studies will be described for each investigated architectural design characteristic.

##### **Number of workplaces in the room**

A surprise regarding the characteristic 'number of workplaces in the room' is that users' prefer the closed room with 2 workplaces over the closed room with 1 or 4 workplaces for both categories of activities. It was expected that the closed room with 1 workplace was preferred when users are performing activities where they do not want to be disturbed. Cell or private offices provide the most privacy and least distractions in the form of noise and interruptions and therefore may be preferable for tasks that require higher need for concentration or privacy like confidential conversations (Al Horr et al., 2016; Kaarlela-Tuomaala et al., 2009; Seddingh et al., 2014; Van der Voordt, 2004; Wohlers & Hertel, 2017). So, why does this study indicate that users' do not prefer to work in a closed room with 1 workplace when performing activities where they do not want to be disturbed? It might be that respondents associated this scenario with a so-called cockpit workplace without window, a type of workplace which is often provided in activity-based working concepts and meant for temporarily occupation during the day (Hoendervanger et al., 2016). A study of Appel-Meulenbroek et al. (2011) showed that this concentration workplace is not considered as comfortable. However, no underlying reasons were identified. A possible explanation can be found in the study of Van der Voordt & Klooster (2008) who found that some users find the cockpit workplace too small. When zooming in on demographic characteristics, the examined preferences are more or less alike.

Furthermore, it is interesting that for both categories of activities, respondents had a higher relative importance for 'assigned or flexible' than for 'number of workplaces'. When combining this with the examined preferences, it can be presumed that it is more important for users to have an assigned workplace than with how many colleagues they are sharing the room. This information might help designers when designing office-type workplaces. However, it is important to consider that these relative importance's might not fit with practice. For example, if users work in an office-type workplace with 4 assigned desks, they still might need to leave their desk when discussing patient confidentially

information or when having meetings. As a result, the designer must make sure that there are spaces in addition to the assigned workplace which facilitate these activities.

### **Assigned or flexible**

The results showed that respondents clearly prefer having an assigned workplace and do not prefer at all to have a totally flexible workplace. In addition, the characteristic 'assigned or flexible' has the highest relative importance for both categories of activities. The strong preference for an assigned workplace is supported by previous research which indicated that users do not seem to switch frequently, or not at all, between different activity settings (Appel-Meulenbroek et al., 2011; Hoendervanger et al., 2016). Hoendervanger et al. (2016) identified the following reasons of users not to switch from workplace: necessity to move stuff, someone else might take the workplace, hard to find for colleagues, no better place available, I always use the same place, IT supplies fall short, too far from my unit and necessity to readjust furniture. In addition, Kim et al. (2016) identified common complaints of users regarding non-assigned workplaces which are: not enough workstations, difficult to locate team members, waste of time of repeatedly finding a desk as well as setting-up and packing-up, limited ability to adjust/personalise workstations to meet one's own needs and comfort standard, and personal hygiene issue due to sharing a desk. However, in practice it might be hard to realise an assigned workplace for each employee because the required capacity and budget.

Zooming in on demographic characteristics, the order of relative importance for females and males is ambiguous which is in line with previous studies (Volker & Van der Voordt, 2005; Well, 2000 in Wohlers & Hertel, 2017). Regarding age, 'assigned or flexible' is more important for respondents older than 40 years than for respondents younger than 40 years. This finding is supported by the study of Pullen (2014) who concluded that the older the respondents, the more negatively they seem to be about the flexible office concept. In addition, Volkert & Van der Voordt (2005) stated that employees aged over 50 are the least satisfied with the sharing of workplaces. As the office-population is ageing, this might lead to possible tensions in the design of future workplaces because various generations with different preferences are working together in the office-type workplace (Haynes, 2011).

### **Placement of windows**

'Placement of windows' is the least important characteristic for both categories of activities. This is remarkable as literature suggests that windows are strongly favoured in the office-type workplace because they provide access to daylight and outside view (Leather et al., 1998; Menzies & Wherrett, 2005). The desire of having a window in the workplace is an issue of emotional and psychological well-being as lack of windows leads to job dissatisfaction, feelings of isolation, depression, claustrophobia, restriction and tension (Leather et al., 1998). Another striking result is that respondents prefer a window without view when performing activities where they do not want to be disturbed. Previous studies are not conclusive regarding this result since Boyce et al. (2003) concluded that windows which provide both daylight and view can be sources of discomfort and represent a loss of privacy, while the study of Dogrusoy & Tureyen (2007) did not confirm this. It can be presumed that when users are performing activities in concentration, privacy is more important for them than the advantages of windows such as providing mental relaxation and relaxation of the eyes (Dogrusoy and Tureyen, 2007).

Regarding the various user groups, females place a higher relative importance to 'placement of windows' than males and their preferences are more pronounced. Previous research on this result is limited. A possible explanation was provided by Dogrusoy & Tureyen (2007) who found that gender is a significant variable for "improving mood", one of the psychological and morale factors in determining window preferences. Women believe windows psychologically improve their emotional states positively.

### **User participation when designing workplaces**

The study showed that it is possible to examine users' design preferences through a quantitative method of user participation. Despite, it can be presumed that a quantitative approach of user participation should not be used as a method on itself but in combination with qualitative or so-called direct involvement methods like interviews, focus groups and workshops. A quantitative method of user participation can be a useful tool to involve large numbers of users in the design process at low costs in order to quickly receive first insights regarding their design preferences. As a next step, qualitative methods can enable the designer to identify underlying reasons behind these preferences and enter the discussion how the design can contribute to users' experience.

In addition, it is interesting that so far, many studies on workplaces focussed on user satisfaction which is a post-design indicator. Might this focus on satisfaction indicates that designers are mostly interested in how their design is experienced by the users' after realisation? And if so, what is the reason for this? In the best case, designers take the learning points of these post-design evaluations with them in future projects. However, then still the question arises why there is not more interest in the scientific field for identifying workplace design preferences as this pre-design indicator can enable the designer to reduce mistakes in the design and increase users' satisfaction with the design process as well as with their realised workplace. Maybe designers are rather reluctant with involving a large number of users during the design process as they experienced it is hard to come to a univocal design which satisfy all workplace occupants. Furthermore, preferences might be at odds with what is feasible and realistic. A design is always limited to a certain available amount of space and budget. Another reason for the strong focus on satisfaction might due to the interest of the designers' client. Maybe designers do not receive the required time and budget from their client to involve users in the design process. Interesting is how user participation in the design process of the workplace will evolve in the future, will there come an end to the standardised office-type workplace, or must we accept that we cannot design an office-type workplace which met all users' workplace design preferences?

#### **5.1.3 Limitations**

As always, also this study is confronted by a number of limitations. A first limitation of this study is that the number of attributes and attribute levels included into the study had to be limited to be able to apply a full-profile conjoint analysis. Although the full-profile method is described as the method that comes close to a real-life situation since all factors are considered and evaluated at the same time, users' preferences can still differ in a non-fictional situation. Bitner (1992) stressed that users respond holistically to their environment, which means that although individuals perceive discrete stimuli, it is the total configuration of stimuli that determines their responses to the environment. Furthermore, in order to visually present the scenarios, the architectural design characteristic 'degree of openness' was fixed to the 'cellular office'. The characteristic 'controllability' of placement of windows was totally excluded from the study scope since it was not possible to present this visually.

Second, this study did not investigate whether respondent's current office-type workplace influenced their preferences. This might be important as Kapteyn et al. (1978) stated that individuals past experiences can influence users' preferences. The respondents were asked about their current situation regarding the characteristics 'number of workplaces' and 'assigned or flexible' with the aim to make them familiar with the topic and to receive insights in the use of the office-type workplace as previous research within hospitals is limited. However, the respondents were not asked about their current situation towards 'placement of windows' because it was assumed that most respondents do have a window in their current office-type workplace. As a result, when other hospitals or other respondents were included in this research, the outcomes may have differed.

## 5.2 Conclusion

This chapter presents the answers to the empirical sub-questions which together form an answer to the main research question: ***What are users design preferences regarding the architectural design features of the office-type workplace?***

### **Users' workplace design preferences**

It can be concluded that users prefer an office-type workplace with the characteristics of a closed room with 2 assigned workplaces. Their preference regarding 'placement of windows' depends on the performed type of activity. Through a full-profile conjoint experiment, users' preferences regarding the architectural design characteristics of the office-type workplace were examined for two categories of activities. The first category are activities where users do not want to be disturbed (undistributed desk work, calling, e-consultation, reading). The second category are activities where users might be disturbed, or which are performed together with colleagues (regular desk work, interactive desk work, planned meetings, unplanned meetings, archiving). When performing activities where they do not want to be disturbed, they prefer a window without view, while when performing activities where they might be disturbed, or which are performed together with colleagues, they prefer a window with view. This difference in preference might be explained by the relative importance of the design characteristic 'placement of windows'. When users perform activities where they might be disturbed, or which are performed together with colleagues, the relative importance is higher (27,2%) than when they do not want to be disturbed (24,0%). However, users' always place the lowest relative importance for this characteristic. When they do not want to be disturbed, assigned or flexible (40,0%) is the most important characteristic followed by 'number of workplaces' (35,9). This order is the same for activities where they might be disturbed, or which are performed together with colleagues: assigned or flexible (40,9%) and 'number of workplaces' (31,9%). So, the relative importance's per category of activity varied with a maximum of 4,0%.

### **Differences between various user groups**

In line with the general preferences, all user groups (males, females, <40 years, >40 years, medical functions and care managers) prefer to have a closed room with 2 assigned workplaces for both categories of activities. Again, the preferences regarding 'placement of windows' varied from a window with view, window without view and even no window. There are also differences in the characteristics' relative importance's of the various user groups. Most user groups have the following order of importance: 1) assigned or flexible, 2) number of workplaces in the room, 3) placement of windows. However, for males and users with a medical function 'number of workplaces' is more important than 'assigned or flexible' when performing activities where they might be disturbed, or which are performed together with colleagues.

### **Sample vs. control group**

As a final note, it can be concluded that the examined relative importance's and preferences of the sample and the control group are in general comparable. For both categories of activities, the control group prefers an office-type workplace with the same three characteristics as the sample. However, for the control group the characteristic 'placement of windows' is the most important when performing activities where they might be disturbed, or which are performed together with colleagues, while for the sample this is the least important characteristic. Next, there are some small differences in the preferences and how explicit they are. Consequently, the examined relative importance's and preferences of the sample can still be seen as unique. In other words, it is not conclusive yet if the examined preferences of the sample are universal for users of the office-type workplace in general.

## 6 Recommendations

The first sub-chapter presents the recommendations for EGM as architectural firm. In the second section, recommendations for further research are discussed. Since EGM also has an own R&D department, these recommendations are also valuable for them.

### 6.1 Managerial recommendations

The first advice for EGM is to take the results of this study with them in future hospital projects in order to increase users' satisfaction with the realised office-type workplace and to strengthen their position as market leader in the care industry. The results indicated that the architectural design characteristic 'assigned or flexible' is the most important for users, followed by 'number of workplaces' and lastly 'placement of windows'. Consequently, it can be concluded that the more important a design characteristic is, the more priority the designer should give to meeting users' preferences because this contribute to users' satisfaction with the realised office-type workplace.

Second, this study shows that it could be interesting for EGM to conduct pilots with a quantitative approach of user participation in their future projects. However, EGM is recommended to apply this approach in triangulation with other methods of user participation in order to enrich the retrieved information. Next, as the researcher of this study experienced some difficulties with finding hospitals and hospital staff willing to participate, it seems beneficial for this target group to combine a quantitative approach of user participation with a more direct involvement method in order to involve a larger number of users in the design process. Examples of direct involvement method are focus groups and workshops (Dewulf & Van Meel, 2002) and interviews. Another possible method is to receive insights into users' preferences with the help of the virtual reality (VR) techniques which are realistic, real time, three-dimensional computer simulations of physical objects and space (Businessdictionary, 2018). This method enables to comes closer to a real-life situation (Dijkstra et al., 2003).

### 6.2 Recommendations for further research

A first recommendation for further research is to examine users' preferences for other architectural design characteristics since some aspects were excluded from this study in order to be able to present the scenarios in a visual way. Furthermore, it might also be beneficial to examine users' preferences for the interior design features and ambient features of the office-type workplace. Despite these features are not the fixed elements of the office-type building and therefore more easily to change after realisation (Harris et al., 2002), realising these preferences in the design will contribute to user's satisfaction (Rothe et al., 2012).

Another recommendation is to conduct a similar study with users of the office-type workplace in other environments than the hospital, for example employees of companies in the trade and industry or education. By doing this, it can be investigated if the examined outcomes are universal for users of the office-type workplace or specifically holding for users within hospitals.

Third, it could be interesting for further research to include other demographic characteristics like personality (Hartog et al., 2018). Mehrabian and Russel (1974) stated that the environment, together with someone's personality, influences an individual's primary emotional response, such as thoughts and feelings (In Bitner, 1992). There are multiple methods to assess someone's personality. Well known approaches are the five-factor model, the Ten-Item personality inventory and Hofstede's cultural dimensions theory.

As a final recommendation, it is interesting for future research to explore the possibilities of applying the quantitative pre-design method of user participation as used in this study to examine users' preferences regarding other aspects of the work environment than the design features. For example, regarding the offered facilities and services like the offer in the canteen or restaurant. This information might enable the Facility Manager to contribute to users' work experience.

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# Appendices

## Appendix I: Explanation of study as send to hospitals

### Toelichting afstudeeronderzoek Chantal Pieterse

Beste meneer/mevrouw,

Mijn naam is Chantal Pieterse. Ik ben een Master studente Facility Management aan de Universiteit van Wageningen. Deze Master focust zich op de invloed van de fysieke omgeving op de gebruikers. Momenteel schrijf ik mijn afstudeerscriptie onder begeleiding van dr. Herman Kok. Ik voer mijn onderzoek uit in samenwerking met EGM architecten uit Dordrecht. Mijn onderzoek richt zich op het in kaart brengen van de **ontwerpvoorkeuren van medisch ziekenhuispersoneel voor de kantoorwerkplek**. Tot dusver is er geen tot weinig onderzoek hiernaar verricht. Dit is een gemiste kans, want wanneer deze voorkeuren bekend zijn kan hier rekening mee gehouden worden in het ontwerpproces. Het doel van het onderzoek is dus niet om de tevredenheid van de gebruikers betreffende de huidige kantoorwerkplek te onderzoeken, maar om de voorkeuren van ziekenhuispersoneel in het algemeen in kaart te brengen.

**Onder kantoorwerkplek wordt verstaan:** De omgeving waar activiteiten worden uitgevoerd zoals: bureauwerkzaamheden, telefoneren en (in)formeel overleg. Het gaat dus niet om de werkplek waar face-to-face contact met de patiënt plaats vindt of waar medische handelingen worden uitgevoerd.

**Onder medisch personeel wordt verstaan:** Arts/hoogleraar/docent, arts-assistenten (AIOS en ANIOS), en/of onderzoekers. Dit is dan ook het medisch personeel dat ik graag wil uitnodigen om mijn enquête in te vullen.

Om inzicht te krijgen in de ontwerpvoorkeuren voor de kantoorwerkplek, wil ik graag een digitale enquête uitzetten bij het medisch personeel van meerdere ziekenhuizen in Nederland in de periode van **begin juni – half juni 2018**. De invultijd van de enquête bedraagt **5 – 10 minuten**.

#### Uitleg enquête

**Deel I:** Een aantal vragen om het profiel van de respondent in kaart te brengen:

- Leeftijd, geslacht, type ziekenhuis (academisch/niet-academisch), medisch specialisme, functie, activiteitenpatroon, huidige type kantoorwerkplek.

**Deel II:** Het ranken van circa 9 ontwerpen van een kantoorwerkplek in relatie tot verschillende activiteiten. Hiermee worden zowel de voorkeuren voor verschillende elementen van de werkplek, als het belang van deze elementen in relatie tot elkaar in kaart gebracht:

- Lay-out (1 persoons, 2 personen of 4 personen)
- Mogelijkheid tot personalisatie (vaste werkplek, flexen met de eigen afdeling, geheel flexen)
- Raam (raam met uitzicht, raam zonder uitzicht, geen raam)

**Deel III:** Een aantal open vragen ter afsluiting

#### Tot slot

Ik hoop u enthousiast gemaakt te hebben voor dit onderzoek. Concluderend is mijn vraag aan u of u de link naar mijn digitale enquête wilt verspreiden onder het medisch personeel van uw ziekenhuis. De resultaten van mijn onderzoek worden natuurlijk aan u teruggekoppeld. Indien u nog vragen heeft kunt u mij bereiken via onderstaande gegevens.

Met vriendelijke groet,  
Chantal Pieterse

E-mail: [chantal.pieterse@egm.nl](mailto:chantal.pieterse@egm.nl)  
Mobiel: 06-53564925



## Appendix II: Survey invitation respondents

Chantal Pieterse, studente Facility Management aan Wageningen University & Research, voert momenteel in het kader van haar Master een onderzoek uit naar de **voorkeuren van medisch personeel voor het ontwerp van de kantoorwerkplek**. Om deze voorkeuren op te halen, wil zij u graag vragen om een digitale enquête in te vullen van ongeveer 5 tot 10 minuten. De resultaten worden alleen gebruikt voor dit onderzoek en uw antwoorden blijven anoniem.

Uw bijdrage is erg waardevol omdat er tot dusver weinig onderzoek naar de ontwerpvoorkeuren voor de kantoorwerkplek in ziekenhuizen is verricht. Wanneer deze voorkeuren bekend zijn, kunnen deze worden meegenomen in de toekomstige bouw/renovatie van ziekenhuizen. Het doel van het onderzoek is niet om de tevredenheid van de gebruikers betreffende de huidige kantoorwerkplek te onderzoeken, maar om de voorkeuren van ziekenhuispersoneel in het algemeen in kaart te brengen. Deze enquête is dan ook uitgezet bij meerdere ziekenhuizen in Nederland.

**De enquête kan worden ingevuld door mensen met de volgende functies:** specialist, hoogleraar, docent, art-assistenten, onderzoekers, leidinggevende zorg en/of medewerker secretariaat.

Link naar de enquête: [https://wur.az1.qualtrics.com/jfe/form/SV\\_9MjnQKdAI91kl37](https://wur.az1.qualtrics.com/jfe/form/SV_9MjnQKdAI91kl37)

De enquête kan t/m woensdag 20 juni worden ingevuld.

Namens Chantal alvast bedankt voor uw deelname aan dit onderzoek!

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### ENGLISH:

Chantal Pieterse, student of the Master Facility Management at Wageningen University & Research, is currently performing a research with the aim to examine employees' preferences for the design of the office-type workplace. To gain insights into these preferences, she would like to ask you to fill in a digital survey which takes approximately 5-10 minutes. The results will only be used for this study and your answers remain anonymous.

Your participation is very meaningful since less research has been conducted so far regarding these design preferences. When the preferences are known, these can be used in the (re)design process of hospitals. Thus, the purpose of the study is not to investigate users' satisfaction regarding the current office-type workplace, but to examine the preferences of hospital employees in general. Therefore, this survey has been sent to multiple hospitals in the Netherlands.

**The survey can be filled in by people with the following functions:** specialist, professor, teacher, AIO's, AINO's (residents), researchers, care manager and/or secretary.

Link to the survey: [https://wur.az1.qualtrics.com/jfe/form/SV\\_9MjnQKdAI91kl37](https://wur.az1.qualtrics.com/jfe/form/SV_9MjnQKdAI91kl37)

When you open the survey, you can choose English as a language option in the upper right corner.

The survey can be filled in until Wednesday, June the 20<sup>th</sup>.

On behalf of Chantal, thank you in advance for your participation to this study!

## Appendix III: Scenarios orthogonal design

	Number of workplaces in the room	Assigned or not	Placement of window
<b>1</b>	4 workplaces	Share workplaces with whole floor/building	Window with view
<b>2</b>	1 workplace	Share workplaces with own department	No window
<b>3</b>	4 workplaces	Assigned workplace	No window
<b>4</b>	1 workplace	Share workplaces with whole floor/building	Window without view
<b>5</b>	2 workplaces	Share workplaces with whole floor/building	No window
<b>6</b>	4 workplaces	Share workplaces with own department	Window without view
<b>7</b>	2 workplaces	Share workplaces with own department	Window with view
<b>8</b>	2 workplaces	Assigned workplace	Window without view
<b>9</b>	1 workplace	Assigned workplace	Window with view

Table 13: Scenarios orthogonal design

## Appendix IV: E-mail survey



Nederlands

Beste meneer/mevrouw,

Met het invullen van deze enquête draagt u bij aan het behalen van mijn Master Facility Management aan Wageningen University & Research.

Het doel van dit onderzoek is om de voorkeuren van medisch personeel betreffende het ontwerp van de kantoorwerkplek in kaart te brengen. Uw bijdrage is erg waardevol omdat er tot dusver weinig onderzoek hiernaar verricht is. Wanneer deze voorkeuren bekend zijn, kunnen deze worden meegenomen in de toekomstige bouw/renovatie van ziekenhuizen.

Het invullen van de enquête duurt ongeveer 5-10 minuten. De resultaten worden alleen gebruikt voor dit onderzoek en uw antwoorden blijven anoniem.

Mocht u nog vragen of opmerkingen hebben over het onderzoek, dan kunt u contact met mij opnemen via [chantal.pieterse@wur.nl](mailto:chantal.pieterse@wur.nl)

Hartelijk bedankt voor de genomen tijd en moeite, ik stel dit zeer op prijs!

Met vriendelijke groet,  
Chantal Pieterse

0%  100%



Nederlands

### Deel 1 - Huidige kantoorwerkplek

Het eerste deel van de vragenlijst bestaat uit 5 vragen over het gebruik van uw huidige kantoorwerkplek.

#### Onder kantoorwerkplek wordt verstaan:

De omgeving waar de volgende activiteiten worden uitgevoerd: bureauwerkzaamheden, telefoneren, e-consults, (on)gepland overleg met collega's en archiveren. Het gaat dus niet om de werkplek waar face-to-face contact met de patiënt plaatsvindt of waar medische handelingen worden uitgevoerd.

0%  100%



Welk van de onderstaande type werkplekken komt het meest overeen met de kantoorwerkplek waar u momenteel het meest werkzaam bent?

- ☐ Gesloten ruimte met 1 werkplek
- ☐ Gesloten ruimte met 2 of 3 werkplekken
- ☐ Gesloten ruimte met 4 werkplekken
- ☐ Open ruimte met minder dan 4 werkplekken
- ☐ Open ruimte met 4 tot 10 werkplekken
- ☐ Open ruimte met meer dan 10 werkplekken
- ☐ Ik heb geen aparte kantoorwerkplek. Ik maak gebruik van een spreek/onderzoekskamer
- ☐ Anders

0%  100%



Heeft u een vaste of flexibele kantoorwerkplek?

*Als u bij de vorige vraag 'spreek/onderzoekskamer' heeft ingevuld, kunt u deze vraag m.b.t. de spreek/onderzoekskamer beantwoorden.*

- ☐ Ik heb een vaste kantoorwerkplek
- ☐ Ik heb geen vaste kantoorwerkplek, ik heb een flexibele kantoorwerkplek welke ik deel met collega's van mijn eigen afdeling
- ☐ Ik heb geen vaste kantoorwerkplek, de kantoorwerkplek is volledig flexibel

Beschikt u over de mogelijkheid om naast de reguliere kantoorwerkplek gebruik te maken van een concentratieruimte en/of overleg ruimte? Er zijn meerdere antwoorden mogelijk.

- ☐ Ja, ik kan gebruik maken van een concentratieruimte
- ☐ Ja, ik kan gebruik maken van een overleg ruimte
- ☐ Nee, ik beschik niet over de mogelijkheid om gebruik te maken van een concentratieruimte en overleg ruimte

0%  100%





Hoeveel uur per week brengt u gemiddeld door op een kantoorwerkplek?

Van de uren die u wekelijks doorbrengt op de kantoorwerkplek, hoeveel % van de tijd spendeert u gemiddeld aan de volgende activiteiten?

Er is onderscheid gemaakt in twee typen activiteiten:

**1. Activiteiten waarbij u niet gestoord wilt worden:**

Ongestoord bureauwerk (geconcentreerd), telefoneren, e-consults, lezen (langer dan 30 min. aaneengesloten)

**2. Activiteiten waarbij u gestoord mag worden, of waarbij u samenwerkt met collega's:**

Algemeen bureauwerk (routinematig), interactief bureauwerk (interactie/samenwerking met collega's), gepland overleg met collega's, ongepland overleg met collega's, archiveren

De percentages moeten samen op 100% uitkomen

Ongestoord bureauwerk (geconcentreerd)	<input type="text" value="0"/> %
Telefoneren	<input type="text" value="0"/> %
E-consults	<input type="text" value="0"/> %
Lezen (langer dan 30 min. aaneengesloten)	<input type="text" value="0"/> %
Algemeen bureauwerk (routinematig)	<input type="text" value="0"/> %
Interactief bureauwerk (interactie/samenwerking met collega's)	<input type="text" value="0"/> %
Gepland overleg met collega's	<input type="text" value="0"/> %
Ongepland overleg met collega's	<input type="text" value="0"/> %
Archiveren	<input type="text" value="0"/> %
Overig	<input type="text" value="0"/> %
<b>Totaal</b>	<input type="text" value="0"/> %

0%  100%



## Deel 2 - Voorkeur voor kantoorwerkplek

Het volgende onderdeel bestaat uit 2 vragen. U wordt gevraagd om verschillende ontwerpen van de kantoorwerkplek te rangschikken op basis van uw persoonlijke voorkeur in relatie tot twee typen activiteiten.

De 2 categorieën van activiteiten zijn:

- Activiteiten waarbij u niet gestoord wilt worden
- Activiteiten waarbij u gestoord mag worden of waarbij u samenwerkt met collega's

Elk plaatje van een ontwerp laat een combinatie zien van een van de volgende opties:

- **Layout:** gesloten ruimte met 1 werkplek, gesloten ruimte met 2 werkplekken of gesloten ruimte met 4 werkplekken
- **Mate van personalisatie:** vaste werkplek, flexen binnen de eigen afdeling of geheel flexen
- **Raam:** raam met uitzicht, raam zonder uitzicht of geen raam

0%  100%



### 1: Activiteiten waarbij u niet gestoord wilt worden

Rangschik de volgende kantoorwerkplekken van 1 t/m 9 op basis van uw persoonlijke voorkeur voor de activiteiten waarbij u niet gestoord wilt worden (ongestoord bureauwerk, telefoneren, e-consults, lezen)

#### Uitleg

1 = Mijn voorkeur gaat het meeste uit naar deze kantoorwerkplek

9 = Mijn voorkeur gaat het minste uit naar deze kantoorwerkplek

*U kunt het plaatje vergroten door erop te klikken.*

☐ 4 persoons kamer, geheel flexen,  
raam met uitzicht



☐ 1 persoons kamer, flexen afdeling,  
geen raam



☐ 4 persoons kamer, vaste werkplek,  
geen raam



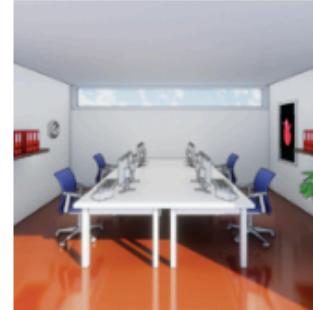
☐ 1 persoons kamer, geheel flexen,  
raam zonder uitzicht



☐ 2 persoons kamer, geheel flexen,  
geen raam



☐ 4 persoons kamer, flexen afdeling,  
raam zonder uitzicht



☐ 2 persoons kamer, flexen afdeling,  
raam met uitzicht



☐ 2 persoons kamer, vaste werkplek,  
raam zonder uitzicht



☐ 1 persoons kamer, vaste werkplek,  
raam met uitzicht



0%  100%

## 2: Activiteiten waarbij u gestoord mag worden of waarbij u samenwerkt met collega's

Rangschik de volgende kantoorwerkplekken van 1 t/m 9 op basis van uw persoonlijke voorkeur voor activiteiten waarbij u gestoord mag worden of waar u samenwerkt met collega's (algemeen bureauwerk, interactief bureauwerk, ongepland overleg met collega's, archiveren).

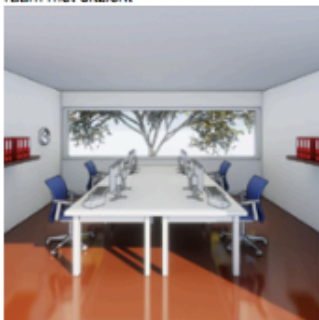
*De activiteit 'gepland overleg met collega's' is niet meegenomen in deze vraag omdat deze activiteit vaak plaatsvindt in een aparte vergaderruimte.*

### Uitleg

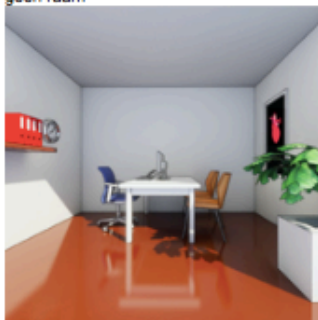
1 = Mijn voorkeur gaat het meeste uit naar deze kantoorwerkplek

9 = Mijn voorkeur gaat het minste uit naar deze kantoorwerkplek

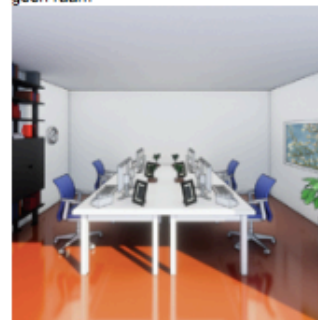
☐ 4 persoons kamer, geheel flexen, raam met uitzicht



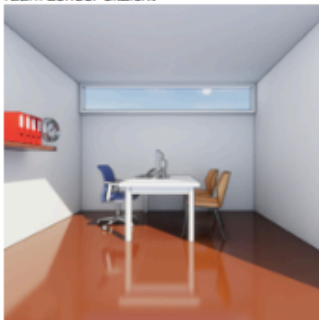
☐ 1 persoons kamer, flexen afdeling, geen raam



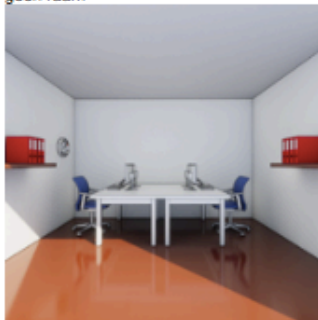
☐ 4 persoons kamer, vaste werkplek, geen raam



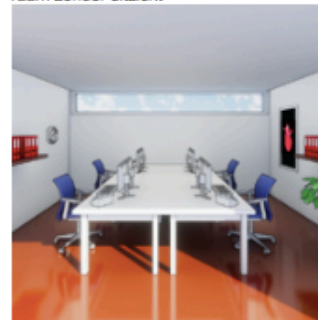
☐ 1 persoons kamer, geheel flexen, raam zonder uitzicht



☐ 2 persoons kamer, geheel flexen, geen raam



☐ 4 persoons kamer, flexen afdeling, raam zonder uitzicht



☐ 2 persoons kamer, flexen afdeling, raam met uitzicht



☐ 2 persoons kamer, vaste werkplek, raam zonder uitzicht



☐ 1 persoons kamer, vaste werkplek, raam met uitzicht



0%  100%

### Deel 3 - Algemene vragen

Om meer inzicht te krijgen in uw persoonlijke profiel, volgen hierna 5 algemene vragen.

Wat is uw geslacht?

- ☐ Man
- ☐ Vrouw
- ☐ Anders

Wat is uw leeftijd?

- ☐ Jonger dan 30 jaar
- ☐ 30- 39 jaar
- ☐ 40- 49 jaar
- ☐ 50-59 jaar
- ☐ 60 jaar of ouder

0%  100%



In welk ziekenhuis bent u werkzaam?

Binnen welk medisch specialisme bent u werkzaam? Als dit meerdere specialismen zijn, benoem deze dan allemaal.

Wat is uw functie? Er zijn meerdere antwoorden mogelijk.

- ☐ Specialist
- ☐ Hoogleraar
- ☐ Docent
- ☐ AIOS
- ☐ ANIOS
- ☐ Onderzoeker
- ☐ Leidinggevende zorg
- ☐ Medewerker secretariaat
- ☐ Anders, namelijk:

0%  100%



Bedankt voor het invullen van de vragenlijst!

Uw antwoord is verzonden.

Vriendelijke groet,  
Chantal Pieterse

0%  100%

## Appendix V: Activity pattern per function

	Specialist	Teacher	AIOS	ANIOS	Researcher	Supervisor Care	Secretary Care	Other
<b>Category 1</b>								
Undisturbed desk work	25,2%	70,0%	16,7%	18,3%	42,5%	15,4%	16,1%	13,9%
Calling	14,5%	5,0%	5,8%	10,0%	3,0%	8,8%	20,4%	20,8%
E-consultation	2,9%	5,0%	0,8%	0,8%	0,0%	4,0%	1,6%	4,3%
Reading	3,1%	0,0%	7,5%	0,8%	10,0%	6,4%	2,2%	2,7%
	<b>45,8%</b>	<b>80,0%</b>	<b>30,8%</b>	<b>30,0%</b>	<b>55,5%</b>	<b>34,6%</b>	<b>40,3%</b>	<b>41,6%</b>
<b>Category 2</b>								
Regular desk work	14,8%	0,0%	12,5%	30,8%	12,5%	17,0%	32,2%	33,1%
Interactive desk work	7,1%	0,0%	5,0%	10,0%	12,0%	10,4%	9,3%	6,3%
Planned meetings	11,9%	10,0%	21,7%	16,7%	7,5%	17,2%	4,0%	4,6%
Unplanned meetings	11,2%	10,0%	12,5%	8,3%	7,5%	13,6%	6,8%	5,4%
Archiving	2,5%	0,0%	10,8%	0,0%	5,0%	2,9%	1,9%	3,3%
	<b>47,5%</b>	<b>20,0%</b>	<b>62,5%</b>	<b>65,8%</b>	<b>44,5%</b>	<b>61,1%</b>	<b>54,2%</b>	<b>52,6%</b>
<b>Other</b>	<b>6,8%</b>	<b>0,0%</b>	<b>6,7%</b>	<b>4,2%</b>	<b>0,0%</b>	<b>4,4%</b>	<b>5,5%</b>	<b>5,8%</b>
<b>Total</b>	<b>100,0%</b>	<b>100,0%</b>	<b>100,0%</b>	<b>100,0%</b>	<b>100,0%</b>	<b>100,0%</b>	<b>100,0%</b>	<b>100,0%</b>

## Appendix VI: Results control group

### Descriptives

#### Demographic characteristics

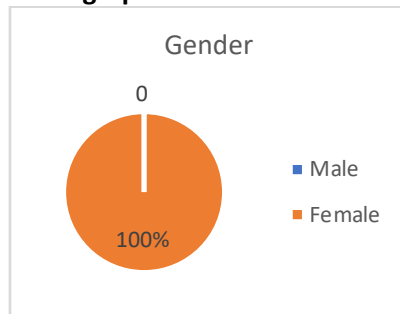


Figure 19: Gender control group

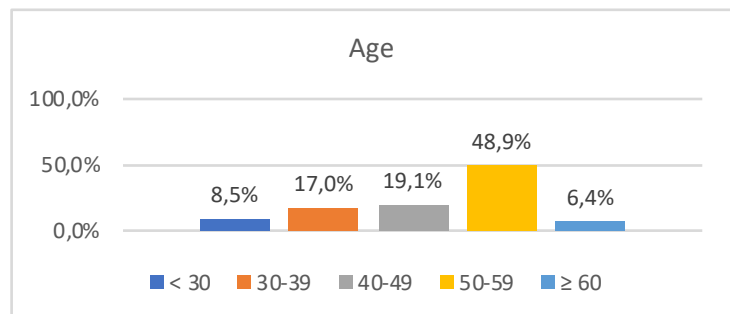


Figure 20: Age of control group

#### Current office-type workplace

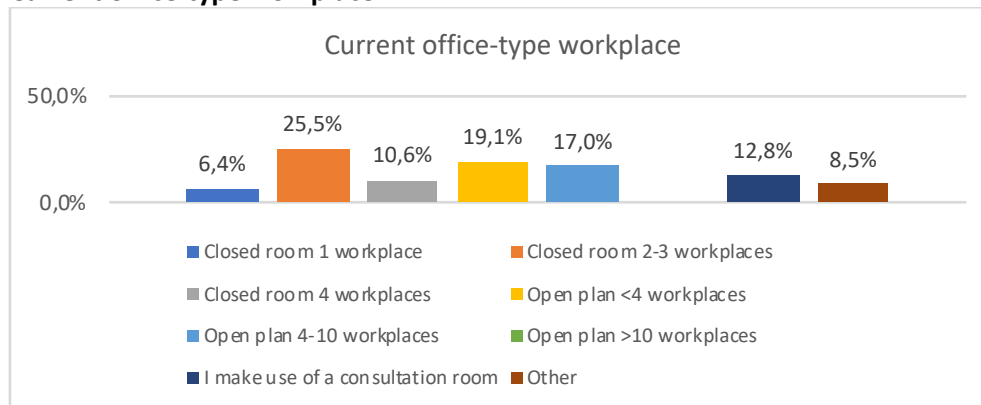


Figure 21: Current office-type workplace (control group)

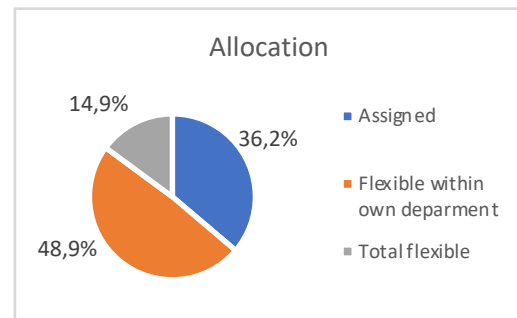


Figure 22: Assigned or not (control group))

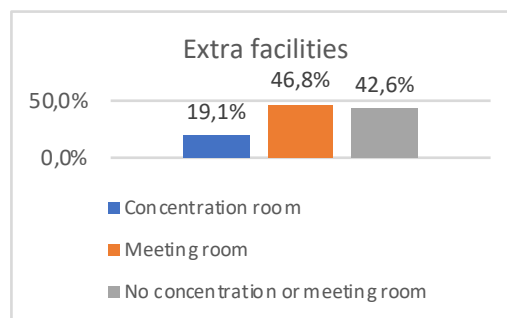


Figure 23: Extra facilities (control group)

#### Activity pattern

The respondents spend on average 18,57 hours per week at an office-type workplace. The minimum hours spend per week at the office-type workplace is 1 and the maximum 40.

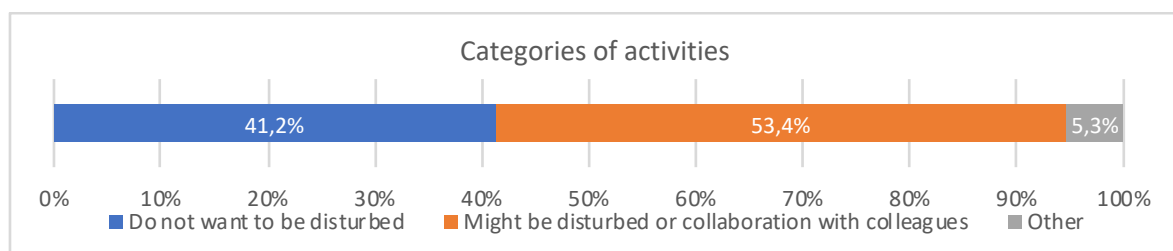


Figure 24: Distribution categories of activities (control group)



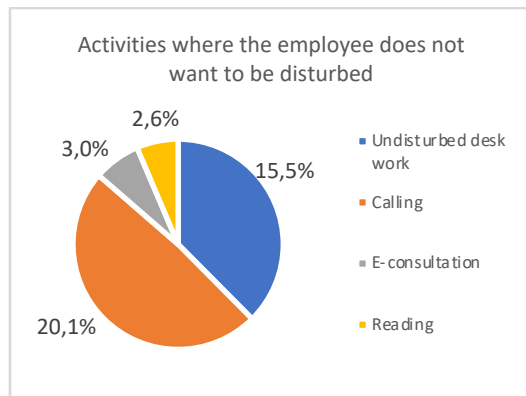


Figure 25: Breakdown of activities category 1 (control group)

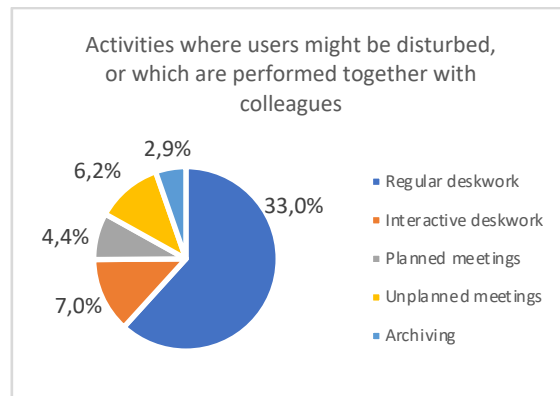


Figure 26: Breakdown of activities category 2 (control group)

### Architectural design preferences

Relative importance design features (%)	Activity 1: do not want to be disturbed	Activity 2: might be disturbed or performed together with colleagues
<b>Number of workplaces</b>	33,4	32,6
<b>Assigned or flexible</b>	36,3	30,8
<b>Placement of windows</b>	30,3	36,6

Table 14: Relative importance architectural design characteristics for control group

### Preferences for activities where users do not want to be disturbed

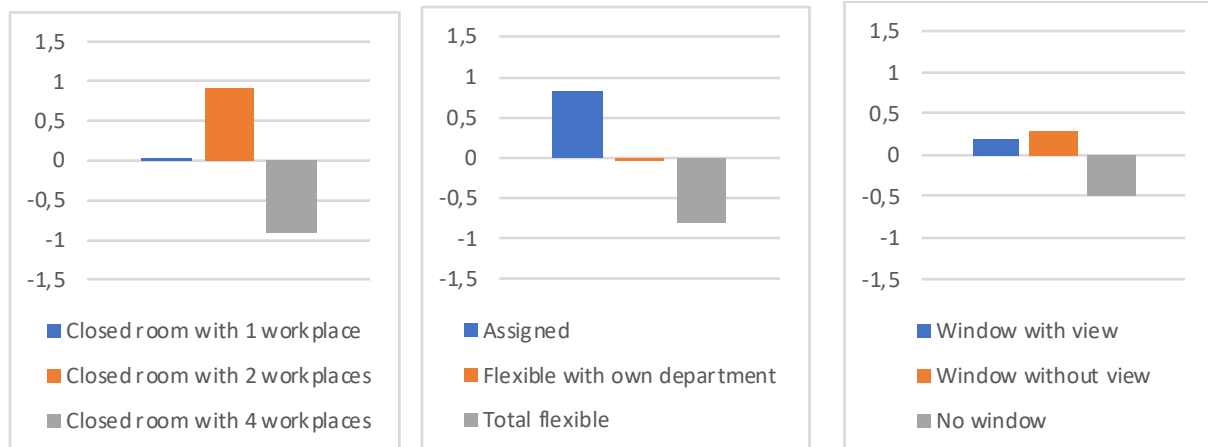


Figure 27a: Utility values per architectural design characteristic (control group)

### Preferences for activities where users might be disturbed, or which are performed together with colleagues

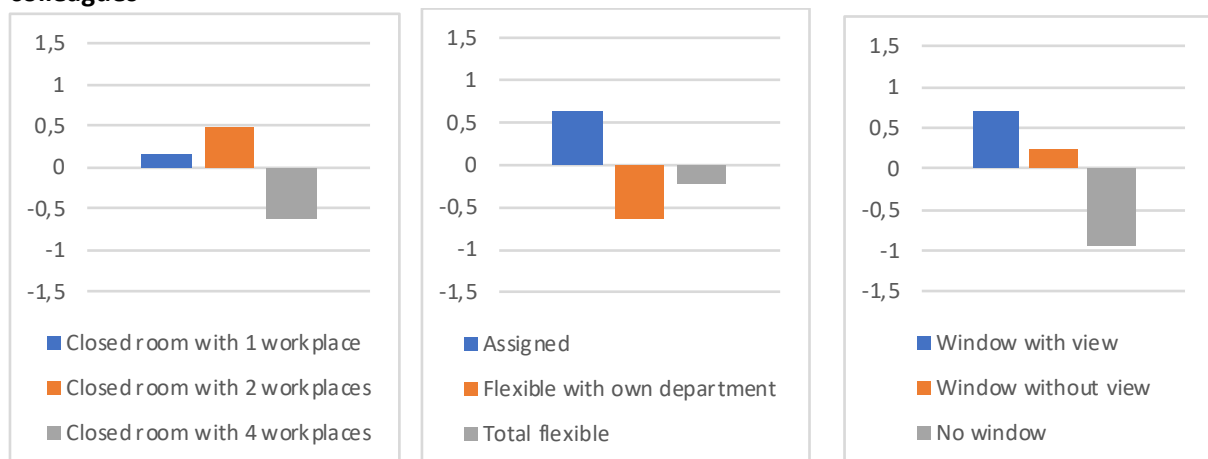


Figure 27b: Utility values per architectural design characteristic (control group)

## Preference per user group – age

<40 years	N=12
>40 years	N=35

Table 15: User groups of control group based on age

Relative importance design characteristics (%)	Activity 1		Activity 2	
	<40 years	>40 years	<40 years	>40 years
Number of workplaces	34,9	32,9	35,5	31,6
Assigned or flexible	28,0	39,1	33,1	30,1
Placement of windows	37,1	28,0	31,4	38,4

Table 16: Relative importance architectural design characteristics per age for control group

### Activities where users do not want to be disturbed

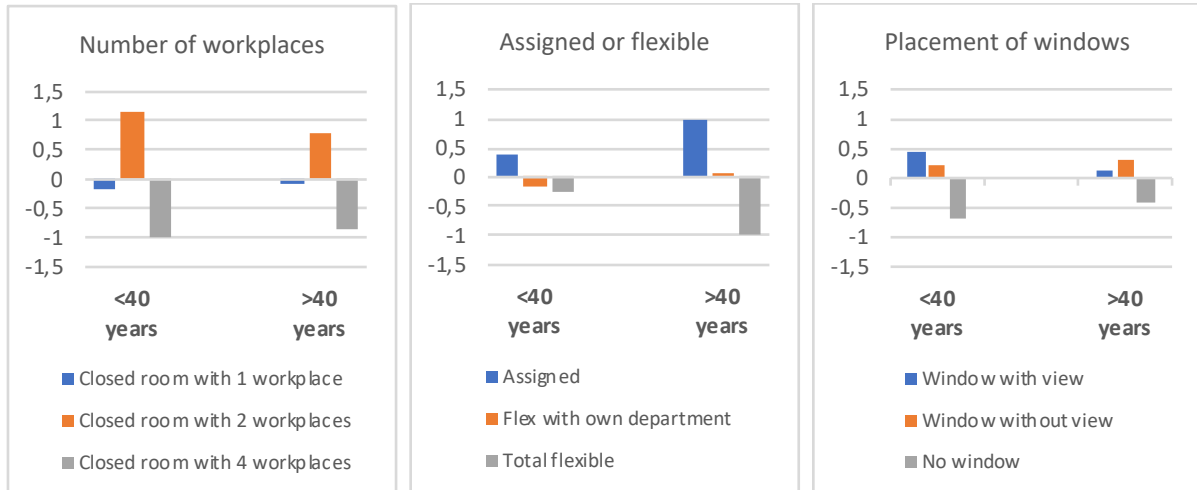


Figure 28a: Utility values per architectural design characteristic for age

### Activities where users might be disturbed, or which are performed together with colleagues

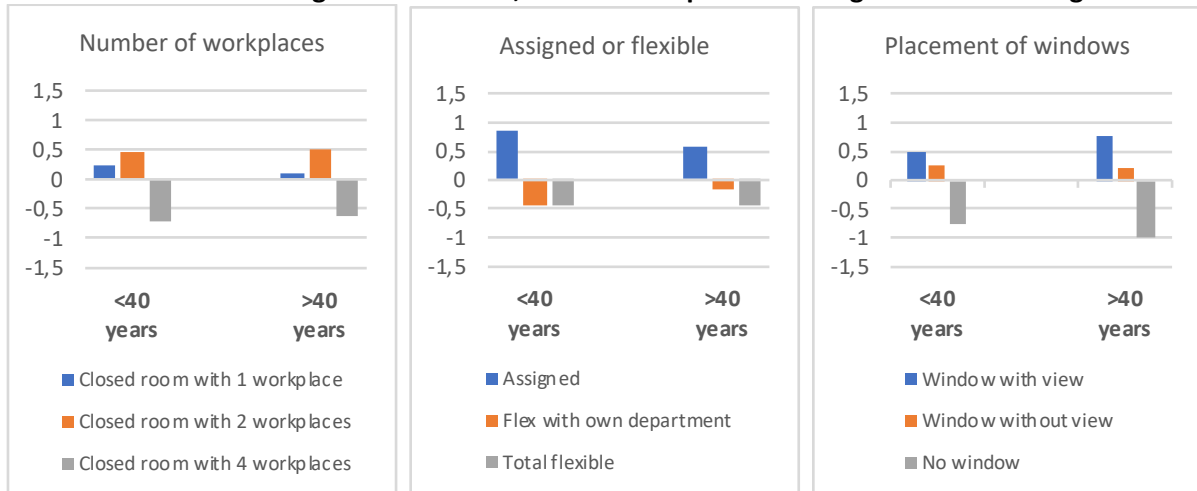


Figure 28b: Utility values per architectural design characteristic for age