

MASTER

Behaviour in conflict scenarios in a smart office environment

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**Behaviour in conflict scenarios in a smart
office environment**

by Dingding Martin

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in partial fulfilment of the requirements for the degree of

**Master of Science
in Human-Technology Interaction**

Supervisors:

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i. Abstract

Smart office buildings are environments that have a high level of shared control and conflicts are likely to occur between colleagues. There are indications that the type of relationship between colleagues and the type of user interface to interact with the smart building influence the conflict management strategy of people.

A factorial survey was used to investigate the conflict management behaviour of employees using scenarios that simulate a conflict with colleagues. Three aspects were manipulated, namely office type, interface type and conflict type. Also, interviews were conducted amongst employees of a smart university building that was only recently occupied.

Regression analyses were performed and small significant effects were found for interface type and conflict type when the model only included the three manipulated variables. However, these effects disappeared when traits of conflict management were added.

Even though the quantitative data was not conclusive, it showed that there were small effects from the manipulated variables. Furthermore, qualitative data gave valuable insights in the importance of context and details when using scenarios. Although small, the effects from office type, interface type and conflict type are present and offer new directions that further research can look into.

ii. Acknowledgements

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1. Behaviour in conflict scenarios in a smart office environment

Smart buildings are a promising technology, envisioned to save time, energy and money. An example of a feature of a smart building could be smart parking, which means that the gate automatically opens when your car approaches by recognising the license plate and guides you to a reserved parking spot. Usually, smart buildings employ an open-plan layout for the office of their employees. An open-plan office has hardly any separate offices with walls and doors but consists of many desks grouped together in one large space. Also, desks are not individually owned, rather they are shared amongst everyone and assigned on a first-come, first-serve basis (Hedge, 1982).

Along with open-plan offices, a flexible mindset is advocated and sharing the new norm. In an open-plan office a group of people are in control of, for instance lights or blinds, compared to an individual office where only the occupied employees were in control. Therefore, as the amount of controllable aspects and users in control increases, so does the chance of conflicts (Niemantsverdriet, 2018). Imagine that you are sitting at a flex desk and working on your laptop, when your colleague opens the window for some fresh air. However, this causes a slight draft and you are already feeling a little bit under the weather. This example is already a conflict and there are several ways to manage conflicts.

De Dreu, Evers, Beersma, Kluwer and Nauta. (2001) created a conflict resolution management model based on Dual Concern Theory from Blake and Mouton (1964) and Deutsch's Theory of Cooperation and Competition (Deutsch, 1973). In this model from De Dreu et al. (2001), there are two variables that influence the conflict resolution strategy, namely concern for self and concern for others. Concern for self indicates how

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important someone finds his or her own needs, when deciding how to manage the conflict. Concern for others indicates how important the needs of the other person(s) are, when deciding how to manage conflict. There are two aspects that will be investigated in this thesis, since there are indications that they influence the decision which resolution strategy to employ (Niemantsverdriet, 2018; Van der Werff, Essen, & Eggen, 2018; Laursen, Finkelstein, & Betts 2001). The first aspect is the relationship between the people involved in the conflict. The second aspect is the type of interface to control the features of the smart building.

Regarding the relationship between people, Niemantsverdriet (2018), Van der Werff et al. (2018) and Laursen et al. (2001) found that people were more reluctant to engage in conflict when there was no relationship between those people. Niemantsverdriet (2018) and Van der Werff et al. (2018) found that, for instance, when people were sharing an office they felt more at ease to make adjustments and expected understanding from the other people. In addition, they perceived less risk of making false adjustments and the interaction of making an adjustment was easier, since tastes and needs of others were readily available. Nevertheless, when people were sitting at a flex desk, they felt more estranged from their colleagues and were reluctant to make adjustments. This was partly due to the fear of disturbing the other people and resulted in no adjustments being made at all as preferred resolution strategy.

Regarding the interface, Niemantsverdriet (2018) found early indications that the type of interface might influence the resolution strategy. She found that when people used a private interface, for example their own smartphone, they were mostly focused on their own needs when making adjustments to the light. In addition, the concern for colleagues

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was low. Contrary, when people were using a shared interface, for example a communal tablet, they were aware of the presence and needs of their colleagues and were considering those needs when making adjustments. Also, it was common courtesy to ask permission to make adjustments before taking action. To summarise, it seems that the type of interface influences the behaviour of people, especially which conflict management strategy to employ. Also, it was mentioned before that shared control environments are more prone to conflicts. As such, this thesis has the following research question:

What is the influence of different types of interface on conflict resolution management strategies of employees in a smart building with shared control?

The theoretical background and accompanying hypotheses are discussed in section 2. The method and design of the experiment are described in section 3. Next, section 4 describes the data analysis and results. Section 5 discusses the findings and last, in section 6 conclusions will be drawn.

2. Theoretical background

In this section, previous studies are discussed in more detail and the resulting hypotheses are presented. First, smart buildings and open-plan offices are explained in more detail in subsection 2.1. Second, conflict management and resolution strategies are discussed in subsection 2.2. Third, shared control in smart lighting systems is presented in subsection 2.3. Last, in subsection 2.4 the hypotheses are formulated.

2.1 Smart buildings

First, the concept smart buildings will be explained in more detail. Wong, Li and Wang (2005) performed an extensive literature review which resulted in over 30 definitions of smart buildings. Two examples of definitions of a smart building are by Cardin (1983), “buildings which have fully automated building service control systems” (Wigginton, & Harris, 2013, p.172) and by the Intelligent Buildings Institution Washington, “intelligent office buildings provide for unique and changing assemblies of recent technologies in appropriate physical, environmental and organizational settings, to enhance worker speed, understanding, communication and overall productivity” (Wigginton, & Harris, 2013, p.172). As can be seen in these examples, most definitions focus on technical features such as communication protocol, building performance and maintenance. Smart buildings are usually aimed at optimising or improving processes or overall management, which can be related to a wide range of concepts, for example electricity use of a building, elevator maintenance or cleaning schedules. As the technology grew more advanced, concepts as “learning ability” and “performance adjustment” were added which indicate increased intelligence of the building. For instance, a building could “learn” that you like the room at 20 degrees Celsius and ensure the temperature will be to your preference in your office. However, equally or even more important are the users in a building, which are less present in most definitions. User satisfaction or stress levels are examples of aspects that are important to consider when examining a smart building from the perspective of the user. Their experience is valuable, since they will occupy the buildings and this in turn can influence their well-being, satisfaction and performance.

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One example of a phenomenon where user experience is pushed to the background and negatively impacts the user is the concept of open-plan offices (Hedge, 1982). As mentioned before, open-plan offices are open floors where desks are grouped together and walls and doors are absent. Most smart buildings consist of an open-plan office layout and many regular offices are implementing open-plan offices in some way. Although open-plan offices are meant to stimulate interaction between colleagues and increase knowledge sharing, there are several studies that show various negative effects and even a decrease in interaction (Danielsson, & Bodin, 2009; Leder, Newsham, Veitch, Mancini, & Charles, 2016; Sundstrom, Town, Rice, Osborn, & Brill, 1994; Van Der Voordt, 2004). Noise complaints and lack of privacy are main factors of higher employee dissatisfaction, lower attention span, increased stress and lower productivity. Nevertheless, open-plan offices continue to become the new office norm, even though studies clearly show negative effects for users. The costs associated with these negative aspects can be quantified, using the 3-30-300 rule which is widely known among real-estate professionals (Pelino, Hewitt, Voce, Maxim, & Garberg, 2018). This 3-30-300 rule shows what a company roughly spends per square foot (around 1/10 of a square meter) for utilities (3 euros), rent (30 euros) and employee costs (300 euros), respectively. Converting this to a European example, it shows that the costs for employees for one square meter is $300 \times 10 = 3000$ euros. Thus, although a cut in energy bills or rent is desirable, the real savings are acquired when reducing employee costs or at least not increasing them. As such, although open-plan offices are widely implemented with savings for the employer in mind, the net savings are much lower because of increased employee costs due to the negative effects. Therefore, this example shows how vital the

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user is in research since open-plan offices are a concept that actually has a negative impact on the user. It is important that smart buildings will positively impact the user instead of negatively. Hence, this study of smart buildings will focus more on the user and less on the technical features.

2.2 Conflict management

This section focuses on the accompanying increase of potential conflicts and how conflicts can be managed in different ways. Hooftman et al. (2017) performed a national survey in the Netherlands, regarding workplace conditions up to twelve months prior to the survey. From 42,000 respondents 32% indicated that they experienced a short or long term conflict with colleagues, supervisors and/or employers. In total, 20.1% reported a short term conflict with one or more colleagues, which is the type of conflict this thesis focuses on. A Finnish study found that 50% of respondents had been in workplace conflicts with co-workers (Appelberg, 1996). A more recent national survey in Sweden found that in twelve months prior to the survey, 32% of the workforce had a conflict with co-workers (Work Environment Statistics, 2012). To conclude, conflicts seem to occur to at least one third of the employees and thus, are quite common in the office. Open-plan offices and flex desks present even more opportunities for conflicts to arise, especially in a smart building (Niemantsverdriet, 2018). There are three reasons why this is the case for smart buildings.

Firstly, shared control is increased. In a conventional office, the office is shared with only a few colleagues and only these colleagues have a say in deciding whether the lights should be on or off or if the window should be opened. However, in an open-plan

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office it is possible that the floor is shared with tens or hundreds of colleagues, which “share” the floor and thus, all have a say in these matters and an opinion.

Secondly, the actually added possibility to customise the work environment increases the potential of conflicts, since conventional offices do not allow employees to change, for instance, the lights except for turning them on or off for the whole floor.

Thirdly, the differences in preferences for settings like the temperature are a cause for more potential conflicts. Imagine you are sitting in the office and you are cold, but your co-worker just mentioned that she thinks it’s warm and changes the temperature to a lower setting. Although these seem insignificant examples that can hardly be called a conflict, it is precisely these kinds of situations that are prone to arise and more the number than the topic of conflict can be problematic. In short, more the quantity than the intensity of the conflicts seems to be the main problem and source of stress.

Even though some research has speculated that conflicts may have positive effects, most studies support the finding that conflicts have a negative impact overall. Conflicts are prone to lead to higher stress levels, lower satisfaction, lower productivity and more absenteeism or decrease of overall health (Danielsson, Bodin, Wulff, & Theorell, 2015; Gladstein, 1984; Leder et al., 2016; Sundstrom et al., 1994; Van Der Voordt, 2004; Wall, & Nolan, 1986). There are several strategies that can be employed looking at the model (see Figure 1) from De Dreu et al. (2001), which is based on Dual Concern theory from Blake and Mouton (1964) and Deutsch’s Theory of Cooperation and Competition (Deutsch, 1973).

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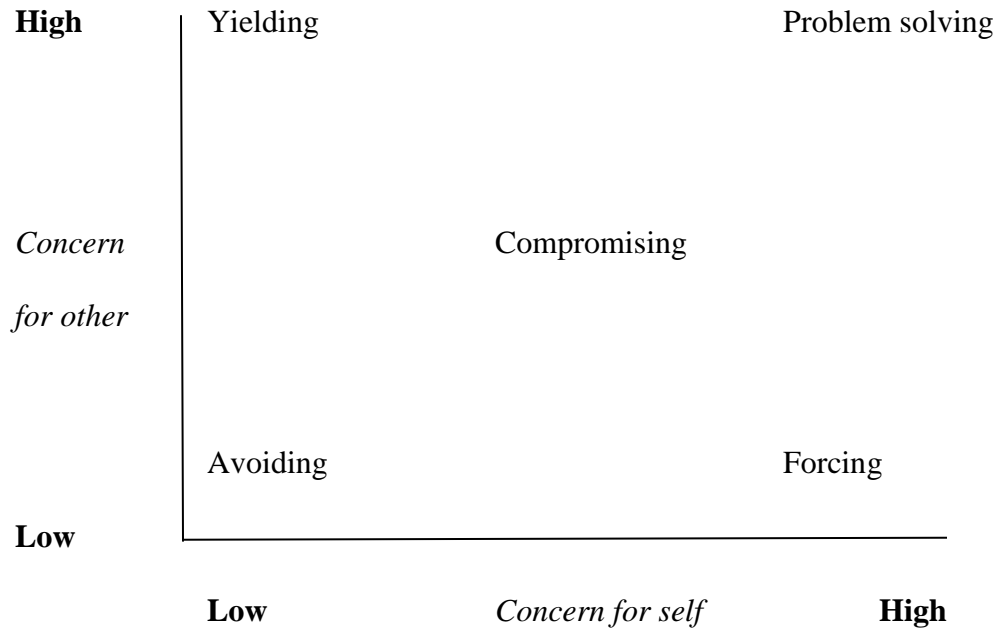


Figure 1: Theoretical representation of five resolution management strategies (De Dreu et al. (2001))

Conflict management strategies can be high or low in two aspects, namely *concern for self* and *concern for other*. If the concern for self is high, then the person finds their own needs important when deciding how to handle the conflict and vice versa for low concern for self. If the concern for the other is high, then the needs of the other party are important when resolving the conflict and vice versa. The concern for self and other are not additive, meaning that concern for self and other can both be high at the same time for one resolution strategy. In total, De Dreu et al. (2001) distinguish five resolution strategies, namely problem solving, compromising, yielding, forcing and avoiding. First, *problem solving* is the strategy where both parties attempt to find an optimal solution for everyone involved, meaning there is high concern for self and the other party. Second, *compromising* is the strategy where both parties gain their wish but also have to give in to

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the wish of the other. As such, this is not an optimal solution and the effort to reach a solution is also lower, compared to problem solving. This strategy is neither high nor low in concern for self and concern for other. Third, *yielding* means the person gives in to the wishes of the other person, where the concern for self is low and the concern for the other high. Fourth, *forcing* means someone gets their wishes satisfied while the other party does not. Here, concern for self is high and concern for the other low. Last, *avoiding* means there is no engagement with the other party and engagement with the other party is completely avoided. Both the concern for self and the other are low in this case. As mentioned before, there is speculation that a positive effect might be gained by type of conflict resolution (Hyde, Jappinen, Theorell, & Oxenstierna, 2006). If the conflict is resolved through an open discussion, then the negative effects are lower. Conflicts that are resolved through discussion have fewest negative effects, which is close to problem solving. The other types of strategies, for example forcing or avoiding, all have negative effects and very little to no differences. Therefore, it seems that the overall effect of conflicts remains negative.

An aspect that could have an influence on which type of resolution strategy is employed is the relationship between both parties. Both Niemantsverdriet (2018) and Van der Werff et al. (2018) found that if people were sharing an office with only a few colleagues, their behaviour was significantly different compared to an open-plan office. The closer relationship in a shared office resulted in higher expectations of others. Some aspects were a higher tolerance and understanding for errors from direct colleagues when making adjustments to the system, an increased knowledge of preference for lighting that the other colleagues have and a lower barrier for starting interactions when making

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adjustments. These factors ensured that overall management of conflicts went rather smoothly and that the needs of colleagues were taken into account, but it was also expected that their own needs were taken into account as well. Contrary, in an open-plan office setting conflict and interaction in general were mostly avoided. Two potential reasons were the fear of disturbing colleagues and the effort needed to engage in interaction when making adjustments to the system.

Another interesting study is the extensive meta-analysis from Laursen et al. (2001), who looked at conflict resolution strategies across different relationships, for example friends or acquaintances. They made the distinction between three different types of styles, namely negotiation, coercion and disengagement. Negotiation is related to the earlier mentioned *compromising* and *problem solving*, where both parties make concessions in resolving the conflict. Coercion is related to *yielding* and *forcing*, where one party (yielding) submits to the demands of the other (forcing). Disengagement is related to *avoiding*, where the conflict is dropped without achieving a resolution. They found that negotiation is the preferred resolution style when people have to self-report regarding their conflict management behaviour, compared to observations. However, negotiation costs effort and people are less willing to negotiate if the relationship is weaker. Negotiation was most likely between romantic partners, next were friends and last were acquaintances. This shows that the lesser the relationship, the less likely people are going to put in effort when choosing how to resolve a conflict. Furthermore, another interesting finding was the difference between self-reported behaviour and observed behaviour in the meta-analysis. Contrary to self-reported negotiation, the most common observed resolution style was coercion. This finding is elaborated upon in the next

section, where two field studies address how people behave in real life with different office environments when managing conflicts in shared system settings.

2.3 Shared control in lighting systems

In this section, two field studies that looked at shared lighting systems will be discussed, since these findings are related to the current research and were conducted in the real world. First, Niemantsverdriet (2018) conducted field research with different user interfaces for shared lighting systems in open-plan offices. The most relevant finding for this thesis was the comparison between a private and shared interface. The private interface was an app on someone's smartphone whereas the shared interface was a communal tablet that was present per group of desks in the open-plan office. She found that when having the option of a private interface, concern for own needs was high and concern for other's needs low. As a result, adjustments to the light were mostly made without thinking about the other people or asking if it was permitted to change the light. Contrary, the shared interface resulted in a high concern for others. It seemed to raise people's awareness that there were other people present with lighting needs as well and mostly, there was a form of communication before actually making the adjustment. Communication could be in the form of making eye contact and gauging whether people were alerted by the move towards touching the tablet, or people specifically asked whether it was okay to change the light. Furthermore, the barrier of making an effort to start a conversation was lowered due to the shared interface and people were also more willing make an effort. Mainly the visibility of the interaction was the reason for lowering the barrier, making it easier to see who made the change and engaging in conversation. Another important finding was the avoidance of conflict in general: either

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the interaction was avoided, people waited until they were the only one left in the room or they would only adjust the lighting in their own area and only make a small adjustment. The avoidance of conflict occurred both when people were not satisfied with the light when they entered the room (avoiding conflict) or when they already made adjustments but someone else changed them at a later point in time (yielding).

Van de Werff et al. (2018) conducted a field study as well with two different user interfaces to change the lighting system in three different settings, namely individual offices, an open-plan office and meeting rooms. The two different user interfaces were an app downloadable on a smartphone and tablets that already had the app installed. They found that personal lighting control was valued in individual offices, since those occupants felt they had ownership over the room and they would not disturb anyone by changing the light. Especially the app on the smartphone was used in individual offices. Contrary, in the open-plan office the findings were different. People did not want to disturb colleagues and although sometimes an effort was made by starting a discussion, mostly this was seen as too much work and no changes were made. Last, participants noted that controls that were readily available were preferred, for example tangible controls on desks or tablets in meeting rooms. In meeting rooms, the tablets were significantly more often used than the phone app, while the opposite was found for individual offices (where the smartphone was used more).

Next, the hypotheses are formulated. Firstly, Niemantsverdriet (2018) found early findings that an individually owned interface (i.e. smartphone) resulted in a focus on personal preferences when making adjustments to the light. Participants were more likely

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to adjust the lighting to their own preferences using a smartphone and were more likely to re-adjust the lighting without discussion if they were unhappy with the changes of their direct colleagues. Also, Van der Werff et al. (2018) found that the smartphone was used most often in individual offices. Relating these findings to the conflict management resolution model from De Dreu et al. (2001), it could be speculated that an individual interface causes the concern for self to be high. This would relate to the strategies Forcing and Problem solving, from which the first pair of hypotheses are formulated as follows:

H1a. An individually owned interface is more likely to lead to forcing as resolution strategy to manage conflicts in a shared control setting

H1b. An individually owned interface is more likely to lead to problem solving as resolution strategy to manage conflicts in a shared control setting

Secondly, Niemantsverdriet (2018) found that if participants had to use a shared interface (i.e. a communal tablet), their awareness of presence and needs of others was increased. It also allowed for more collaborative ways to handle conflict when the interaction was visible, which is the case with a communal tablet. Relating these findings to the conflict resolution strategy model (De Dreu et al., 2001), it could be speculated that a shared interface causes the concern for self to be low. This would relate to the strategies Yielding and Avoiding, from which the second pair of hypotheses can be drawn:

H2a. A shared interface is more likely to lead to yielding

H2b. A shared interface is more likely to lead to avoiding

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Thirdly, Niemantsverdriet (2018) found that participants found interaction easier if they had a relationship, since more information was available about the needs of their direct colleagues. Also, participants would favour to avoid the complete possibility of risk of conflict and not engage in interaction at all if the chance of negative impact was present. Furthermore, Laursen et al. (2001) found that if the relationship was higher, i.e. romantic partners, the effort to put into the resolving of a conflict was higher as well. Problem solving was most likely to occur between romantic partners, less likely to occur between friends and least likely to occur between acquaintances. Relating these findings to the conflict resolution strategy model (De Dreu et al., 2001), it could be speculated that a shared office and the accompanying relationship causes the concern for others to be high. This would relate to the strategies Problem solving and Yielding, from which the third pair of hypotheses can be drawn:

H3a. A shared office is more likely to lead to problem solving

H3b. A shared office is more likely to lead to yielding

Fourthly, as noted before open-plan offices are becoming the new office norm and it is common that there is no fixed work desk or office (Hedge, 1982). As a result, the relationship that is formed with daily colleagues becomes more difficult to establish in an open-plan office. It is therefore hypothesised that the opposite occurs when working at a flex desk than working in a shared office. The relationship with colleagues is lower in a flex desk setting and thus, the concern for others is low as well. This would relate to the conflict management strategies Avoiding and Forcing and the last pair of hypotheses can be formulated:

H4a. A flex desk is more likely to lead to avoiding

H4b. A flex desk is more likely to lead to forcing

After formulating the hypotheses, the method is presented in the next section.

3. Method

In this section, the details of the questionnaire are explained. First, the experimental design is explained. Second, the participants are described. Third, the material and complete questionnaire are presented. Last, the procedure of the questionnaire is described in more detail, as well as the setup of additional interviews conducted amongst academic staff that moved to a smart building.

3.1 Research Design

The experiment had a 2 (Office type: shared office vs. flex desk) x 2 (Interface type: private vs. shared interface) x 2 (Conflict type: light vs. temperature) between-subjects design. The experiment was conducted in the form of a factorial survey making use of scenarios to present participants with fictitious situations. A factorial survey is useful to incorporate various factors and measure beliefs, attitudes and behaviour (Wallander, 2009). Participants were asked to evaluate one scenario out of eight possible scenarios, in which a conflict was simulated. The dependent variables were the conflict management behaviour in the conflict scenario and the importance of the needs of those involved in the conflict.

3.2 Participants

Approximately 1,200 employees of CGI were contacted to participate in the questionnaire. CGI is a large and international IT consultancy company with various

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locations throughout the Netherlands. It was attempted to only reach employees based in Rotterdam, which was the location of the head office and the internship. However, after posting a message on the Dutch internal network of CGI, other consultants throughout the Netherlands could participate in the survey as well. A total of 309 responses were collected, however, after removing partially filled in questionnaires, 220 responses remained. Regarding demographic variables, biological sex, department and duration of employment were measured. The majority of respondents was male (82%, $N = 181$), which was mostly due to the IT focus of the company and the resulting greater number of male compared to female employees. Regarding the departments, employees from 13 departments filled in the questionnaire. Approximately half of participants ($N = 101$) were employed at the current company for more than 10 years ($M = 6.23$ years). Most participants were likely Dutch, considering the general composition of this company's staff; however, this was not measured and it is not guaranteed that all 220 participants were Dutch.

Also, approximately 10 employees who recently moved to a smart university building were approached to participate in additional interviews, to gain more insights about the first impression and user experience of employees in a smart building. A total of six participants agreed to participate in the interviews. Gender, age and nationality were not asked and cannot be reported, to guarantee anonymity.

3.3 Measures

Biological sex, department and duration of employment were probed as demographic variables. Next, participants received an explanation of a smart building and the interface. Conflict management strategies in the conflict scenario were measured

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using newly generated items based upon the DUTCH scale from De Dreu et al. (2001). Also, traits of conflict management strategies were measured using the original DUTCH scale (De Dreu et al., 2001).

Explanation smart building. Participants received the task to imagine their current office undergoing renovation to become a smart building. In this new office, they could change the settings of the blinds, lights, temperature and open or close windows. Next, there were two possible interfaces to control the smart buildings, namely a private interface or a shared interface. The private interface was visualised as a smartphone application and the shared interface was visualised as a tablet application (see Appendix A, figure 2 and figure 3 respectively). Both interfaces had an extra title including “private” or “shared”, to increase the clarity of which type of interface they see. One single item was asked to measure the clarity of the explanation “Please indicate to what extent you agree with the following statement: I understand the explanation” using a seven-point Likert scale ranging from 1 - “I completely agree” to 7 - “I completely disagree”.

Scenarios. There were eight possible scenarios that a participant could receive, which can be found in Appendix B. These scenarios varied on office type (private shared office vs. flex office), interface type (private vs. shared) and conflict type (different light setting vs. different temperature setting). All four aspects (blinds, light, temperature, window) were tested in a pilot which showed that differences in light and temperature were perceived as important in a conflict scenario whereas the blinds and window were perceived as less important. Therefore, to limit the number of scenarios only light and temperature were chosen for this study.

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Conflict management in scenarios. Conflict management behaviour was measured by creating new items based on the five conflict management strategies from De Dreu et al. (2001). Two items were generated per strategy, resulting in a total of 10 items (see Appendix C). The 10 items to measure conflict management behaviour were presented in random order for each participant. Participants could indicate the likelihood using a Likert scale ranging from 1 - “Not likely at all” to 7- “Very likely”. Furthermore, the importance of the different preference (light or temperature), the needs of the other party and their own needs when managing the conflict were asked using a seven-point Likert scale ranging from 1 - “Very important” to 7 - “Not important at all”. Participants were randomly assigned to one of the eight scenarios, using software for online questionnaires (Limesurvey).

Traits of conflict management. The DUTCH scale from De Dreu et al. (2001) was chosen to measure how participants usually solve conflicts with colleagues (see Appendix D). This scale is widely used to measure traits in conflict resolution management strategies and shows high validity and reliability. It consists of four items per resolution strategy with five resolution strategies, resulting in a total of 20 items. These 20 items were presented in random order and participants could indicate the likelihood of the behaviour using the original five-point Likert scale ranging from 1 - “Not at all” to 5 - “Very much”. Since most participants were Dutch and English was likely their second language, two items were slightly rewritten using easier words. The first altered item was “14. I concur with the other party” which changed into “I agree with the other colleague”. The second item “19. I try to make differences loom less severe” was rewritten to “I try to make differences look less severe”. Also, to describe the

behaviour in a valid context, for all items the term “the other party” was rewritten to “the other colleague”.

3.4 Procedure

In this section, the procedures from both the questionnaire and the interviews are presented in more detail.

3.4.1 Procedure Questionnaire. Employees from a large consultancy company in the Netherlands (CGI) and academic staff from Eindhoven University of Technology (NL) were asked to participate by filling in a 5-7 minute questionnaire. The participants were contacted via email and received a reminder approximately one week later. In addition, due to a low response and unknown respondents due to anonymity, the employees of the company were approached in person in one day and personally asked to participate. They were ensured that participation was anonymous, which was also in the informed consent form they had to sign before participating. They also received a small token of appreciation in the form of sweets. Due to the low response from academic staff (7 responses), their data were not used in the analysis.

Participants could access the questionnaire via a universal link which guaranteed anonymity. It was intended that the questionnaire was filled in alone, however, this was not verified. It was possible that other colleagues could view the questionnaire or interrupt the participant, due to the open-plan office layout of the company. It was also possible that the participant filled in the questionnaire at another time than in the office, which could also mean that the participant was not alone. It is expected that this will not cause any problems, especially since the questionnaire is short and the chance of interruptions thus lower.

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Participants were asked to fill in the questionnaire and guided through each section. First, demographic variables were asked. Next, they received the explanation of the smart building and interface. Third, participants were randomly assigned to one of eight scenarios. Then, conflict management behaviour was measured using the newly generated 10 items which were based on the DUTCH and the items were presented in random order. Also, the importance of conflict and needs was asked. Fourth, they received the DUTCH scale to measure traits and the 20 items were presented in random order. Last, the participants received two open questions, namely if there were any scenarios they had trouble with and if there were any remarks. Participation was voluntary and participants were thanked for their contribution when they finished the questionnaire.

3.4.2 Procedure interviews. Semi-structured interviews were conducted amongst academic staff of Eindhoven University of Technology. A smart building was opened recently and thus, the opportunity presented itself to gather insights on the user experience of a smart building. Participants were introduced to the purpose of the research via an informed consent form, which also guaranteed their anonymity and explained that the interviews were completely voluntary. Also, participants were informed that at any point in time, they could contact the research to withdraw and delete their data. The interviews lasted between 10 and 15 minutes and follow-up questions were asked if needed, hence the semi-structure. The semi-structured questions can be found in Appendix E. A total of six participants were interviewed, where most were PhD students. One participant, P0, was a colleague from a participant who made some interesting remarks but did not participate in the complete interview. As such, the

remarks have been added but P0 is not formally counted as a participant. Gender and age were not asked to guarantee anonymity and were not expected to be needed for the analysis of qualitative data. The interviews were conducted when the participants had occupied the new building for a few weeks. Therefore, the first impression and initial user experience were obtained with these interviews.

4. Results

In this section, the data analysis and results are discussed. All analyses were conducted in Stata. First, several analyses were performed to test the reliability of the scales and subtract factors from data, which are shown in subsection 4.1. Next, several series of regressions were performed and different models were tested, which are described in subsection 4.2. Last, qualitative results have been obtained via the questionnaires and interviews, which are presented in subsection 4.3.

4.1 Analyses

Ten items were used to measure the conflict resolution management style in a conflict scenario in a smart building, corresponding to five conflict management styles (problem solving, compromising, yielding, forcing and avoiding). A Kaiser-Meyer-Olkin (KMO) measure was conducted to analyse the adequacy of the sample for both the 10 items to measure conflict management strategies in the scenario and the DUTCH scale from De Dreu et al (2001). For conflict management scenario, the overall KMO measure was adequate (.79) with values ranging from .66 to .87. However, one item (Forcing 1) had an unacceptable KMO measure (.43). For the DUTCH scale, the overall KMO measure was adequate as well (.77) with values ranging from .64 to .86.

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A factor analysis of the correlation matrix was performed to see how many factors could be derived from the data from the ten items to measure conflict management strategy in the scenarios (see Table 1). Factor loadings were rotated and the principal-component factor method was used to analyse the correlation matrix. Three factors were found with an eigenvalue > 1 and on average factor loadings $> .7$ (see Table 2). The first factor named *yielding* corresponds to the four items to measure yielding and avoiding with values > 0.5 (see Table 1). The second factor *problem solving* corresponds to the four items for compromising and problem solving. The third factor *forcing* corresponds to the two items to measure forcing. Also, the reliability of the factors and the DUTCH scale were measured, which are shown in Table 3 and Table 4 respectively. The internal consistency of factor 3 (Forcing) is low. The other factors and DUTCH scale have appropriate internal consistency with alphas $> .6$. The three factors will be the dependent variables for the regression analyses, since they represent the conflict management behaviour of the participants in the scenarios.

Table 1

Rotated factor loadings of the factor analysis of the items to measure conflict resolution strategies in the scenarios

<i>Item</i>	<i>Yielding</i>	<i>Problem solving</i>	<i>Forcing</i>
scenario_forcing1	.01	.08	.90
scenario_forcing2	-.45	-.33	.47
scenario_compromising1	-.30	.73	.02
scenario_compromising2	.03	.43	-.40
scenario_problemsolving1	.03	.79	.11
scenario_problemsolving2	-.30	.70	-.11
scenario_yielding1	.81	-.25	-.11

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scenario_yielding1	.58	-.50	-.07
scenario_avoiding1	.87	-.08	.03
scenario_avoiding2	.82	-.04	.02

Table 2

Eigenvalues and variance of factors

<i>Item</i>	<i>Eigenvalue</i>	<i>Variance</i>
Factor 1 - Yielding	3.43	2.81
Factor 2 - Problem solving	1.81	2.27
Factor 3 - Forcing	1.07	1.23

Table 3

Reliability analysis for the items to measure conflict management style in the scenario

	<i>Alpha</i>
Yielding	.83
Problem solving	.66
Forcing	.37

Table 4

Reliability analysis for the DUTCH scale to measure baseline conflict management behaviour

	<i>Alpha</i>
Problem solving	.74
Compromising	.80
Forcing	.67
Yielding	.70
Avoiding	.63

4.2 Hypotheses testing

Three series of multiple regressions were tested to attempt to explain the dependent variables, which consist of the three factors (Yielding, Problem solving and

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Forcing) subtracted from the factor analysis of the conflict management behaviour in the scenario. Three different models were tested for each factor. Model 1 only tested the directly manipulated independent variables as predictor, namely office type, interface type and conflict type. Model 2 included the traits of conflict management from the DUTCH scale as well (De Dreu et al., 2001). Last, in Model 3 the demographic variables were tested as predictor. The results are presented per factor.

Factor 1: Yielding. The results of the three multiple regression analyses for the conflict management behaviour Yielding are shown in Table 5. Regarding the first Model, a multiple regression was calculated to predict factor 1 (Yielding) based on office type, interface type and conflict type. A significant regression equation was found ($F(3, 216) = 3.22, p = .02$) with an $R^2 = .04$. It was found that interface type significantly negatively predicted Yielding ($\beta = -.15; p = .03$), indicating that when using a tablet, Yielding was less likely. Yielding was also significantly predicted by conflict type ($\beta = -.14; p = .04$), indicating that a conflict over light was less likely to result in Yielding.

Looking at the second Model, traits of conflict management using the DUTCH scale (De Dreu et al., 2001) were added as predictors. This resulted in a significant model ($F(8, 211) = 8.08, p < .001$) with $R^2 = .23$. Compared to Model 1, the significant effects from interface type and conflict type disappeared in Model 2. Moreover, Yielding was significantly negatively predicted by the traits for problem solving ($\beta = -.12, p = .05$) and forcing ($\beta = -.15, p < .02$), and significantly positively predicted by avoiding ($\beta = .24, p < .001$) and yielding ($\beta = .31, p < .001$).

Last, in the third Model the demographic variables biological sex, duration of employment and department were added. This also resulted in a significant equation

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($F(22, 197) = 3.59, p < .001$) with $R^2 = .29$. Yielding was marginally significantly negatively predicted by traits for problem solving ($\beta = -.12, p = .06$) and significantly negatively predicted by forcing ($\beta = -.18, p = .01$). Also, Yielding was significantly positively predicted by avoiding ($\beta = .27, p < .001$) and yielding ($\beta = .32, p < .001$). In addition, Yielding was more likely in department 5 ($\beta = .14, p = .08$), department 8 ($\beta = .21, p = .03$), department 9 ($\beta = .19, p = .06$) and department 11 ($\beta = .14, p = .06$), which correspond to Police, Banking & Insurance (B&I), Oil, Utilities & Communications (OUC) and Health, respectively. No significant interactions were found and all regression assumptions were met in the three models.

Comparing the results to the relevant hypotheses, it seems H2a (A shared interface will lead to yielding) and H2b (A shared interface will lead to avoiding) are not supported. Contrary, the data seems to indicate the opposite occurs, namely that Yielding is less likely. Furthermore, H3b (A shared office will lead to yielding) and H4a (A flex desk will lead to avoiding) are not supported. The direction of the data was in the right direction for H4a, but the effect was small and the results non-significant (Model 1: $\beta = .04, p = .51$; Model 3: $\beta = .01, p = .89$).

Table 5*Three regression analyses for conflict management strategy Yielding.*

	Model 1				Model 2				Model 3			
	<i>b</i>	β	<i>t</i>	<i>p</i>	<i>b</i>	β	<i>t</i>	<i>p</i>	<i>b</i>	β	<i>t</i>	<i>p</i>
<i>flex</i>	.09	.04	.66	.51	-.02	-.01	-0.12	.90	.02	.01	.14	.89
<i>tablet</i>	-.29	-.15	-2.17	.03*	-.18	-.09	-1.47	.14	-.13	-.07	-1.03	.31
<i>light</i>	-.27	-.14	-2.06	.04*	-.17	-.09	-1.41	.16	-.13	-.06	-1.01	.32
<i>Dutch_compromising</i>					-.09	-.09	-1.45	.15	-.09	-.09	-1.39	.17
<i>Dutch_problemsolving</i>					-.12	-.12	-1.94	.05*	-.12	-.12	-1.92	.06†
<i>Dutch_avoiding</i>					.24	.24	3.95	.00**	.27	.27	4.34	.00**
<i>Dutch_yielding</i>					.31	.41	5.16	.00**	.32	.32	5.00	.00**
<i>Dutch_forcing</i>					-.15	-.15	-2.44	.02*	-.18	-.18	-2.82	.01**
<i>female</i>									-.26	-.10	-1.48	.14
<i>emp</i>									-.00	-.02	-.28	.78
<i>dep1</i>									.42	.18	1.41	.16
<i>dep2</i>									.28	.07	.78	.44
<i>dep3</i>									.50	.10	1.21	.23
<i>dep4</i>									-.02	-.00	-.03	.98
<i>dep5</i>									.74	.14	1.78	.08†
<i>dep6</i>									.46	.20	1.55	.12
<i>dep7</i>									.53	.11	1.28	.20
<i>dep8</i>									.74	.21	2.14	.03*
<i>dep9</i>									.63	.19	1.92	.06†
<i>dep10</i>									.02	.00	.04	.97
<i>dep11</i>									1.03	.14	1.93	.06†
<i>dep12</i>									.66	.08	1.12	.27
	R^2	Adj R^2	F	<i>p</i>	R^2	Adj R^2	F	<i>p</i>	R^2		F	<i>p</i>
			3,216				8,211				22,197	
	.04	.03	3.22	.02	.23	.21	8.08	.00	.29	.21	3.59	.00

Note: † = $p < 0.1$, * = $p < 0.05$ ** = $p < 0.01$

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Table 6

Three regression analyses for conflict management strategy Problem solving.

	Model 1 (Robust SE)				Model 2 (Robust SE)				Model 3 (Robust SE)			
	<i>b</i>	β	<i>t</i>	<i>p</i>	<i>b</i>	β	<i>t</i>	<i>p</i>	<i>b</i>	β	<i>t</i>	<i>p</i>
<i>flex</i>	.02	.01	.14	.89	-.05	-.03	-.47	.64	-.02	-.01	-.17	.86
<i>tablet</i>	.00	.00	.00	.99	.01	.00	.06	.95	.03	.01	.24	.81
<i>light</i>	-.01	-.00	-.05	.96	-.07	-.04	-.71	.48	-.05	-.02	-.44	.66
<i>Dutch_compromising</i>					.43	.43	7.58	.00**	.44	.44	7.80	.00**
<i>Dutch_problemsolving</i>					.33	.32	4.84	.00*	.33	.33	4.86	.00**
<i>Dutch_avoiding</i>					-.28	-.28	-4.37	.00**	-.27	-.27	-4.24	.00**
<i>Dutch_yielding</i>					.14	.14	2.45	.02*	.15	.15	2.51	.01*
<i>Dutch_forcing</i>					.02	.02	.38	.70	.02	.02	.28	.78
<i>female</i>									.12	.04	.76	.45
<i>emp</i>									.02	.09	1.43	.15
<i>dep1</i>									.07	.03	.33	.74
<i>dep2</i>									-.24	-.06	-.84	.40
<i>dep3</i>									-.17	-.03	-.37	.71
<i>dep4</i>									-.02	-.00	-.03	.97
<i>dep5</i>									-.08	-.02	-.20	.84
<i>dep6</i>									.16	.07	.64	.52
<i>dep7</i>									-.22	-.04	-.61	.54
<i>dep8</i>									.35	.10	1.24	.22
<i>dep9</i>									.01	.00	.03	.98
<i>dep10</i>									-.10	-.01	-.34	.74
<i>dep11</i>									.33	.04	1.05	.29
<i>dep12</i>									.30	.04	1.08	.28
	<i>R</i> ²	Adj <i>R</i> ²	F	<i>p</i>	<i>R</i> ²	Adj <i>R</i> ²	F	<i>p</i>	<i>R</i> ²	Adj <i>R</i> ²	F	<i>p</i>
	.00	-	3,216	.99	.39	-	8,211	.00	.42	-	22,197	.00
							16.39				9.57	

Note: † = $p < 0.1$, * = $p < 0.05$ ** = $p < 0.01$

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Table 7

Three regression analyses for conflict management strategy Forcing.

	Model 1 (Robust SE)				Model 2 (Robust SE)				Model 3 (Robust SE)			
	<i>b</i>	β	<i>t</i>	<i>p</i>	<i>b</i>	β	<i>t</i>	<i>p</i>	<i>b</i>	β	<i>t</i>	<i>p</i>
<i>flex</i>	-.24	-.12	-1.73	.09†	-.15	-.08	-1.12	.27	-.14	-.07	-.98	.33
<i>tablet</i>	.09	.05	.67	.50	.02	.01	.17	.86	-.01	-.00	-.05	.96
<i>light</i>	.26	.13	1.97	.05*	.18	.09	1.39	.17	.24	.12	1.67	.10†
<i>Dutch_compromising</i>					-.10	-.10	-1.47	.14	-.13	-.13	-1.68	.10†
<i>Dutch_problemsolving</i>					-.04	-.04	-.60	.55	-.04	-.04	-.47	.64
<i>Dutch_avoiding</i>					-.05	-.05	-.90	.37	-.07	-.07	-1.12	.26
<i>Dutch_yielding</i>					.13	.13	1.96	.05*	.12	.12	1.73	.09†
<i>Dutch_forcing</i>					.30	.30	4.46	.00**	.31	.31	4.21	.00**
<i>female</i>									.26	.10	1.35	.18
<i>emp</i>									-.01	-.06	-.88	.38
<i>dep1</i>									.05	.02	.14	.89
<i>dep2</i>									-.14	-.04	-.37	.71
<i>dep3</i>									-.22	.04	-.50	.62
<i>dep4</i>									-.46	-.05	-.87	.38
<i>dep5</i>									-.53	.10	1.29	.20
<i>dep6</i>									.11	.05	.33	.74
<i>dep7</i>									.08	.02	.17	.87
<i>dep8</i>									.00	.00	.01	.99
<i>dep9</i>									.12	.04	.32	.75
<i>dep10</i>									-.10	-.01	-.18	.86
<i>dep11</i>									-.19	-.03	-.47	.64
<i>dep12</i>									.09	.01	.15	.88
	<i>R</i> ²	Adj <i>R</i> ²	F	<i>p</i>	<i>R</i> ²	Adj <i>R</i> ²	F	<i>p</i>	<i>R</i> ²	Adj <i>R</i> ²	F	<i>p</i>
			3,216				8,211				22,197	
	.03	-	2.34	.07	.15	-	4.78	.00	.18	-	2.27	.00

Note: † = $p < 0.1$, * = $p < 0.05$ ** = $p < 0.01$

Factor 2: Problem solving. The results of the three multiple regression analyses for the conflict management behaviour Problem solving are shown in Table 6. Regarding the first Model, a multiple regression was calculated to predict factor 2 (Problem solving) based on office type, interface type and conflict type. Since normality of the distribution of errors was violated, a robust regression was performed. A non-significant regression equation was found ($F(3, 216) = .01, p = .99$) with an $R^2 < .001$. None of the three predictors were significant and effects were very small ($\beta < .01$).

Looking at the second Model, traits of conflict management using the DUTCH scale (De Dreu et al., 2001) were added as predictors. Homoscedasticity, constant variance and normal distribution of errors were violated and therefore, a robust regression was performed. This resulted in a significant model ($F(8, 211) = 16.39, p < .001$) with $R^2 = .39$. Compared to Model 1, the traits were significant predictors of Problem solving. Problem solving was significantly positively predicted by the traits for compromising ($\beta = .43, p < .001$), problem solving ($\beta = .33, p < .001$) and yielding ($\beta = .14, p = .02$). Moreover, Problem solving was significantly negatively predicted by the trait for avoiding ($\beta = -.28, p < .001$).

Last, in the third Model the demographic variables biological sex, duration of employment and department were added. Constant variance and normal distribution of errors were violated and therefore, a robust regression was performed. This also resulted in a significant equation ($F(22, 197) = 9.57, p < .001$) with $R^2 = .42$. The effects from Model 2 were sustained in Model 3 with only slight variations ($< .01$). Problem solving was significantly positively predicted by the traits for compromising ($\beta = .44, p < .001$), problem solving ($\beta = .33, p < .001$) and yielding ($\beta = .15, p = .01$). Moreover, Problem

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solving was significantly negatively predicted by the trait for forcing ($\beta = -.27, p < .001$). No significant interactions were found.

Comparing the results to the relevant hypotheses, it seems H1b (An individually owned interface will lead to problem solving) and H3a (A shared office will lead to problem solving) are not supported. For H1b, the results indicate a non-significant trending in the opposite direction for interface type, namely that an individual interface leads to less Problem solving (Model 2: $\beta < .001, p = .95$; Model 3: $\beta = .01, p = .81$; coded 0 = smartphone, 1 = tablet). Results do indicate a non-significant trending in the hypothesised direction for H3a regarding office type, but the effects are small and non-significant (Model 2: $\beta < .001, p = .95$; Model 3: $\beta = .01, p = .81$; coded 0 = shared office, 1 = flex desk). No significant interactions were found.

Factor 3: Forcing. Last, the results of the three multiple regression analyses for the conflict management behaviour Forcing are shown in Table 7. Regarding the first Model, a multiple regression was calculated to predict factor 3 (Forcing) based on office type, interface type and conflict type. Since constant variance was violated, a robust regression was performed. A marginally significant regression equation was found ($F(3, 216) = 2.34, p = .07$) with an $R^2 = .03$. Results indicated a marginally significant effect of office type ($\beta = -.12, p = .09$), namely that participants were less likely to perform Forcing in a flex desk setting. Also, there was a significant effect of conflict type ($\beta = .13, p = .05$), indicating that people were more likely to perform Forcing if conflict type was light.

Looking at the second Model, traits of conflict management using the DUTCH scale (De Dreu et al., 2001) were added as predictors. Normal distribution of errors was

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violated and therefore, a robust regression was performed. This resulted in a significant model ($F(8, 211) = 4.78, p < .001$) with $R^2 = .15$. Compared to Model 1, effects from office type and conflict type disappeared. Also, the traits were significant predictors of Forcing. Forcing was significantly positively predicted by the traits for forcing ($\beta = .30, p < .001$) and yielding ($\beta = .13, p = .05$).

Last, in the third Model the demographic variables biological sex, duration of employment and department were added. Normal distribution of errors was violated and therefore, a robust regression was performed. This also resulted in a significant equation ($F(22, 197) = 2.27, p < .001$) with $R^2 = .18$. The effect from the trait for forcing in Model 2 was sustained in Model 3 ($\beta = .31, p < .001$). Results indicated three marginally significant effects, namely conflict type ($\beta = .24, p = .1$), trait for compromising ($\beta = -.13, p = .1$) and trait for yielding ($\beta = .12, p = .09$). No significant interactions were found.

Comparing the results to the relevant hypotheses, it seems H1a (An individually owned interface will lead to forcing) and H4b (A flex desk will lead to forcing) are not supported. Regarding H1b, results indicate a non-significant trending in the hypothesised direction that an individual interface leads to forcing, though the effect is small and only present in Model 3 ($\beta < -.001, p = .96$). For H4b, the results indicate a non-significant trending in the opposite direction, namely that a flex desk leads to less Forcing (Model 1: $\beta = -.12, p = .09$; Model 2: $\beta = -.08, p = .27$; Model 3: $\beta = -.07, p = .33$; coded 0 = shared office, 1 = flex desk).

4.3 Qualitative results

In this section, the qualitative data will be discussed. First, the insights from the open-ended questions at the end of the questionnaire are presented. Second, the findings from the interviews at Eindhoven University of Technology are elaborated upon.

4.3.1 Questionnaire. Many participants left comments or remarks for the open-ended questions, which are summarised in Appendix F (Table 8). The most recurring remarks will be discussed in this subsection in arbitrary order.

Missed answer options

First, participants found that the answer options were not considering all options. A form of avoiding, namely finding another workplace, was for 10 participants a likely behaviour to perform but not present in the answer options. Some statements were “I missed the possibility to find another place to work where the conditions meet my needs more”, “..or find a different workplace today”, “No option given of finding another desk to work at” and “I missed the option: look for another place that is more in accordance with my needs”.

Real situation different from scenario

Second, for 11 participants it was difficult to indicate which behaviour they would perform, since it was a scenario and not a real situation in which they had to perform the actual behaviour. This was concluded from the statements “...sometimes it is difficult to decide because you are not really in the situation ...”, “...without a specific situation I am not sure what my specific behaviour is”, “...because it depends on the situation” and “Theory and practice are probably different”.

Colleague important to handle conflict

Third, the specific colleague that they would be having a conflict with would make a difference in choosing behaviour for 15 participants. For example, they stated that if the other colleague was willing to engage in problem solving, they would also be more likely to perform problem solving as behaviour. However, when the other colleague would be unwilling to show effort, they were also less likely to choose problem solving as behaviour. “My behaviour in such situations will probably be dependent on the (initial) reaction of the others at the desks (e.g. if they react defensively rather than cooperative, I will probably be less cooperative as well)”, “Deciding which behaviour I would perform depends on how well I know my colleague”, “Behaviour also depends on who your colleagues are” and “I think it can make a difference in balancing own opinion versus colleagues opinion if the office setting is a flex environment (different colleagues a day) or a fixed setting (same colleagues every day)”.

Reason and impact conflict important

Fourth, 15 participants indicated that their behaviour depended on the importance of the reason of the conflict. For some participants, a difference in temperature did not matter while a draft or glare from the sun would be problematic. Other participants indicated that as soon as it obstructed them from working properly, they would see it as a serious problem on which they had to act. “Behaviour depends very much on the importance of the issue”, “In the case when it's so cold that I am not feeling well (white fingers) I would be less willing to adjust to my colleagues”, “My behaviour depends on a certain topic's importance to me. Very important to me drives different behaviour than

less important” and “I think temperature is not worth arguing about, so I would really not make it an issue”.

Lacked context and details

Fifth, another factor that participants missed were more detailed scenarios. 16 participants mentioned that the scenarios lacked information about variables that would influence their behaviour, for example how long they would have to work there and how acquainted they really were with the colleagues that caused the conflicts. “The choice I would make depends on the situation...”, “People have emotions, moods, blind spots and pet peeves. Sometimes they can be plainly vindictive with colleagues for whatever reason”, “...depends very much on the situation, I would respond differently in numerous conflicts...”, “You don’t have the same mood every day. One day I could totally avoid any discussions and the next I would gladly debate any issue” and “Given the limited context my real behaviour will be influenced by actual situation and may be different!”.

Questions and/or answers perceived as similar

Sixth, another interesting remark was that for 16 participants, the answers and/or questions were perceived as similar. This could have made it more difficult for the participants to determine which behaviour they would perform and which they were less likely to, since the distinction was less clear to these participants. It is also possible that the questionnaire was seen as boring because of repetitive questions, which could have influenced the motivation of the participants and the attention span. “...because the answers were a bit the same”, “Contradicting / equal questions but with just a little difference in wording”, “Very similar / repeating questions”, “Many questions were

actually the same as far as I see it” and “Finding a compromise for me is not different from seeking a solutions that is mutually beneficiary”.

After presenting the qualitative data from the questionnaire, the qualitative data from interviews conducted amongst academic staff from a smart building is presented.

4.3.2 Interviews. A new smart building was occupied by academic staff from three different faculties at Eindhoven University of Technology at the beginning of 2019. Since this presented a unique opportunity to gain insights in the user experience, interviews were conducted amongst academic staff. The full thematic analysis can be found in Appendix G (figure 4) and the themes are shortly presented in this subsection, in arbitrary order.

Compromise

The first theme was formed since certain situations arose where participants would obviously make a compromise without labelling it as such, which is a common conflict management strategy. P2 stated that “I could actually hear you from our own office when you were doing the interview with my colleague, I know it’s a short interview so it’s okay”, indicating there was a noise complaint. P4 prefers sunlight, but a colleague would lower the blinds later resulting in a compromise: “It is only from 4 o clock and later that the blinds are lowered so I don’t mind”.

Prospects

The second theme, prospects, covers both prospects before and after the move. Participants would indicate how they dreaded the move and the noise is much less than expected. They also compared their current experience to the experience in the previous office, which was the basis for the satisfaction with the new building. Also, they would

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look at the current situation and already think about how this might change in the future, since the smart building is not completely finished yet in terms of customisability.

Regarding reflecting on the previous situation, P2 stated “The students made way more noise than the current colleagues”, whereas P4 reflected on the previous colleagues “In IPO the windows were an issue because of the colleagues”. P5 even stated that “Honestly, it’s less horrible than I expected”, which is about the current noise complaints and the new smart building. P4 also worried about the future, saying “The light may cause more conflicts later, it is more personal”.

Proximity

Theme three shows the positive effects of colleagues being closer to each other. Especially P6 mentions that “... I also think it’s easier to solve these conflicts [because we are closer together]”.

Coping

The fourth theme shows the interesting ways in which people react to noise complaints that cannot be resolved easily. For instance, if colleagues have important meetings in common spaces or if they forgot to close their door. P5 states “I listen more to music now” whereas P6 notes “...I put on my headphones. I’m thinking of buying noise-canceling headphones”.

Absence

Theme five shows an interesting phenomenon that eases the differences in preferences, namely that colleagues are periodically absent and this causes the participants to be alone and customise the office to their own needs. P2 makes use of this situation in the following way: “But if someone is out of the office, I can use her standing

desk”. P3 states that “I don’t really have a lot of conflicts, I guess we’re not often here at the same time”.

Relation

The sixth theme, relation, reflects how the relationship between colleagues influences behaviour. A good relation between peers results in more asking and problem solving, whereas a different relation, for example strangers in a common space as mentioned before or a senior, shows different conflict management behaviour. Mostly yielding and avoiding are resorted to in the latter situations, which is indicated by P1 “If it is a common room, I cannot ask them to leave or be more quiet” and P3 “...and I am the least senior member so if there is a conflict I will give in”. Examples of problem solving are provided by P1 “If they have a meeting, we ask them to close the door” and P5 “...but I think it also helped that I was already with the people I was sitting in the office”.

Temperature

Although the conflicts between colleagues were absent, an unpleasant temperature was mentioned by nearly every participant and they also showed clear dissatisfaction. Therefore, this has been chosen as theme seven. During the first few weeks, the temperature was first too cold and when the interviews were conducted, it was too warm. P2 said “Biggest discomfort was the temperature” and P4 stated “Usually it was very hot in our office...”. Interestingly, P6 said “You can only adjust the temperature with two degrees” and indicated that this was inconvenient if the temperature had to be adjusted by more than two degrees. It could be interpreted that the limited control, i.e. only changing by two degrees, is a deeper control problem rather than merely a temperature problem.

Noise

As is common in offices, noise was a complaint for many participants and chosen as theme eight. The smart building consisted of different layouts which were combined, meaning there were open spaces combined with meeting rooms and private offices shared with three or four people. The participants that were interviewed were all part of private shared offices with a few colleagues but still, noise complaints were quite present due to the combination with the open-plan layout. Also, in the old office building the common space was separate from the offices, which is another factor that causes more noise complaints. It should also be mentioned that because the building is new, people are more excited and walking around more which causes more noise. This specific reason should diminish over time. P1 mentions regular noise “If people are talking, we can hear that quite well” whereas P2 states “Because it is new, people are just looking around a lot, checking out other offices, a lot of people walking around”.

Problem solving

Last, theme nine shows that most people in the building are open to problem solving and that the general atmosphere encourages creating a pleasant work environment for everyone. Part of this effect is due to the new building, however, part is also due to the nature of the work environment and the people who work at the faculty. P0 stated “When someone enters with a question I try to estimate the time it will take to answer” and would then make the decision where to answer the question inside the office or outside and try to disturb the colleagues as least as possible. P5 stated that “We are also pro-actively caring for each other” and mentioned that if someone put on a scarf, they would ask if the person was cold and if they should adjust the temperature.

5. Discussion

In this section, the results and overall research is discussed. First, the research question, hypotheses and findings are discussed in subsection 5.1. Second, limitations are elaborated upon in subsection 5.2. Last, subsection 5.3 links the findings to practice and speculates upon future research.

5.1 General discussion

The aim of this thesis was to analyse the influence of different types of user interfaces on conflict management styles in smart buildings (i.e. smart office buildings). Also, the influence of the relationship between the participant and the other party in the conflict was researched. Using the conflict management strategy model from De Dreu et al. (2001), it was hypothesised that a private interface, e.g. a smartphone, was more likely to lead to forcing or problem solving when managing a conflict in a shared control setting. Secondly, it was hypothesised that a shared interface, e.g. a communal tablet, was more likely to lead to yielding or avoiding. Thirdly, a shared office with fixed colleagues and thus, a stronger relationship, was more likely to lead to problem solving or yielding. Lastly, a flex desk with strangers was more likely to lead to forcing or avoiding. Data were gathered through a factorial survey using conflict scenarios with different interfaces and relationships to measure conflict management behaviour. Next, the results are elaborated upon. First, the quantitative data is discussed in subsection 5.1.1. Next, the findings from both the quantitative and qualitative data are linked together in subsection 5.1.2.

5.1.1 Quantitative data. Looking at the quantitative data, three types of conflict management behaviour could be subtracted from the data using a factor analysis, namely

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Yielding, Problem solving and Forcing. Although it was expected to find five different types of behaviour (i.e. compromising, problem solving, yielding, avoiding and forcing), the difference between compromising and problem solving, and yielding and avoiding is small and difficult to establish. Looking at the Kaiser-Meyer-Olkin (KMO) measure, which was conducted to analyse the adequacy of the sample, the results showed that the data were adequate for the conflict management strategies in the scenario (.79) and DUTCH scale (.77). However, one item (Forcing 1) had an unacceptable KMO measure (.43), which indicated that this item was not appropriate enough for a factor analysis. Thus, it is advised to change that item in future research. Furthermore, looking at factor loadings, although it would have improved the validity of the analysis if all factor loadings were $> .5$, there were some loadings that were below this threshold, e.g. .44 or .47 (see Table 4). Nevertheless, these occurred only once per factor, meaning that the other items did have a rather high loading and it was not expected to be problematic. Discussing the reliability analyses and alpha values, the alpha for Forcing (.37) was quite low (see Table 1). This indicated that the internal consistency was not sufficient and it is possible that the items did not accurately measure forcing behaviour. As such, for further research different items should be constructed to measure forcing or the items from the original, validated DUTCH scale should be used. Since there were many possible predictor variables, three different regression models were tested per factor, where the three types of conflict management behaviour were the dependent variables.

5.1.2 Combined findings. In this section, the three manipulated independent variables are discussed, namely the office type, interface and reason of conflict. Both the regression analyses and findings from qualitative data are investigated in more detail.

Office type

Firstly, office type was a marginally significant predictor for Forcing ($\beta = -.12, p = .09$), indicating that participants were less likely to show Forcing in a flex desk setting (see Table 7). Nevertheless, this small effect was only present in the first Model where only office type, interface type and conflict type were included as predictors. When the other predictors were added and tested, the effect disappeared and only the traits for avoiding and forcing were (marginally) significant. Regarding office type and the accompanying difference in relation to colleague, another interesting aspect which is part of the relationship is seniority. In both the qualitative data from the questionnaire and the interviews seniority was mentioned, which would influence the behaviour and is another aspect to consider. Furthermore, the qualitative data do mention that the relationship is important to people to decide how to solve conflicts. Several studies found that the relationship was an important aspect to influence the behaviour (Niemantsverdriet, 2018; Van der Werff et al., 2018), which also relied on qualitative data. It seems that qualitative data in general support the effect of relationship while the quantitative data from this study do not.

Comparing the discrepancy between quantitative and qualitative data, it is possible that the ecological validity was questionable in the scenarios. A pilot was conducted to test the first version of the scenarios and one finding was that the relationship to the colleagues was not clear enough. Therefore, the second version of scenarios attempted to clarify this in more detail by adding whether they were the same colleagues or colleagues that were never seen before, next to the distinction of office type (see Appendix B). However, it is possible that this was still not enough to explain the

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context of the relationship to the participants. It seems that a more detailed description of the exact relationship with the colleagues would have improved the ecological validity of the scenario. This was also mentioned by the participants from the questionnaire, who thought the relationship was important to consider and it was not explained well enough in their eyes. Furthermore, it could have helped the participants to relate to the scenario and better imagine how they would behave in a certain situation.

Another reason which could explain the difference between quantitative and qualitative data is the measurement. A common theme that is mentioned alongside relationship is effort. It is possible that the conflict management strategies do not reflect effort appropriately and if effort would have been measured, perhaps the gap would have been smaller.

Interface type

Secondly, interface type only significantly predicted Yielding in the first Model (see Table 5) with a small effect ($\beta = -.15, p = .03$), indicating that participants were less likely to Yield when using a tablet. Comparing this to the qualitative data, interface type is not mentioned at all and it is high likely that this was caused by the difference between a scenario and real situation. The manipulation from user interface may have been subtle and as Niemantsverdriet (2018) mentioned, mostly increased awareness of the presence of others and allowed for visibility of interaction. It is possible that this manipulation was lost in the scenario, since awareness of presence of others was difficult since participants were not really surrounded by the colleagues and there was no visible interaction, only a description in the scenario. It is possible that if participants would have been in the actual

situation and sees the smartphone or tablet on their desk, then the effects would have been stronger and more present.

Conflict type

Thirdly, conflict type significantly predicted Yielding ($\beta = -.14, p = .04$) and Forcing ($\beta = .13, p = .05$) in the first Model (see Table 5 and 7 respectively) and marginally predicted Forcing ($\beta = .12, p = .1$) in the third Model (see Table 7). The qualitative data also showed that the importance of the conflict was an important aspect that participants considered when deciding how to behave. If the problem was more pressing, people were more willing to engage in interaction and ensure a pleasant environment for themselves. Van der Werff et al. (2018) noticed as well that in open-plan offices, people were mostly reluctant to exert effort to engage in interaction when they were not satisfied with the lighting. This could be explained by both the lesser importance of the conflict and the barrier of exerting effort when engaging in interaction with people with whom the relationship is lower.

Qualitative data

Summarising the qualitative data from the questionnaire, the general impression is that it was difficult for participants to imagine how they would behave in the scenario, due to a lack of context, lack of details and difficulty for themselves to imagine how likely they were to solve a conflict in a certain way. This could have influenced the results and painted a more nuanced picture of their behaviour than the reality, since the difficulty in imagining their behaviour also means it is unlikely that extreme values are chosen compared to neutral answers.

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Another aspect that seems rather important in deciding how to handle conflict is likely the context of the situation and work environment. Besides that participants indicated that the scenarios lacked details, the quantitative data from employees at the company showed that traits of conflict management strategy were an important indicator of conflict management behaviour which diminished the influence of other predictors. Nevertheless, the qualitative data from the interviews showed that compromising and problem solving are quite common, while it is unlikely that all six participants are in general problem solvers or compromisers. Therefore, it seems that the work environment, work culture and specific context of the research has an important effect on the influence and effectiveness of the predictors.

Last, another interesting phenomenon occurred. Participants from the questionnaire indicated several times that it would seem troublesome to have many customisable aspects and that they did not see the benefit of incorporating them. Furthermore, the interviews with actual inhabitants of a smart building showed that before the move, they had the same feelings about the prospective move. However, after the move their experience was quite positive and participants are happy with the possibility to change the temperature (when it works properly) and open the window. It is perhaps a daring conclusion since the evidence is not overwhelming, but I think it can be concluded that people are dreading the situation beforehand and only notice the benefits if they actually experience them. In the next section, the limitations of the research are summarised.

5.2 Limitations

There are several aspects that could be improved and may have influenced the results of this study. First, the ecological validity seemed to suffer from the choice to conduct research using a factorial survey and manipulating three variables in the scenarios (office type, interface type and conflict type) while simultaneously, keeping the scenarios as short as possible. The description of the scenarios and the relationship with the colleagues was lacking in details. Many participants indicated that they had trouble with deciding which behaviour was more likely and that the scenarios lacked details. If the scenarios would have been more detailed, especially regarding the relationship, then the results would have been better and perhaps participants would have had less trouble imagining the scenarios. However, while the choice for a factorial survey over a field study is a setback in terms of ecological validity, the DUTCH scale is a valid method to measure intention and conflict management strategy. The De Dreu et al. (2001, p. 20) state that “Work settings tend to remain relatively stable over time...The consequence is that an individual’s actual and preferred conflict management strategies are likely to be stable over time.” As experts in the field, it can be assumed that their knowledge of conflict management strategies is vast and a factorial survey combined with their scale has credibility to some extent.

Second, the timing of the qualitative interviews may have been too soon. It is possible that because people moved to a new building quite recently, everyone tries to be positive and make the best of the situation, for example looking at the noise complaints and temperature problems. Although the first user experience is valuable as well, follow-

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up research at a later point in time would show more valid results that are also more applicable to other smart buildings.

Third, the smart building was not yet fully functional, for instance, the customisability of light was not implemented yet, the temperature did not seem to function properly yet and people did not fully discover all possibilities of the new building. For example, not all interviewees knew that windows could be opened and tried it out after the interviews. As with the previous limitation, it would be advised to conduct research again at a later point in time, to gain more valid results where there is also more room for conflict.

Fourth, although the results from the factorial survey should be more applicable since it was conducted under employees, these employees were not employees working in a smart building. This means that it was even more difficult to imagine behaviour, since they do not even know how it feels to work in a smart building. In addition, even though the smart university building is currently state of the art, it is not quite smart. For instance, temperature can be regulated by the user which is already a luxury compared to conventional offices, but automatic prediction and optimisation is limited. Also, it seemed difficult to indicate how likely their behaviour was and answer options were seen as repeating or the same. It is possible that the questionnaire was more developed for academic staff than for employees unfamiliar with this field of study and therefore, it may have been unclear to them how to answer the questionnaire or how to imagine the likelihood of behaviour. This could have had a negative influence on the results.

Fifth, the use of the word 'conflict' might have caused some nuanced answers. During the interviews, when asking for conflict the participants replied that there were

none. However, when probing for more answers or details it did turn out that there were conflicts. Nevertheless, participants would not label them conflicts and saw conflict as a very strong word to use in the work environment. It is possible that this was also experienced by the participants from the questionnaire and caused them to give more nuanced answers, to make up for the strong use of conflict. Therefore, it would be better to use another word, for example disagreements or different opinion, in future research to avoid the misconception of conflict. Another option would be to consider the Critical Incident Technique, which would specifically research cases of conflicts and obtain in-depth information about each case, instead of asking for conflicts in general (Woolsey, 1986). If this method would be used and conflicts explained in a more nuanced way, it is high likely more valid data would be obtained.

Sixth, as seen in the method section (section 3) some Likert scales were reversed to keep the participant alert. Nevertheless, around 10 participants noted that this was annoying or they nearly missed it. As such, in the future it is advised not to keep the participant alert but make it as easy as possible, with the chance of a lazy participant. At least they will not find the study annoying which should improve their mood and experience of the questionnaire.

5.3 Practical implications

There are several implications that these results have for practice. First, I believe it is advised to incorporate more details in scenarios and increase the ecological validity. This should result in more accurate results and show that factorial surveys are a valid way to obtain result regarding behaviour without having to spent months or years on a field study. Field studies and especially qualitative data are indispensable when conducting

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research about behaviour. Nevertheless, scenarios are useful to capture behaviour and are capable of obtaining valid results, so it is advised to consider them and not avoid them for fear of invalid and unreliable results. Another option would be the Critical Incident Method, which would make obtaining data easier and also ensure that relevant data is acquired (Woolsey, 1986). Especially effort is another area that should be investigated, to examine the link between effort and relationship which was not researched in this study.

Second, although the effect of the type of interface or relationship to the colleague may be small or subtle, it should still be considered and used to stimulate a better work experience. If a communal tablet triggers some people to think about their colleagues instead of forcing their own settings, this finding should continue to be considered valuable for future decisions and the fostering of a pleasant work environment. It would be advised that future research obtains valid data in a quantitative way and confirms the true effect of interface type. Since the manipulation from the interface type is subtle, it may be better to conduct field studies or perform lab experiments where the interface can be experienced directly by the participant, but data can be gathered in a quantitative way. Future research should study the effect of interface type and especially the exact nature and subtleness of the effect.

Third, this study shows the importance of user experience and the value of qualitative research. Even if the offices of the interviewees are shared in this smart university building, part of the floor does incorporate an open-plan layout and noise complaints are present. These show that even with the knowledge we have from studies today, it is still difficult to create work environments that are pleasant. To create pleasant work environments, continuous interaction with the user is advised to obtain that goal.

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Through qualitative methods, underlying problems can be found and valuable insights gained, which would be lost without these methods. The addition of two open-ended questions at the end of the questionnaire provided many insights that would not be obtained with quantitative measures alone. Therefore, it is advised that even if research is conducted in a quantitative way, some qualitative measure should be added at the end of the study or questionnaire, which can result in very interesting insights and help understand the nature of the data.

Last, as mentioned in the theoretical background, specific research towards the user experience of smart buildings was difficult to find. Although numerous studies looked at shared control systems (i.e. shared lighting) and open-plan offices, the studies looking at smart buildings was more focused on technical aspects than the user. The first steps towards gathering insights user experience have been taken and although the results from this study are not conclusive, more research should be conducted in smart office environments. Smart buildings are being implemented more and more, although in a slow pace, and the user experience is vital to improve smart buildings and contribute to a better society.

6. Conclusions

The user experience of smart buildings was investigated, mainly looking at conflicts that are prone to arise in shared control systems. The effects of office type, interface type and conflict type were tested using a factorial survey. Only small effects were found and traits of conflict management behaviour showed to have a bigger effect on behaviour than the small manipulations. In addition, the initial user experience of

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academic staff in a new smart university building was obtained via interviews. These showed that although there were temperature and noise complaints, in general conflicts were absent or solved in cooperative ways.

The questionnaire showed how complex behaviour is and context is vital for capturing behaviour correctly, whereas qualitative data proved invaluable for explaining quantitative data and user experience. Although the hypotheses were not supported, the research showed the value of user experience and qualitative data. Also, it gave insights for future research which could look more into user experience in general, the subtle manipulation of interface type and the effect of effort and relationship. It is therefore, hoped that this research inspires others to remember that although technology should move forward, it should move forward together with the user and provide a pleasant user experience instead of breaking yet another meaningless technical achievement that ignores the ones who have to use it.

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Appendix A

Figure 2

Screenshot of smartphone application

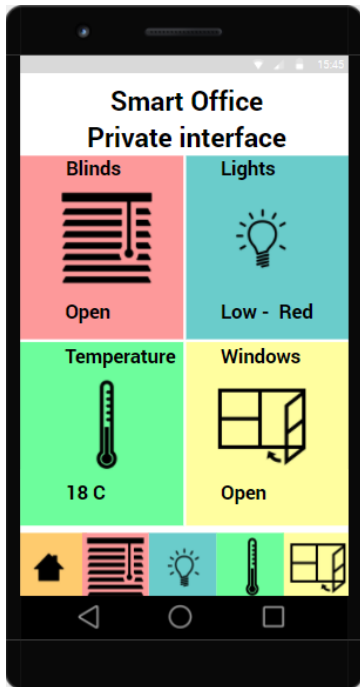
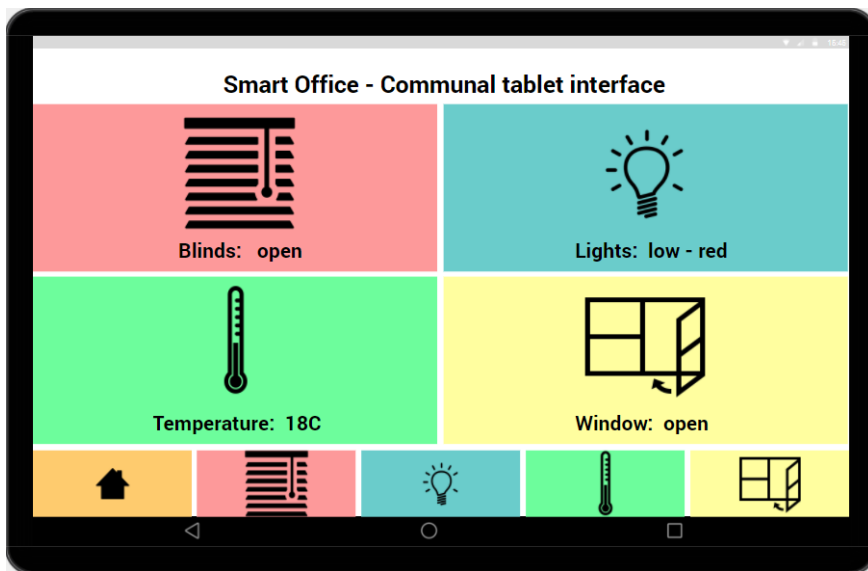


Figure 3

Screenshot of tablet application



Appendix B

List 1

List of eight scenarios with the independent variables underlined

Scenario 1

Please imagine it is a regular work day and you are working in a shared office today.

When you arrive at the shared office, you see that your three other colleagues are already present. As you sit down, you notice that the lights are a reddish hue and on low brightness, making it difficult to read. It is possible to change the settings using your private smartphone.

Scenario 2

Please imagine it is a regular work day and you are working at a flex desk today. When you arrive at the office floor, you find a free desk with three colleagues you have never seen before. As you sit down, you notice that the lights are a reddish hue and on low brightness, making it difficult to read. It is possible to change the settings using your private smartphone.

Scenario 3

Please imagine it is a regular work day and you are working in a shared office today.

When you arrive at the shared office, you see that your three other colleagues are already present. As you sit down, you notice it is rather cold. It is possible to change the settings using your private smartphone.

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Scenario 4

Please imagine it is a regular work day and you are working at a flex desk today. When you arrive at the office floor, you find a free desk with three colleagues you have never seen before. As you sit down, you notice it is rather cold. It is possible to change the settings using your private smartphone.

Scenario 5

Please imagine it is a regular work day and you are working in a shared office today. When you arrive at the shared office, you see that your three other colleagues are already present. As you sit down, you notice that the lights are a reddish hue and on low brightness, making it difficult to read. It is possible to change the settings using the communal tablet.

Scenario 6

Please imagine it is a regular work day and you are working at a flex desk today. When you arrive at the office floor, you find a free desk with three colleagues you have never seen before. As you sit down, you notice that the lights are a reddish hue and on low brightness, making it difficult to read. It is possible to change the settings using the communal tablet.

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Scenario 7

Please imagine it is a regular work day and you are working in a shared office today.

When you arrive at the shared office, you see that your three other colleagues are already present. As you sit down, you notice it is rather cold. It is possible to change the settings using the communal tablet.

Scenario 8

Please imagine it is a regular work day and you are working at a flex desk today. When you arrive at the office floor, you find a free desk with three colleagues you have never seen before. As you sit down, you notice it is rather cold. It is possible to change the settings using the communal tablet.

Appendix C

List 2

List of items to measure conflict resolution behaviour in the scenarios

Problem solving

1. I try to make sure both me and my colleagues are completely satisfied with the settings
2. I discuss which solution would make me and my colleagues most happy

Compromising

3. I attempt to reach a middle ground with my colleagues, where we both give in a little
4. I accept the middle way as current setting between my preference and my colleagues' preferences

Forcing

5. I use my smartphone/the communal tablet to change the settings to my preference
6. Even if my colleagues don't agree, I persist to change the settings to my preference

Yielding

7. I leave the settings as they are because I know my colleagues prefer these settings
8. I adapt to the preferences of my colleagues

Avoiding

9. I leave the settings as they are and continue to work
10. I do not engage with my colleagues about the settings

Appendix D

List 3

*DUTCH scale from De Dreu et al. (2001) including two alterations, marked with **

Problem solving

1. I examine issues until I find a solution that really satisfies me and the other colleague
2. I stand for my own and the other colleague's goals and interests
3. I examine ideas from both sides to find a mutually optimal solution
4. I work out a solution that serves my own as well as the other colleague's interests as good as possible

Compromising

5. I try to realise a middle-of-the-road solution
6. I emphasise that we have to find a compromise solution
7. I insist we both give in a little
8. I strive whenever possible towards a fifty-fifty compromise

Forcing

9. I push my own point of view
10. I search for gains
11. I fight for a good outcome for myself
12. I do everything to win

Yielding

13. I give in to the wishes of the other colleague
14. I agree with the other colleague* (original *concur* instead of *agree*)
15. I try to accommodate the other colleague
16. I adapt to the other colleague

Avoiding

17. I avoid confrontation about our differences
18. I avoid differences of opinion as much as possible
19. I try to make differences look less severe* (original *loom* instead of *look*)
20. I try to avoid a confrontation with colleagues

Appendix E

List 4

Semi-structured interview question set

Question 1

What is your occupation?

Question 2

What do you know about the features in Atlas to customise the work environment, for example lights or temperature?

Question 3

Have you experienced discomfort in any way so far and why (not)?

Question 4

Have you experienced conflicts or disagreements involving colleagues? Can you think of any reasons why (not)?

Question 5

Do you think these happen more often compared to your previous office? Why (not)?

Question 6

If you could redesign your office in Atlas, what would you change?

Appendix F

Table 8	
<i>Table with analysis of open-ended questions of the questionnaire using counting, where N p stands for “Number of participants” who had the same comment</i>	
Summarised comment	N p
Missed possibility to find another workplace [avoiding]	10
Clear	5
Opening window unlikely	1
Unnecessary gadgets that do not contribute	5
Scenario difficult because not in real situation	11
Behaviour heavily dependent on who the colleague is	15
Behaviour dependent on importance issue	14
Behaviour consecutive instead of “one option”	2
Behaviour heavily context-dependent that scenario does not cover	14
Behaviour interpreted as mutually exclusive [which is not]	4
Answers / questions were same	16
Preferred setting unclear / different for everyone	1
Switched answer options annoying / nearly missed	10
Contradicting answer options [unknown colleague – known preference]	2
Answer options unclear	5
Interpretation answer options could differ	1
Explanation interface ambiguous / unclear	1
Different wording same behaviour gave different feeling	1
Accepted intuitively opposing statements	1
Relation colleague [balance relation and own preference]	1
Foresee different behaviour with different relation	1
Clear needs necessary	1
Seniority in age or level important for decision	1
Questions are leading to an answer	1
Avoid conflicts to maintain pleasurable image	1

CONFLICT MANAGEMENT IN A SMART OFFICE ENVIRONMENT

Appendix G

Figure 4

Thematic analysis of semi-structured interviews amongst academic staff after occupying a smart building for a few weeks

