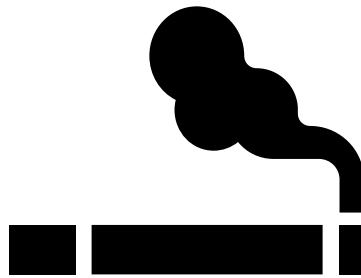


Master Thesis

Nudging crowding smokers away from a building's entrance.



Julie ten Brink
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Wageningen University and Research
Department of Management Studies

Master Thesis Management Studies

To what extent does a nudging intervention influence the crowding of smokers at an entrance site?

Student:	Julie ten Brink
Student number:	950315124070
University:	Wageningen University and Research
Study:	Management, Economics and Consumer Studies
Specialisation:	Management Studies
Profile:	Facility Management
Course code:	BMO-80436
Supervisor:	dr. H.B. Kok
First examiner:	dr. H.B. Kok
Second examiner:	Jasmina Rueger

Abstract

The ban of smoking inside public places results often in smokers crowding at the entrance of a building. The crowding of smokers at an entrance has many disadvantages. Changing something in the physical environment, by using a nudge, can be a way to encourage smokers to behave differently. Therefore, the objective of this study is to find out if nudging interventions are effective in moving the crowding of smokers from the entrance of a building to a designated smoking area.

The empirical study is executed at the entrance site of a building at the campus of Wageningen University as a case and 1,278 smoker observations have taken place for five weeks. The nudging interventions were the removal of the ashtrays at the entrance (week 2) and a combined nudging intervention of the removal of ashtrays at the entrance in combination with posters placed around the entrance calling for not to smoke at the entrance and to go to a designated place (week 4). During the other weeks no nudging interventions were implemented. A paired samples t-test showed that during week 4 the percentage of smokers close to the entrance was significantly different ($P < 0.1$) compared to all of the other weeks. This study shows that nudging interventions are effective in preventing smokers from gathering at the entrance of a building and inducing them to gather at a designated smoking area.

Key words: nudging, nudging interventions, crowding, entrance

Management summary

Background

Over the last decades the public opinion and attitude towards smoking has changed from a popular and fashionable social activity to an addictive and harmful habit. In 2018 the amount of smokers in the Netherlands decreased to 21.7%, which means still one-fifth of the populations is smoking. The Dutch government is trying to reduce the amount of smokers by taking different measures like banning smoking inside public places. This resulted in that smokers now often smoke at the entrance of a building. However, the crowding of smokers at the entrance also has many disadvantages like congestion, litter, second hand smoking and a negative image for the organization inside the building. Thus, it would be useful to make smokers smoke at an alternative place. Changing something in the physical environment, by using a nudge, can be a way to encourage smokers to behave differently. Therefore, the objective of this study is to find out if nudging interventions are effective in moving the crowding of smokers from the entrance of a building to a designated area.

Methodology

A case study was conducted at the entrance site of a building at the campus of Wageningen University to investigate the influence of nudging interventions on the crowding of smokers. The experiment was based on a pre-test/post-test study. 1,278 smoker observations have taken place for five weeks. The smokers were observed when they were making the decision to stand or sit somewhere at the entrance site.

The observation period did last five weeks. The first week was a baseline observation in which the current smoking behavior was observed. During the second week the first nudging intervention was implemented (removing the ashtrays) and the third week was a control week so the nudging intervention was removed again (replacing the ashtrays). In the fourth week the second nudging intervention was implemented (placing posters and removing the ashtrays). The fifth week was the second control week.

Results

The obtained data regarding the observations show that the amount of smokers close to the entrance decreased slightly from week 1 (80.6%) to week 2 (79.9%). The amount of smokers decreased slightly again during week 3 (77.5%). During week 4 the amount of smokers in the entrance area decreased significantly to 29.3%. In week 5 this amount increased again largely to levels similar to the first three weeks (70.3%).

The goal of this study was to find out if nudging interventions are effective in moving the crowding of smoking from the entrance of a building to an designated area. The percentage of smokers in de designated smoking area decreased to some degree from week 1 (17.2%) to week 2 (11.3%). The amount of smokers increased to some degree again during week 3 (19.9%). During week 4 the amount of smokers in the entrance area increased significantly to 45.8%. In week 5 this amount decreased again to levels similar to the first three weeks (16.1%).

Conclusion

This study shows that nudging interventions are effective in preventing smokers from gathering at the entrance of a building and inducing them to gather at a designated smoking area. A combined nudging intervention of the removal of ashtrays at the entrance in combination with posters placed around the entrance calling for not to smoke at the entrance and to go to a designated place, significantly influenced the positioning of smokers. The number of smokers at the entrance decreased 51%, and the increase of smokers at the designated place was 29%, both relative to the baseline week count. Only removing the ashtrays proved ineffective, this apparently does not have a sufficient disciplining

effect. Since the removal of ashtrays is not substituted with an environmental cue, smokers are not encouraged to change their behavior.

This study showed that for the nudge to be effective the intervention should be salient; the nudge must stand out clearly, especially in an area where it is crowded. Also, the intention of the nudge must be immediately clear. People are sometimes persistent not to show the desired behavior and in these cases the influence of the nudge is less effective since a nudge cannot do more than subtly guide behavior.

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1. Introduction

This first chapter contains an introduction to the research topic. Next to this, the problem statement, research questions, the research framework and the research outline will be discussed.

1.1 Background

Over the last decades the public opinion and attitude towards smoking has changed from a social activity to an addictive habit. During the first half of the 20th century the amount of people that smoked cigarettes did grow rapidly. Automatic cigarette rolling machines were invented and smoking was promoted strongly (Cummings & Proctor, 2014). Different brands advertised with explicit health claims like “gentle on my throat” (Lucky Strike, 1937), “play safe with your throat” (Philip Morris, 1941), and “Fresh as mountain air” (Old Gold, 1946). In America, Camel even advertised that smoking a cigarette would help to digest your meal and that smokers therefore should smoke a cigarette between every Thanksgiving course. Around 1950 smoking has grown into a popular fashionable element of social events (Cummings & Proctor, 2014). After that, assumptions arose that smoking could be related to cancer resulting in a slight decrease in the sales of cigarettes. The cigarette industry did respond to these health concerns by introducing “filtered” cigarettes. The advertised health benefits of these specific cigarettes were later proven to be false (Cummings & Proctor, 2014). However, smokers were convinced by the benefits and 60% of the smokers would shift to “filtered” cigarettes.

Around 1960 cigarette brands were still promoted by doctors, athletes and celebrities, and cigarette brands were important sponsors for TV shows. The public attitudes about smoking and the cigarette consumption would only started changing after the release of the Surgeon General's Advisory Committee report in 1964. Smokers became more aware of the dangers of smoking. This was followed by cautionary labels on the cigarette packaging and antismoking advertisements, causing that the public perception of smoking started to shift even more. Despite this, smoking was permitted almost everywhere even into the 1980s (Cummings & Proctor, 2014).

The 1988 Surgeon General's Report did help changing the perception of smoking from habit into a harmful addiction. Next to that, the influences of healthism became more noticeable, meaning that people would pay more attention to living in a healthy way, for example by consuming healthy food and exercising more (Van Reek & Adriaanse, 1987). However, it was not before 2001 that the public opinion started to change strongly, resulting in a strong decrease in the amount of people that smoked and the main part of the population favoring a ban on smoking in public places. Currently the amount of people smoking is still decreasing, but the yearly decrease has diminished to 1% till 2% (Cummings & Proctor, 2014; Kelly, Vuolo, Frizzell & Hernandez, 2018).

To indicate the severeness of smoking, according to the online databank of Statistics Netherlands 35.2% of the Dutch adult population smoked in 1990. In 2015 approximately 20,000 people in the Netherlands died because of smoking-related diseases like cancer, respiratory diseases and heart diseases (Trimbos instituut, 2017; Ayar et al., 2019; Connolly et al., 2009; Fu et al., 2016; Cummings & Proctor, 2014; Alesci, Forster & Blaine, 2003). In 2018 the amount of smokers decreased to 21.7% (RIVM, z.d.; Trimbos instituut, z.d). Even though the dangers of smoking are getting a lot of attention in the Netherlands, still one-fifth of the population does smoke (Bosdriesz et al., 2016; RIVM, z.d.; Trimbos instituut, z.d).

Next to the negative effects smoking has on the smoker itself, second hand smoking is also a concern for the public health (Kaufman et al., 2010; Bertin, Lipsky & Erblich, 2018; Connolly et al., 2009; Fu et al., 2016; Kaleta et al., 2017). Second hand smoking is the inhalation of the smoke by non-smokers in the neighborhood of the smoker. They inhale the smoke that is exhaled by the smoker or they inhale the side stream smoke coming from the burning cigarette itself. The cigarette smoke can be

experienced negatively by non-smokers because of the smell, irritation of the eyes and general respiratory irritation, but the second hand smoke is also a long-term health risk. The side stream smoke contains even more toxic particles than the 'normal' smoke and can cause the same diseases as it would for the smoker itself (Kaufman et al., 2010; Bertin, Lipsky & Erbllich, 2018; Connolly et al., 2009; Fu et al., 2016; Kaleta et al., 2017; Sureda et al., 2012).

Governments take steps to make people aware of the risks and disadvantages of smoking. The Dutch government is trying to reduce the amount of smokers through the "Smoke free generation" campaign. They aim at that by 2040 none of the children will start smoking, pregnant women will not smoke and only 5% of the adult population will smoke. In order to help smokers quit or reduce their consumption and to reduce the uptake of social smoking for non-smokers, smoke-free places were created. For example, it is no longer allowed anymore to smoke in public places like restaurants, bars and workplaces (Ministerie van Volksgezondheid, Welzijn en Sport, 2018a; Ministerie van Volksgezondheid, Welzijn en Sport, 2018b; Ministerie van Volksgezondheid, Welzijn en Sport, n.d.a.; Kelly et al., 2018; Verdonk-Kleinjan et al., 2013). The ban of smoking from public places and other measures, like the prominent warning on the packaging of cigarettes, rising prices and the fact that smoking materials are no longer allowed to be visible in stores, are meant to discourage the Dutch population to smoke (Bosdriesz et al., 2016). These measures make smoking less convenient. Next to that, studies have shown that banning smoking inside has an influence on the social acceptability of smoking. The bans do not only intervene with the possibilities to smoke in public but might simultaneously define smoking as an anti-social act and "undercut the social support network for smokers" (Kelly et al., 2018; Bosdriesz et al., 2016; Fu et al., 2016; Cummings & Proctor, 2014).

Perhaps a negative side effect of all these measures is that when smokers are not allowed to smoke indoors anymore, they often gather at the entrance of buildings (Kaufman et al., 2010). The crowding of smokers at the entrance of a building may cause congestion, which causes limited space for physical movement. This can be experienced as uncomfortable by people who are trying to enter or leave the building. Next to that, the smoke can still easily enter the building when smokers chose to stand just outside the building and non-smokers still be exposed to second-hand smoke. Also, the crowding of smokers at the entrance of a building can lead to more garbage, like cigarette litter, a higher fire risk and a negative image of the organisation to the outside world (Kaufman et al., 2010; Templeton, Drury & Philippides, 2018; Fu et al., 2016; Sureda et al., 2018; Parry, Platt & Thomson, 2000). That is why moving the smokers to a different place, more distant from the entrance, is necessary.

Encouraging people to behave differently can be done by adjusting the physical environment. There are many different ways to do this, but one possibility is using a nudge. Nudging interventions can be used in order to move smokers from the entrance of the building to a designated place. A nudge is "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2009). When something is changed in the environment of the entrance in order to subtly guide people to smoke at the smoking zone this is called a nudge (Hofmann & Stanak, 2018; Wu & Paluck, 2018). The effectiveness of interventions to influence the behavior of people should be tested and analyzed (Dolan et al., 2012).

1.2 Problem statement

Several researchers have studied the motivation of smokers to smoke, being a way to cope with stress, a way to socialize and improve interpersonal relationships and a way of feeling more comfortable in their social environment (Ayar et al., 2019; Zhao et al., 2017). Reasons why these smokers pick specific places to smoke are less studied. According to Kaufman et al. (2010) do smokers decide to smoke close

to entrances of buildings because of shelter, proximity to their workplace and limited time available to go outside. The crowding of smokers at entrances results in congestion, more garbage, like cigarette litter, a higher risk of fire, a health risks because of second hand smoking while entering the building just as the smoke being able to enter the building easily, the bad smell, challenges in finding smoke-free outdoor spaces, smokers being negative role models and a negative image of the organization inside the building (Kaufman et al., 2010; Templeton, Drury & Philippides, 2018; Fu et al., 2016; Sureda et al., 2018; Parry, Platt & Thomson, 2000; Bertin, Lipsky & Erlich, 2018; Connolly et al., 2009; Kaleta et al., 2017). According to Kaufman et al. (2010), particularly smoking at doorways is experienced as problematic and difficult to avoid by non-smokers. Buffer zones around entrances may reduce the expose of non-smokers to these disadvantages. Next to that, there is scientific evidence that "... the presence of smoking may act as a cue for smoking, resulting in fewer quit attempts and greater incidence of relapse" (Kaufman et al., 2010). So, it would be beneficial to create more distance between smokers and the entrance.

Would it be possible to move the smokers by changing something in the physical environment of the entrance? A way to do this may be using nudging interventions. Different studies looked into the effectiveness of nudging in helping smokers stop smoking (Thaler & Sunstein, 2009; Sunstein, 2015; Hall et al., 2018). However, despite all the disadvantages of smoking, one-fifth of the Dutch population is still smoking, the fact that the presence of people smoking may act as a cue for smoking while the absence of people smoking might result in more quit attempts and the fact that simply forbidding smoking is considered to interfere with personal freedom (Schmidt, 2016), the effectiveness of nudging interventions in order to move smokers to other designated areas is not studied yet.

Therefore, the scientific relevance of this study is finding out the effectiveness of nudging interventions used in order to move smokers to an alternative area. The practical relevance of this study is finding out which nudging interventions could be used so smokers will crowd at a designated area, so the people who are entering the building won't be disturbed by crowding, secondhand smoke and cigarette litter.

The objective of this study is to find out if nudging interventions are effective in moving the crowding of smokers from the entrance of a building to a designated area.

1.3 Research question

The purpose of this study is to find a way to nudge the crowding of smokers at the entrance of buildings towards a designated area. This resulted in the following research question:

*To what extent does a **nudging intervention** influence the **crowding of smokers** at an entrance site?*

In order to answer this main research question the following sub research questions were formulated:

Theoretical sub-questions

1. How can crowding behavior be operationalized and measured?
2. What explains smokers' crowding behavior in general, and in particular at the entrance of a building?
3. How can a nudging intervention be operationalized and measured?
4. What explains the effectiveness of nudging interventions?

Empirical sub-question

1. To what extent do smokers crowd at an entrance site before, during and after a nudging intervention?

1.4 Research framework

The main activities and the relationship between these activities can be found in the research framework. The research framework of this study is shown in figure 2.

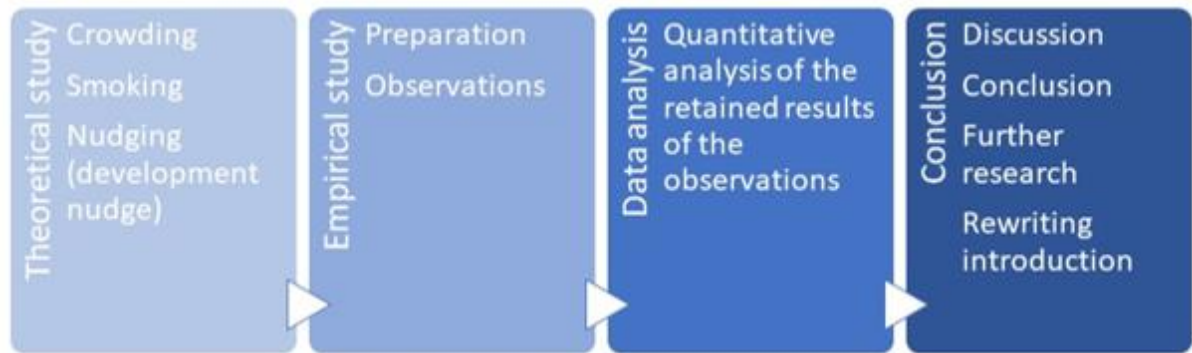


Figure 1 - Research framework

1.5 Research outline

After this first chapter, which contained an introduction to the research topic, the problem statement, research questions, the research framework and the research outline, the theoretical framework will be discussed in chapter 2. The theoretical framework consists of theory behind the crowding behavior, the behavior of smokers close to an entrance and nudging interventions.

In the third chapter the research methodology will be discussed. This chapter consists of the research design, methods of data collection, procedure of measurements and the data analysis. The results of the research will be discussed in chapter 4. This contains the effects of the used nudging interventions. Chapter 5 contains the conclusion and discussion of this research. Next to that, the limitations of this research and the recommendations for future research will be discussed.

2. Theoretical framework

This chapter contains the theoretical framework of this study. The crowding behavior of the smokers at an entrance site and the effectiveness of nudging interventions will be discussed.

2.1 Crowding behavior

When a lot of people are gathering in the same physical environment, this is called a crowd (Musse & Thalmann, 1997). A crowd is defined by Musse & Thalmann (1997) as: “a large group of individuals in the same physical environment, sharing a common goal”. People have the need to have social relations and to belong to a group. Presumably the need of belonging is part of the human biological inheritance and forming social groups is a characteristic and fundamental motivation for human beings. Groups exist in every culture and people tend to form social relationships quite easily, however the type of groups and how many groups are joined differ (Baumeister & Leary, 1995). Having social bonds is beneficial for survival and reproduction. Being part of a group enlarges your chances to receive care, food and protection (Baumeister & Leary, 1995; Mellor et al., 2008). Groups can share food, are needed in order to hunt for example a large animal, provide mates, are needed in order to defend themselves against enemies and help care for offspring. According to Baumeister & Leary (1995) do people “... who have anything in common, who share common (even unpleasant) experiences, or who simply are exposed to each other frequently...” easily engage in social relationships. Many of the emotions that are experienced the strongest related to belonging (Baumeister & Leary, 1995). Belonging to a group gives people positive feelings but being rejected is linked to negative feelings. Also, not belonging and the lack of social relationships result in physical and psychological health problems; “Behavioral pathologies, ranging from eating disorders to suicide, are more common among people who are unattached.” (Baumeister & Leary, 1995; Mellor et al., 2008). So, belonging to a group is not only pleasant but actually a need and a powerful influence on human behavior.

When the members of the crowd do feel like they belong to the group, they are part of a psychological crowd (Templeton, Drury & Philippides, 2018). This means they are not only standing next to each other but also share some kind of social identity or feel like they belong to the same social group. The members of the social group often do not share more than a similar perception of their own identity, based on some simple impressions, but it still seems beneficial for them to act as a group by coordinating their behavior and standing closer to the other members of the group (Turner, 1982). Like discussed before does belonging to a group often results in positive feelings for the members of the group. On the contrary, a psychological crowd is often perceived as an entity by outsiders because the outsiders do not belong to the group and the people in the group are all behaving in a similar way (Templeton, Drury & Philippides, 2018). For example, people at a sports event wearing the color of their favourite sports team share a social identity with the other people wearing the color of the same sports team. They feel like they belong to the same group and that will make them feel good. At the same time this crowd can be perceived as constraining or threatening for the people who support another team and do not wear that particular color (Desor, 1972; Filingeri et al., 2017; Tirachini, Hensher & Rose, 2013; Lee & Graefe, 2003; Yildirim & Akalin-Baskaya, 2007; Zehrer & Raich, 2016).

So people experience benefits when they feel like they belong to a crowd, but the crowd can be perceived as threatening when they do not belong to it. Like said before, members of the crowd do act as a group, coordinate their behaviour and also tend to stand closer to each other. The density between the members of the crowd increases, but where members of the group probably perceive this as something positive, this can also be experienced in a negative way. The feeling of having insufficient space is called crowding. Crowding is the psychological perception of the physical limitations of space (Neuts & Vanneste, 2018). According to Neuts & Vanneste (2018) crowding is often associated with a person perceiving that the social carrying capacity of an area is exceeded. This will

result in discomfort and suboptimal experiences in the physical environment. So crowding is the uncomfortable feeling that can be experienced when the density in a space is in violation with an individual's personal preference (Schuckert & Wu, 2021; Yin et al., 2020).

Crowding can be experienced in all physical environments. Crowding has been studied in streets, pedestrian movement, public transportation and emergency evacuation among other things (Haghani, 2020; Haghani & Sarvi, 2018; Neuts & Vanneste, 2018; Yap, Cats & van Arem, 2020) all using different methods to measure crowding. For example, the method used for pedestrian movement can be field observations, where the behavior is simply observed without implementing any kind of interventions or influence by the researcher, or experimental observations, where some kind of intervention or influence by the researcher is implemented (Haghani, 2020). Crowding in public transportation was, for example, measured by a survey that the respondents' perception and opinion of pictures of different levels of crowding, where the level of crowding is the amount of people per square meter (Tirachini et al., 2017; Batarce, Muñoz & de Dios Ortúzar, 2016).

To understand and quantify crowding behavior, crowding should be operationalized. Since crowding is experienced when the density of people is perceived in a negative way, the amount of people in a physical environment is important. In this study crowding is operationalized as the amount of people at the determined area.

2.2 Crowding behavior of smokers

Several researchers have studied the motivation of smokers to smoke in general, being a way to cope with stress, a way to socialize and improve interpersonal relationships and a way of feeling more comfortable in their social environment (Ayar et al, 2019; Zhao et al., 2017). Since smokers are not allowed to smoke indoors they often gather at the entrance of buildings. Smokers choose entrances of buildings because of shelter, proximity to their workplace, limited time available for a break and the gathering of other smokers (Kaufman et al, 2010). When people are smoking at the entrance of a building they are visible for all other people leaving and entering the building. Visibility and shelter are aspects of the physical environment and have an effect on people's behaviour. Also, smokers often just go outside to quickly smoke a cigarette. Therefore they often have little time and is a place close to the entrance of the building (Hills, Farpour-Lambert & Byrne, 2019; Kaufman et al, 2010).

The high visibility of smokers could be associated with social norms and smokers can be role models (Alesci, Forster & Blaine, 2003; Kaufman et al., 2010). According to Alesci, Forster & Blaine (2003) social norms are: "community's collective expectation for behaviors considered desirable and appropriate.". This means that when smokers see a lot of other people smoke they get the feeling that smoking is normal and that other people also perceive this as approved behavior. Like said before is smoking a way of feeling more comfortable in a group and a way to socialize. Also according to Moore, Annechino & Lee (2009) do some of the smokers see smoking outside as a source for social networking and solidarity. So smokers immediately feel like they belong to the same social group. One of the respondents in the study of Kaufman et al. (2010) said: "...being part of that huddle. It's kind of funny, but it's like a social thing. Because you're going out there for a reward for the smoking, right? It's sort of like your time to get away from your desk for ten minutes, socialize with your friends that are smoking.". This illustrates that smoking is not only about smoking the cigarette, but that it is also considered as an easily accessible source for social contacts and when more people are smoking that this behavior is considered as accepted sooner. At the same time smokers becoming more aware that their smoke might bother others. Many of the respondents in the study of Kaufman et al. (2010) stated that they felt more comfortable finding a place away from non-smokers to smoke. When they would smoke close to an entrance they would also hold their cigarette down or move temporarily, in order

not to be a burden. So smokers are more aware that smoking can be annoying and harmful for non-smokers. This might be a result from the norm shifting from smoking as a fashionable- to a harmful habit. The amount of people smoking is decreasing and this might result in that the remaining smokers will find support in each other even more.

It is proven that the presence of smokers will result in fewer quit attempts and more chance of stopped smokers who will start smoking again. When smoking is less visible and less convenient, smokers might smoke less or even quit (Kaufman et al., 2010; Parry, Platt & Thomson, 2000). By changing something about the physical environment at the entrance of the building, smokers might feel less comfortable smoking there and the smoking behavior might be changed.

The entrance of buildings should be accessible and hospitable (Sureda et al., 2012). When the entrance is polluted and not easy accessible this has an influence on the perception of the entrance. The perception of the built environment has an influence on the perception of the organization inside the building. The physical environment already communicates the image of the organization and its purpose towards the visitors and employees (Bitner, 1992; Rapoport, 1990). All aspects of the physical environment can be seen as cues (Rapoport, 1990). These cues give an indication of what kind of situation people are in and how people are expected to behave. According to Rapoport (1990) do "people typically act in accordance with their reading of environmental cues.". These cues are provided by the physical environment and the organization and result in a certain behavior, but the organization is also judged by this behavior.

When the entrance is polluted this has a negative influence on the perception of the organization. This can be seen as a cue that the organization does not even care about their entrance. They could take action by for example hiring a cleaner or by placing ashtrays or garbage bins, but a shabby or neglected entrance gives the impression that the organization does not care at all. Even though this does not necessarily have to say anything performance of the organization itself, this does not help to get a positive first impression. Also, when it is difficult to enter the building this could have a negative influence on the perception of the organization. When a group of smokers is standing at the entrance they might hinder people trying to enter the building because the way to the inside is simply not easy accessible. This inconvenient and, like said before, a high density of people is likely to be experienced negatively. Next to that, the non-smokers can perceive the crowd of smokers as an entity and this could be experienced as threatening by them (Templeton, Drury & Philippides, 2018). In case of emergencies, congestion at an entrance can even be dangerous since entrances are often also used as an exit to leave the building (Zhou et al., 2019).

It might even be that crowding keeps people from entering the building. Previous research studying crowding in public transport showed that crowding did significantly influence the choice between train and bus (Zhou et al., 2019). This could also mean that there are alternative buildings to enter for the same purposes, people could decide to enter a building where they do not experience crowding. So the crowding behavior of smokers could have a negative influence on the perceived accessibility and hospitality by non-smokers.

According to Thomson et al. (2013) there are different methods to measure the crowding behaviour of smokers. Examples of these methods are a static visual scan by a stationary observer once every time slot, continuous observations of each person entering an area, counting the amount of people entering a certain area and the proportion smoking, observations by a walking observer and continuous observations. Kaufman et al (2010) did use a map to capture smoking behavior at different sites. To calculate the percentage of smokers that were within a 9m radius from the entrance, this amount was divided by the total amount of smokers at the observation area. A simple method to register the obtained data is by using a tally table. The tally table could be written down on paper, but

a more unobtrusive way is by using a mechanical hand counter or a personal digital assistant (Thomson et al., 2013).

2.3 Nudging interventions

Since the crowding of smokers close to an entrance can be experienced negatively, it could be useful to know what are possible ways to change this behavior. One way to do this is by using a nudging intervention. When something is changed in the environment in order to subtly guide people to a certain choice or behavior this is called a nudge (Hofmann & Stanak, 2018; Wu & Paluck, 2018). A nudge is “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives” (Thaler & Sunstein, 2009). According to McCoy et al. (2018) a nudge is “an intervention into human behavior that gently encourages a change in a persons’ behavior.” A nudge should be cheap and easy to avoid (Forberger et al., 2019). According to Forberger et al. (2019) are nudging interventions appealing because an individual’s decision for a certain behavior can be influenced with minimal effort. By using an intervention, like a nudge, decisions and behavior can be influenced.

The Mindspace framework can be used to effectively change the behavior of people (Dolan et al., 2012; Liu et al., 2017). Our behavior and decisions are influenced by the context they are presented in. The Mindspace framework consist of the concepts messenger, incentives, norms, default, salience, priming, affect, commitment and ego. The nine concepts mentioned influence context, and can change behavior. Therefore the concepts can be used as inspiration for a nudging intervention.

Messenger - We are heavily influenced by who communicates information to us. When the message is delivered by a credible messenger the message is more likely to be judged as being true. A credible messenger is a person with authority, an expert, a person that is similar to the receiver of the message or a person we like.

Incentives - We use mental shortcuts to respond to incentives. For the effectiveness of these incentives the reference point is important. An incentive that influences one person to change their behavior might not be enough for another person to change their behavior. There are also other biases that influence our behavior. For example, people have a loss aversion, people do overweight the small probabilities and people rather have a smaller benefit today than a larger benefit in the future.

Norms - Norms are behavioral expectations. People are influenced by what others do and what they think is socially acceptable. However, they are not always aware that they are influenced. Because of the automatic system 1 thinking people influenced by social norms might act in unpredictable ways. Norms can also work as a signal of the best option. For example, when a shelf in the supermarket displays similar products, people might pick the product that with the fewest amount left on the shelf.

Default - The default option is the option that people will end up with when they will not make a choice is the default option. Since people often do not make an choice or simply just go for the easiest option, this is also an effective way to achieve a certain behavior. An example of this is the Dutch government switching from letting people actively choose to register as a donor of their organs after they die, to an architecture where people have to register when they do not what to donate their organs.

Salience - The attention of people is drawn to things that stand out, are new, are simple to understand and people can relate to. When people do not notice the nudge it probably will not have that much of an effect. When it stands out and people can for example relate to their personal experiences the nudge is more likely to be successful. Footsteps towards the stairs will probably have more effect than a poster supporting people to work out (Dolan et al., 2012).

Priming - Most of the time we make decisions unconsciously. Cues in the environment can influence these decisions and the behavior of people. Actually certain perceptions are linked to certain behavior and actions. These cues can be words, sights or sensations. For example, when a person is confronted with words that are related to movement, like “fit” and “active”, they were more likely to use the stairs. Asking people questions about their intended behavior also has an influence on their actual behavior. When a person is asked how many times they are going to walk the stairs the coming week, their actual use of the stairs will increase. The same applies to the use of sights and smells. When people are confronted with running shoes and running magazines they are more likely to adopt a “healthy lifestyle”. The smell of detergent will cause that people are more likely to clean up after themselves.

Affect - All perceptions a person does have, are also related to emotions. When we observe an object we often link it to a feeling. For example we see a pretty or an ugly car. A campaign to improve the use of hand soap focused on provoking the feeling of disgust instead of promoting the use of soap.

Commitment - People are concerned by their public reputation. People are scared that if they fail in making the commitment this might have an influence on their reputation. However, people have trouble making long term commitment. Helping them with commitment and the costs of failure can influence them in showing the desired behavior. Reciprocity is also an important aspect of commitment. People will commit if other people will do that too and when they do people a favor they might expect a favor in return. An marketing tool leaning on the concept of reciprocity is giving away free samples of a product.

Ego - People behave in a way that supports a positive and consistent self-image. Positive things happen due to themselves and negative things happen due to others. In order to maintain a positive self-image people tend to compare themselves with others and they often believe, while doing this, that they are “above average”. This also applies to groups people identify themselves with. People want to feel good about themselves and this could also be a way to influence behavior. When dealing with consistency people tend to change their believes before they change their behavior. However, when they changed a small thing in their behavior they want to be consistent with this behavior. The foot-in-the-door technique can be used to change people’s behavior by first asking them to changing something small followed up by larger changes.

A nudging intervention can use one or more of these concepts. Nudges are the most successful when they align with a person’s personal motivation. When the nudge is not in line with a person’s motivation this nudge is less effective (Wu & Paluck, 2018). So nudges steering to smoking in the smoking area will probably not have a lot of effect on who really do not want to smoke in the smoking area.

There are quite some studies concerning nudging in relation to health decisions. A lot of nudging interventions in regard to food choices and health have been tested already. There vary from priming nudges, to salience nudges, to descriptive labels and calorie content labels (Wilson et al., 2016). Also applying traffic light labels to food products, with green being the healthy choice and red the unhealthy choice, have been tested. During this study the sales of the green labelled items did increase significantly (Wilson et al., 2016). Often colors do also have a meaning. For example, the color blue on a water bottle is associated with still water and red is associated with sparkling water, or biologically based proclivities, for example the color red that signals the readiness of fruit for eating (Mohebbi, 2014; Elliot & Maier, 2007). So do the colors of a traffic light have a meaning and strong associations too; green means “go” or “healthy”, yellow/orange does mean “caution” and red does mean “stop” or “unhealthy”. During the studies in the review of Wilson et al. (2016) the consumers did automatically

link the meaning of these colors to the food choices. Therefore you can wonder if the smokers at an entrance sit will do the same thing.

Making healthier choices in regard to tobacco food has also been studied. However, these studies are mostly focused on making people smoke less or quit. Examples are putting taxes on cigarettes, labelling on the packages or simply forbidding people to smoke at certain places. Still, limited research is done in regard to making smokers smoke at a designated place. However, there are studies where nudging interventions were used to move people. Landais et al. (2020) did a systematic review focused on the nudging interventions to change physical activity and sedentary behavior. The review consist mainly about studies testing the effect of nudging interventions promoting the use of stairs (arrows to the stairways, footsteps on the floor towards the stairs, motivational posters, email-based encouragements, leaflets with walking trails, slim making mirrors placed around the stairs and elevators, delaying elevator speed, stairways decorated, music played in the stairways, art in the stairways and using a video of a well-known colleague using the stairs). There were also some studies included that focused on physical activity in general. The nudging interventions used were using motivational posters with different messages, a step challenge with a specific goal, a step challenge in teams, being assigned to a team with anonymous peers having to attend exercise classes and putting all sit-stand-desks in the office at standup height.

Using posters as a nudge to promote a desire behavior are not always effective (Landais et al., 2020; Van der Meiden, 2018), but they can be (Ledderer et al., 2020). A study of Caris et al. (2018) showed that posters can be an effective way to increase the use of alcohol-based hand rub when the posters are placed prominently next to the dispensers. The way the message was formulated also proved to be of great importance. This also applied to the study of Ogawa et al. (2011) were the sales of vegetables increased after placing posters providing health information in display spaces for vegetables and at the checkout counters.

A lot of the studies that have been done in regard to nudging interventions in the reviews of Landais et al. (2020) and Wilson et al. (2016), were some sort of an experiment were the data was conducted via observations. Nudging interventions can be experienced consciously, but often they are mend to unconsciously influence people. Next to that, it is better to see what people will actually do than to ask them what they think they would do. Often a nudging intervention is considered successful when there is a significant difference between the baseline observations and the observations when a nudge is implemented. Also in this study the nudge will be considered effective when there is a significant difference between the amount of smokers at the entrance before and during the implementation of the nudge.

2.4 Effectiveness

In the next subchapter the effectiveness of a nudge, so the change in behavior, will be explained. Behavior depends on a lot of factors. The theory of planned behavior is a model designed in order to explain and predict human behavior (Ajzen, 1991). The actual behavior of a person is influenced by the persons intentions. The intentions are motivations for a person to show a certain behavior. According to Ajzen (1991) the intentions are "... indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior." So if a person has a strong intention to show a certain behavior, it is more likely that they will also show this certain behavior. The intention is influenced by three factors: Attitude toward the behavior, subjective norm and perceived behavioral control. The attitude toward the behavior is the degree to which the person likes or dislikes the behavior. The subjective norm is the extent to which the person feels the social pressure to show the certain behavior. The perceived behavioral control is the expected easiness of difficulty of showing

that certain behavior (Ajzen, 1991). This is strongly based on the belief to be able to show that certain behavior. These three factors have an influence on the intentions to show a certain behavior and the actual shown behavior. However, the impact of the influence of the factors can vary across different situations. The theory of planned behavior also has an influence on the crowding of smokers at a certain place. For example, when a smoker has a negative attitude towards smoking in the smoking area this will probably result in the smoker smoking close to the entrance. However, if the smoker feels like the subjective norm is to smoke in the smoking area this could

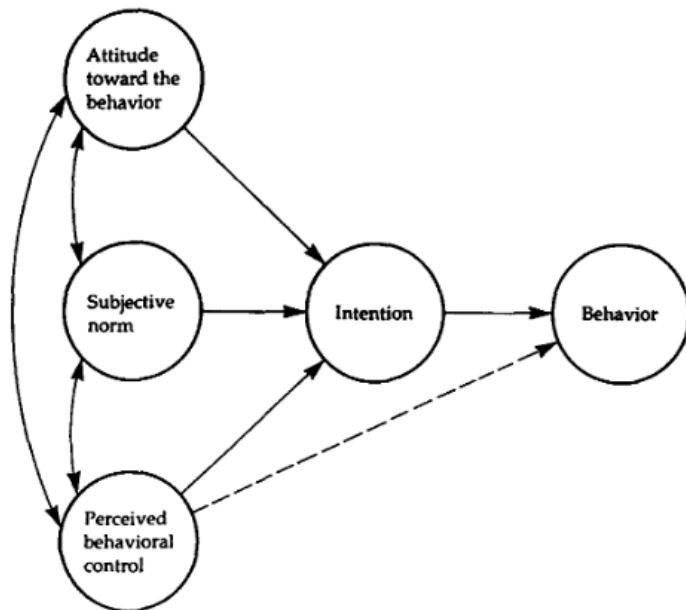


Figure 2 - Theory of planned behavior (Ajzen, 1991)

mean that the smoker will intend to smoke in the smoking area. The relations between the concepts of the theory of planned behavior are shown in figure 2.

There is still a gap between the intention of a certain behavior and the actual behavior, also known as the Intention-Behavior Gap. People can have the intention to show a certain behavior but might not actually do this in the end. According to Sheeran & Webb (2016) do intentions get translated into behavior approximately one-half of the time. This also depends on the quality of the intentions. When a person is more convinced to show a certain behavior they are more likely to actually show this behavior than when they value these intentions less. However, the decision for a certain behavior is not only depend on a person's intentions, but also on the other information available and processed.

Information gets processed in different ways. The first way is the automatic, fast and effortless 'System 1' thinking or 'Automatic system'. The second way is the conscious, slow and rational 'System 2' thinking or 'reflective system' (Dolan et al., 2012; Evans, 2003; Thaler & Sunstein, 2009). Our brain is not able to process all received information in the system 2 way. Therefore, it is forced to use system 1 thinking for the greater part of the information it has to process. When system 1 thinking is used to make a decision only the outcome is registered consciously (Evans, 2003; Liu et al., 2017). The decisions are based on biases, heuristics or shortcuts, like common sense and educated guesses, and are influenced by the environment, the situation and emotions (Hofmann & Stanak, 2018; Moseley & Stoker, 2013; Dolan et al., 2012). A nudging intervention can make use of the same heuristics and biases in order to stimulate a different decision. The nudge can change the underlying choice architecture. The choice architecture is the way in which a choice is presented to a decision maker. The goal of the nudge is to change the choice architecture in such a way that the desired decision is to most attractive one to make (Kim et al., 2020).

2.5 Conceptual framework

Little is known of nudging interventions in regard to making, specifically, smokers move. However, nudging interventions have been studied in other situations. Because other studies have proven nudging interventions in regard to moving people to be effective, it is assumed that nudging interventions at the entrance site will have a positive effect on moving the position of the crowding of smokers to a place more distant from the entrance of a building. This is shown in figure 3.

Next to that, it is assumed that weather conditions will have an influence on the effect of the nudging interventions on the positioning of the crowding of smokers on the entrance site. Also, it is assumed that the presence of non-smokers close to the entrance will have an influence on the effectiveness of the nudging intervention. Finally, there might be other influences that are not in the scope of this study.

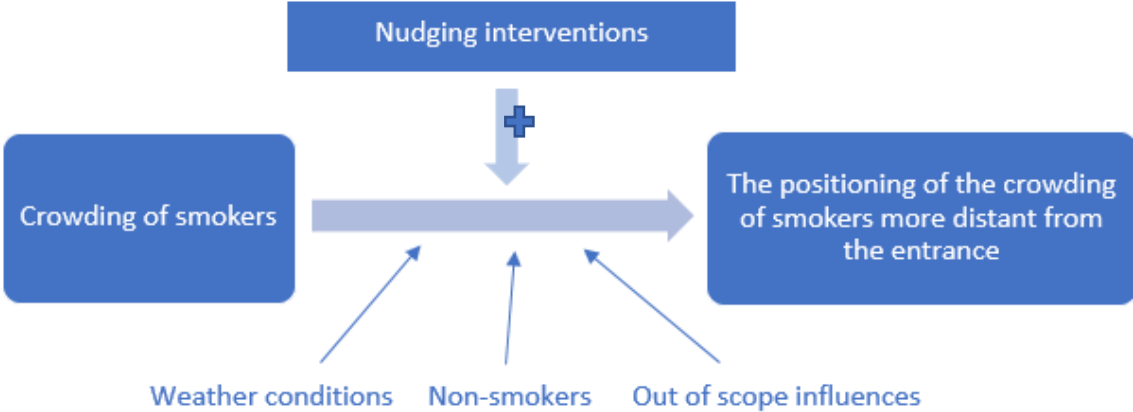


Figure 3 - Conceptual framework

3. Research methodology

In this chapter the research design, the methods of data collection, the procedure of measures and the data analysis will be discussed.

3.1 Research design

The objective of this study was to find out if nudging interventions are effective in moving the smokers that crowd at the entrance of a building to an designated area. In order to test this an experiment was prepared.

This study was based on quantitative research. The experiment was based on a pre-test/post-test study design in which positioning and behavior of smokers were observed. The behavior of the smokers during the baseline observations and control weeks were compared, to the smoking behavior after implementing a nudging intervention. The nudging intervention aimed to change the behavior of smokers. During the observation, the behavior of smokers was taken into account. However, non-smokers did also walk around at the entrance site. Their behavior was also observed.

3.2 Methods of data collection

The method of data collection that was used in this study is observations. The goal of observing was collecting information about the natural behavior of the smokers. This can be done best by unobtrusive observations, where the smokers do not know that they are being observed. When the smokers are aware that they are being observed they might adjust their behavior. This bias is also known as the Hawthorne effect (Van Haperen et al., 2019; Gould et al., 2017).

The type of observations used in this research is not-participant. The researcher did not participate in the activities of the research units. The research units of this study were mainly students and employees of the Wageningen University that did smoke at the entrance site of a building of Wageningen University. Visitors might also be included since they couldn't easily be distinguished from students and employees. The observations were done at the entrance site of a building at the campus of Wageningen University. The entrance site was divided in an 'entrance area', a 'distant area' and the 'smoking zone' by the researcher. The entrance area was the area from the entrance of the building till 8.6 meters away from the entrance. Within the distance of 2 meters from a cigarette the risks of second hand smoke are high. When a distance of 10 meters from the lighted cigarette is ensured the risks of second hand smoke are a lot smaller. Still this depends on the wind and the amount of lighted cigarettes (Kaufman et al., 2011). The distant area did start at the end of the entrance area and did continue further away from the entrance. This division was not noticeable by the research units. Next to the 'entrance area' and the 'distant area', a smoking area was present. The smoking zone was recognizable and known by smokers. In the ideal situation all smokers will smoke in the smoking area. A map of the entrance site can be found in appendix A.

The research units were observed when they were making the decision to stand or sit somewhere at the entrance site. When a research unit decided to leave the entrance site after a short stop (within approximately one minute) they were removed from the data. This was done since these people were only using the entrance site to enter or leave the building and were not using the site to take a break or smoke a cigarette. When a research unit was moving through the different areas, the observation moment was also excluded from the data. The decision to assign them to one of the areas would have been subjective and a person cannot be in several areas at the same time. The percentage of smokers per week in the different areas was calculated by taking the mean of the percentages of smokers per day.

The observation period did last five weeks. The first week was a baseline observation in which the current smoking behavior was observed. During the second week the first nudging intervention was implemented and again the behavior of smokers was observed. The third week the nudging intervention was removed and the behavior of smokers was observed to measure the lasting effect of the nudging intervention on the current smoking behavior. During the fourth week the second nudging intervention was implemented and again the smoking behavior of the research units was observed. The fifth week was the second control week. The second nudging intervention was removed again to measure the lasting effect of the nudging intervention on the smoking behavior.

The different study weeks of the university might have an effect of the amount of smokers smoking at the entrance site. The observation period will be during the fourth till the eighth week of the education period of the university. During these weeks, most of the students will follow classes that will have similar schedules during these weeks. Therefore it is assumed that the smokers observed in all five weeks do belong to the same group.

There might be other factors, besides the nudging intervention, that could have influenced the difference among the amount of smokers in the different areas in different weeks. Firstly, the presence of non-smokers at the entrance site might have influenced the positioning of smokers. Therefore the amount of non-smokers at the entrance site was also counted. Secondly, the weather conditions in the different weeks could have influenced the smoking behavior of smokers in different weeks. Smokers have to go outside to smoke and weather conditions have an influence on the human behavior (Brum-Bastos, Long & Demšar, 2018). Therefore the weather conditions were also noted. Three options were used to measure the weather conditions (1= sunny, 2= cloudy and 3= rainy).

3.3 Procedure of measures

The observation period did last five weeks. The smoking behavior was observed on Wednesday, Thursday and Friday morning from 10:00h till 12:15h. These time slots were chosen because it was expected that the students and employees present in the building would go outside to have a break from 10:00h onwards. From 12:15h onwards significantly more people would go outside to have a break and the researcher was not able anymore to keep track of all research units.

The observer was located outside the entrance site. The observer had a clear overview of the smokers using the different areas of the entrance site to smoke. While observing, the obtained data was written down in a tally table.

Week 1: Baseline operations

In the first week three observation sessions were conducted. In these sessions the researcher was observing the smoking behavior of smokers at the entrance of the building. The first week of the experiment was focused on observing the current smoking behavior.

Week 2: First nudging intervention

During the second week the first nudging intervention was implemented. The first nudging intervention was removing the ashtrays that are normally placed outside the entrance. According to Kaufman et al. (2010) and Fu et al. (2016) do smokers often smoke at places where cigarette receptacles are present because of practical reasons but also because this can be seen as a sign that smoking is allowed. The absence of ashtrays might on the contrary send the message that smoking is not allowed. The researcher is fully aware that removing the ashtrays could result in a lot of litter, and that this collateral damage could outweigh the benefits of the nudge.

Week 3: First control week

The third week of the observations was the first control week. The nudging intervention was removed and after this the researcher started observing again. The control was carried out in order to find out whether the previous presence of the nudging intervention might still have an effect on the smoking behavior of the smokers. Again, it was assumed that the smokers do belong to the same group of smokers as in the previous weeks because of the education period.

Week 4: Second nudging intervention

In the fourth week the second nudging intervention was implemented. The second nudging intervention was the placement of two different posters at the entrance site. The posters were red (close to the entrance, 40 meters from the smoking area) and orange (more distant from the entrance, 30 meters from the smoking area). Below the image of the cigarette the following sentence was placed: "Please do not smoke in front of the revolving door but at the designated smoking area near the bridge". The placement of the posters on the entrance site is shown in the map of the entrance site in appendix



Figure 4 - Posters

A. The ashtrays were also removed again during week 4. The observer did observe the smoking behavior of smokers at the entrance site. Again, it was assumed that the smokers do belong to the same group of smokers as in the previous weeks because of the education period.

Week 5: Second control week

The fifth and last observation week was again a control week. The nudging intervention of week 4 was removed again. For the last time the researcher did observe the smoking behavior on the entrance site. This second control week was carried out in order to find out whether the second nudging intervention might still have an effect on the smoking behavior of the smokers. Again, it is assumed that the smokers do belong to the same group of smokers as in the previous weeks because of the education period.

3.4 Data analysis

The goal of this study was to find out if nudging interventions are effective in moving the crowding of smokers from the entrance of a building to a designated smoking area. The collected data in the tally tables were counted and the amounts and percentages were put in a general table. Effectiveness was measured at the level of change in the percentage of smokers both in front of the entrance to the building and the designated smoking area based on direct observation, with 90% reliability as cut off. The percentages of people smoking in the different areas during the different weeks, with and without nudging intervention, were compared. To find out the differences in smoking behavior between the different weeks with different conditions a paired samples t-test was used (McCrum-Gardner, 2008) at a significance level of $p < 0.1$. This P-value was chosen because the researcher could have missed certain things during conducting the observations. The different weeks that were compared are shown in figure 2.

To measure the effect of the first nudging intervention the data obtained was compared to the data of other weeks. Week 2 was compared to week 1 to test the difference between first nudging intervention and the baseline observations (arrow A). Arrow B represents the comparison of week 2 with week 3 (first control week). Week 4 was compared to week 3 to test the effect of the second nudging intervention (arrow C). The comparison between week 4 and week 5 (The second control

week) is displayed by arrow D. Week 4 (the second nudging intervention) was also compared to the baseline observations (arrow E) because the results week 3 could have been influenced by the first nudging intervention. The difference in the effect of the different nudging interventions was tested by comparing week 2 to week 4 (arrow F). To test the effects of the nudging interventions week 1 was compared to week 3 (arrow G), week 1 was compared to week 5 (arrow I) and week 3 was compared to week 5 (arrow H). The nudge was considered effective when there is a significant difference between the compared weeks.

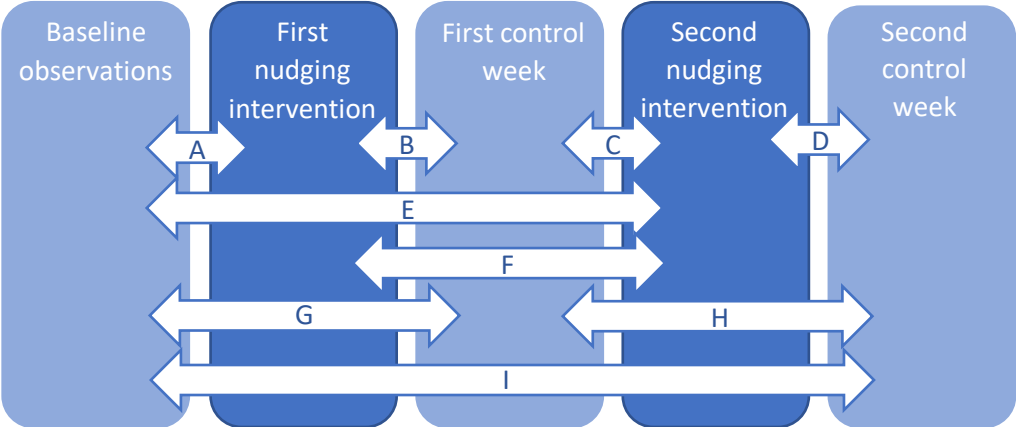


Figure 5 - Compared observation weeks

Background variables

Other factors, besides the nudging intervention, could have influenced the difference in smoking behavior in the different weeks. The presence of non-smokers might have had an influence on the smoking behavior of smokers. To test whether there is a significant difference in non-smokers among the different weeks a paired samples t-test was used.

A Chi-square test was done to check whether there are significant differences in weather conditions in the different weeks. Weather conditions will be measured by three options (1= sunny, 2= cloudy and 3= rainy).

4. Results

This chapter describes the results of this study. First, the results of the observations will be discussed, followed by the obtained data from the survey questionnaire.

4.1 Observations

In total there were 2,331 observation moments in the observation period, of which 1,278 observation moments did concern smokers and 1,053 observation moments did concern non-smokers. An observation moment in this study was the time between a person entering and leaving the entrance site.

During the baseline observations 80.6% of the smokers was positioned at the entrance area, 2.2% was positioned at the distant area and 17.2% was positioned at the smoking area (standard deviation (SD)= 7.16). After the implementation of the first nudging intervention 79.9% of the smokers was positioned at the entrance area, 8.8% at the distant area and 11.3% at the smoking area (SD= 12.41). During the first control week 77.5% of the smokers was positioned at the entrance area, 2.6% was positioned at the distant area and 19.9% was positioned at the smoking area (SD = 10.05). After the implementation of the second nudging intervention 29.3% of the smokers was positioned at the entrance area, 24.9% at the distant area and 45.8% at the smoking area (SD = 8.44). During the second control week 70.3% of the smokers was positioned at the entrance area, 13.6% was positioned at the distant area and 16.1% was positioned at the smoking area (SD = 5.87).

4.2 Effect of the nudging interventions

The goal of this study was to find out if nudging interventions are effective in moving the crowding of smoking from the entrance of a building to a designated smoking area. In order to find out the effectiveness of the nudging interventions, the weekly results of the observations had to be compared.

Figure 6 shows that the percentage of smokers that smoked in the entrance area decreased slightly from week 1 (80.6%) to week 2 (79.9%). The amount of smokers decreased slightly again during week 3 (77.5%). During week 4 the amount of smokers in the entrance area decreased to 29.3%. In week 5 this amount increased again (70.3%).

So the percentage of smokers in the different area's did not change that much during the first nudging intervention. However, during the second nudging intervention the percentage of smokers in the entrance area did decrease a lot while the percentage of smokers in the distant area (24.9%) and smoking area (45.8%) did increase. During week 5 the average percentage of smokers in the entrance area increased largely again. This is also shown in table 1.

After implementing the first nudging intervention in week 2 the percentage of smokers in the distant area increased with 6.6% while the percentage of the smoking area decreased with 5.9%. Figure 6 shows that after implementing the second nudging intervention in week 4 the percentage of smokers in the entrance area decreased. The percentage of smokers in the distant area increased with 22.3% and the percentage of smokers in the smoking area increased with 26.0% in this week.

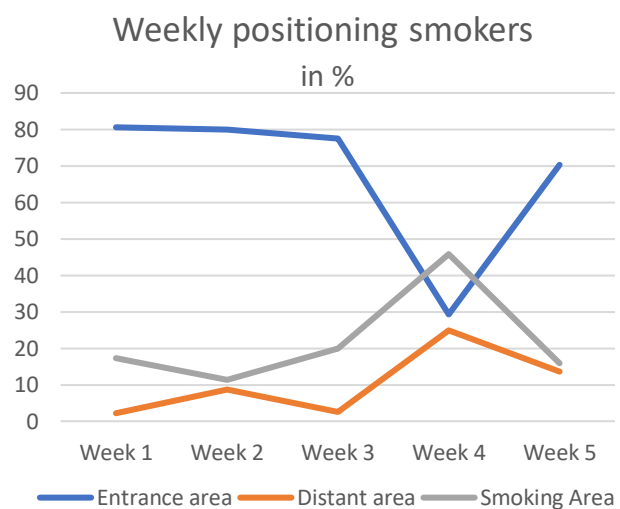


Figure 6 - The weekly percentages of smokers in the different areas

Table 1 - Average percentage of- and change in smokers in the entrance area

Week	Nudging intervention	Average % smokers entrance area	% Change compared to previous week	% Change compared to baseline week
1	None (baseline)	80.6	0.0	0.0
2	Removing ashtrays	79.9	-0.7	-0.7
3	None (control 1)	77.5	-2.4	-3.1
4	Posters + removing ashtrays	29.3	-48.3	-51.3
5	None (control 2)	70.3	+41.0	-10.3

To find out if there are significant differences in the percentage of smokers in the entrance area between the different weeks with different conditions a paired samples t-test was used. It was tested if there are significant differences between week 1 and 2 (first intervention), week 2 and 3 (first control week), week 3 and 4 (second intervention), week 4 and 5 (second control week), week 1 and 4 (second intervention compared to baseline), week 2 and 4 (between nudging interventions), week 1 and 3 (between baseline and first control week), week 3 and 5 (between control weeks), and week 1 and 5 (between baseline and second control week).

It was assumed that the nudging interventions will cause that the amount of smokers in the entrance area will decline. This means that when a nudging intervention is implemented the percentage of smokers in the entrance area will decrease. For this study the difference in percentage of smokers in the entrance area is significant if the P-value is smaller than 0.1 ($P < 0.1$). Table 2 shows the outputs of the outputs of the paired sample t-test for the amount of smokers in the entrance area.

The difference in the percentage in the smoking zone was not significant for: week 1 and 2, week 2 and 3, week 1 and 3, week 3 and 5 and week 1 and 5. The difference in the percentages in the entrance area between week 3 and 4 ($P=0.045$), week 4 and 5 ($P=0.033$), week 1 and 4 ($P=0.024$) and week 2 and 4 ($P=0.004$) were significant.

Table 2 - Brief overview of the outputs of paired samples t-test entrance area

Arrow figure 3	Week	P	Significant with $p < 0.1$?
A	1 & 2	0.948	No
B	2 & 3	0.868	No
C	3 & 4	0.045	Yes
D	4 & 5	0.033	Yes
E	1 & 4	0.024	Yes
F	2 & 4	0.004	Yes
G	1 & 3	0.502	No
H	3 & 5	0.281	No
I	1 & 5	0.214	No

The removal of the ashtrays during the first intervention week did not show a difference in the percentage of smokers in the entrance area, but it caused a lot of litter. The smokers would still smoke here and just throw their cigarette butts on the ground.

Also, the placement of the posters did show significant differences compared to all other weeks. However, there were still smokers that would smoke their cigarette at the entrance area. The researcher observed that some of the smokers did choose to stand in the entrance area but did this just behind the poster frames. This showed that they did probably notice the poster, but decided to stand just behind it.

The goal of this study was to find out if nudging interventions are effective in moving the crowding of smoking from the entrance of a building to a designated smoking area. The change in the percentage in smokers at the entrance area does not mean that these smokers will now smoke at the entrance area. Therefore, the percental change of smokers in the smoking area are also studied. The average percentage of smokers per week in the smoking area and the change compared to the previous week and the change compared to the baseline week are shown in table 3.

Table 3 - Average percentage of- and change in smokers in the smoking area

Week	Nudging intervention	Average % smokers smoking area	% Change compared to previous week	% Change compared to baseline week
1	None (baseline)	17.2	0.0	0.0
2	Removing ashtrays	11.3	-5.9	-5.9
3	None (control 1)	19.9	+8.5	+2.6
4	Posters + removing ashtrays	45.8	+26.0	+28.6
5	None (control 2)	16.1	-29.7	-1.2

To find out if there are significant differences in the percentage of smokers in the smoking area between the different weeks with different conditions a paired samples t-test was run. Table 4 shows a brief overview of the outputs of the paired sample t-test. The difference in the percentage in the smoking zone was not significant for: week 1 and 2, week 2 and 3, week 3 and 4, week 1 and 3, week 3 and 5 and week 1 and 5. The difference in the percentage in the smoking zone between week 3 and 4 (P=0.096), week 4 and 5 (P=0.015), week 1 and 4 (P=0.042) and week 2 and 4 (P=0.013) were significant.

Table 4 - Brief overview of the outputs of paired samples t-test smoking area

Arrow figure 3	Week	P	Significant with p <0.1 ?
A	1 & 2	0.474	No
B	2 & 3	0.484	No
C	3 & 4	0.096	Yes
D	4 & 5	0.015	Yes
E	1 & 4	0.042	Yes
F	2 & 4	0.013	Yes
G	1 & 3	0.509	No
H	3 & 5	0.524	No
I	1 & 5	0.708	No

4.3 Background variables

Other factors, besides the nudging intervention, could have influenced the difference in smoking behavior in the different weeks. The presence of non-smokers might have had an influence on the smoking behavior of smokers. To test whether there is a significant difference in the amount of non-smokers among the different weeks a paired samples t-test was used. The means of the observed amount of non-smokers present at the entrance site during the different weeks were compared. There were no significant differences between the weeks and the amount of non-smokers. An overview of the results of paired sample t-test can be found in appendix B.

A Chi-square test was done to check whether there are significant differences in weather conditions in the different weeks. There were no significant differences between the different weeks and the weather conditions (P = 0.246). This means the weather conditions were equally divided over the different weeks and therefore did in all probability not influence the results. In appendix B an overview of the daily weather conditions are shown.

5. Conclusion and discussion

The research question of this study was “*To what extent does a nudging intervention influence the crowding of smokers at an entrance site?*”. This first subchapter contains the conclusion and the discussion. The limitations of the research are stated in the second subchapter. Finally, some recommendations for further research are given.

This study shows that nudging interventions are effective in preventing smokers from gathering at the entrance of a building and inducing them to gather at a designated smoking area. A combined nudging intervention of the removal of ashtrays at the entrance in combination with posters placed around the entrance calling for not to smoke at the entrance and to go to a designated place, significantly influenced the positioning of smokers. The number of smokers at the entrance decreased 51%, and the increase of smokers at the designated place was 29%, both relative to the baseline week count. There was a gap of 22% between the decrease of smokers at the entrance and increase of smokers at the designated area. This implies that due to the nudging intervention smokers also moved to other areas than the smoking zone or the area close to the entrance.

Since only removing the ashtrays proved ineffective, this apparently does not have a sufficient disciplining effect. Where the ashtrays, as cues of the physical environment, give the signal to smokers that smoking is allowed, the absence of the ashtrays apparently is not a strong signal to not smoke. The lack of ashtrays apparently does not appeal to desirable behavior. Since the removal of ashtrays is not substituted with an environmental cue, smokers are not encouraged to change their behavior (Hofmann & Stanak, 2018; Wu & Paluck, 2018; Rapoport, 1990; Dolan et al., 2012). Stronger, because it led to littering, it apparently fueled undesirable behavior. The litter, then again, can have a negative influence on the image of the organization located in the building (Bitner, 1992). On the other hand, what do you signal as an organization by placing ashtrays in front of the entrance of the building? Therefore, we believe that in order to permanently move smokers to the smoking area, the ashtrays should not be at the entrance at all in the first place.

The posters showing an icon of a cigarette on a white circle with a red border may have also been recognized as a prohibition sign. In that respect, this nudge does not meet the definition of Thaler & Sunstein (2009) being “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options”. However, it is not sure if the smokers did actually perceive the posters as a prohibition since we did not ask them.

This study showed that for the nudge to be effective the intervention should be salient; the nudge must stand out clearly, especially in an area where it is crowded. Also, the intention of the nudge must be immediately clear. According to the planned behavior theory, the smokers that already planned to find a place more distant from the entrance to smoke are probably affected more by the interventions, than the smokers that are determined to keep smoking at the place they are always smoking. This may well be illustrated by the smokers ‘hiding’ behind the poster frames, assuming them to have noticed the call for not to smoke, not willing to adjust their behavior. We assume they decided to stand just behind the poster frames in order to not be in violation with the message of the poster. This shows that people sometimes are persistent not to show the desired behavior and that in these cases the influence of the nudge is less effective since a nudge cannot do more than subtly guide behavior.

5.1 Limitations

During conducting this research different limitations have appeared that may have influenced the results.

Several studies using observations as a method of collecting data have been consulted and the observations were conducted in a uniform way. Therefore, the validity of the observations is ensured. However, since this study was a case study the results are not generalizable. There is the presumption that the presence of the observant did not influence the behaviour of the people at the entrance site. We do not know about this since we simply did not ask them.

The lasting effect of the nudges was not taken into account. Even though this was not the aim of the study it would be useful to know whether the positive effect of the nudging interventions would perpetuate the smokers' behavior after they are removed.

The posters were executed in a one-sided way with the posters facing the entrance. In this way the posters were only focused on the people leaving the building. However, the people who were just arriving could also decide to smoke a cigarette before entering the building. We are not sure that these people did not notice the posters, but the effect of the nudge might have been even greater when the posters were shown at both sides of the poster frames and, therefore, probably seen by more people.

Lastly, we do not know whether the smokers did notice the nudging intervention. A survey questionnaire should have been carried out to get more insights regarding the smokers noticing the nudge.

5.2 Further research

Some possibilities for further research have shown up during conducting this research.

Firstly, future nudging studies could consider extending the observation period. According to Dolan et al. (2012) is the attention of people drawn to things that stand out and that are new. So it is interesting to know what the smokers will do when the posters are no longer new. With an extended observation period the results might be more reliable.

Secondly, the lasting effect of the nudging interventions could be studied. We will know whether people will automatically adopt the desired behaviour after being confronted with the nudge for a while or if they will go back to their behavior from before the implementation of the nudge. By knowing if the nudges will also have a lasting effect on the behaviour of the smokers after the nudges are removed, we will know how important it is to keep the nudge implemented to guide the smokers to the desired behaviour.

Thirdly, it would be useful to know if the smokers do experience the poster as a prohibition sign or not, so we know the posters do meet the definition of Thaler & Sunstein (2009) of a nudge. This could be done by asking them, for example via a survey questionnaire.

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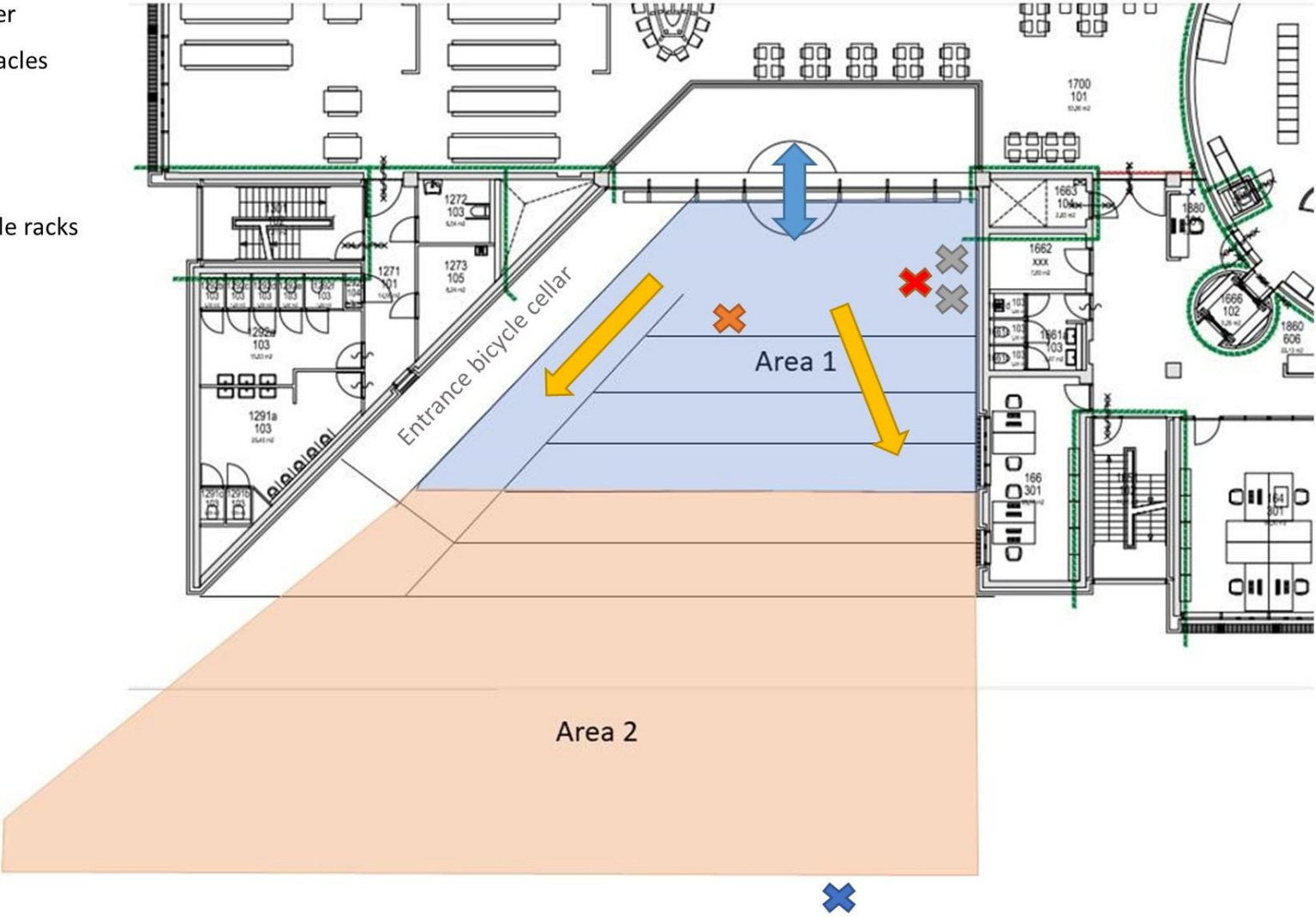
Appendices

Appendix A: Map entrance site

Appendix B: Observation analysis

Appendix A: Map entrance site

-  = Location observer
-  = Cigarette receptacles
-  = Poster red
-  = Poster orange
-  = Entrance
-  = Way to the bicycle racks



Appendix B: Observation analysis

Overview observation data per day smokers

Week	Day	Nudging Intervention	Entrance Area	Entrance Area %	Distant Area	Distant Area %	Smoking Area	Smoking Area %	Total	Total %
1	Wed	None (baseline)	72	75.00	5	5.21	19	19.79	96	100.00
	Thu		86	88.66	0	0.00	11	11.34	97	100.00
	Fri		57	78.08	1	1.37	15	20.55	73	100.00
2	Wed	Removing ashtrays	59	72.84	12	14.81	10	12.35	81	100.00
	Thu		53	72.60	7	9.59	13	17.81	73	100.00
	Fri		49	94.23	1	1.92	2	3.85	52	100.00
3	Wed	None (control 1)	74	77.08	1	1.04	21	21.88	96	100.00
	Thu		72	87.80	3	3.66	7	8.54	82	100.00
	Fri		65	67.71	3	3.13	28	29.17	96	100.00
4	Wed	Posters + removing ashtrays	20	27.78	23	31.94	29	40.28	72	100.00
	Thu		18	21.69	22	26.51	43	51.81	83	100.00
	Fri		33	38.37	14	16.28	39	45.35	86	100.00
5	Wed	None (control 2)	82	75.93	11	10.19	15	13.89	108	100.00
	Thu		63	70.79	13	14.61	13	14.61	89	100.00
	Fri		52	64.20	13	16.05	16	19.75	81	100.00
Total			855	67.52	129	10.42	294	22.06	1278	100.00

Overview observation data per week smokers

Week	Nudging Intervention	Entrance Area %	Distant Area %	Smoking Area %	Total %
1	None (baseline)	80.6	2.2	17.2	100.0
2	Removing ashtrays	79.9	8.8	11.3	100.0
3	None (control 1)	77.5	2.6	19.9	100.0
4	Posters + removing ashtrays	29.3	24.9	45.8	100.0
5	None (control 2)	70.3	13.6	16.1	100.0
Total		67.5	10.4	22.1	100.0

Overview observation data per day non-smokers

Week	Day	Nudging Intervention	Entrance Area	Entrance Area %	Distant Area	Distant Area %	Smoking Area	Smoking Area %	Total	Total %
1	Wed	None (baseline)	45	65.22	22	31.89	2	2.89	69	100.00
	Thu		83	97.64	1	1.18	1	1.18	85	100.00
	Fri		53	82.81	10	15.63	1	1.56	64	100.00
2	Wed	Removing ashtrays	75	77.32	21	21.65	1	1.03	97	100.00
	Thu		50	67.57	22	29.73	2	2.70	74	100.00
	Fri		20	86.96	2	8.69	1	4.35	23	100.00
3	Wed	None (control 1)	60	78.94	13	17.11	3	3.95	76	100.00
	Thu		67	84.81	12	15.19	0	0.00	79	100.00
	Fri		42	79.25	11	20.75	0	0.00	53	100.00
4	Wed	Posters + removing ashtrays	37	50.00	32	43.24	5	6.76	74	100.00
	Thu		19	40.43	20	42.55	8	17.02	47	100.00
	Fri		53	74.64	15	21.13	3	4.23	71	100.00
5	Wed	None (control 2)	55	74.32	16	21.62	3	4.06	74	100.00
	Thu		39	60.94	23	35.94	2	3.12	64	100.00
	Fri		49	47.57	51	49.52	3	2.91	103	100.00
Total			747	70.94	271	25.74	35	3.32	1053	100.00

Overview observation data per week non-smokers

Week	Nudging Intervention	Entrance Area %	Distant Area %	Smoking Area %	Total %
1	None (baseline)	81.9	16.2	1.9	100.0
2	Removing ashtrays	77.3	20.0	2.7	100.0
3	None (control 1)	81.0	17.7	1.3	100.0
4	Posters + removing ashtrays	55.0	35.6	9.3	100.0
5	None (control 2)	61.0	35.7	3.4	100.0
Total		71.2	25.1	3.7	100.0

Overview paired sample t-test amount of non-smokers

Week	P (total)	Significant with P < 0.05?
1 & 2	0.728	No
2 & 3	0.781	No
3 & 4	0.749	No
4 & 5	0.219	No
1 & 4	0.615	No
2 & 4	0.981	No
1 & 3	0.598	No
3 & 5	0.635	No
1 & 5	0.702	No

Overview daily weather conditions per week

Week	Nudging Intervention	Sunny	% within week	Cloudy	% within week	Rainy	% within week	Total	Total %
1	None (baseline)	1	33.33	1	33.33	1	33.33	3	100.00
2	Removing ashtrays	2	0.00	0	0.00	1	33.33	3	100.00
3	None (control 1)	0	0.00	3	100.00	0	0.00	3	100.00
4	Posters + removing ashtrays	1	33.33	2	66.77	0	0.00	3	100.00
5	None (control 2)	0	0.00	3	100.00	0	0.00	3	100.00
Total		4	26.77	9	60.0	2	13.33	15	100.00