

MARTIJN VOS

SPOTLESS?

Perceived cleanliness
in service environments

SPOTLESS?

**Perceived cleanliness
in service environments**

Martijn Vos

SPOTLESS?

Perceived cleanliness in service environments

PROEFSCHRIFT

ter verkrijging van
de graad van doctor aan de Universiteit Twente,
op gezag van de rector magnificus,
prof. dr. ir. A. Veldkamp,
volgens besluit van het College voor Promoties
in het openbaar te verdedigen
op vrijdag 24 juni 2022 om 12.45 uur

door

Martijn Christiaan Vos
geboren op 12 maart 1991
in Lichtenvoorde, Nederland

Dit proefschrift is goedgekeurd door:

Promotor

prof. dr. A.T.H. Pruyn

Co-promotoren

dr. M. Galetzka

dr. M.P. Mobach

Cover design: evelienjagtman.com

Printed by: Ipskamp Printing, Enschede

Lay-out: evelienjagtman.com

ISBN: 978-90-365-5370-4

DOI: 10.3990/1.9789036553704

© 2022 Martijn Christiaan Vos, The Netherlands. All rights reserved. No parts of this thesis may be reproduced, stored in a retrieval system or transmitted in any form or by any means without permission of the author. Alle rechten voorbehouden. Niets uit deze uitgave mag worden vermenigvuldigd, in enige vorm of op enige wijze, zonder voorafgaande schriftelijke toestemming van de auteur.

Samenstelling promotiecommissie:

Voorzitter / Secretaris: prof. dr. T. Bondarouk
Promotor: prof. dr. A.T.H. Pruyn, University of Twente
Co-promotoren: dr. M. Galetzka, University of Twente
dr. M.P. Mobach, Hanze University of Applied Sciences
Referent: dr. M. van Hagen, Nederlandse Spoorwegen
Leden: prof. dr. ir. P.C. de Weerd - Nederhof, University of Twente
prof. dr. M.D.T. de Jong, University of Twente
prof. dr. A. Marmot, University College London
prof. dr. G.P. van Wee, TU Delft

Chapter 0.
General introduction
| P9

Part 1: defining and measuring perceived cleanliness

Chapter 1.
Theoretical perspectives on perceived cleanliness:
a systematic literature review | P23

Chapter 2.
Practical perspectives on perceived cleanliness:
a Delphi approach | P53

Chapter 3.
Measuring perceived cleanliness:
concept validation and
scale development | P77

Part 2: Influencing perceived cleanliness

Chapter 4.
Theoretical approach:
environmental cues and priming | P101

Chapter 5.
Cleaned: the role of more visible cleaning | P113

Chapter 6.
Cleaned and fresh: the role of scent and colour | P143

Chapter 7.
Cleaned, fresh, and uncluttered:
the role of scent and
architectural clutter | P167

Contents

Part 3: theoretical and practical contributions

Chapter 8.

General discussion | P199

Chapter 9.

Practical implications | P217

Addendum

References | P233

Appendix A | P257

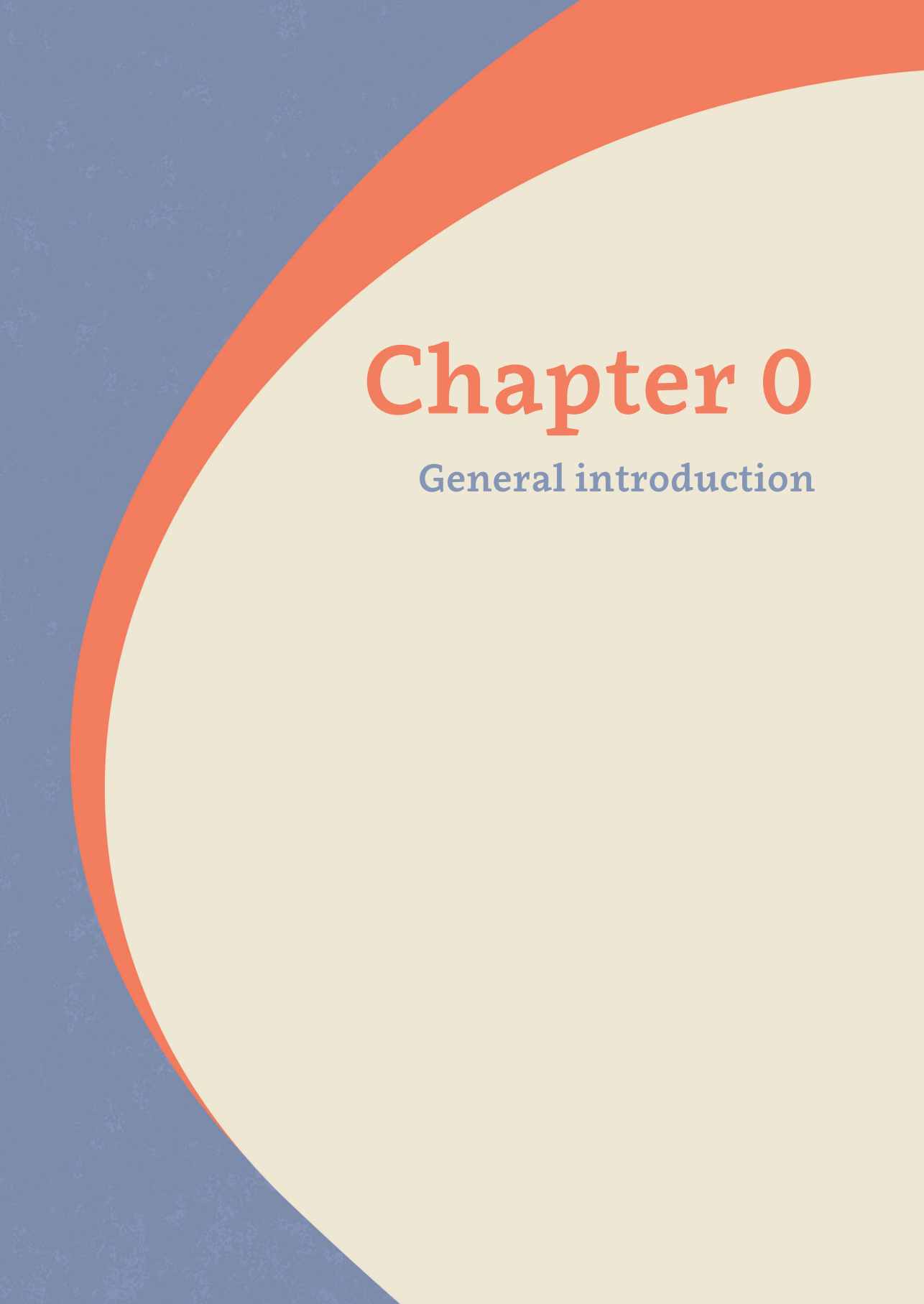
Appendix B | P261

Summary | P2671

Samenvatting | P281

Dankwoord | P291

About the author | P297



Chapter 0

General introduction

0.1 Introduction

Cleanliness is an inevitable part of our lives – the act of cleaning and the experience of cleanliness are omnipresent. While the absence of stains, litter, and dust is a prerequisite for cleanliness, people use numerous other cues to determine the cleanliness of their surroundings. For example, cleaners play an essential role in creating clean environments while other cues such as their (uniformed) appearance and behaviour are also important in how cleanliness is perceived. Whereas yet, other cues, not directly related to the cleaning process, impact upon how cleanliness is perceived. Fresh scents contribute to the impression that cleaning just had taken place. Bright lighting provides overview and signals reliability as it offers the opportunity to readily examine the cleanliness of an environment. And uncluttered architectural design radiates organisation, symmetry, and the impression of a well-kept environment. This dissertation aims to unravel how such cues in service environments are exactly related to how cleanliness is perceived.

0.2 Practical relevance

Clean environments positively influence how people feel and encourage positive behaviour. The positive effects of clean environments on physical and mental wellbeing of customers also have been widely reported – especially since the COVID-19 pandemic (Magnini & Zehrer, 2021; Park & Almanza, 2020; Yu et al., 2021). Hence, it is crucial to understand how customers determine whether an environment is clean. The qualities of cleaning services and cleaning staff are expected to be key predictors of perceived cleanliness. But is this the case? And in what way do other cues in the service environment play a role, such as scent, lighting, and the built environment? Customers perceive the surroundings of a service environment holistically (Bitner, 1992), this is also expected when customers evaluate cleanliness. Based on the cues that are available, customers make inferences about the unknown (Peter & Olson, 2002). As cleanliness encompasses a part that can be perceived visually or physically and a part that is more ambient in nature, customers will also use other cues that are not primarily related to the cleaning process when evaluating cleanliness (Baker et al., 2020; Wakefield & Blodgett, 1994). This is especially the case when cues related to the cleaning process do not directly provide sufficient information on how clean an environment is.

The notion that the service environment affects customers' perception of cleanliness slowly but gradually penetrates the (facility) service industry. Following the introduction of the 'experience economy' (Pine & Gilmore, 1998), in facility management the sole focus on cleaning activities has shifted towards customer experience, which also allows a wider perspective on perceived cleanliness. Especially larger organisations with larger cleaning budgets are taking a more holistic approach on cleanliness. For instance, by experimenting with (environmental) cues that complement their cleaning services, Schiphol Airport (Netherlands) introduced wellness toilets with a minimalistic design, natural materials, and light colours. This approach required less frequent cleaning and obtained similar levels of perceived cleanliness and general satisfaction when compared to non-refurbished toilets (Moon et al., 2017). This approach of customer experience on cleanliness is relatively new and a result of the idea that the experience of a service is of added value to the customer – and will eventually outweigh the value of the service itself (Pine & Gilmore, 1999).

In the previous decade, service organisations in the fields of healthcare, leisure, transportation, and business started developing policies on more customer focused cleaning which contributed to their primary service processes. In essence, the cleaning industry distinguishes a client (the organisation that needs to be cleaned; hereafter

referred to as '*client organisation*') from an internal contractor (the department of the client organisation that cleans; hereafter referred to as '*facility department*') and an external contractor (the external organisation that cleans; hereafter referred to as '*facility service provider*'). As the degree of outsourcing is relatively high ($\approx 95\%$) in the cleaning industry, most customer-focused cleaning services were developed in cooperation with facility service providers. The focus of these policies has predominantly been on cleaning services as such, for example, by increasing or changing the cleaning frequency or providing cleaning staff with hospitality training. Hence, client organisations and facility service providers have made first steps in the direction of more customer focused cleaning.

Although first steps have been made, client organisations and facility service providers mainly use cleaning services as a cue to improve perceived cleanliness while ignoring other cues. This is because of two main reasons. Firstly, there is no common understanding or agreement in the service industry on how perceived cleanliness should be defined. It seems that assessment of cleanliness perceptions relies on the practice-based expertise of service professionals. In this context, current developments seem to be limited to cleaning quality and friendly cleaning staff. However, precise definitions and measurements are prerequisites, not only for an advanced understanding of the concept of 'perceived cleanliness', but also for the development of real-world service environments that are perceived as clean. Secondly, many service organisations neither have the skills or knowledge to influence perceived cleanliness with a wider perspective than cleaning-process-related cues. Knowledge on how perceived cleanliness may be influenced using the service environment is scarce but growing and the skills needed to develop this kind of knowledge are not available in most service organisations.

0.3 Theoretical relevance

Besides the growing attention for perceived cleanliness in practice, scientific literature on this topic is growing steadily as well. However, the concept of perceived cleanliness has yet to be clearly defined in literature. The scarce studies available mostly focus on specific service settings, such as hotels or restaurants and limit their scope to how customers perceive the cleanliness of specific spatial elements; for example, floor, window, or toilet. It seems that current literature predominantly focuses on developing practical knowledge for specific service settings. Research on the definition and measurement of perceived cleanliness lacks, but is essential to further explore, define, and influence customers' perception of cleanliness (Baker et al., 2020).

Despite of the lack of a clear definition and operationalisation of perceived cleanliness, the concept received attention across different academic disciplines. Most studies have been performed in the areas of service management, facility management, and social psychology. Cleanliness research in service management is limited to studies that include perceived cleanliness as a dimension in an overall measure of environmental quality (Wakefield & Blodgett, 1994). Having emerged as a discipline of service management, facility management research has mainly emphasized the organisational or financial perspective on cleanliness (Koch & Eitzinger, 2019). Social and environmental psychologists in the area of cleanliness mainly focus on cleaning quality and the presence of litter affect perceptions, social norms, and human behaviours in public settings (Keizer et al., 2008). Academic research on perceived cleanliness as a stand-alone variable is almost non-existing; and the research on how cleanliness is perceived by customers that is available, is mostly explorative and conceptual in nature (Baker et al., 2020). Hence, empirical investigation into the concept of cleanliness from the point of view of the customer is needed to enhance the understanding of the concept.

More specifically, research on determinants of perceived cleanliness is dominated by divergent studies, such as literature reviews and qualitative studies that aim to identify determinants of perceived cleanliness (Magnini & Zehrer, 2021; Whitehead et al., 2007). More convergent empirical studies are needed to better understand how individual environmental cues influence perceived cleanliness and to further cleanliness research. Based on Bitner's (1992) work on servicescapes, it is known that customers perceive the environment holistically, but also that they observe individual cues, including cleaning quality. But it is the total configuration of the service environment that influences how the environment is experienced. This approach seems new in research on determinants of perceived cleanliness.

0.4 Priming cleanliness

The current dissertation aims to increase our understanding of how environmental cues influence perceived cleanliness in service environments. Customers extract information from service environments by using different mechanisms. Following one of the key mechanisms in this area, customers blend different cues into a unitary (holistic) impression that combines the information of individual cues and their interrelationships (Bitner, 1992).

However, in addition to the holistic experience of service environments, other mechanisms take a more detailed approach by examining one-to-one relationships between specific environmental cues. In the experimental studies of this dissertation, priming mechanisms are used to explain how environmental cues influence perceived cleanliness. Because of the range and complexity of priming effects presented, such effects cannot be comprehended using a single model (Janiszewski & Wyer, 2014). However, general consensus exists on the idea that priming is an experimental framework in which exposure to one cue influences the response to a subsequently encountered other cue (Bargh, 2006).

More specifically, a distinction is made between affective and cognitive priming mechanisms. Affective primes directly transfer meanings or emotions to how cleanliness is perceived (Thorndike, 1920). Following this mechanism, customers transfer their feelings about one cue to other, (seemingly) unrelated attributes. Exposure to friendly cleaning staff, a clean environment, or a pleasant song can, for example, result in more positive perceptions of service quality or cleanliness. Additionally, customers also make inferences based on cognitive primes (Anderson, 1983). Cognitive primes use associative processes to activate connections between concepts in the brain. For example, green colours are related to the concept of sustainability and fresh scents to the concept of cleanliness.

In this dissertation, priming mechanisms are applied to the concept of perceived cleanliness in service environments. Although a wealth of literature exists on priming mechanisms and effects, priming effects have seldomly been explored in relation to perceived cleanliness. Yet, priming seems a logical starting point for exploring how environmental cues influence perceived cleanliness in service environments. The identification of general priming mechanisms will help scholars and practitioners to better understand how environmental cues can be used to influence perceived cleanliness.

0.5 Research context

The majority of the empirical studies of this dissertation have taken place in train stations. The train station represents a very specific service environment. Train stations share characteristics with other semi-public environments, such as airports and shopping malls. These are typical non-places, places of anonymity that are necessary for rapid circulation of people and goods (Aubert-Gamet & Cova, 1999; Augé, 1995). Due to the public nature of train stations, cleanliness and the general condition of the service environment carry special relevance in signalling social safety and trust in the service provider and environment (Vilnai-Yavetz & Gilboa, 2010). Transportation research acknowledges the importance of cleanliness of train stations; several studies identified perceived cleanliness as a key determinant of passengers' perception of service quality and satisfaction (Beck & Rose, 2016; Cascetta & Cartenì, 2014; Eboli et al., 2018). Although valuable, most research on service quality and perceived cleanliness is rather abstract. Literature that contributes to the understanding and improving cleanliness perceptions on train stations is yet very limited.

However, this research has taken place in Dutch train stations of Netherlands Railways (NS) and seeks to contribute to this gap. Together with other determinants, such as perceived safety, punctuality, and comfort, customers' perception of cleanliness explains an important share of the overall perceived service quality that NS delivers to its customers. Just before this dissertation was initiated, the trains and stations of NS had been the scene of a number of national cleaning strikes (between 2010 and 2014). Overflowing trashcans on stations across the country and NS office staff who were busy cleaning trains adorned the frontpage of Dutch national newspapers. Although cleaning services were up and running soon after the final strike, NS had difficulties to get a grip on customers' perception of cleanliness. This gave rise to a need for improved insight into the concept of perceived cleanliness and its determinants.

0.6 Focus of the thesis

The aim of this thesis is to contribute to the understanding of how environmental cues influence customers' perceptions of cleanliness in service environments. This research on this matter will take place on the crossroads of service marketing, facility management, built environment, environmental psychology, and social psychology. More specifically, this research focusses on how environmental cues serve as primes that trigger cognitive and affective associations which, in turn, will shape cleanliness perceptions. Although the empirical studies mainly take place in train stations, findings carry relevance for the entire services industry.

The studies aim 1) to enhance the definition, operationalisation, and measurement of perceived cleanliness in service environments, 2) to identify environmental cues that influence perceived cleanliness, and 3) to show to what extent the effects of these cues can be explained by priming.

0.7 Thesis outline

This dissertation consists of three parts, an overview is graphically presented in Table 0.1. **Part 1** focusses on defining and measuring perceived cleanliness. **Chapter 1** explores the state of current literature on actual and perceived cleanliness through a systematic literature review. The review included studies in which stimuli, organism, and response (SOR paradigm) variables were examined in relation to actual and perceived cleanliness. Three streams of research on cleanliness were identified, including: (1) research on the relationship between stimuli and organism variables, (2) stimuli and response variables, and (3) organism and response variables. **Chapter 2** examines how perceived cleanliness should be defined according to customers, client organisations, and facility service providers. The customers, client organisations, and facility service providers were consulted in four rounds of qualitative and quantitative research following a Delphi approach. These results served as input for the development of an instrument for measuring perceived cleanliness in service environments. **Chapter 3** describes the development of this measurement instrument through two qualitative studies on five train stations. Factor analysis was used to reduce the initial five dimensions of perceived cleanliness into three main dimensions: *cleaned*, *fresh* and *uncluttered*. The study resulted in the twelve-item Cleanliness Perceptions Scale (CP-scale) that is used to measure perceived cleanliness in the experimental studies which together constitute the next **Part 2**.

Part 2 contains the experimental studies in which the effects of environmental cues on perceived cleanliness were evaluated. **Chapter 4** serves as an introduction to the experimental studies and priming as the theoretical approach for the experiments. Each empirical chapter focusses on a different dimensions of perceived cleanliness. As cleaning staff was frequently mentioned in literature and by experts in relation to perceived cleanliness, **Chapter 5** started with the exploration of how enhanced physical presence of cleaning staff functions as primes of the *cleaned* dimension of the scale. Experimental studies were performed in a running train and at a train station. **Chapter 6** primarily focused on the *cleaned* and *fresh* dimension of perceived cleanliness. In a lab experiment, the influence of colour and scent on customers' perceptions of cleanliness were tested. In **Chapter 7**, all three dimension of perceived cleanliness are central. A field experiment in a train station on the effects of scent and architectural clutter were presented.

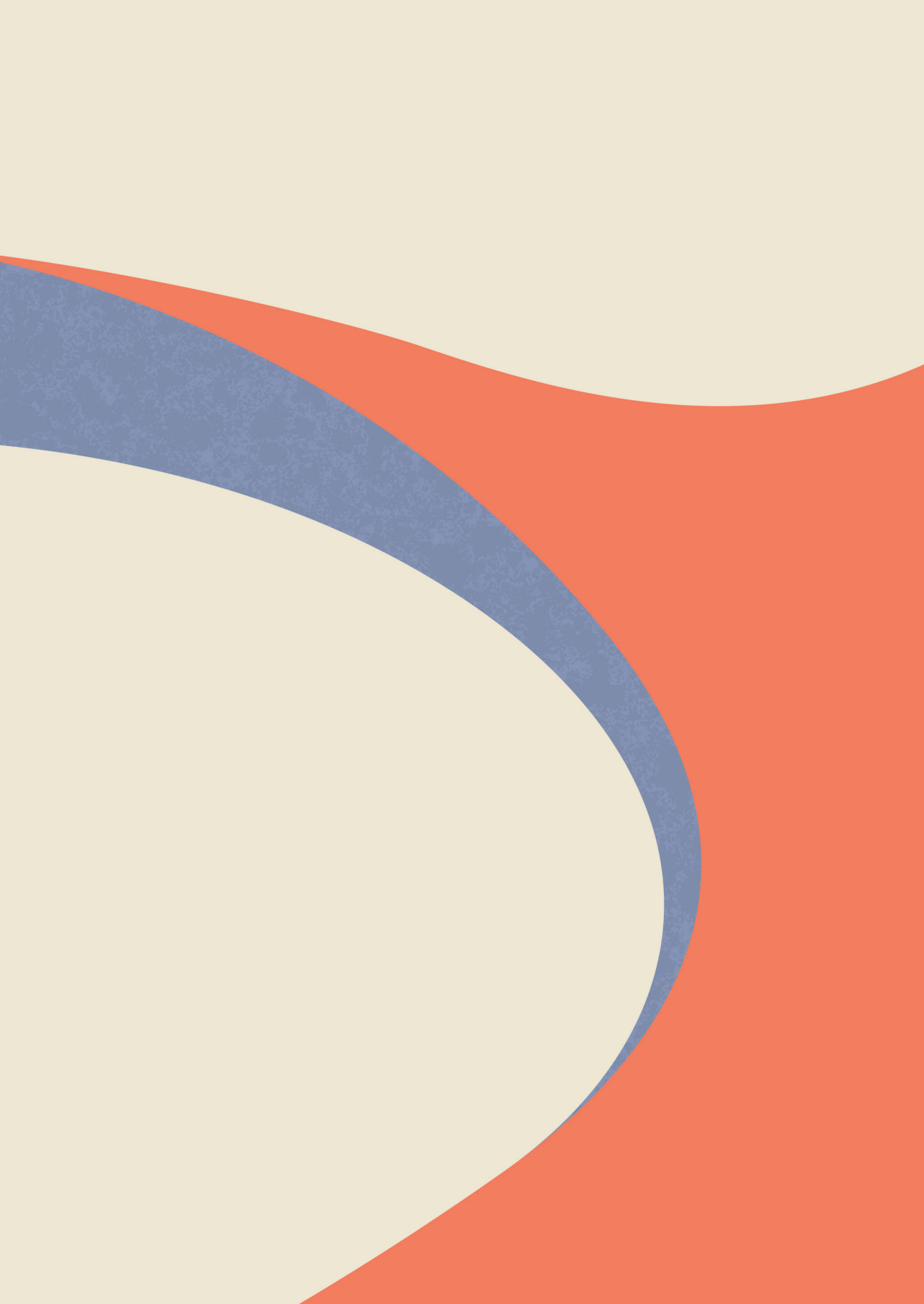
Part 3 includes the general discussion and practical implications of the findings. An overview of the main findings and implications, limitations, and directions for future research are discussed in **Chapter 8**. Finally, **Chapter 9** includes the practical implications.

After each chapter a brief summary of the chapter is presented, together with a short preview of the next chapter. Chapter 1, 2, 3, and 5.2 have been published as individual articles (Vos et al., 2018a, Vos et al., 2018b, Vos et al., 2019a, Vos et al., 2019b), chapter 5.2, 6, and 7 formed the basis for three articles that have been submitted to scientific journals. To ensure that each chapter can be read independently, the introductions of the chapters show some overlap.

Table 0.1

Part 1: defining and measuring perceived cleanliness		
1. Theoretical perspectives on perceived cleanliness: a systematic literature review		
2. Practical perspectives on perceived cleanliness: a Delphi approach		
3. Measuring perceived cleanliness: concept validation and scale development		
Part 2: influencing perceived cleanliness: Influencing perceived cleanliness: effects of environmental cues		
4. Theoretical approach: environmental cues and priming		
5. Cleaned: the role of more visible cleaning	6. Cleaned and fresh: the role of scent and colour	7. Cleaned, fresh, and uncluttered: the role of scent and architectural clutter
Part 3: theoretical and practical contributions		
8. General discussion		
9. Practical implications		

Dissertation outline



Part 1

Defining and
measuring perceived
cleanliness

Chapter 1

Theoretical perspectives on perceived cleanliness: a systematic literature review

This chapter has been published as: Vos, M.C., Galetzka, M., Mobach, M.P., van Hagen, M., & Pruyn, A.T.H. (2018). Cleanliness unravelled: a review and integration of literature. *Journal of Facilities Management*, 16 (4), pp. 429-451, <https://doi.org/10.1108/JFM-06-2017-0025>

1.1 Introduction

The impact of the physical environment on the perception of consumers has been described in different service management studies (Baker, 1987; Bitner, 1990, 1992; Kotler, 1974; Mari and Poggesi, 2013). According to Kotler (1974), the physical environment is one of the most significant features of the total product or service. The place, or more specifically, the atmosphere is in some cases more important than the product or service in the perception of consumers (Kotler, 1974). Consumers continuously look for cues in the physical environment which may reveal something about the capabilities and quality of the service organization (Bitner, 1992). Previous reviews on this topic clearly state that a combination of multiple atmospheric cues (Ramlee & Said, 2014; Turley & Milliman, 2000) as well as single cues such as music (Evans, 2002), lighting (McColl & Veitch, 2001), colour (Labrecque et al., 2013), crowding (Mehta, 2013) and temperature (Hancock et al., 2007) are able to affect outcomes such as approach and avoidance behaviours and spending. Surprisingly, the effect of cleanliness on such outcomes has received little attention in literature (Barber & Scarcelli, 2010). In spite of this, there is general agreement about the importance of cleanliness. Research shows that cleanliness is able to enhance customer service satisfaction while uncleanliness may lead to dissatisfaction (Brown et al., 1991; Wakefield & Blodgett, 1996).

It is important to make a distinction between actual cleanliness and the perception of cleanliness. Actual cleanliness refers to the number of smudges and amount of litter. Objective measures, such as actual cleanliness, are assumed to represent a less biased view of the environment than the perception of cleanliness does (Van Ryzin et al., 2008). As opposed to actual cleanliness, perceived cleanliness is based on information captured through the senses (Orstad et al., 2017). In general, rules and guidelines to manage actual cleanliness are well established. Most in-house and corporate facility managers, however, lack the knowledge on how to manage end-users' perceptions of cleanliness (Whitehead et al., 2007).

An overview and integration of research on the relationship between actual cleanliness and perceived cleanliness currently lacks. Huffman et al. (1995) took a first step by integrating literature on social strategies that reduce littering behaviour. Signs and verbal communication, adequate availability of trash cans, an initially clean environment, community involvement and rewards were identified as the most effective strategies to reduce littering behaviour. The current literature review takes a broader scope and aims to identify environmental strategies that reduce littering behaviour as well. In addition, an overview of antecedents and consequences of

perceived cleanliness will be presented. The overall aim of this study is to integrate current theoretical and empirical findings on cleanliness into a conceptual framework by reviewing studies from different disciplines that are performed in various settings.

The stimulus-organism-response (SOR) model of Mehrabian and Russell (1974) and Bitner (1992) servicescape framework were used to guide the literature review and develop a conceptual framework (Figure 1.1). In service research, both models are often used to present and explain environmental variables and their effect on individuals internal states and external responses (Turley & Milliman, 2000). The current conceptual model (Figure 1.1) made a distinction between ambient conditions (e.g., cleanliness, noise); space/function (e.g., arrangement of space); and signs, symbols and artefacts (e.g., signs, personal objects). Internal responses (e.g., pleasure, arousal) were added to the conceptual framework as well.

This review sought for studies in which single or multiple stimulus, organism and response variables were examined in relation to actual or perceived cleanliness. Instead of solely identifying SOR variables, relationships between stimulus and organism variables, stimulus and response variables and organism and response variables were discussed. The overall aim of this review was to create an evidence-base that could be used to inform scholars and in-house and corporate facility managers and serve as a source for future research.

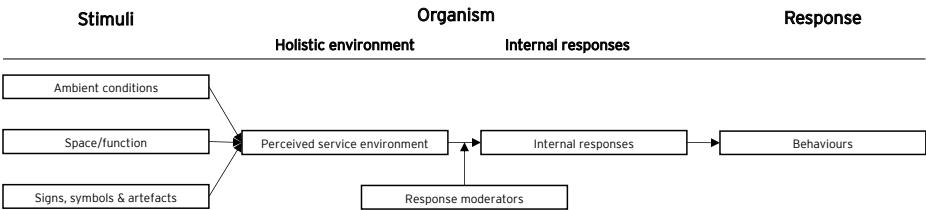


Figure 1.1
Conceptual framework (based on: Bitner, 1992; Mehrabian & Russell, 1974)

1.2 Search methods

A systematic approach was employed to identify relevant articles for this literature review. This was done according to the Cochrane Collaboration Method (Henderson et al., 2010). This approach is very common in service research (e.g., Cheng, 2016; Ramlee & Said, 2014). Electronic searches were carried out in June 2016 using the following databases: Scopus, Web of Science, and Ebscohost.

1.2.1 Inclusion criteria

To be included, actual or perceived cleanliness needed to be the dominant subject of study. More specifically, articles were included when the abstract or keywords contained the word “cleanliness” or a related synonym (Table 1.1). Moreover, to be included articles should also contain the keywords: stimulus, organism and response or related synonyms. The review did not focus on a specific setting (e.g., health care, public space and offices). Yet, it is acknowledged that the relative importance of actual and perceived cleanliness might vary, depending on the setting. There were no limitations on the publication year or authority of the paper (e.g., citations, impact factor). The only language restriction was an abstract written in Dutch or English. The main focus of this review was on peer-reviewed papers, dissertations, unpublished studies, book chapters, abstracts, and theses; studies published in non-peer-reviewed journals were included as well.

Table 1.1
Inclusion criteria systematic literature review

Main keywords	Synonyms
Cleanliness	clean, dirt, litter, smudges, pollution, binning, littering
Stimulus	cause, cue, antecedent
Organism	emotion, experience, perception
Response	outcome, result, behaviour, intention

1.3 Results

The search strategy revealed 1,190 papers of which 264 duplicates were removed, leaving 926 papers. After reviewing the titles and abstracts 90 papers remained for full text review. A flowchart (Figure 1.2) was used to systematically present the different reasons for exclusion.

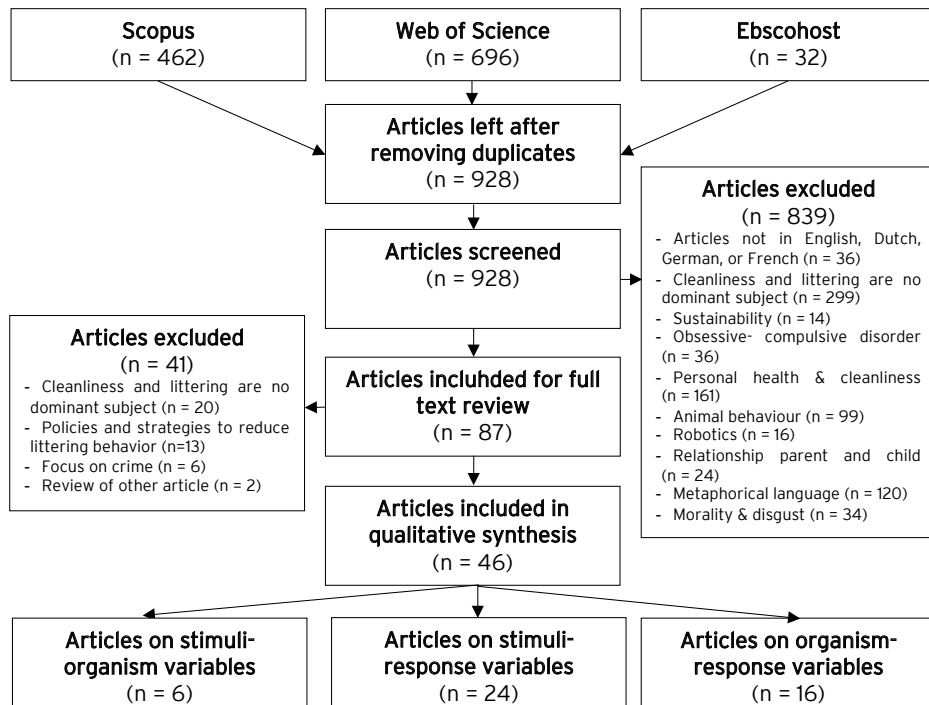


Figure 1.2

Flowchart selection process articles

1.3.1 Methodological characteristics of the studies

After a full-text review of 88 papers, 46 papers were included. A majority (n = 26) of the included studies could be described as field studies (e.g., survey, observations, interviews), the remaining studies as field (n = 13) and laboratory experiments (n = 7). Moreover, most of the studies (n = 42) were quantitative, only a few studies (n = 4) were qualitative.

Stimulus-organism relationship

Six of the included articles contained single or multiple stimulus variables related to different organism variables (Table 1.2). The different stimuli comprised: actual cleanliness, scent, disorder, deterioration, shininess, and staff behaviours. The main focus of the stimulus variables was on the physical environment and human behaviours.

Actual cleanliness

Together with scent, actual cleanliness is considered to be an ambient condition which is able to influence perceptions of the service environment. Two qualitative studies (Whatley et al., 2012; Whitehead et al., 2007) investigated the effect of actual cleanliness, and more specific visible dirt and stains and presence of litter, on perceived cleanliness of hospital environments. In addition to the effect of actual cleanliness on the perception of cleanliness, it appeared that actual cleanliness is able to influence perceptions of service quality in a hospital environment as well. Service quality (e.g., medical treatment, catering) was perceived as being poorer when actual cleanliness of the hospital did not meet expectations of visitors.

Scent

The effect of scent on perceived cleanliness was discussed in the study of Whatley et al. (2012). It seemed that the absence of strong odours and presence of pleasant odours in hospital environments was associated with more positive perceptions of cleanliness.

Disorder

Three studies (Lagrange et al., 1992; Medway et al., 2016) were identified in which the effect of disorder on several organism variables was evaluated. Lagrange et al. (1992) found that people exposed to signs of disorder (e.g., graffiti, unreturned shopping carts, visible violation of rules) had less positive perceptions of risk and more fear of crime. In the study of Medway et al. (2016) the effect of litter was evaluated. It appeared that people who were exposed to litter had less favourable perceptions of social incivilities (e.g., teenagers hanging around, noise) and physical incivilities (e.g., vandalism, graffiti). Moreover, people exposed to litter were more likely to think that crime was a problem in that area.

Condition of the environment

Another variable influencing functionality of space, closely related to disorder, is the condition of the environment. The effect of the condition of the environment on the perception of cleanliness was examined in three studies. Environments

that were in a poor condition were associated with less positive perceptions of cleanliness. In the study of Wells and Daunt (2015), the condition of the environment was linked to perceptions of cleanliness. It appeared that older lecture rooms were perceived as less clean, while the level of actual cleanliness was similar to new lecture rooms. Similarly, Whitehead et al. (2007) and Whatley et al. (2012) stated that the age and aesthetics of buildings influences perceptions of cleanliness. Spaces that were less attractive or looked old were in general perceived as less clean.

Shininess

Broeders et al. (2011) evaluated the effect of shiny and dull table tops on cleaning behaviour. The researchers demonstrated that people sitting at the table with the shiny table top ate longer and had more positive perceptions of cleanliness.

Staff behaviour

Two qualitative studies (Whatley et al., 2012; Whitehead et al., 2007) investigated the effect of staff behaviour on perceived cleanliness and service quality. Witnessing cleaning staff actively clean (Whatley et al., 2012) and, more specifically, the appearance and commitment of cleaning staff (Whatley et al., 2012; Whitehead et al., 2007) were associated with more positive perceptions of cleanliness and service quality.

Summary of findings

Articles on the relationship between stimulus and organism variables were discussed in this paragraph. In most articles, the effect of different stimuli on perceived cleanliness was evaluated. Higher levels of actual cleanliness, witnessing cleaning staff actively clean, environments that are in a good condition, absence of strong odours and shiny materials were associated with positive effects on perceived cleanliness and service quality.

Hence, though the different stimuli were defined independently, it is the total configuration of stimuli that determines the way individuals perceive the environment: the holistic environment (Bitner, 1992). Most stimuli were identified in qualitative studies (actual cleanliness, staff behaviour, scent). It was, therefore, impossible to determine their relative importance and determine at what level they positively influence organism variables.

Human behaviour was identified as a stimulus variable that affects perceptions. A clear implication of servicescape framework (Bitner, 1992) is that the physical environment is able to support or hinder the achievement of organizational goals (e.g., increasing satisfaction or turnover). As noted by Tombs and McColl-Kennedy (2003), the influence of behaviours of staff and other customers on customer perception should not be underestimated. An intimate dinner for two can be negatively influenced by rude staff members or rowdy customers at a neighbouring table, even though the physical environment is perfect (e.g., clean, pleasant lighting and comfortable seating). Human behaviour was, therefore, added to the final conceptual framework (Figure 1.3).

Stimulus- response relationship

It appeared that 24 of the identified articles contained single or multiple stimulus variables related to different response variables (Table 1.3). The following stimulus variables were identified: presence of litter, presence and behaviour of others, scent, disorder, availability of trash cans, and informational strategies. The following response variables were identified: littering behaviour, place attitude, and unethical behaviour.

Presence of litter

A total of eight studies evaluated the effect of litter on several behavioural variables. A lower level of actual cleanliness, and more specific the presence of litter, had a negative effect on littering behaviour and place attitude. Among researchers, there is a general consensus that littering is significantly more likely to occur in a littered setting than in a litter-free setting (Bateson et al., 2013; Cialdini et al., 1990; Keizer et al., 2011; Reno et al., 1993; Schultz et al., 2013). Al-Khatib (2009) identified inadequate street cleaning as one of the main reasons for Palestinian children to engage in glass littering behaviours. Dur and Vollaard (2015) demonstrated that the presence of litter not only leads to littering but also can evoke the opposite response. Some of the residents started to clean up after themselves when public cleaning services were diminished. All other studies demonstrated that people are more likely to litter in a littered environment and less likely to litter in a litter-free environment. Besides the effect of litter on littering behaviour, Parker et al. (2015) demonstrated that people exposed to littered places have a less positive attitude towards that place.

Table 1.2*Characteristics of included studies on the relationship between stimuli and organism variables*

Author(s)	Year	Sample	Setting	Country
Broeders, R., Lakens, D., Midden, C.J.H., and Ham, J.R.C.	2011	n/a	-	Netherlands
Lagrange, R. L., Ferraro, K. F., and Supancic, M.	1992	1,101 participants	Neighbourhood	US
Medway, D., Parker, C., and Roper, S.	2016	662 participants	-	UK
Wells, V. K. and Daunt, K. L.	2015	209 students	Education	UK
Whatley, V., Jackson, L., and Taylor, J.	2012	n/a	Hospital	UK
Whitehead, H., May, D., and Agahi, H.	2007	114 patients and hospital staff	Hospital	UK

Notes.* citations: number of times cited in accordance with Scopus, benchmark year: 2016, ** impact factor: impact factor of the journal in accordance with Scientific Journal Rankings (SJR), benchmark year: 2016

Presence and behaviour of others

The effect of the presence and behaviour of others on littering behaviours was discussed in four of the included papers. Littering behaviour decreased when others were around or others were picking up litter and throwing it in a trash can. The opposite occurred when people saw others littering. Although Bateson et al. (2013) primarily focused on the relationship between a photo of “watching eyes” and littering behaviours, they found that the watching eyes were only effective when other people were around. Cialdini et al. (1990) also found that littering rates decreased when people were around, but littering rates increased when other people littered. Moreover, results were reversed when litter was swept into piles, suggesting cleaning staff recently swept the litter into piles. In addition, Kallgren et al. (2000) and Reno et al. (1993) found that littering rates decreased when people saw others picking up litter and throwing it into a trash can.

Methods	Stimulus variables	Analysis methods	Citations*	Impact factor journal**
Laboratory experiment	Shininess	Unknown	0	0.552
Field study, interviews	Disorder	Regression analysis	310	3.194
Laboratory experiment, online film based	Disorder, litter	t-test	0	1.072
Field study, observations	Deterioration	Structural equation analysis	0	0.433
Field study, focus groups	Actual cleanliness, staff behaviour, deterioration, scent	Qualitative analysis	1	0.251
Field study, focus groups	Actual cleanliness, staff behaviour, deterioration	Qualitative analysis, descriptive statistics	16	n/a

Scent

The effect of scent on cleaning and littering behaviours was discussed in two studies. The presence of citrus scent enhanced the mental accessibility of the concept cleanliness and positively influenced cleaning and littering behaviours. Holland et al. (2005) evaluated the effect of citrus-scented all-purpose cleaner on the mental accessibility of the concept cleanliness and subsequent cleaning behaviours. Again, the mental accessibility of the concept cleanliness was enhanced by the smell of citrus-scented cleaner. The citrus-scented cleaner also caused participants to keep their environment more clean whilst eating. Similarly, de Lange et al. (2012) evaluated the effect of a citrus scented cleaner on behaviours in train compartments. It appeared that passengers in scented train compartments littered less than passengers in unscented compartments.

Disorder

The effect of disorder (e.g., graffiti, unreturned shopping carts and visible violation of rules) on littering and unethical behaviours was discussed in five studies. In these studies, higher levels of disorder negatively affected actual cleanliness through littering behaviours. This mechanism is known as the broken windows theory (Wilson & Kelling, 1982). The broken windows theory says that signs of disorder function as visual cues that convey information about the quality of the social environment. The more signs of disorder are present, the more likely people are to engage in unsocial behaviour themselves. Keizer et al. (2008) demonstrated in a series of field experiments that people who are exposed to signs of disorder are more likely to litter or violate rules. Ramos and Torgler (2012) tested the effect of disorder on littering behaviour in the break room of a university department. It appeared that staff was more likely to litter in the disordered condition than in the ordered condition. Similarly, Bossuyt et al. (2016) replicated the study of Keizer et al. (2008) in a retail setting and demonstrated that consumers are more likely to engage in unethical behaviours (e.g., not report cashiers' mistakes) in a disordered store environment. Weaver (2015) tested the effect of disorder on littering behaviour in a quasi-natural experiment in a ordered (i.e. scenic vistas, well-maintained housing and green spaces) and disordered neighbourhood (i.e. liquor stores, vacant buildings and noisy interstate highway). Littering was more likely to happen in the disordered neighbourhood. Finally, Murphy (2012) found in an ethnographic study that disorder is used by long-time residents to falsely accuse black poor renters of littering.

Availability of trash cans

The effect of the availability of trash cans, the distance to trash cans, the design of trash cans on littering behaviour and, subsequently, actual cleanliness was studied in five articles. Along with many others, Arafat et al. (2007), Bator et al. (2011), Liu and Sibley (2004) and Schultz et al. (2013) found that littering can be reduced by increasing the number of trash cans and reducing the distance to the trash cans. However, as demonstrated by De Kort et al. (2008), littering can also be reduced by introducing a more persuasive trash can design (e.g. signs, colours and material use). Suggesting that actual cleanliness can be enhanced by influencing the number or design of trash cans.

Informational strategies

The effect of several informational strategies (e.g., the placement of signs, banners, flyers) on littering behaviour was discussed in eight articles. Signs, banners, and flyers can be used to positively influence littering behaviours. Cialdini et al. (1990), Kallgren et al. (2000), Miller et al. (1975), and Reich and Robertson (1979) demonstrated that

littering behaviours can be reduced by written statements (e.g., flyers, text) which evokes external pressure and is directly related to the littering norm. Similarly, Hansmann and Scholz (2003) demonstrated that littering in cinema's can be reduced by encouraging visitors to put their litter in the trash can through messages prior to the film. Sibley and Liu (2003) and Liu and Sibley (2004) performed two comparable studies on the effect of a banner and a corresponding article in a student magazine on cigarette littering. The banner and article led to a structural reduction of littering behaviours among regular visitors of the university square. Finally, Keizer et al. (2011) tested the effect of prohibition signs on littering behaviour. It appeared that the signs were only effective when the environment was not communicating the opposite (e.g., litter, graffiti).

Summary of findings

Following the SOR model, response variables are influenced by stimulus variables through organism variables. Most articles focussed on the effect of different stimulus variables on littering and other unethical behaviours. The presence of other people, especially when they are picking up litter, citrus scent, the availability of trash cans and a variety of instruments such as signs or banners were identified as effective in terms of reducing littering and improving actual cleanliness. Presence of litter, seeing others littering and disorder were identified as stimulus variables that increase the likelihood that people will litter.

Similarities between findings in this paragraph and findings in the previous paragraph on stimuli and organism were observed. Shared topics were cleanliness of the environment (i.e. actual cleanliness, the presence of litter), behaviours of others (i.e. staff behaviours, behaviours of other people) and the condition of the environment (i.e. age, disorder). Cleanliness of the environment, behaviours of others and the condition of the environment are believed to influence perceptions (S-O) as well as behaviours (S-R). While research on stimuli and perceived cleanliness is scarce, much research was done on stimuli associated with littering behaviours. Except for the stimulus variables disorder and scent, the findings of this review were in line with another review on littering behaviour performed by Huffman et al. (1995), which concluded that signs and verbal communication, adequate availability of trash cans, an initially clean environment, community involvement and rewards were identified as the most effective strategies to reduce littering behaviour.

Table 1.3*Characteristics of the included studies on the relationship between stimuli and response variables*

Author(s)	Year	Sample	Setting	Country
Al-Khatib, I.A.	2009	240 children	Neighbourhood	Palestine
Arafat, H.A., Al-Khatib, I.A, and Shwahneh, R.D.H.	2007	1,000 residents	Neighbourhood	Palestine
Bateson, M., Callow, L., Holmes, J.R., Redmond Roche, M.L., and Nettle, D.	2013	620 students & university staff	Education	UK
Bator, R.J., Bryan, A.D., and Schultz, P.W.	2011	102 participants	Nature	US
Bossuyt, S., Van Kenhove, and P., De Bock, T.	2016	291 students & university staff	Retail	Belgium
Cialdini, R.B., Reno, R.R., and Kallgren, C.A.	1990	1,367 participants	Education	US
De Kort, Y.A.W., McCalley, C.J.H., and Midden, C.J.H.	2008	2,017 participants	Retail	Netherlands
De Lange, M.A., Debets, L.W., Ruitenburg, K., and Holland, R.W.	2012	n/a	Railway	Netherlands
Dur, R. and Vollaard, B.	2015	1,927 residents	Neighbourhood	Netherlands
Hansmann, R. and Scholz, R.W.	2003	4,329 cinema visitors	Cinema	Germany
Holland, R.W., Hendriks, M., and Aarts H.	2005	128 participants	-	Netherlands
Kallgren, C. A., Reno, R. R., and Cialdini, R. B.	2000	552 students	-	US
Keizer, K., Lindenberg, S., and Steg, L.	2008	666 participants	City	Netherlands
Keizer, K., Lindenberg, S., and Steg, L.	2011	752 participants	City	Netherlands
Liu, J. H. and Sibley, C. G.	2004	2,621 students & university staff	Education	New-Zealand
Miller, R.L., Brickman, P., and Bolen, D.	1975	180 students	Education	US
Murphy, A.K.	2012	n/a	Neighbourhood	US

Methods	Stimuli variables	Analysis methods	Citations*	Impact factor journal**
Field study, interviews	Presence of litter	Cross-tabulation analysis	9	1.764
Field study, interviews	Availability of trash cans	Descriptive statistics, Analysis of variance	19	0.619
Field experiment	Signs, behaviour of others, presence of litter	Regression analysis	6	1.395
Field study, observations	Availability of trash cans	Regression analysis	11	1.344
Laboratory experiment	Presence of litter, disorder	Chi square test	0	3.004
Field experiment	Presence of litter, behaviour of others, flyers	Log linear analysis	1263	5.040
Field study, online survey	Signs, availability of trash cans, age	Chi square test	21	1.344
Field experiment	Scent	Analysis of variance	3	0.569
Field experiment	Presence of litter	Regression analysis	4	2.892
Field experiment	Prompts	Analysis of variance	15	1.344
Laboratory experiment	Scent	Analysis of variance, t-test	106	4.375
Laboratory experiment	Behaviour of others, prompts	Regression analysis	286	2.726
Field experiment	Disorder	Chi square test	280	13.217
Field experiment	Presence of litter, signs	Chi square test	14	1.151
Field experiment, observations	Availability of trash cans, prompts	Chi square test	26	1.072
Field experiment	Prompts	Analysis of variance	127	5.040
Field study, observations, interviews	Disorder, litter	n/a	7	1.164

Table 1.3*Continued.*

Author(s)	Year	Sample	Setting	Country
Parker, C., Stuart, R., and Medway, D.	2015	662 participants	City	UK
Ramos, J. and Torgler B.	2012	49 students & university staff	Education	Australia
Reich, J. W. and Robertson, J. L.	1979	390 participants	City	US
Reno, R. R., Cialdini, R. B., and Kallgren, C. A.	1993	441 participants	City	US
Schultz, P. W., Bator, R. J., Large, L. B., Bruni, C. M., and Tabanico, J.J.	2013	9,757 participants	City	US
Sibley, C. G. and Liu, J. H.	2003	452 participants	Education	New-Zealand
Weaver, R.	2015	223 participants	Neighbourhood	US

Notes.* citations: number of times cited in accordance with Scopus, benchmark year: 2016, ** impact factor: impact factor of the journal in accordance with Scientific Journal Rankings (SJR), benchmark year: 2016

Organism-response relationship

A total of 17 articles contained single or multiple response variables related to perceived cleanliness (Table 1.4). A total of 16 articles emerged from the initial search, and one article (Wakefield & Blodgett, 1996) was added after the initial search. The keywords and abstract of the depending article did not match with the keywords but was considered to be relevant. The following response variables were identified: satisfaction, approach behaviours, physical activity and pro-social behaviours.

Perceptions of cleanliness

Positive perceptions of cleanliness were related to higher satisfaction, approach behaviours, and higher levels of physical activity and pro-social behaviours. The relationship between the perception of cleanliness and satisfaction in a service setting was evaluated by Chua et al. (2015), Chuang et al. (2011), Emir and Saraçlı (2011), Lam et al. (2011), S. Y. Lee and Kim (2014), and Wakefield and Blodgett (1996). The

Methods	Stimuli variables	Analysis methods	Citations*	Impact factor journal**
Laboratory experiment, online film based	Presence of litter	Analysis of variance	1	0.859
Field experiment, observations	Disorder	Multivariate analysis of variance	2	0.196
Field experiment	Prompts	Chi square test	28	0.639
Field experiment, observations	Presence of litter, behaviour of others	Chi square test	313	5.040
Field study, observations	Presence of litter, availability of trash cans	Regression analysis	19	1.344
Field study, observations	Prompts	Chi square test	15	1.344
Field experiment, observations	Disorder	Chi square test, Log linear analysis	1	1.306

different studies were performed in a ski-resort, train, hotel, office, casino, a baseball, and football stadium respectively. Interestingly, Lam et al. (2011) made a distinction between cognitive and affective satisfaction. Cognitive satisfaction is based on the evaluation of whether an environment meets expectations. Affective satisfaction is based on the emotional state of people. People who are affectively satisfied are more likely to describe their experience of the service as pleasurable and exciting, rather than as frustrating and enraging. The perception of cleanliness was related to cognitive satisfaction and not to affective satisfaction. The researchers argued that people do not necessarily experience more pleasure visiting a clean environment. In addition, Wakefield and Blodgett (1996) evaluated the effect of perceived cleanliness on satisfaction in three different leisure settings (i.e., football stadium, baseball stadium, & casino). The effect of perceived cleanliness on satisfaction was stronger in the casino compared to the football and baseball stadium. This suggests that cleanliness becomes more important when customers spend more time in a service

environment. Moreover, Honold et al. (2012) found that a more positive perception of cleanliness, together with the perception of public green spaces, noise, and air quality leads to higher levels of neighbourhood satisfaction. Vilnai-Yavetz and Gilboa (2010) found that positive perceptions of cleanliness were related to feelings of pleasure, trust, attributed prestige to the service provider (i.e. reputation), and approach behaviours, such as intentions to revisit and to stay longer, in a variety of service contexts. Similarly, Lee and Kim (2014) and Tudor and Williams (2006) found that positive perceptions of cleanliness positively influence approach behaviours such as the intention to revisit an office or beach, and willingness to spend more money on an airport.

Duncan and Mummery (2005), Gropp et al. (2012), Lee et al. (2016), and Mier et al. (2013) found that more favourable perceptions of cleanliness and the absence of litter lead to higher levels of children's outdoor playtime and physical activity. Duncan and Mummery (2005) noted that it is plausible that people who are more active are more aware of neighbourhood cleanliness than people who are less active. Moreover, Powell-Wiley et al. (2013) found that less favourable perceptions of neighbourhood cleanliness are associated with psychosocial stress and an increased prevalence of obesity. Finally, Edwards and Bromfield (2009) evaluated the effect of perceived safety, cleanliness, and belonging among children on pro-social behaviour. It appeared that children living in neighbourhoods that were perceived as cleaner exhibited higher levels of pro-social behaviour.

Summary of findings

Articles on the relationship between organism and response variables were treated in this paragraph. In most articles, the effect of perceived cleanliness was evaluated on multiple response variables. It appeared that perceived cleanliness was often studied together with perceived safety. A more positive perception of cleanliness and safety positively influenced satisfaction and approach behaviours, physical activity and pro-social behaviour. Moreover, the relationship between demographic variables and perceived cleanliness was discussed.

Interestingly, multiple studies (Chua et al., 2015; Chuang et al., 2011; Emir & Saraçlı, 2011; Lam et al., 2011; Lee and Kim, 2014; Wakefield & Blodgett, 1996) identified perceived cleanliness as an organism variable influencing customer satisfaction. Together with other variables such as safety and temperature, cleanliness is according to the two-factor theory a hygiene factor (Herzberg, 1966; Vilnai-Yavetz & Gilboa, 2010). Following to the two-factor theory, cleanliness is only able to cause dissatisfaction when insufficient. Based on the studies presented in this review, cleanliness is able to

cause satisfaction as well. In this context and based on the expectancy disconfirmation paradigm (Oliver, 1980), Vilnai-Yavetz and Gilboa (2010) argued that cleanliness functions both as a hygiene factor and a motivator at the same time. When cleanliness is as expected, the confirmation of expectations influences perceptions or satisfaction neither positively nor negatively. When cleanliness of an environment is better than expected, the perception will be positive and will, thus, lead to satisfaction. When cleanliness is poorer than expected, cleanliness is a hygiene factor that may cause dissatisfaction.

The aim of this paragraph was to analyse studies evaluating the relationship between organism and response variables. Following the conceptual model (Figure 1.1), stimuli influence perceptions of the environment which evoke certain internal response and finally lead to behaviour. Vilnai-Yavetz and Gilboa (2010) evaluated the relationship between perceptions, internal responses (pleasure, trust, attributed prestige) and satisfaction. Besides this study, no internal response variables were encountered.

Response moderators

In general, people respond to stimuli through perceptions, and internal responses which ultimately determine how they behave. The strength and direction of the relationship between variables is however moderated by personal and situational factors (Bitner, 1992). Several response moderators were identified during the review process. In the study of Barber and Scarcelli (2010) and Wakefield and Blodgett (1996) the effect of gender and educational level was evaluated on the perception of cleanliness. Females and people with a lower educational level had a less positive perception of cleanliness compared to males and people with a higher educational level. In addition, a few studies, described in the previous paragraphs, evaluated the effect of gender (Cialdini et al., 1990; De Kort et al., 2008), age (Bator et al., 2011; Cialdini et al., 1990; De Kort et al., 2008), average income, and literacy degree (Santos et al., 2005) on littering behaviour. Cialdini et al. (1990) found no effects for gender and age. Bator et al. (2011) and De Kort et al. (2008) found that younger people and males are more likely to litter. In addition, Santos et al. (2005) found that littering was more common in areas with lower income and a higher illiteracy degree.

Table 1.4*Characteristics of included studies on the relationship between organism and response variables*

Author(s)	Year	Sample	Setting	Country
Barber, J. and Scarcelli, J.M.	2010	351 participants	Restaurant	US
Chua, B.L., Lee, S., Huffman, L., and Choi, H.S.	2015	308 tourists	Ski resort	US
Chuang, H.M., Chu, C.P., and Lin, T.	2011	242 passengers	Railway	Taiwan
Duncan, M. and Mummery, K.	2005	1,281 residents	Neighbourhood	US
Edwards, B. and Bromfield, L. M.	2009	4,983 four-to-five-year old children	Neighbourhood	Australia
Emir, O. and Saraçlı, S.	2011	534 tourists	Hotel	Turkey
Gropp, K.M., Pickett, W., and Janssen, I.	2012	3,997 students	City	Canada
Honold, J., Beyer, R., Lakes, T., and van der Meer, E.	2012	428 residents	Neighbourhood	Germany
Lam, L.W., Chan, K.W., Fong, D., and Lo, F.	2011	513 gaming customers	Casino	China
Lee, S.Y. and Kim, J.H.	2014	594 users of public service facilities	Office	South-Korea
Lee, R.E., Soltero, E.G., Jáuregui, A., K. Mama, S., Barquera, S., Jauregui, E., Lopez y Taylor, J., Ortiz-Hernández, L., Lévesque, L.	2016	1,509 children	Neighbourhood	Mexico
Powell-Wiley, T.M., Ayers, C.R., de Lemos, J.A., Lakoski, S.G., Vega, G.L., Grundy, S., Das, S.R., Banks-Richard, K., and Albert, M.A.	2013	5,907 residents	Neighbourhood	US
Mier, N., Lee, C., Smith, M.L., Wang, X., Irizarry, D., Avila-Rodriguez, E.H., Trevino, L., and Ory, M.G.	2013	67 children	Neighbourhood	Mexico

Methods	Organism variables	Analysis methods	Citations*	Impact factor journal**
Field study, online survey	Demographics	Factor analysis, Multivariate analysis of variance	14	1.286
Field study	Perceptions of cleanliness	Structural equation analysis	0	0.343
Field study, online survey	Perceptions of cleanliness, perceptions of safety	Structural equation analysis	0	n/a
Field study, interviews	Perceptions of safety, perceptions of aesthetics	Regression analysis	150	2.893
Field study	Perceptions of cleanliness, perceptions of belonging	Regression analysis	22	0.969
Field study	Perceptions of cleanliness	Structural equation analysis	2	0.43
Field study	Neighbourhood perceptions,	Regression analysis	8	2.216
Field study	Neighbourhood perceptions	Chi square test, regression analysis, & analysis of variance	11	1.072
Field study	Perceptions of cleanliness	Regression analysis	23	1.887
Field study	Perceptions of cleanliness	Structural equation analysis	6	0.313
Field study	Neighbourhood perceptions, perceptions of cleanliness	Regression analysis	0	1.344
Field study	Neighbourhood perceptions	Regression analysis	13	2.016
Field study, focus groups	Neighbourhood perceptions	Qualitative analysis	0	0.221

Table 1.4
Continued

Author(s)	Year	Sample	Setting	Country
Santos, I.R., Friedrich, A.C., Wallner-Kersanach, M., and Fillman, G.	2005	196 participants	Beach	Brazil
Tudor, D. T. and Williams, A. T.	2006	2,306 visitors	Beach	UK
Vilnai-Yavetz, I. and Gilboa, S.	2010	403 participants	Restaurant	Israel
Wakefield, K.L. and Blodgett, J.G.	1996	1,263 participants	Leisure settings	US

Notes.* citations: number of times cited in accordance with Scopus, benchmark year: 2016, ** impact factor: impact factor of the journal in accordance with Scientific Journal Rankings (SJR), benchmark year: 2016

Conceptual framework

Based on the insights gathered through this systematic literature review a conceptual framework was proposed (Figure 1.3). This framework was based on the SOR model of Mehrabian and Russell (1974), complemented by the servicescape framework of Bitner (1992). In contrast to the original servicescape framework, it is expected that the conceptual framework operates cyclically. Some of the response variables, such as staff behaviour and norm exceeding behaviours are able to positively or negatively influence stimulus variables. Unclean environments will for example negatively influence perceptions and internal responses of (cleaning) staff and will lead to action to improve actual cleanliness. The same applies to norm exceeding behaviours and the condition of the environment.

Methods	Organism variables	Analysis methods	Citations*	Impact factor journal**
Field study	Demographics	Correlation analysis	55	0.784
Field study, observations	Perceptions of cleanliness, perceptions of litter, perceptions of safety	Descriptive statistics	31	0.938
Laboratory experiment, photo based	Perceptions of cleanliness	t-test	9	0.374
Field study	Perceptions of cleanliness	Structural equation analysis	763	1.021

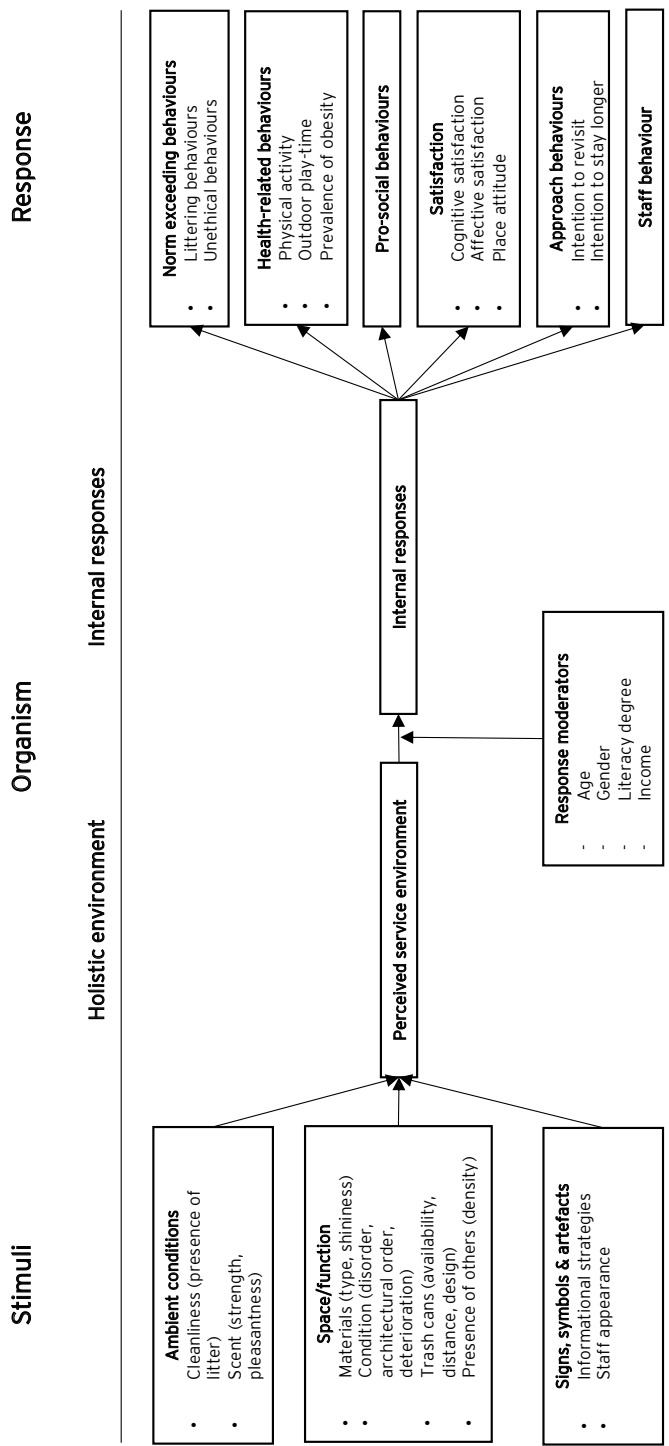


Figure 1.3

Conceptual framework on S-O-R variables related to cleanliness (based on: Bitner, 1992; Mehrabian & Russell, 1974)

1.4 Discussion

Based on a review of the selected 46 papers, this study identifies current research paths to broaden the understanding of the relationship between stimulus, organism, and response variables related to cleanliness. Articles were categorized according to the SOR model (Mehrabian & Russell, 1974) and the servicescape framework (Bitner, 1992). A distinction was made between articles evaluating the relationship between stimuli and organism variables (S-O), stimulus and response variables (S-R), and organism and response variables (O-R).

First, research on the relationship between stimulus and organism variables appeared to be limited and mostly qualitative. Therefore, additional research on the effect of stimuli on perceived cleanliness is needed. A large number of papers were included on the relationship between stimuli and response variables. The majority of these articles evaluated the effect of different stimuli on littering behaviour. Except for findings regarding disorder and scent, findings were in line with a previous review of Huffman et al. (1995). Moreover, a relatively large number of studies on the relationship between organism and response variables were identified.

Secondly, the findings of this review suggest that cleanliness does not only work as a “hygiene factor” (Herzberg, 1966) to maintain sales levels and avoid dissatisfaction among customers. This review demonstrated that cleanliness is able to positively influence perceptions, emotions, and responses such as satisfaction, approach behaviour, and physical activity. Suggesting cleanliness is an important element of the service environment rather than a negligible aspect of the maintenance process. Vilnai-Yavetz and Gilboa (2010) argued, based on the expectancy disconfirmation paradigm (Oliver, 1980) that cleanliness functions as both a hygiene factor and motivator at the same time depending on expectations of individuals. A difference between expectations and outcomes might lead to dissatisfaction. When cleanliness exceeds expectations customers will be satisfied, confirmation of expectations will result in basic satisfaction.

Thirdly, it is expected that the conceptual framework (Figure 1.3) is cyclic. Response variables such as staff behaviour and norm exceeding behaviour can positively or negatively influence stimulus variables that determine the appearance of the environment. Uncleanliness will negatively influence perceptions and emotions of facility managers and cleaning staff, generally resulting in cleaning behaviour which positively influences actual cleanliness. Similarly, environments that are unclean or in a poor condition negatively influence perceptions and emotions of customers and might lead to littering behaviour which negatively influences actual cleanliness.

The present study is limited because of several reasons. Because of the explorative character of the current literature review, included studies were performed in several settings (e.g., health care, public space and offices). As noted by Wakefield and Blodgett (1996), the relative importance of actual and perceived cleanliness may vary, depending on the setting. This might influence reproducibility of the current findings in different settings. Due to the applied nature of the concept of cleanliness, the aim of this review was to include many different types of research (dissertations, unpublished studies, book chapters, abstracts, thesis and studies in non-peer-reviewed journals). However, the review primarily included peer-reviewed papers. Finally, it appeared that not all major studies on cleanliness appeared when following the search criteria. The study of Wakefield and Blodgett (1996) was for example not found as none of the keywords were included in the abstract or keywords of the paper. As the paper of Wakefield and Blodgett (1996) was cited by multiple papers that were included in this review (Chua et al., 2015; Lam et al., 2011; Lee & Kim, 2014; Vilnai-Yavetz & Gilboa, 2010; Wells & Daunt, 2015), it was decided to include the paper of Wakefield and Blodgett (1996) after the initial search.

Future literature review studies could use other research methods to include other sources of research as well and elicit more insights about antecedents and consequences of perceived cleanliness. As noted, the number of studies on the relationship between stimuli and organism variables were low. The majority of the results were derived from two qualitative studies (Whatley et al., 2012; Whitehead et al., 2007). This could be considered as a main advantage of qualitative research. However, on the basis of this review it is not possible to conclude at what exact level actual cleanliness or scent positively influences, for example, perceptions, satisfaction, and behaviour. This should be solved by performing additional experimental research on the effect of stimuli on organism and response variables.

1.5 Conclusions and implications

This study provides a systematic review of literature on cleanliness. Insights were derived through discussion of the research contexts, methods and findings of the included studies. Moreover, a conceptual framework (Figure 1.3) was proposed based on the SOR model of Mehrabian and Russell (1974). The findings of this literature review carry several important implications.

Firstly, the effect of cleanliness has in general been considered trivial and not included in studies (on the service environment). However, cleanliness has been shown to exercise a noteworthy influence on perceptions and actual behaviours. In this respect, an overview of the current state of literature was provided. Moreover, a conceptual framework was proposed to present stimuli, organism, and response variables related to cleanliness. This framework aims to advance knowledge on antecedents and consequences of a clean environment and provides a theoretical foundation for future research.

Secondly, the present study should encourage to perform more research on cleanliness. Research on stimuli influencing perceived cleanliness was limited. As noted, most stimuli were derived from two qualitative studies (Whatley et al., 2012; Whitehead et al., 2007) performed in a healthcare setting. Experimental field studies could be performed on the qualitative findings. For example, by evaluating the effect of actual cleanliness and staff behaviour on perceptions and behaviours in various types of settings (e.g., retail, healthcare, offices, transport). Wakefield and Blodgett (1996) evaluated the effect of cleanliness in different settings (i.e., football game, casino) and discovered that the effect of cleanliness on satisfaction increased when customers spend more time in the service environment. Moreover, future research should also investigate the interaction of actual cleanliness with other atmospheric cues such as scent, architectural order, lighting, and density. The experience of a(n) (service) environment is holistic since people are exposed to several environmental elements at the same time. In addition, future research should pay attention to the effect of actual cleanliness in the light of the two-factor theory (Herzberg, 1966) and the expectancy disconfirmation paradigm (Oliver, 1980). As proposed by Vilnai-Yavetz and Gilboa (2010) cleanliness can function as both a hygiene factor and motivator at the same time depending on expectations of individuals. This finding was however never empirically tested.

Thirdly, the stimulus, organism, and response variables identified in the conceptual framework allows in-house and corporate facility managers to better understand and identify most effective interventions that positively influencing actual and perceived

cleanliness. Instead of investing in additional cleaning services to improve actual cleanliness and thereby the perception of cleanliness, other possibly more effective stimuli were identified. Perceived cleanliness can, for example, be improved by promoting interaction between customers and cleaning employees. Moreover, scent could be applied to, for example, train compartments or office buildings to positively influence the perception of cleanliness. Actual cleanliness can be improved by simply rethinking the placing and availability of trash cans or restoring disorder by removing graffiti and doing deferred maintenance to restore the condition of the environment.

In brief, the findings of this article provide a useful review of the effects of actual and perceived cleanliness offering starting points for future empirical research. Future research should contribute to a further unravelling and understanding of how cleanliness affects perceptions and behaviours in different environments.

In brief - chapter 1

Chapter 1 provided a systematic overview and integration of scientific literature on cleanliness in a broad sense. The main focus was on stimulus, organism, and response variables related to actual and perceived cleanliness. Articles were categorized into one of the three relationships in which cleanliness is involved:

1. Relationship between stimuli and organism variables
2. Relationship between stimuli and response variables
3. Relationship between organism and response variables

Based on this first chapter, it is concluded that most research focusses on (1) how actual cleanliness affects littering behaviour and (2) on the relationship between perceived cleanliness and outcomes such as customer satisfaction (3). Research on how environmental cues can be used to influence perceived cleanliness is mainly explorative. Empirical research in this area is necessary to thoroughly determine which cues in service environments can be used to influence perceived cleanliness.

Now that an overview of the current literature on the concept of perceived cleanliness is presented, the next step is to consider the perspective of service experts and customers on perceived cleanliness. Chapter 2 provides a first step in developing a conceptualisation of perceived cleanliness by qualitatively exploring the viewpoint of service experts and customers in a Delphi study.

Chapter 2

Practical perspectives on perceived cleanliness: a Delphi approach

This chapter has been published as: Vos, M.C., Galetzka, M., Mobach, M.P., van Hagen, M., & Pruyn, A.T.H. (2018). Exploring cleanliness in the Dutch facilities management industry: a Delphi approach. *Facilities*, 36 (9/10), pp. 510-524, <https://doi.org/10.1108/F-09-2017-0092>.

2.1 Introduction

One of the aims of in-house and corporate facility managers is to provide clean environments to their end-users. By doing so, facility managers ensure that millions of end-users work, live or stay in environments that are both hygienic (Whitehead et al., 2007) and enjoyable (Vilnai-Yavetz & Gilboa, 2010). Following previous research, cleanliness is one of the key factors influencing overall customer satisfaction (Wakefield and Blodgett, 1996). In The Netherlands, the business of cleanliness is a big business. Dutch organisations spend billions on cleaning services every year, representing approximately 1 per cent of the gross national product (Van Diepen-Knegjens & Veenstra, 2017), highlighting its significance in facility management.

Very often, a distinction is made between actual cleanliness and perceived cleanliness. Actual cleanliness is monitored by trained inspectors through predetermined indicators, such as the actual cleanliness of windows, floors or furniture (Sherlock et al., 2009). As opposed to actual cleanliness, end-user perceptions of cleanliness are based on information captured through the senses (Orstad et al., 2016). More or less objective criteria to evaluate actual cleanliness are widely available (e.g., number of fingerprints on a window and number of stains on a table). But what are the antecedents of the more subjective end-user perceptions of cleanliness?

Whitehead et al. (2007) took a first step by performing a qualitative study among end-users (patients and medical staff) to identify key antecedents that influence end-user perceptions of cleanliness in a hospital setting. Actual cleanliness, cleaning staff behaviour, and the appearance of the environment were identified as key antecedents. Cleaning staff behaviour is about social interactions between staff members and between staff members and end-users (Bitner, 1992). The appearance of the environment includes all antecedents related to ambient conditions, architectural features, and the arrangement of equipment and furnishing in a space (Bitner, 1992). As noted by Whitehead et al. (2007), research into the antecedents of perceived cleanliness is scarce and relatively new. As a result of this knowledge gap, facility managers are not always able to make well-informed decisions when it comes to end-user perceptions of cleanliness. Therefore, the aim of this chapter is to define the concept of end-user perception of cleanliness. Which antecedents of end-user perceptions of cleanliness can be distinguished? Which antecedents are used in practice? Which of these antecedents can be used for the development of an instrument to measure end-user perceptions of cleanliness?

In this chapter, observed antecedents of perceived cleanliness were categorised into the following categories identified by Whitehead et al. (2007): actual cleanliness, cleaning staff behaviour, and the appearance of the environment. Moreover, the servicescape framework of Bitner (1992) was applied to operationalise the concepts of cleaning staff behaviour and the appearance of the environment. Current literature will be used to develop a set of propositions that will be evaluated by experts in the field of facility management and end-users.

2.2 Theoretical framework

2.2.1 The cleaning industry

In The Netherlands, cleaning is considered to be a secondary process with a standard quality that does not directly contribute to the success of a client organisation but is relatively easy to produce and buy (Toffolutti et al., 2017; Van Vlijmen & Van den Hoogen, 2013). The Dutch cleaning market is characterised by a high degree of outsourcing and an oligopolistic market structure with five large facility providers, accounting for more than half of the total market turnover. Additionally, many smaller facility service providers exist as investments and knowledge associated with starting a cleaning business are relatively low. Similar developments and characteristics (i.e. outsourcing rates and market structure) are observed in other Western countries (Haugen & Klungseth, 2017). In The Netherlands, due to the recent economic crisis and the surge of workplace innovations, such as 'new ways of working' and 'smarter working', clients have substantially reduced their real-estate properties and thereby spaces that need to be cleaned. The decrease in market volume, combined with a high degree of outsourcing (demand) and a large number of facility service providers (supply), leads to strong competition based on price instead of quality which is standardised (Van Vlijmen & van den Hoogen, 2013).

Following the dynamic market theory (De Jong, 1989) and the product life cycle approach (Anderson & Zeithaml, 1984), the cleaning industry could currently be considered to be in the saturation phase. This stage is characterised by limited market growth, cost control, standardisation, and high levels of competition (Rogier, 1998). Businesses try to differentiate by shifting their focus from price to quality and by investing in innovations (Cooper, 2011). Moreover, the number of mergers increase, leading to a highly centralised market. Based on these insights, it is expected that facility service providers try to differentiate and be competitive by shifting their focus from price to quality and by investing in innovations. This empirical expectation will be tested in practice; more specifically, the following proposition was formulated:

P1: Competition in the cleaning industry is strong. Facility service providers try to be competitive by shifting their focus from price to quality and by investing in innovations.

2.2.2 Actual cleanliness, cleaning performance, and end-user perceptions

The relationship between a client and facility service provider is often mediated by a consultant who monitors if the cleaning activities performed by facility service providers are sufficient, or not. Literature presents two main methods to evaluate actual cleanliness, namely, visual assessment (Van Ryzin et al., 2008) and microbiological methods (Sherlock et al., 2009). Internationally, visual assessment is considered to

be the primary method to assess actual cleanliness. Microbiological methods are believed to be more accurate but are more expensive and time-consuming. These methods are especially used in health-care settings in which cleaning reduces the incidence of health care-associated infections (Weinstein and Hota, 2004).

In practice, several national and international standards are available to monitor actual cleanliness (e.g., The Netherlands: NEN 2075; and USA: ISSA). Audits of actual cleanliness most often include visual inspections to evaluate actual cleanliness but are not about actual cleanliness only. The quality of the cleaning process is considered as well by evaluating whether cleaning activities (e.g., sweeping and emptying bins) are performed sufficiently. Actual cleanliness may, however, relate only weakly to the outcomes that end-users experience directly or care about the most (Van Ryzin et al., 2008). More subjective outcomes such as scent or architecture are often not included in monitoring systems for cleanliness.

The above studies show that the monitoring system for cleanliness mainly relies on actual cleanliness rather than antecedents of perceived cleanliness. Hence, a similar outcome is expected in practice:

P2: When monitoring cleanliness, practitioners will have a stronger focus on criteria of actual cleanliness as opposed to antecedents of perceived cleanliness.

2.2.3 Influencing end-user perceptions of cleanliness

As given in the previous paragraph, antecedents of perceived cleanliness are not well represented in current standards that measure cleanliness. In addition, there is currently no instrument available that can be used to measure perceived cleanliness. In the present chapter, a basis for the development of such an instrument was created by identifying antecedents of perceived cleanliness in current literature.

First, actual cleanliness was found to influence end-user perceptions of cleanliness. Two qualitative studies (Whatley et al., 2012; Whitehead et al., 2007) and one quantitative study (Van Ryzin et al., 2008) evaluated the effect of actual cleanliness on perceived cleanliness. The studies suggest that actual cleanliness, and more specifically visible dirt and stains, and presence of litter may indeed influence end-user perceptions of cleanliness (Whatley et al., 2012; Whitehead et al., 2007).

Second, the appearance of the environment influences perceived cleanliness. The appearance of the environment is determined by a set of ambient conditions, architectural features, and the arrangement of equipment and furnishing in a space

(Bitner, 1992). Scent, lighting, use of materials, density, and the condition of the environment (i.e. deterioration, aesthetics and architectural order) were identified in literature as antecedents influencing the appearance of the environment. The absence of unpleasant scents and the presence of pleasant scents were expected to positively influence perceptions of cleanliness (Whatley et al., 2012). Molenaar and Hu (2013) found that an environment is perceived as cleaner when lighting is pointed at traces of litter. Broeders et al. (2011) demonstrated that people sitting at a table with a shiny table top ate longer and had more positive perceptions of cleanliness. Whitehead et al. (2007) identified the crowdedness (i.e. human density and number of people in a confined space) of an environment as a predictor of perceived cleanliness. Moreover, several studies focussing on the relationship between environmental variables (i.e. deterioration, aesthetics, and architectural order) and perceived cleanliness were evaluated. In the study of Wells and Daunt (2015), the level of deterioration was linked to the perception of cleanliness. Higher levels of deterioration were associated with less positive perceptions of cleanliness. In addition, Whitehead et al. (2007) and Whatley et al. (2012) found that age and aesthetics of spaces influences perceptions of cleanliness: less attractive or older buildings were perceived as less clean. In the study of Da Luz Reis and Dias Lay (2009), architectural order was associated with perceived cleanliness. Architectural order is about the art of balancing individual architectural parts and is able to provoke satisfaction or dissatisfaction (Hasse & Weber, 2012).

Third, cleaning staff behaviour and, more specifically, the interaction between cleaning staff and end-users, influences perceived cleanliness. Following the servicescape framework of Bitner (1992), the service environment does influence the nature and quality of staff-end- user interactions. Witnessing cleaning staff actively clean (Whatley et al., 2012; Vos et al., 2017), and more specifically, the appearance, and commitment of cleaning staff (Whatley et al., 2012; Whitehead et al., 2007), was associated with more positive end-user perceptions of cleanliness.

Based on literature, it is concluded that actual cleanliness, the appearance of the environment and cleaning staff behaviour can be used to positively influence end-user perceptions of cleanliness. To enrich current literature and contribute to the development of an instrument that measures perceived cleanliness, the aim is to explore which antecedents of perceived cleanliness are used in practice. In line with the previous propositions, it is expected that practitioners will mainly focus on actual cleanliness as actual cleanliness is most often the only antecedent included in cleanliness monitoring systems. This leads to the following proposition:

P3: When influencing end-user perceptions of cleanliness, practitioners will have a stronger focus on actual cleanliness as opposed to the appearance of the environment, and cleaning staff behaviour.

2.3 Method

2.3.1 Delphi method

A Delphi method was used, which is considered to be an interactive method that enables experts to discuss a complex problem through a structured iterative communication process (Rowe & Wright, 2001; Pijls et al., 2017; Wunderlich et al., 2013). Experts were consulted in four rounds with the aim of identifying antecedents of perceived cleanliness. In addition, the aim is to provide an overview of criteria that are currently used in practice and could possibly be used for the development of an instrument that can be used to measure perceived cleanliness. In a first step, information was collected from individual experts by performing face-to-face interviews. In the second step, the expert information was collated, analysed and resubmitted to the experts. The third step entailed the exchange of ideas between the consulted experts in a group discussion. A survey among the experts was performed in the fourth step. Finally, end-users were consulted in the fifth and final step.

2.3.2 Participants

A total of 24 experts (18 men) of 30-60 years of age, representing six facility service providers, ten clients and two consultancy firms, as well as seven end-users, participated in this study. More specifically, the experts represented a wide range of service organisations in health care, amusement, business, travel and government (Table 2.1). Of the 18 experts, 6 participated in all phases of this study (1 facility service supplier, 3 client organisations and 2 consultancy firms). During the different steps of the study, some of the participants dropped out (e.g., no reaction and not able to attend). In these cases, new participants with similar background characteristics replaced the participants who dropped out. Despite of great efforts, not all drop-outs from Step 2 (feedback) to Step 3 (group discussion) were replaced. In line with the principles of the Delphi method (Wunderlich et al., 2013), consistency and continuation were maintained by providing a summary of the results of the previous round to the respondents after Steps 2, 3, and 4. In the final step of the study, seven experienced end-users, members of a fixed customer panel of a Dutch railway company, were consulted (two male and five female) on their perspective on cleanliness. A distinction was made between frequent ($n = 4$) and infrequent passengers ($n = 3$).

2.3.3 Procedure

The study consisted of five steps. The procedure and corresponding number of participating experts and end-users is visualised in Figure 2.1.

Table 2.1*An overview of the characteristics of the participants (organisation type, position, gender, age)*

Participants	Organisation type	Position	Gender	Age
Expert 1	Facility service provider 1	Director	Male	50-60
Expert 2	Facility service provider 1	Operations manager	Female	30-40
Expert 3	Facility service provider 2	Quality manager	Male	50-60
Expert 4	Facility service provider 3	Director	Male	40-50
Expert 5	Facility service provider 3	Project manager	Male	20-30
Expert 6	Facility service provider 4	Project manager	Male	50-60
Expert 7	Facility service provider 5	Director	Male	40-50
Expert 8	Facility service provider 5	Project manager	Male	40-50
Expert 9	Facility service provider 6	Operations manager	Male	50-60
Expert 10	Client 1, amusement park	Market researcher	Female	30-40
Expert 11	Client 1, amusement park	Facility manager	Male	50-60
Expert 12	Client 2, railway operator	Facility manager	Female	30-40
Expert 13	Client 2, railway operator	Operations manager	Male	40-50
Expert 14	Client 3, prison	Project manager	Male	40-50
Expert 15	Client 4, railway operator	Director	Male	40-50
Expert 16	Client 5, bank	Facility manager	Female	40-50
Expert 17	Client 6, holiday resort	Facility manager	Male	40-50
Expert 18	Client 7, airport	Market researcher	Female	40-50
Expert 19	Client 8, hospital	Facility manager	Male	40-50
Expert 20	Client 9, airline	Market researcher	Male	30-40
Expert 21	Client 10, museum	Facility manager	Male	30-40
Expert 22	Consultant 1	Managing consultant	Female	50-60
Expert 23	Consultant 1	Director	Male	50-60
Expert 24	Consultant 2	Consultant	Male	20-30
End user 1	-	-	Female	20-30
End user 2	-	-	Female	40-50
End user 3	-	-	Female	40-50
End user 4	-	-	Female	30-40
End user 5	-	-	Female	30-40
End user 6	-	-	Male	30-40
End user 7	-	-	Male	60-70

Step 1 - interviews: In total, 17 experts, together representing 14 facility service providers, clients and consultants, were interviewed between February and June 2016. In 3 of the 14 interviews, two instead of one expert(s) participated. The average duration of the interviews was 1 hour. Each interview was transcribed, summarised and presented to the interviewees to verify whether their opinion had been worded correctly. Subsequently, inductive thematic analysis was performed (De Casterle et al., 2012) using the software ATLAS.ti.

Step 2 - feedback: Theoretical propositions that were not mentioned by the experts during the interviews were phrased as propositions and returned to the participants between February and March 2017. The experts individually provided feedback on the propositions by e-mail. In total 14 experts, together representing 14 facility service providers, clients, and consultants responded to the propositions.

Step 3 - group discussion: During a seminar, experts exchanged views on the propositions in a group discussion which took place in April 2017. New information from this seminar complemented previous findings. In total, 14 experts, together representing ten facility service providers, clients and consultants, participated in the group discussion. The discussion was led by a professional moderator.

Step 4 - questionnaire: The effectiveness of the identified antecedents was quantified through an online semi-structured questionnaire that was distributed directly after the group discussion. Participants were asked to indicate in which antecedents they had invested in the past two years (i.e. recent developments) and which antecedents they expected to have the strongest effect on perceived cleanliness. Anonymous responses were collected from 12 participants of the discussion. The total response to the questionnaire was higher compared to the number of experts participating in the group discussion as not all experts were able to participate in the group discussion but received an invitation to fill out the questionnaire.

Step 5 - feedback end-users: The findings of the previous rounds were presented to a group of end-users (n = 7) in August 2017. The goal was to find out if the end-users agreed with the views of the experts. Seven participants took part in the group discussion, which took 2.5 hours and was led by a professional moderator. All participants were experienced members of a fixed customer panel of a Dutch railway company.

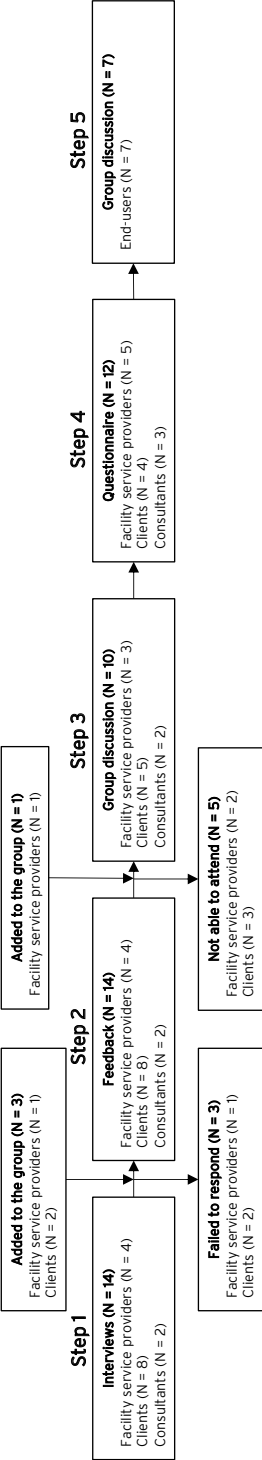


Figure 2.1
Visualisation of procedure (research methods & participants)

2.4 Results

2.4.1 Step one: interviews

The cleaning industry

It is expected that competition in the cleaning industry is strong; facility service providers try to be competitive by shifting their focus from price to quality and by investing in innovations (P1).

The majority of the facility service providers stated that they are following a growth strategy in a shrinking market. To grow, contracts are being offered at 'competitive prices'. As competitive contracts are in most cases not profitable, facility service providers create revenues by trying to perform as many additional activities (e.g., window cleaning and deep cleaning of carpets) that were initially not included in the contract. Another strategy is to decrease costs by understaffing (e.g., schedule two instead of three employees). One of the participants noted:

"... and unfortunately, that is how the cleaning industry works. They sell you 100 hours of cleaning and perform 80 hours only"

According to the clients and consultants, facility service providers only focus on the deployment of cleaning hours. According to one of the participants, the prominent place of price in the business model combined with fear of losing profits leads to a certain way of thinking that hinders innovation to take place. Facility service providers reported that interactions with clients are the major source of innovation. As illustrated by the following statement by one of the facility service providers:

"We were shocked when one of our clients asked us to share our vision on hospitality because we did not have one at that time."

Participants confirmed that competition in the cleaning industry is strong. However, in contrast with the theoretical expectations, facility service providers do not invest in innovation and are not shifting their focus from price to quality, the main focus is on standardisation and price.

Actual cleanliness and end-user perceptions

Based on literature, it is expected that practitioners will have a stronger focus on criteria of actual cleanliness as opposed to antecedents of perceived cleanliness when it comes to the monitoring of cleanliness (P2).

Participants argued that in the contracting phase, both client and facility service provider determine (usually together with a consultant) which indicators will be used to measure actual cleanliness (e.g., floor, walls and furniture). The standards (e.g., NEN 2075, ISSA) do not determine which factors should be included in the cleanliness monitoring system. Standards do, however, provide guidance on how to evaluate the cleanliness of different indicators of actual cleanliness (e.g., floors, walls and furniture). As noted by one of the participants:

"... If you decide to put in your contract that the table should be evaluated only, the table will be evaluated and all other elements are ignored. Measures of cleaning performance are based on your contract. Your contract is not based on standard measures of cleaning performance."

Surprisingly, some of the participants included antecedents of perceived cleanliness in their cleanliness monitoring system. In such case, inspectors evaluate, for example, the scent (e.g., pleasant or not), and behaviour of cleaning staff (e.g., friendly or not).

In general, two schools of thought for monitoring cleanliness were observed. First, for some, actual cleanliness should be leading rather than the unpredictable perceptions of end- users. Second, for others, a full or almost full reliance on end-user perceptions of cleanliness is of vital importance. Participants who follow this latter line of reasoning have argued that actual cleanliness does not sufficiently represent end-user perceptions. Instead, in this group, it was argued that customer satisfaction scores for cleanliness determine whether the quality of the cleaning services is sufficient. In general, both groups of participants do agree that end-user perceptions deserve more attention. There are different ways to do so, for example, by letting inspectors evaluate the scent or temperature of a place. Another way is to pay more attention to antecedents that are expected to have most effect on perceptions of end-users. One of the experts puts more emphasis on physical "touchpoints" (e.g., guardrail and seating). These touchpoints receive more attention in daily operations and actual cleanliness audits.

Participants reported that cleanliness is mainly monitored through indicators of actual cleanliness. Antecedents of perceived cleanliness are included if the persons involved in the monitoring of cleanliness have experience in this area.

Influencing end-user perceptions of cleanliness

Multiple antecedents of perceived were identified in literature; the aim of this study was to better understand which of these antecedents are used in practice. In addition,

it is expected that practitioners will have a stronger focus on actual cleanliness as opposed to the appearance of the environment and cleaning staff behaviour when it comes to influencing end-user perceptions of cleanliness (P3).

Firstly, literature indicated that higher levels of actual cleanliness positively influence end-user perceptions of cleanliness. All participants mentioned actual cleanliness as an important antecedent that positively influences perceived cleanliness.

Secondly, scent, lighting, materials, density, deterioration, and architecture were identified as antecedents related to the appearance of the environment that positively influences end-user perceptions of cleanliness. During the interviews, participants reported that antecedents such as scent, lighting, deterioration and the use of smooth materials influence perceived cleanliness. The use of fresh scents, such as citrus or lavender, was frequently mentioned and used by participants to positively influence perceived cleanliness. Besides its positive effects on end-user perceptions of cleanliness, scent is in many cases also used to conceal unpleasant scents of urine or waste. Moreover, participants reported that high lighting intensities positively influence perceived cleanliness. According to the participants, high light intensities may contribute to the impression that a space is new and well maintained. According to the participants, new spaces do in general have a more clean appearance compared to older spaces. A higher level of actual cleanliness is needed to obtain a similar level of perceived cleanliness in older spaces. Moreover, smooth and natural materials have a clean appearance and are in most cases easier to clean. Participants did not mention the effect of density and architectural order on perceived cleanliness.

Thirdly, literature indicated that interactions between cleaning staff and end-users positively influence end-user perceptions of cleanliness. Participants reported witnessing cleaning staff actively clean, experiencing signs of cleanliness, and behaviour of cleaning staff as antecedents of perceived cleanliness. Witnessing staff actively clean was most frequently mentioned during the interviews. Participants believe that witnessing cleaning staff actively clean gives the feeling that the environment is taken care of. The effect is expected to be even greater when end-users are confronted with one and the same cleaner in their work or travel environment every day. Experiencing physical evidence of the behaviour of cleaning staff (e.g., cleaning cart and cleaning checklist) might in some cases be sufficient as well. The behaviour of cleaning staff was frequently mentioned. More specifically, cleaners should try to make eye contact and have small conversations with end-users to build relationships.

Participants reported that they do not necessarily focus on actual cleanliness only when influencing end-user perceptions of cleanliness. The main focus of the participants is on the antecedents that are directly related to the cleaning process and are situated in their sphere of influence (i.e., maintenance, scent and cleaning staff behaviour).

2.4.2 Step two: feedback

Based on the interviews, it remained unclear how participants see the relationship between cleanliness monitoring systems and end-user perceptions of cleanliness (P2). Similarly, the antecedents density and architectural order were not mentioned by the participants.

In the previous step, it was concluded that cleanliness is mainly monitored through indicators of actual cleanliness and corresponding cleanliness monitoring systems. Despite most of the participants seeing the shortcomings of focussing on actual cleanliness only, more attention is paid by participants (and especially facility service providers) to actual cleanliness than to end-user perceptions of cleanliness. However, it was noted that actual cleanliness is not the only antecedent of perceived cleanliness. Other antecedents such as scent and deterioration are ignored by most cleanliness monitoring systems.

Almost all participants agreed with the proposition that the number of people in a space influences perceived cleanliness. Following the participants, density is able to influence perceived cleanliness in two different ways. First, density is positive as it covers traces of uncleanness but hinders the efficiency of the cleaning process. Second, density is negative as it relates to crowdedness (e.g., irritation) and the idea that other people are a (potential) source of litter, diseases, and unpleasant odours. Density is included in most business models as a variable that limits the efficiency of the cleaning process (P2).

The majority of the participants reported that architecture has more effect on the experience of end-users than cleanliness. In general, participants believe that good architecture can have positive effects on the end-user (perceptions of cleanliness), irrespective of the level of cleanliness. Despite most participants do not include architecture in their cleanliness monitoring systems, architecture is considered to be an effective antecedent of perceived cleanliness.

2.4.3 Step three: group discussion

Based on the outcomes of the previous rounds, it remained unclear how antecedents of end-user perceptions should be integrated in cleanliness monitoring systems (P2). Furthermore, experts had high expectations about architecture; it remained, however, unclear how architecture should be defined in the light of perceived cleanliness.

Participants agree that end-user perceptions of cleanliness are poorly represented in most cleanliness monitoring systems. Participants indicated that the two measures should be integrated, for example, by letting inspectors evaluate the scent (e.g., pleasant or not) and the quality of the interaction between cleaning staff and end-users (e.g., friendly or not).

All participants agree that good architecture positively influences perceived cleanliness by giving the feeling that the environment is taken care of. The participants reported that good architecture can be modern and new as well as classic and monumental. Light, new, transparent and ordered were mentioned as architectural variables positively influencing perceived cleanliness.

2.4.4 Step four: questionnaire

Overall, it appeared that most participants invested (or advised to invest) in the performance of more (visible) cleaning activities to positively influence the perception of cleanliness (Table 2.2). Thereafter, participants invested most in maintenance, clean toilets and scent.

Moreover, the aim was to quantify the importance (on a five-point scale) of the different antecedents based on the experience of the participants. It appeared that participants expected more (visible) cleanliness to have the most positive effect on end-user perceptions of cleanliness (Table 2.3). Moreover, clean toilets, architecture and use of materials were found to be of major importance. These expectations were even stronger for facility service providers, when compared with clients and consultants.

2.4.5 Step five: feedback end-users

End-users identified cleanliness, visibility of cleaning staff, architecture, use of materials and scent as most important antecedents of end-user perceptions of cleanliness. These findings were consistent with the findings in the expert groups.

Table 2.2

Antecedents in which participants invested (or advised to invest) to positively influence end-user perception of cleanliness

Antecedents	Overall (N = 12)	Clients (n = 5)	Facility service providers (n = 5)	Consultants (n = 2)
More (visible) cleaning	10	3	5	2
Maintenance	7	2	3	2
Toilets	6	1	3	2
Scent	6	0	2	2
Use of materials	4	0	2	2
Use of colour	3	2	1	0
(Ambient) lighting	1	0	1	0
Daylight	1	0	1	0
Architecture	0	0	0	0

Table 2.3

Evaluation of the importance of the different antecedents by the participants (on a 5-point scale)

Antecedents	Overall mean (N = 12)	Clients (n = 5)	Facility service providers (n = 5)	Consultants (n = 2)
More (visible) cleaning	4.46	4.20	4.80	4.33
Toilets	4.15	3.40	4.80	4.33
Architecture	3.92	4.40	3.80	3.33
Use of materials	3.92	3.60	4.40	3.67
Scent	3.69	3.40	3.80	4.00
Maintenance	3.62	3.80	3.40	3.67
(Ambient) lighting	3.23	2.80	3.60	3.33
Use of colour	3.08	2.80	3.40	3.00
Daylight	3.00	3.20	3.00	2.67

Only small differences were observed between the experts and end-users. Interestingly, end-users mentioned communication as an important antecedent of end-user perceptions of cleanliness, especially to create awareness among end-users about their efforts to create clean and appealing service environments. Although end-users did refer to the state and quality of the built environment, maintenance was not mentioned explicitly.

2.5 Conclusion

The purpose of this study was to define the concept of end-user perceptions and find out which antecedents of perceived cleanliness can be distinguished and which antecedents are used in practice and could possibly contribute to the development of an instrument that can be used to measure perceived cleanliness.

Competition in the cleaning industry is strong. Based on literature, it is expected that facility service providers try to be competitive and successful by shifting their focus from price to quality and investing in innovations. These expectations were not confirmed. Facility service providers do not invest in innovation, and their focus is not shifting from price to quality. Their main focus is on standardisation of cleaning services and price.

Cleanliness can be monitored through indicators of actual cleanliness (i.e., actual cleanliness of flooring or furniture, and quality of cleaning activities) and antecedents of perceived cleanliness (i.e., actual cleanliness, cleaning staff behaviour, and appearance of the environment). Due to the lack of standards and instruments that monitor perceived cleanliness, more attention is paid to indicators of actual cleanliness than to antecedents of perceived cleanliness. National and international standards on how to monitor actual cleanliness are widely available.

The main antecedents of end-user perceptions of cleanliness that emerged from the analysis are actual cleanliness, cleaning staff behaviour, and the appearance of the environment. More specifically, the first four antecedents mentioned in Tables 2.2 and 2.3 and that were consistent with the findings of the discussion with end-users (i.e., more [visible] cleaning, maintenance, toilets, scent, architecture and use of materials) offer interesting starting points for research on perceived cleanliness. By doing so, a basis may be provided for the development of an instrument for perceived cleanliness.

2.6 Discussion

2.6.1 Theoretical and practical implications

This study has both implications for current literature and practice. The study contributes to the understanding of the concept of end-user perceptions of cleanliness and antecedents that influence perceived cleanliness. Compared to similar studies of Whitehead et al. (2007) and Whatley et al. (2012), this study has taken a broader perspective by focussing not on the health-care sector and end-users (i.e. patients and medical staff) only but focus on the facility management sector as a whole by consulting end-users and experts with different backgrounds. The results of this study are applicable to different types of service environments; however, the relative importance of the antecedents may vary depending on the type of environment and end-user.

The identified key antecedents may allow practitioners in the cleaning industry to better understand and identify different antecedents that positively influence the perceptions of their end-users. The cleaning industry does not typically focus on antecedents other than actual cleanliness. The development of an instrument that includes other antecedents (i.e. cleaning staff behaviour, and appearance of the environment) may contribute to the understanding that end-user perceptions are not affected by actual cleanliness only. But what should the instrument for perceived cleanliness look like? In contrast to standards of actual cleanliness, perceived cleanliness should be monitored by end-users, for example, by monitoring the quality of different antecedents through questionnaires or more interactive methods such as customer panels or online feedback monitors.

The development of this instrument might have serious consequences for the business models of facility service providers. The current focus of business models should shift from selling as many hours as possible to selling the highest end-user experience as possible. One could think of an approach in which clients and facility service providers agree on a certain “level” of end-user experience (e.g., 7.0 on a scale of 0-10). Based on their experience, facility service providers determine how many hours of cleaning are needed to achieve the agreed end-user experience. Prices are fixed for the duration of the contract and based on the level of end-user experience multiplied by the number of full-time equivalents, square metres or desks the client is responsible for. As a result, facility service providers might decide to invest in (research on) antecedents that are not necessarily related to actual cleanliness or the cleaning process.

2.6.2 Limitations and suggestions for future research

The present study is limited because of different reasons. Despite of the high efforts, 9 of the 24 experts, representing one facility service provider, three clients, and two consultants, participated in all phases of this study. Consistency and continuation were maintained by providing a summary of the results of the previous round to the respondents after Steps 2, 3, and 4. In addition, findings of the experts were verified by seven experienced members of a fixed customer panel of a Dutch railway company. Although the groups of participants were small, results of the different steps were valuable and resulted in a relevant foundation for future research on end-user perceptions of cleanliness.

Differences were noted between the clients and facility service providers during the discussion. Clients came up with more compelling topics and answers compared to facility service providers. A possible reason could be that facility service providers do not care about the topic and are mainly concerned with selling cleaning activities. The expectation is that facility service providers were also on the background due to the presence of competitors and lucrative clients. Therefore, facility service providers were given the opportunity to share their view through a survey in the fourth round.

The current study mainly focusses on the experience of practitioners in the field of facility management, and future research should consider the end-user perceptions of cleanliness. A first step to do so is by developing an instrument that can be used to monitor end-user perceptions of cleanliness. Despite the importance of cleanliness, no instrument is available to monitor end-user perceptions of cleanliness in a reliable way.

In line with the development of the instrument for perceived cleanliness, additional research on antecedents of perceived cleanliness is needed. It would, for example, be relevant to evaluate the relative importance of the antecedents in different settings (e.g., office, hospital, and airport), especially in the light of the development of the instrument for perceived cleanliness.

Finally, future research should investigate the combined effect of actual cleanliness and, for example, scent or architecture, on end-user perceptions of cleanliness in real-life settings. Most of the studies that were mentioned in the literature review were qualitative or performed in a lab-setting.

In brief - chapter 2

In chapter 1, a systematic overview of the literature on cleanliness was presented. The main conclusion was that research on the concept of perceived cleanliness is limited. Also, experimental studies on possible determinants of perceived cleanliness are lacking.

That is why a qualitative Delphi study with service experts and customers was performed to create an overview of more practical knowledge on perceived cleanliness in Chapter 2. Through interviews, group discussions, and a survey, several variables that may be used to define and influence perceived cleanliness were identified. Actual cleanliness, cleaning staff behaviour, and the appearance of the environment were identified as the three main variables.

Chapter 3 describes the development of the Cleanliness Perceptions Scale (CP-scale) that can be used to measure perceived cleanliness in any service environment. Based on the variables identified in Chapter 2, a 24-item version of the instrument was tested in a first quantitative study with 743 visitors of a train station. The initial scale was reduced to a scale of 14 items, that was validated in a second quantitative study with another 738 visitors of different train stations. This resulted in the twelve-item CP-scale.

Chapter 3

Measuring perceived cleanliness: concept validation and scale development

This chapter has been published as: Vos, M.C., Galetzka, M., Mobach, M.P., van Hagen, M., & Pruyn, A.T.H. (2019). Measuring perceived cleanliness in service environments: scale development and validation. *International Journal of Hospitality Management*, 83, pp. 11-18, <https://doi.org/10.1016/j.ijhm.2019.04.005>.

3.1 Introduction

Cleanliness of service environments is a key determinant of overall customer satisfaction, perceived service quality, and customer intention to return to a service provider (Barber & Scarcelli, 2010; Moon et al., 2017; Pizam & Tasci, 2019; Wakefield & Blodgett, 1996). The service industry is characterised by many short encounters, during which customers respond to their environment holistically (Bitner, 1992). Cleanliness is especially important, as it impacts customers' first impression of the service environment and organisation (Harris & Sachau, 2005; Vilnai-Yavetz & Gilboa, 2010). Customers consider uncleanliness as the most serious service failure, partly because cleanliness, compared with redecoration or reconstruction, is the environmental dimension that is perceived as being the cheapest and easiest to control (Hooper et al., 2013).

Traditionally, cleanliness has been considered to be a hygiene factor, an aspect of the service environment that adds little to the overall service value provided by a service organisation (Herzberg, 1966). In recent decades, the body of literature on cleanliness as a determinant of service experience has increased considerably (for an overview, see: Pizam & Tasci, 2019; Vos et al., 2018a). Nevertheless, the concept of perceived cleanliness has yet to be clearly defined (Vos et al., 2018a). Improved insight into its underlying dimensions is essential to further exploring, defining, and influencing customer perceptions of cleanliness.

The sparse research that does explore the definition and dimensions of perceived cleanliness mainly examines how customers perceive the cleanliness of specific elements of the service environment; for example, floor, windows, or toilet (Barber & Scarcelli, 2010). Although valuable, this approach seems rather limited. Literature shows that whereas customers' experience of a service is influenced by discrete cues, such as those related to cleaning (Vos et al., 2019b), it is the total configuration of cues that determines their response to the environment (Baker et al., 2002; Bitner, 1992; Mari & Poggesi, 2013).

As the available validated instruments focus on restaurants (Barber & Scarcelli, 2010) and hotels (Lockyer, 2003), it is difficult to generalise them to other service settings. The facility management industry, which is responsible for providing clean environments in a wide variety of service settings, including restaurants and hotels, would greatly benefit from a well-founded instrument to measure perceived cleanliness generally.

3.2 Objectives

This chapter aims to:

1. Define the concept of perceived cleanliness and its underlying dimensions;
2. develop a scale to measure perceived cleanliness in a wide variety of service environments.

The ultimate aim is to develop a scale that can be applied in *any* service environment and is easy for customers and practitioners to understand. A multi-method approach is taken, combining an extensive literature review, qualitative study involving customers, and two quantitative field studies.

3.3 Literature background

3.3.1 Role of cleanliness in service environments

Since the emergence of the field of service management, service quality has been a core concept (Kunz & Hogueve, 2011). Traditionally, service quality is defined as a judgement that results from an evaluation process, whereby customers compare the service they perceive to have received with their expectations of that service (Behdioğlu et al., 2019; Grönroos, 1984; Rust & Chung, 2006). From the service provider's perspective, service quality could be seen as set of all the customer-oriented actions that a service organisation employs to enhance the level of customer satisfaction, customer loyalty, word of mouth, and customer profitability (Cronin Jr & Taylor, 1992; Roy et al., 2018). Generally well accepted is the SERVQUAL model (Parasuraman et al., 1988) of service quality, which distinguishes five dimensions: tangibles (i.e., neatness of staff, cleanliness of physical facilities), reliability (i.e., provision of promised service), responsiveness (i.e., willingness to help), assurance (i.e., knowledge of employees, ability to inspire trust), and empathy (i.e., caring, individualised attention). That tangibles can influence customer perception and behaviour is well documented and widely accepted in service management literature (Raajpoot, 2002). Terms such as atmospherics, environmental psychology, and servicescapes have been used in research on the impact of tangibles on customers (Turley & Milliman, 2000). The servicescape framework of Bitner (1992) has received the greatest attention and is most often used to understand the tangible properties of perceived service quality (Mari & Poggesi, 2013). Among the many tangibles that are present in the service environment, cleanliness is considered to be one of the key predictors of perceived service quality (Lockyer, 2003; Wakefield & Blodgett, 1996).

The servicescapes framework comprises three environmental dimensions: ambient conditions (i.e., temperature, cleanliness), space/function (i.e., including equipment, layout of space), and signs, symbols, and artefacts (i.e., signage, style of décor). These dimensions are antecedents of the perceived servicescape (i.e., perceived service quality, perceived cleanliness) and subsequent internal (i.e., satisfaction) and external responses (i.e., approach/avoidance behaviour). Although customers perceive individual environmental stimuli, including cleanliness, it is the total configuration of the different environmental dimensions that determines their perception of the servicescape (Bitner, 1992).

In the servicescape framework, perceived cleanliness has two functions. Firstly, its dimensions are influenced by their environmental antecedents (i.e., ambient conditions, space/function, signs, symbols, and artefacts). Secondly, it interacts with other variables in the perceived servicescape (i.e., perceived service quality) and affects subsequent internal and external responses.

3.3.2 Effects of perceived cleanliness

Having emerged as a discipline in the field of service management in the 1980s, service marketing is concerned with servicescapes and research on perceived cleanliness (Kunz & Hogreve, 2011). Over the past decade, research interest in cleanliness as a key aspect of service marketing has evolved steadily. Traditionally, cleanliness has been considered as a *hygiene factor* (Brown et al., 1991; Vilnai-Yavetz & Gilboa, 2010): an element of the service environment that should be managed incrementally in order to maintain sales and avoid customer dissatisfaction. However, in more recent research, cleanliness and perceived cleanliness have been shown to have a noteworthy positive influence on internal and external customer responses (Pizam & Tasci, 2019; Vos et al., 2018a). More positive perceptions of cleanliness are associated with more positive perceptions of service quality and therefore higher levels of customer satisfaction (Breiter & Milman, 2006; Cha & Borchgrevink, 2019; Chua et al., 2015; Emir & Saraçlı, 2011; Ju et al., 2019; Kearney et al., 2013; Lam et al., 2011; Lee et al., 2015; Lee & Kim, 2014; Lucas, 2003; Miles et al., 2012; Siu et al., 2012; Truong et al., 2017; Wakefield & Blodgett, 1996), loyalty intentions (Harris & Ezech, 2008; Shashikala & Suresh, 2013), trust in the service provider (Vilnai-Yavetz & Gilboa, 2010), and intentions to return (Lee & Kim, 2014; Tudor & Williams, 2006; Vilnai-Yavetz & Gilboa, 2010). There has been reaffirmation of the key role of perceived cleanliness in the functioning of service settings, including hedonistic (e.g., Lucas, 2003; Wakefield & Blodgett, 1996) and utilitarian service settings (e.g., Breiter & Milman, 2006; Lee & Kim, 2014).

Although there is a wealth of literature describing the effects of perceived cleanliness on various outcomes – most importantly, customer satisfaction – research on the definition and dimensions of perceived cleanliness seems limited and mainly focused on a specific service setting.

3.3.3 Dimensions of perceived cleanliness

The present study aims to give greater insight into the concept of perceived cleanliness and its underlying dimensions revising the dominant measurement scales. The literature search (based on a literature review by Vos et al., 2018a) on definitions and dimensions of perceived cleanliness yielded only a few relevant articles, mostly in the context of hospitality and hospitals (Barber & Scarcelli, 2010; Lockyer, 2003; Whatley et al., 2012; Whitehead et al., 2007). Lockyer (2003), asked hotel guests to rank cleanliness dimensions in order of perceived importance and found that bathroom and toilet cleanliness (operationalised as: walls, floor, shower cubicle, toilet pan/seat, smell or odour, basin or sink, towels) were rated as most important. Whatley et al. (2012) and Whitehead et al. (2007) explored perceived cleanliness in hospital

environments and found that patients associated it with their appearance, their physical cleanliness (i.e., of floors, walls, ceilings, doors and toilets), the behaviour of cleaning staff (i.e., personal hygiene, cleanliness of uniform) and the absence of strong odours.

Barber and Scarcelli (2010) developed a scale for measuring perceived cleanliness in restaurants. They distinguish five dimensions and 23 items rated on a bi-polar scale (with respect to cleanliness: not at all important to extremely important): exterior of restaurant (i.e., garden and driveway; building exterior; parking lot; age of building; neighbourhood of restaurant), restroom appearance (i.e., dirty or soiled sink; dirty floor; dirty, cracked wall and ceiling tiles; trash in toilet; odour in restroom), interior of restaurant (i.e., seat cushion; carpet and floors; windows; furniture; bar/lounge; windowsills), restroom personal hygiene (i.e., no toilet paper; no soap; no hot water; no paper towels/drying device), and dining room personal health (i.e., placeware and eating utensils; glassware; table cloth and napkins).

Table 3.1 shows the concepts related to perceived cleanliness that were identified in the literature.

Table 3.1
List of concepts related to perceived cleanliness according to literature

Concept	Mentioned in article
Appearance of environment	Whatley et al. (2012); Whitehead et al. (2007)
Cleanliness of environment	Barber and Scarcelli (2010); Lockyer (2003); Whatley et al. (2012); Whitehead et al. (2007)
Condition of environment	Barber and Scarcelli (2010); Lockyer (2003); Whatley et al. (2012); Whitehead et al. (2007)
Smell of environment	Barber and Scarcelli (2010); Lockyer (2003); Whatley et al. (2012); Whitehead et al. (2007)
Staff behaviour	Whatley et al. (2012); Whitehead et al. (2007)

Note. Concepts were included if mentioned in at least two articles

Table 3.2
Phases and activities in the development of the cleanliness perceptions scale (CP-scale)

Phase	Methodology	Sample	Data collection
Phase 1: Item generation and content validity assessment	Qualitative study	7 customers (item generation), 19 customers and 4 experts (content validity assessment)	Group discussion, face-to-face & e-mail
Phase 2: pilot study for scale refinement	Quantitative study, survey	673 visitors to a train station	Face-to-face, printed questionnaire
Phase 3: major study for scale validation	Quantitative study, survey	738 visitors to four different train stations	Face-to-face, printed questionnaire

3.4 Overview of the phases

The aim of the present study is to define perceived cleanliness and its underlying dimensions in order to develop the cleanliness perceptions scale (CP-scale). In three phases, the items and dimensions are determined, definitions are provided, measurement scale is developed, pilot study and major study are performed, statistical analysis is executed, and reliability and validity issues are discussed. An overview of the phases is shown in Table 3.2. The methodology is in accordance with the scale development paradigms of Churchill Jr (1979) and Matsunaga (2010).

Setting (<i>daily passengers, year of construction</i>)	Type of analysis	Results
n/a	Content analysis	5 dimensions comprising 24 items
Amsterdam Central (167.000, 1889)	Principal component analysis (PCA), exploratory factor analysis (EFA)	PCA: 3 dimension comprising 18 items (6 items deleted). EFA: 3 dimensions comprising 14 items (4 items deleted)
Almere Centrum (23.000, 1987), Amersfoort (42.000, 1997), Lelystad Centrum (13.000, 1988), Rotterdam Central (85.000, 2014).	Confirmatory factor analysis (CFA)	Added 4 new items. CFA: 3 dimensions comprising 12 items (6 items deleted)

3.5 Development and validation of the CP-scale

3.5.1 Phase 1: Item generation and content validity assessment

In this phase, the initial version of the measurement tool is designed, the CP-scale, in two steps: item generation and content validity assessment.

Item generation

The initial pool of 54 items was created on the basis of (1) a review of dominant scales and current literature on (measuring) perceived cleanliness (based on a literature review by Vos et al., 2018a), and (2) an extensive focus-group discussion with customers. The aim of the focus group discussion was to verify and operationalize the findings of the literature review.

The first set of items was compiled from previous research on perceived cleanliness (Barber and Scarcelli, 2010; Lockyer, 2003; Whatley et al., 2012; Whithead et al., 2007). Then, seven experienced members of a fixed customer panel of a Dutch railway company were invited. Each of the members had an academic background (four frequent and three infrequent customers, aged 30 to 66). The discussion lasted 140 minutes and was moderated by an experienced qualitative researcher. Each participant was invited to describe one service environment that they had perceived as clean and another that they had perceived as unclear. They were then asked

to name variables that influenced their perception in both situations. Finally, the participants reflected on the items that were previously identified in the literature. Inductive thematic analysis was performed on the transcript of the discussion using the ATLAS.ti software package (De Casterle et al., 2012). First, sentences referring to perceived cleanliness were labelled, then the labels were categorized into more general dimensions of perceived cleanliness.

Content analysis of the focus-group discussion yielded six concepts associated with perceived cleanliness: cleaned, cleaning-staff behaviour, fresh, maintained, smooth, and uncluttered (Table 3.3). Four of the concepts (cleaned, cleaning-staff behaviour, fresh, maintained) had also emerged from the literature review. The concepts smooth and uncluttered had not been identified in the literature as (potential) dimensions of perceived cleanliness. The concept smooth refers to the tactile perception of a service environment. Participants felt that the use of smooth and shiny materials (e.g., stair rails, door knobs) contributed to a clean perception. Participants argued that uncluttered environments are perceived as visually pleasing and clean because they are spacious, orderly, and/or coherent.

Content validity assessment

The initial pool of 54 items was refined by assessing their content validity through customers' and experts' reviews. A total of 19 customers of a Dutch railway company reviewed the initial pool of items by identifying redundancy and content ambiguity. In addition, four experienced service researchers identified redundancy, content ambiguity, and representation of the construct. This process eliminated 30 items, leaving 24 for further analysis (see Table 3.3). These items were translated from Dutch to English by two independent translators, and disagreements on the most appropriate wording were settled by a native English speaker. Since the response pattern for positive items (i.e., it is clean) differs from its negative counterpart (i.e., it is dirty), the positive items were included only (Solís Salazar, 2015; Weems et al., 2006). In general, participants respond more positively to negative items than to positive items (Kamoen et al., 2013). As a result, negative items tend to be more inter-correlated, form different dimensions and impede scale development (Schriesheim et al., 1991; Solís Salazar, 2015).

Of the six concepts identified in the previous step as potential dimensions of perceived cleanliness, only cleaning-staff behaviour was omitted by the experts. In contrast to other dimensions (e.g., maintained), cleaning-staff behaviour cannot be detected at a particular moment in the service environment, since most cleaning activities take place when customers are absent. The experts reasoned that cleaning-staff behaviour functions as an antecedent of the dimensions of perceived cleanliness.

Table 3.3*Cleanliness perceptions scale (CP-scale) items following phase 1 of scale development*

Dimensions	Cleaned	Fresh	Maintained	Smooth	Uncluttered
Description	visual perception of cleanliness	olfactory perception of the environment	visual perception of the condition of the environment	tactile perception of the environment	visual perception of the organisation of the environment
Scale items	<i>it is ... here</i> clean hygienic neat dust-free tidy	<i>it smells ... here</i> clean hygienic fresh sterile	<i>it is ... here</i> well maintained undamaged well looked after	<i>what you touch here is ...</i> clean smooth hygienic dust-free warm robust	<i>it is ... here</i> organised spacious light transparent new beautiful

3.5.2 Phase 2: Pilot study for scale refinement

The pilot study aims: (1) to reduce the initial set of items to a more manageable size using principal component analysis (PCA); and (2) to determine the underlying structure of the data using exploratory factor analysis (EFA).

Method

The final CP-scale consisted of 24 items (Table 3.3), to which two items on perceived service quality, and items of age, gender, nationality, and visiting frequency were added. Visitors to Amsterdam Central Station in the Netherlands ($N = 743$) were invited to participate in a study on their experience of the train station by filling out a printed questionnaire. For completing the questionnaire, participants were rewarded with a coffee coupon. The sample consisted of 57 different nationalities (84% European, 16% non-European). The participants were asked to mark their agreement with each of the 30 items on a continuous Likert scale (ranging from totally disagree to totally agree).

Scale purification was performed according to the procedure described by Matsunaga (2010). The dataset obtained at Amsterdam Central Station was split into two random datasets: one to conduct the PCA ($n = 371$), the other to conduct the EFA ($n = 372$).

Results

PCA was performed on the 24-item CP-scale ($n = 371$) using the promax rotation method, because were expected to be correlated. The Kaiser-Meyer-Olkin (KMO) test of sampling adequacy was sufficient for PCA (KMO = .90). Items were retained if the primary factor loading exceeded 0.6 and the second highest factor loading did not exceed 0.3 (Henson & Roberts, 2006; Matsunaga, 2010). Six items were deleted (see Table 3.4). The remaining 18 items were spread over three factors and explained 67.4% of the total variance.

To discover the underlying factor structure, the remaining 18 items were subjected to exploratory factor analysis (EFA) (principal axis factoring and promax rotation) based on the second dataset ($n = 372$) (Matsunaga, 2010). Employing the 0.6/0.3 retention criteria, another four items were deleted from the scale (see Table 3.4). Based on the Kaiser-Guttman criterion (Guttman, 1954; Kaiser, 1960), a scree test (Cattell, 1966), and parallel analysis (Hayton, Allen, & Scarpello, 2004; Turner, 1998), a three-factor solution was found to be the most adequate.

An overview of the results is presented in Table 3.4. The final three factors were labelled as *cleaned*, *fresh*, and *uncluttered*, together explaining 72.9% of the total variance. The Cronbach's alphas of the three factors are all well above the minimum of 0.7 (Field, 2013). The dimensions identified in the first qualitative phase were grouped into three dimensions of perceived cleanliness. Two items of the *maintained* dimension were merged into the *cleaned* dimension. One item was removed from the *fresh* dimension and two items from the *uncluttered* dimension. The *smooth* dimension was eliminated, and one of its items was added to the *cleaned* dimension.

3.5.3 Phase 3: Major study for scale validation

In this phase, the factor structure was validated by using structural equation modelling and confirmatory factor analysis (CFA) on a new dataset according to a multi-criteria strategy.

Method

To validate the three-factor model that resulted from the PCA and the EFA, a CFA was performed on a totally new dataset collected at four train stations in the Netherlands ($N = 738$). Visitors to Rotterdam Central station ($n = 268$), Amersfoort ($n = 238$), Lelystad Centrum ($n = 116$), and Almere Centrum ($n = 116$) were invited to participate in this phase of the study. As in the previous phase, participants completed a printed questionnaire and were rewarded with a coffee coupon. In this phase, the sample comprised 29 different nationalities (99% European, 1% non-European).

Table 3.4*Results of exploratory factor analysis (principal axis factoring & promax rotation, n = 372)*

Item	H ²	Factor loadings		
		Cleaned	Fresh	Uncluttered
it is well looked after here	.68	.89	-.12	.03
it is dust-free here	.65	.89	-.05	-.13
it is neat here	.60	.77	-.05	.07
what you touch here is dust-free	.51	.74	.12	-.11
it is clean here	.78	.73	.07	.09
it is hygienic here	.80	.67	.18	.03
it is well maintained here	.71	.64	.03	.20
it smells clean here	.73	-.00	.94	-.06
it smells hygienic here	.79	.03	.90	-.02
it smells fresh here	.63	-.03	.71	.12
it is transparent here	.46	-.07	.00	.82
it is organized here	.58	.01	.05	.65
it is light here	.52	-.03	.05	.63
it is spacious here	.52	.08	-.09	.62
Eigenvalue		7.38	1.78	1.04
% of variance		52.77	12.71	7.42
Cumulative % of variance		52.77	65.49	72.91
Cronbach's alpha (α)		.92	.89	.84

deleted items: it is tidy here. It smells sterile here. It is undamaged here. What you touch here is clean. What you touch here is smooth. What you touch here is hygienic. What you touch here is warm. What you touch here is robust. It is new here. It is beautiful here

The 14-item scale that resulted from the EFA was complemented with four new items (i.e., "it is spotless here", "it is well swept here", "it smells sterile here", "and it is orderly here"). These items were added to the scale to ensure that the different dimensions consisted of at least three and preferably four or more items (e.g., DiStefano & Hess, 2005). A dimension measured by too few items may cause estimation and construct interpretation problems. See Table 3.5 for an overview of the items and dimensions evaluated in this phase of the study.

Model fit was evaluated according to a multi-criteria strategy, including the chi-square fit index, the goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), standardized root-mean-square residual (SRMR), normed fit index (NFI), and root-mean square error of approximation (RMSEA). The data were analysed using IBM SPSS AMOS 24 (Hu & Bentler, 1999; Matsunaga, 2010). Finally,

criterion-related validity was evaluated with reference to the explanatory power of the final dimensions on the perception of overall service quality, which was calculated using standard multiple regression.

Table 3.5

Items of the cleanliness perceptions scale (CP-scale) prior to confirmatory factor analysis (CFA)

Cleaned	Fresh	Uncluttered
well looked after	clean	transparent
dust-free	hygienic	organized
neat	fresh	light
dust-free (tactile)	sterile	spacious
clean		orderly
hygienic		
well-maintained		
spotless		
well swept		

Results

Before performing the CFA, the samples of the three studies were checked for differences (PCA, EFA, CFA, see Table 3.6). A chi-square test revealed that the samples did not differ significantly with respect to the age and gender of participants.

The model was evaluated according to a multi-criteria strategy, using IBM SPSS AMOS 24 (Hu & Bentler, 1999). The three-factor model was validated, even though the PCA did not initially meet all the necessary criteria. Therefore, the fit of the model was improved by removing six items and then found to be adequate (see Table 3.7). The chi-square fit index was significant ($\chi^2 = 248.76$; $df = 46$, $p < .01$) and the values of the Goodness-of-Fit index (GFI, .94), Adjusted Goodness-of-Fit index (AGFI, .91), Comparative Fit Index (CFI, .97), standardized root-mean-square residual (SRMR, .02), normed fit index (NFI, .97), and root-mean square error of approximation (RMSEA, .07) indicated an acceptable model fit ($GFI > .90$, $AGFI > .85$, $CFI > .90$, $SRMR < .08$, $NFI > .95$, $RMSEA < .08$).

As can be seen in Table 3.7, the criteria for convergent validity and discriminant validity were also met by this model (Campbell & Fiske, 1959). Convergent validity was demonstrated in three tests: for all factors, (1) significant factor loadings ranged from .73 to .93 ($p < .01$); (2) composite reliability scores exceeded .7 (Helms et al., 2006); and (3) average variance extracted values exceeded the threshold of .5 (Bagozzi &

Yi, 1988). Discriminant validity was also sufficient, as proven by two tests: (1) factor correlations (Table 3.8) did not exceed .85 (Kline, 2005) and (2) the average variance extracted (AVE), maximum shared variance (MSV), and average shared variance (ASV) (Table 3.7) showed discriminant validity, because $MSV < AVE$ and $ASV < AVE$ (Farrell & Rudd, 2009; Hair et al., 1998). In addition, internal consistency appeared to be sufficient for all factors (Table 3.7). The Cronbach's alphas for the first two factors, and Spearman-Brown coefficient for the third two-item factor (Eisinga et al., 2013) were all well above the minimum value of .7 (Field, 2013).

In conclusion, the CP-scale was validated and consists of three dimensions - *cleaned*, *fresh*, and *uncluttered*. For an overview of the full CP-scale, see appendix A.

The criterion-related validity of the model was also found to be sufficient (Table 3.9). The analysis revealed that the three dimensions of the CP-scale had a significant effect on the perception of overall service quality ($p < .001$), together explaining 64% of the variance of the overall perception of service quality, which indicates a sufficient model fit. The *cleaned* dimension had the largest contribution, followed by the *fresh* and *uncluttered* dimensions.

Table 3.6

Profile of the three samples

Variable	Principal component analysis (PCA, $n = 371$)	Exploratory factor analysis (EFA, $n = 372$)	Confirmatory factor analysis (CFA, $N = 738$)
Age in years	percentage	percentage	percentage
< 25	43.3	43.8	50.0
26-35	19.1	18.0	14.9
36-45	8.8	10.4	6.6
46-55	10.9	9.3	8.9
56-64	4.2	5.8	7.6
65 >	13.6	12.2	11.9
Male	43.0	35.7	41.1
Female	50.6	58.8	56.6
Other	6.3	5.5	1.8

Table 3.7
Results confirmatory factor analysis (CFA)

Factors and corresponding items	Factor loading	Cronbach's alpha (α)	Spearman-Brown Coefficient
Cleaned		.94	n/a
- it is neat here	.85*		
- it is clean here	.87*		
- it is hygienic here	.84*		
- it is well swept here	.83*		
- it is well maintained here	.82*		
- it is well looked after here	.86*		
- it is dust-free here	.73*		
Fresh		.92	n/a
- it smells clean here	.91*		
- it smells hygienic here	.93*		
- it smells fresh here	.83*		
Uncluttered		n/a	.91
- it is organised here	.89*		
- it is orderly here	.93*		

* $p < .01$, for the full scale, see Appendix A

deleted items: it is spotless here, what you touch here is dust-free, it smells sterile here, it is transparent here, it is light here, it is spacious here.

Table 3.8
Correlation matrix

	Cleaned	Fresh	Uncluttered
Cleaned	1.00		
Fresh	.75	1.00	
Uncluttered	.82	.66	1.00

Table 3.9
Results of regression analysis of CP-scale on overall perception of service quality

	Overall service quality			
	B	Std. error	Beta	p
Cleaned	.76	.05	.56	< .001
Fresh	.21	.03	.17	< .001
Uncluttered	.17	.04	.12	< .001
Adjusted R²	.64			

	Composite reliability (CR)	Average variance extracted (AVE)	Maximum shared variance (MSV)	Average shared variance (ASV)
	.93	.68	.68	.62
	.92	.79	.57	.50
	.90	.83	.68	.56

3.6 Discussion and conclusion

3.6.1 Theoretical and practical implications

In developing the CP-scale, the present study contributes to the theoretical understanding and measurement of perceived cleanliness in service environments. The CP-scale has a broader perspective than the instrument devised by Barber and Scarcelli (2010), focussing not only on how customers perceive the cleanliness of specific elements of the service environment (e.g., floor, windows, toilet) but also considering more generic dimensions of perceived cleanliness. In addition, whereas the instrument of Barber and Scarcelli (2010) only measured perceived cleanliness in restaurants, the CP-scale can be applied in a wide variety of service settings. Due to its generic nature, the CP-scale is especially relevant to the facility management industry, which is mainly concerned with providing cleaning services to various primary service processes and monitoring perceived cleanliness.

The CP-scale is similar to existing conceptualizations and measures of perceived cleanliness but adds new dimensions. Whereas, to some extent, the *cleaned* and *fresh* dimensions were included in most previous studies that defined perceived cleanliness (e.g., Barber & Scarcelli, 2010; Lockyer, 2003; Whatley et al., 2012; Whitehead et al., 2007), the *uncluttered* dimension is new. The appearance of an environment as a dimension of perceived cleanliness was introduced by Whatley et al. (2012) and Whitehead et al. (2007). They reasoned that visually pleasing environments might impress customers as being clean. In this study this was expanded to include the notion that environments should be *uncluttered* (i.e., organised, orderly) in order to be perceived as visually pleasing and therefore cleaner.

The initial conceptualization of perceived cleanliness, based on literature and a qualitative study involving customers, was not fully confirmed by the quantitative data. The *maintained* dimension did not emerge as unique dimension but was merged with the *cleaned* dimension. From a managerial viewpoint, maintenance and cleaning are different disciplines; however customers perceive the service environment holistically and may not make this distinction. Also, the tactile items did not emerge from the empirical data as a dimension of perceived cleanliness, perhaps because respondents were not asked to evaluate the tactile qualities of materials by, for example, touching a railing or sitting on a bench. As a result, participants probably evaluated the materials visually instead.

From a practical perspective, the research contributes to a deeper understanding of the concept of perceived cleanliness. The new instrument enables practitioners to measure and compare perceived cleanliness and thus identify interventions – related to one of the three dimensions (i.e., *cleaned*, *fresh*, & *uncluttered*) – that can positively influence perceived cleanliness.

3.6.2 Limitations and future research opportunities

The present study has several limitations. Firstly, the focus was on only one service environment in one country. Nonetheless, data were collected at five different train stations, from customers with both utilitarian and hedonic goals, and from 57 nationalities. Other scholars are invited to revalidate the new instrument in other service settings, to investigate cultural differences in relation to perceived cleanliness, and to compare results in different countries. Such studies might result in greater confidence regarding the dimensions that were included in this instrument.

The development of the CP-scale is just a small step in the mission to better understand how perceived cleanliness of service environments can be measured and influenced. Fellow scholars are encouraged to start using the CP-scale in a variety of settings and thereby contribute to advancing understanding and definition of the underlying dimensions of perceived cleanliness. Doing so will enable service providers to create and maintain service environments that are not only clean but also perceived as clean.

3.5.3 Conclusion

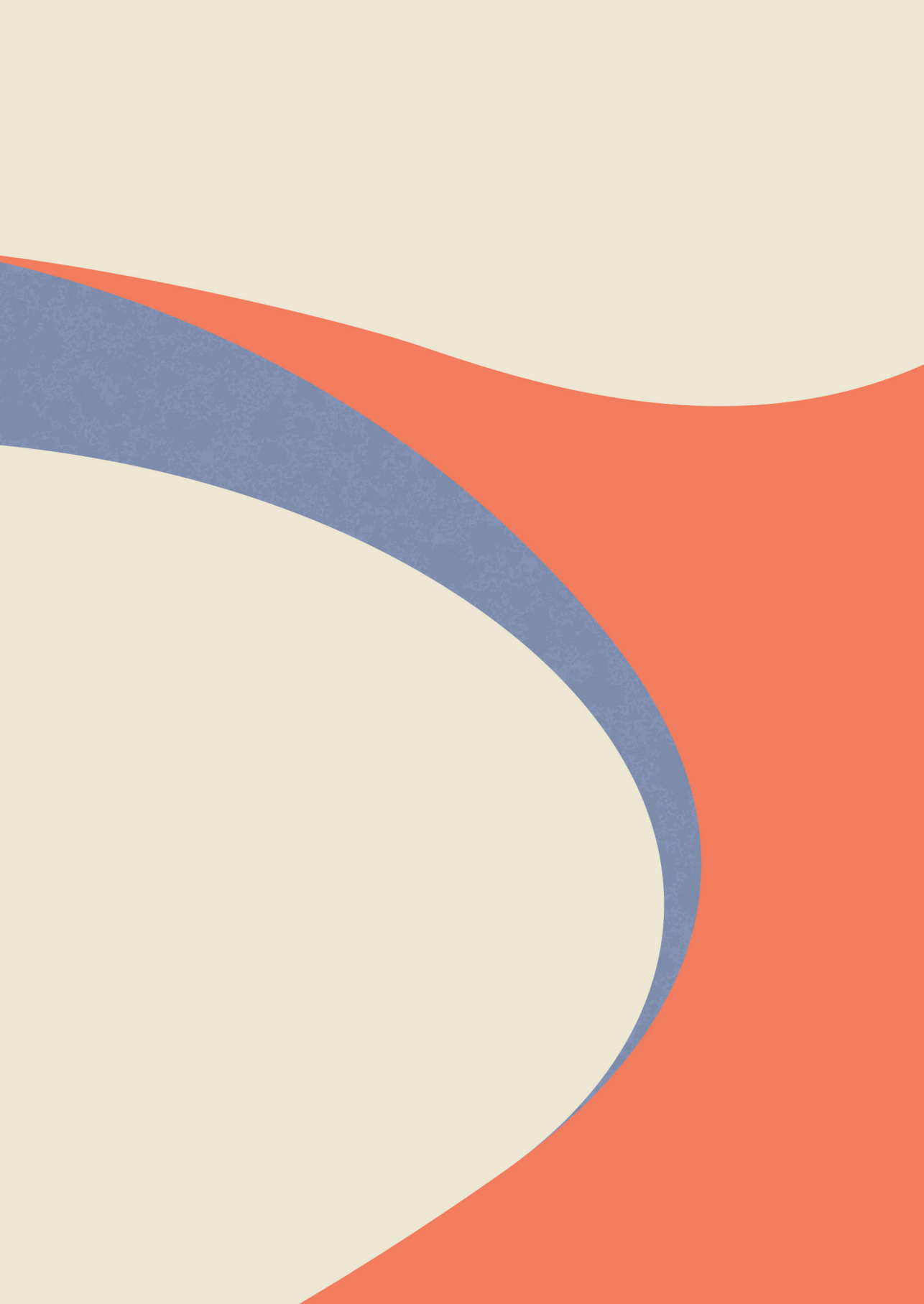
The CP-scale developed in this study can be effectively used to monitor and improve the cleanliness of service environments as perceived by customers. Although it was developed and tested in the context of public transport, this instrument may be useful to service providers in many other sectors. The findings of this study give managers valuable insights into the dimensions that are involved in how customers perceive cleanliness. These insights may be used to better manage and improve perceived cleanliness and thus the overall service experience. Hopefully, this measurement scale will not only be used by managers to systematically assess and improve perceived cleanliness but also stimulate additional research in this important area.

In brief - chapter 3

In Chapter 3, the development and validation of the CP-scale was described. The scale can be used to measure perceived cleanliness in any service setting. The initial variables that had been revealed in Chapter 2 were further reduced to three main dimensions: cleaned, fresh, and uncluttered. Hence, perceived cleanliness can be defined as a mixture of the experience of the three dimensions cleaned, fresh, and uncluttered.

The CP-scale consists of twelve items that are distributed over the three discriminating dimensions: cleaned, fresh, and uncluttered. Together, these dimensions explain 64% of the variance of the overall evaluation of service quality, indicating an adequate coverage of the construct. The development of the CP-scale was a prerequisite for measuring effects of environmental manipulations on perceived cleanliness in Part 2 of this dissertation.

Chapter 4 is an introduction to the experimental research of Part 2. The theoretical approach will be introduced by elaborating on the focus on service environment and environmental cues, also priming and cue-congruency are introduced as the basis for the experimental studies.



Part 2

Influencing perceived
cleanliness

Chapter 4

Theoretical approach:
environmental cues
and priming

4.1 Introduction

Now that the understanding of perceived cleanliness is improved and an instrument that can be used to measure perceived cleanliness was developed, the next step is to focus on the influence of environmental cues on perceived cleanliness. In this chapter the theoretical approach of the experimental studies will be explained. Firstly, the focus on service environments and environmental cues is elaborated on. Secondly, priming is introduced as the theoretical approach for the experiments. Finally, the structure and design of the experimental studies is explicated.

4.2 The service environment

Service research shows that the experience of customers in service environments is influenced by various factors. Some factors can be controlled but other factors, such as personal and situational factors, are outside of control of the service organisation. Personal factors or individual differences concern personality traits, mood state, cultural background, and prior experiences with a service or service environment (Bitner, 1992; Lin & Worthley, 2012). Situational factors include the reason for visiting, companion, and the type of service (Bitner, 1992; Dabholkar & Bagozzi, 2002).

However, there are factors that service organisations can use to actively influence customers' perceptions. Besides effects of the service itself, other factors can roughly be categorized as social or environmental cues (Baker 1987; Baker et al., 2020; Bitner, 1992; Mari & Poggessi, 2013). Social cues are about the influence of people's appearance and behaviour; both employees and customers. Environmental cues include visible and non-visible attributes of the physical environment. Although it has been widely demonstrated that social and environmental cues influence customers' perceptions, especially research on effects of environmental cues on perceived cleanliness is almost non-existing (Baker et al., 2020).

In the previous decades, effects of the physical service environment on customers have been examined in the fields of environmental psychology and service marketing. In environmental psychology, effects of the physical environment on people's thoughts, feelings, and behaviours have been captured in the classic stimulus-organism-response (SOR) model (Mehrabian & Russell, 1974). Following this model, environmental stimuli (S) affect organism's thoughts and feelings (O), which leads to approach or avoidance responses (R). Hence, the physical environment triggers feelings which encourage a customer to stay in a service environment or leave it. From the perspective of this research, environmental stimuli influence the organism variable perceived cleanliness which in turn leads to approach or avoidance behaviour. Most likely, positive perceptions of cleanliness lead to approach behaviour, whereas avoidance behaviour is triggered by negative perceptions of cleanliness.

In service marketing, scholars are mostly interested in effects of the physical environment on service evaluation and customer behaviour. The intertwined concepts atmospherics and servicescapes represent two streams of research that aim to understand the influence of the physical service environment (Mari & Poggessi, 2013). The concept of atmospherics was introduced by Kotler (1973) as "the effort to design buying environments to produce in the buyer specific emotional effects that

enhance his purchase probability” (p. 50). Following Kotler (1973), the atmosphere includes aspects of the physical surroundings that customers perceive through their senses. The term *servicescapes*, coined by Bitner (1992), builds upon the SOR model (Mehrabian & Russell, 1974) and concept of *atmospherics* (Kotler, 1973) refers to the physical surroundings that impact upon the behaviour of customers and service employees. The framework comprises three environmental dimensions: ambient conditions (i.e., temperature, cleanliness), space/function (i.e., equipment, layout of space), and signs, symbols, and artefacts (i.e., staff appearance, style of décor). Although the emphasis in the *servicescapes* framework is on interior and exterior factors, such as interior design and ambient scent, some scholars argue that staff members are part of the physical environment as well (Kaminakis et al., 2019; Line & Hanks, 2018) as their presence may affect interpretation of environmental stimuli.

The SOR model, the concept of *atmospherics* and the *servicescapes* framework have been used to evaluate effects of various environmental cues, such as sound, lighting, colour, and architectural design. Effects of environmental cues were reported for service evaluations and behaviour in various service settings, including restaurants, hotels, retail, and public transport. For a recent overview of effects of service environments, please refer to Baker et al. (2020).

4.2.1 Outcome variables

The effects of service environments on customers have primarily been studied in relation to approach behaviours, including purchase behaviours, littering behaviours, and time spent in the environment (e.g., De Lange et al., 2012; Herrmann et al., 2013; Knoeferle et al., 2017). Also, many studies evaluated how service environment influence service evaluations, such as perceptions (Babin et al., 2003; Mattila & Wirtz, 2001; Orth & Wirtz, 2014; Sharma & Stafford, 2000), emotions (Ladhari et al., 2017; Walsh et al., 2011; Rychalski & Hudson, 2017), satisfaction (Park, 2019; Mensah & Mensah, 2018; Moon et al., 2017; Wakefield & Blodgett, 1996), and behavioural intentions (Baker et al., 2002; Harris & Ezech, 2008).

Hence, effects of the service environment have been evaluated on a wide variety of customer outcomes. Yet, attention for perceived cleanliness in fields of environmental psychology, service marketing, built environment, and facility management is scarce; research on the relationship between the service environment and perceived cleanliness is almost non-existent (Baker et al., 2020). Some scholars included perceived cleanliness as a dimension in an overall measure of general service quality (Lockyer 2003; Wakefield & Blodgett, 1994). Such measures have been used in multiple studies to demonstrate that perceived cleanliness is related to other

organism variables, such as perceived service quality and customer satisfaction (e.g., Truong et al., 2017; Vilnai-Yavetz and Gilboa, 2010). However, perceived cleanliness has rarely been empirically tested as a stand-alone outcome variable; evidence on how environmental cues influence perceived cleanliness is limited.

However, there are some operationalizations of service quality that, now that it is known what customers perceive as clean, seem to have to do with the concept of perceived cleanliness. Barber and Scarcelli (2010) developed a scale for measuring perceived cleanliness in restaurants. This instrument includes some references to the *cleaned* and *fresh* dimensions of perceived cleanliness, for example by evaluating the dirtiness and odour in the restroom. In addition, the tangibles dimension of SERVQUAL shows some references to the *cleaned* and *uncluttered* dimensions of perceived cleanliness. SERVQUAL has been introduced by Parasuraman et al. (1988), containing the service quality dimensions: tangibles, reliability, responsiveness, assurance, and empathy. The tangibles dimension refers to the extent to which equipment is up-to-date, facilities are visually appealing, and employees appear well-dressed and neat. The neatness of staff and visual appeal of the physical environment are conceptually related to the cleaned and uncluttered dimensions.

Interestingly, SERVQUAL has hardly been used to evaluate effects of the physical environment despite of being one of the renowned instruments in service literature. Following Reimer and Kuehn (2005) the relative contribution of the tangibles dimension has been underestimated as a consequence of an inadequate operationalisation. As the term 'tangibles' indicates, only the more physical aspects of the physical surroundings were included. With an improved operationalisation that also included intangible aspects of the service environment, Reimer and Kuehn (2005) showed a higher contribution of the physical environment to SERVQUAL dimensions. However, even after this study, only a few studies have been conducted on the SERVQUAL dimension (e.g., Ryu & Han, 2011; Chua et al., 2015), but without explicitly addressing the tangibles dimension.

In conclusion, the hospitality and facility management literature contain research on definitions and measurement of perceived cleanliness in service environments. However, research in these areas mainly focuses on cleaning quality, for example by evaluating how customers perceive the cleanliness of different servicescape elements (e.g., restroom, restaurant table). Effects of other environmental cues are largely ignored. The fields of environmental psychology and service marketing contain large amounts of literature on the influence of the service environment on various customer outcomes. However, perceived cleanliness is rarely evaluated in these disciplines.

Based on the number of studies that show that service environments influence how people feel, think, and behave, environmental cues (other than cleaning quality) are likely to contribute to how cleanliness is perceived.

In the second part of this dissertation, the effects of environmental cues on customers' perceptions of cleanliness are explored in service environments through multiple experiments. In the following paragraph it is evaluated how customers process environmental cues into perceptions and feelings.

4.2.2 Processing of environmental cues

Customers process environmental cues through different mechanisms. Initially, customers process their surroundings holistically (Bitner, 1992; Harris & Ezech, 2008; Mari & Poggesi, 2013). Meaning that customers blend cues into a unitary (holistic) impression that combines the information of individual cues and their interrelationships (Bitner, 1992; Morin et al., 2007).

As service environment consist of many cues, the processing of most stimuli takes place automatically at an unconscious level (Custers & Aarts, 2010; Dijksterhuis et al., 2005). Cues attract our attention and are processed at a more conscious level when they stand out because they are, for example, unpleasant (e.g., loud noise, bad smell) or deviating from the mass (e.g., warning sign). The extent to which we are conscious of our surrounding depends on our goals. We are usually unaware of our spatial surrounding, for example, when watching a movie or having an intensive conversation.

In most service environments, customers perceive the physical surroundings before they experience the actual service (Berry & Wall, 2006). Based on the environmental cues present, expectations are formed of products and services (LeBlanc & Nguyen, 1996; Lin, 2004). Following the direct inference theory, customers intuitively derive meaning about concepts and relationships based on the cues present (e.g., Baker et al., 1994; Lunardo et al., 2016). For example, the use of warm colours, jazzy music, and dimmed lighting in a hotel lobby may lead to the experience that the entire hotel organisation is welcoming and warm. In the experimental studies, it is evaluated whether such environmental cues can be used to influence customers' perceptions of cleanliness. Besides holistic processing of service environments, other mechanisms take a more detailed approach by examining one-to-one relationships between specific environmental cues. In the following paragraph the concept of priming is introduced, which will serve as a theoretical basis for the experimental research in this dissertation.

4.3 Priming mechanisms

In the previous decades of psychological research, a constant stream of priming research has been produced (Dijksterhuis et al., 2007; Doyen et al., 2014; Molden, 2014). Because of the range and complexity of priming effects presented, effects are hard to summarize or explain using a single model (Janiszewski & Wyer, 2014). Generally, priming is considered as an experimental framework in which the processing of an encountered cue influences the response to a subsequently encountered cue (Bargh, 2006; Janiszewski & Wyer, 2014). In the experimental studies, two types of priming are distinguished: affective and cognitive priming.

Firstly, affective primes directly transfer meanings or emotions to how customers perceive their surroundings. The halo-effect (Thorndike, 1920) is an example of this type of inference in which people transfer their feeling about one attribute to other (seemingly) unrelated attributes. A service environment with pleasant scent or music can, for example, lead to the experience that the service will also be pleasant (Spangenberg, 1996; Turley & Milliman, 2000). Following the principles of affective priming, the service organisation is assessed as being of the same quality as the service environment. Hence, the affective tone of the environmental cue is most important, a conceptual relationship between the cue and outcome is no prerequisite. Whereas affective primes relate to the direct projection of environmental characteristics onto characteristics of the organisation as a whole, secondly, cognitive primes and associative processes are the result of activating connections between concepts that are linked in memory based on previous experiences. Following this theory, information in our memory consists of individual pieces of information called nodes. These nodes make up a network of associations that develops over time. When exposed to a cognitive prime, a node will be stimulated and associated nodes are also automatically activated (Keller, 1993; Henderson et al., 1998). Information about service environments is also stored in such associative networks. For example, Verhoeven (2010) demonstrated that the use of vivid art in service environments improved the perceived excitement of the service organisation. Hence, it is expected that exposure to environmental cues related to cleanliness can be used to influence perceived cleanliness. In the experimental studies, affective and cognitive priming mechanisms are evaluated that can be used to influence customers' perceptions of cleanliness. In the following paragraph the concepts of cue-congruency and processing fluency will be introduced.

4.3.1 Cue-congruency and processing fluency

The effect of service environments on customers cannot really be understood on a 'sense-by-sense' basis as service environments comprise many cues that interact in different ways (Labrecque et al., 2013; Zellner, 2013). Psychologists have known about the existence of cue-congruency (also: multisensory interactions, cross modal correspondences) for many years (for early research, see: Jespersen, 1922 and Wertheimer, 1958). Cue-congruency refers to the match between two or more environmental cues, research shows that congruent cue-combinations positively influence customer evaluations and responses (e.g., Cheng et al., 2009; Imschloss & Kuehnl, 2017; Morrison et al., 2011).

Following Spence (2011), there are two general ways in which cues can be matched. Cues can be related in terms of some common stimulus features, for example, the match between high sound volume (pitch) and bright colours (e.g., Imschloss & Kuehnl, 2017; Krishna et al., 2010). Congruency may also be established at a more abstract level, such as in terms of their pleasantness or cognitive meaning, for example, matching arousing music with an arousing scent. In related vein, it has also been suggested that cue-congruency can be established at the level of the effect that the cue has on the customer. For example, cues may be congruent if they both happen to increase a customer's level of arousal (e.g., Demoulin, 2011; Flavián et al., 2021; Helme Falk & Hultén, 2017; Mattila & Wirtz, 2001). For example, Mattila & Wirtz (2001) demonstrated that when scent and music were congruent with each other in terms of their arousing qualities, customers rated the service environment as more positive.

Why do congruent cues lead to more positive perceptions of cleanliness? It is proposed that the processing fluency paradigm can be used as an explanation. The assumption of this theory is that customers unconsciously monitor the ease of performing a mental task, such as the processing of environmental cues (Oppenheimer, 2008; Winkielman et al., 2003). The processing of congruent cues is generally easier compared to incongruent cues which translates to enhanced accessibility and a more positive attitude towards the cues and associated concepts (Herrmann et al., 2013). To conclude, in the experimental studies it will be evaluated if congruently primed cues related to the concept of cleanliness generate processing fluency and subsequently lead to positive perceptions of cleanliness.

4.4 Outline of experimental studies

The coming chapters of this dissertation describe the experimental studies on the effects of environmental cues in service environments on perceived cleanliness of customers. The aim of the experimental studies is to:

- To identify environmental cues that contribute to customers' perceptions of cleanliness in service environments, and specifically to its dimensions *cleaned*, *fresh*, and *uncluttered*.
- And to show to what extent the effects of these environmental cues on perceived cleanliness can be explained by priming.

The following three chapters describe four experimental studies in which effects of environmental cues on perceived cleanliness were evaluated. Chapter 5 starts with the role of physical presence of cleaning staff in the experience of the *cleaned* dimension. The physical presence of cleaning staff was frequently mentioned in the Delphi study as a key determinant of perceived cleanliness. Following Bitner's (1992) servicescapes taxonomy, the physical presence and appearance of (cleaning) staff are considered as environmental cues. In two experimental studies in a running train and a train station, it is explored if enhanced physical presence of cleaning staff influences the *cleaned* dimension of perceived cleanliness.

Chapter 6 primarily focusses on how colour and scent influence the *cleaned* and *fresh* dimensions of perceived cleanliness. More specifically, findings of a lab experiment on the effects of lighter colours and scents on the *cleaned* and *fresh* dimensions of perceived cleanliness are presented. The lab experiment took place in the context of a train station.

Chapter 7 concentrates on the effects of scent and architectural clutter and their role in the experience of the *cleaned*, *fresh*, and *uncluttered* dimensions of perceived cleanliness. The findings of a field experiment performed in a train station are presented.

In each study one or two environmental cues served as independent variables which were used to prime the concept of cleanliness. The dimensions of the cleanliness perceptions scale developed in the first part of this dissertation, served as dependent variables.

In brief - chapter 4

Chapter 4 introduced the theoretical approach to the experimental studies in this second part of the dissertation. The service environment and environmental cues were introduced together with priming and cue-congruency theories. Generally, priming is considered as an experimental framework in which the human processing of an encountered cue influences the response to a subsequently encountered cue. For example, scholars previously demonstrated that exposure to vivid art in service environments improved the perceived excitement of the service organisation. Cue-congruency refers to the extent to which multiple cues match, and research has shown that congruent cues lead to synergy effects on customer evaluations and responses. Priming demonstrated to be useful in understanding the one-to-one relationships between environmental cues and perceived cleanliness. Cue-congruency was included to understand the interaction between cues, because service environments always consist of multiple cues.

In Chapter 5 to 7 the effects of environmental cues on perceived cleanliness are examined through the lens of priming and cue-congruency. In the next chapter, the effects of the visible presence of cleaning staff on perceived cleanliness are explored. The effects of the visible presence of cleaning staff are evaluated first as it was most frequently mentioned in the literature review and especially in the qualitative study of chapter 2.

Chapter 5 comprises two experimental studies. The first experiment (paragraph 5.1) is performed as an explorative study before the CP-scale was developed. As empirical evidence from field experiments of perceived cleanliness is limited in literature, it is explored whether it is possible to influence perceived cleanliness through manipulation of environmental cues. Instead of the CP-scale, initially a practice-based generic measurement instrument for service quality was used, perceived cleanliness was one of the dimensions of the instrument. In the second experiment (paragraph 5.2), the CP-scale was used and effects of the visible presence of cleaning staff on the *cleaned* dimension of perceived cleanliness are examined.

Chapter 5

Cleaned: the role of more visible cleaning

Paragraph 5.1 (study 1) has been published as:

Vos, M., Sauren, J., & Knoop, O. (2017). Out of the shadows: influencing train passengers' perceptions and satisfaction by increasing visibility of cleaning staff. In *25th European Facility Management Conference (EFMC) 2017* (pp. 213-219). Polyteknisk Boghandel og Forlag.

Vos, M.C., Sauren, J., Knoop, O., Galetzka, M., Mobach, M.P., & Pruyn, A.T.H. (2019). Into the light: effects of the presence of cleaning staff on customer experience. *Facilities*, 37 (1/2), pp. 91-102, <https://doi.org/10.1108/F-10-2017-0105>.

5.1 Study 1: effects of enhanced visibility of cleaning staff in trains

5.1.1. Introduction

Cleanliness is one of the key drivers of overall customer satisfaction (Wakefield & Blodgett, 1996, van Lierop et al., 2017). Very often a distinction is made between actual cleanliness and subjective perceptions of cleanliness (in the following: end-user perceptions of cleanliness). Knowledge and standards on how to manage actual cleanliness are widely available in literature (e.g., Van Ryzin et al., 2008, Johanne Klungseth, 2014) and practice (e.g., the Netherlands: NEN 2075, international: ISO 9001). Knowledge on how to manage and positively influence end-user perceptions of cleanliness is limited in current literature (Whitehead et al., 2007, Vos et al., in press). The following variables were identified as variables that positively influence end-user perceptions of cleanliness: actual cleanliness (Van Ryzin et al., 2008), scent (Whatley et al., 2012), deterioration (Wells & Daunt, 2015), shininess (Broeders et al., 2011), architectural order (Da Luz Reis & Dias Lay, 2009), and the presence of cleaning-staff in a healthcare setting (Whatley et al., 2012, Whitehead et al., 2007).

Interestingly, research on cleaning staff or cleaning in general is scarce (Klungseth & Olsson, 2013). Only a few researchers have investigated cleaning work from the perspective of the cleaning staff and/or end-users (Aguilar, 2001, Hood, 1988). A step toward a more human-centred approach in facilities management research was taken by presenting a study in which cleaning-staff was taken out of the shadows, into the light. Currently, most cleaners in this sector work during night time without having direct contact with end-users. As part of this study, these workers are taken “out of the shadows, into the light” by introducing daytime work. Their physiques, uniforms, and work are visible and exposed to end-users. The main aim of the two studies that are presented in this chapter is to evaluate the effects of the presence and behaviour of cleaning staff in trains on the experience of train passengers. The following research question will be addressed: “to what extent does the presence of cleaning staff influence the experience of train passengers?”.

5.1.2 Theoretical framework

First, the role of (cleaning) staff in the experience of the service environment was addressed. Secondly, the current literature on the effects of the visibility of cleaning staff in the service environment was discussed.

Factors influencing customer experience

The customer experiences that companies create, matter more than ever (Pine and Gilmore, 1998). Customer experience was defined as a multidimensional construct that is holistic in nature and involves the customers' cognitive, affective, emotional, social, and physical responses to the service provider (Lemon & Verhoef, 2016). Design, ambient, and social factors are considered to be important predictors of customer experience (e.g., Bitner, 1992, Baker et al., 2002, Baker, 1987). (1) Design factors can be divided into two dimensions, a functional dimension and an aesthetic dimension. The functional dimension comprises the layout and comfort of the service environment, the aesthetic dimension includes architecture, colour, and materials. In general, design factors are more visual and tangible in nature compared to ambient factors which tend to affect nonvisual senses (Baker et al., 2002). (2) Ambient factors are considered to be background conditions that influence the subconscious experience of end-users. Examples of such factors are climate, lighting, acoustics, scent, and music. In most cases, end-users will only be aware of these factors when they are absent or exist at an unpleasant level (Baker, 1987). The experience of the service environment is influenced by (3) social factors as well. Very often, a distinction is made between the presence of other customers and service personnel. In general, the number, appearance, and behaviour of other customers is believed to influence the end-user experience of the environment (Baker, 1987). There are often multiple end-users in a service environment simultaneously, and the experience of each end-user can impact that of others (Verhoef et al., 2009). Eye-contact, one's general appearance, loud voice may, for example, be perceived as disturbing or even threatening (e.g., Aronoff et al., 1992, Verhoef et al., 2009). The interaction between customers and service personnel (i.e., the service encounter) is considered to be a crucial factor in the service delivery process which influences customer experience. In many cases, the service encounter itself is considered as the service from the end-user point of view (Bitner et al., 1990, Vilnai-Yavetz & Rafaeli, 2011). Service personnel is able to communicate a firm's ideals and attributes through the service encounter. By doing so, service personnel is able to positively (or negatively) influence customer satisfaction and perceptions of service quality (Baker et al., 1994). To conclude, customer experience is defined as a set of variables that can be influenced by the quality of design, ambient, and/or social factors.

Presence of cleaning staff

In general, most research focusses on the presence of employees in a retail environment who are part of the service encounter (e.g., cashiers, sales people). Research on the presence of cleaning staff or cleaning in general could be considered as underexposed in current facility management literature (Klungseth & Olsson,

2013). A literature search in the databases of two major facility management journals (i.e., *Facilities*, *Journal of Facilities Management*) yielded only a handful of relevant studies on cleaning and the presence of cleaning staff. Most of these studies are about the managerial side of cleaning by focussing on the make or buy decision for cleaning services (e.g., Gbadegesin & Babatunde, 2015; Houston & Youngs, 1996; Klungseth et al., 2016), end-user satisfaction with cleaning services (e.g., Hui et al., 2013; Hui & Zheng, 2010), and cost management (e.g., Bywater, 1990). The qualitative studies of Whitehead et al. (2007) and Whatley et al. (2012) are to the knowledge of the authors the only studies evaluating the effect of cleaning staff on end-user perceptions. In both studies, the presence of cleaning staff and more specifically the appearance, behaviour, and attitude of cleaning staff were identified as 'social cues' that positively influence perceptions of cleanliness. Both studies were however performed in a health-care setting, research on the presence of cleaning staff in the (public) service environment lacks. As noted, the interaction between cleaners and customers is considered to be one of the main advantages of increased presence of cleaning staff. Previous research stated that the experience of employees in the service environment is correlated with the experience they create for their customers (e.g., Parish et al., 2008; Schneider et al., 2005). Besides the positive implications of the presence of cleaning staff for end-users, research indicates that cleaning staff may benefit as well. Whereas cleaners who work during the night might feel ignored and experience the dirty-work stigma (Ashforth & Kreiner, 1999; Van Vlijmen, 2017), day-time cleaners might benefit from the feeling of being part of the primary service delivery process. To conclude, research in facility management on the effects of the presence of cleaning staff on end-user perceptions is limited. The qualitative work available (Whatley et al., 2012; Whitehead et al., 2007) demonstrated that the presence of cleaning staff in the service environment might be beneficial for end-users.

Concluding: from theory to practice

The current study evaluates the effect of the presence and behaviour of cleaning staff on the experience of train passengers. Van Hagen and Sauren (2014) operationalised the train passenger experience by developing a measurement instrument that includes the three dimensions of customer experience (i.e., design, ambient, & social factors). Based on this distinction, the train passenger experience was defined as following:

1. Design factors: perception of comfort;
2. Ambient factors: perception of atmosphere and cleanliness;
3. Social factors: perception of staff and other customers.

In addition, the perception of time was included as well since (the subjective experience of) time is an important aspect for passengers who undertake a train journey (Van Hagen et al., 2014). Previous research (Whatley et al., 2012; Whitehead et al., 2007) demonstrated that the presence of cleaning staff may positively influence perceptions of cleanliness. The expectation is that the presence of cleaning staff positively influences the perception of staff, cleanliness, comfort, trip speed, atmosphere, and the general satisfaction of passengers (see Figure 5.1). It is expected that the presence of cleaning staff is perceived as a social cue which implies the presence of other positive traits in the environment. This phenomenon can be interpreted following the “*halo effect*” (Eagly et al., 1991). The “*halo effect*” suggests that people tend to assume that one positive trait (i.e., presence of friendly and helpful cleaning staff) implies the presence of other positive traits (e.g., cleaner environment, comfortable seating, shorter travel time). Two field experiments were performed to determine if the presence of cleaning staff influenced perceptions and satisfaction of passengers. The first study took place in trains of Netherlands Railways on the trajectory between the train stations of Assen and Groningen in July 2015. The second study was carried out in similar trains but on the trajectory between the central train station of Utrecht and train station ‘Amsterdam Amstel’ in September and October 2015. In the both studies, (male and female) cleaners were instructed to empty the bins and perform minor cleaning activities. After the first study, the cleaners received a hospitality training and corporate uniforms (see Figure 5.1 and Figure 5.2 for difference). The expectation is that the effects of the presence of cleaners will be even stronger in the second study due to the intervention (i.e., hospitality training, corporate uniforms).

5.1.3 Method

Procedure

Data for the two studies were collected during off-peak hours (i.e., 9 AM- 16 PM). The distance and travel time between Assen-Groningen (35 kilometres, 18 minutes) and Utrecht-Amsterdam (40 kilometres, 21 minutes) is comparable. Cleaners participated voluntarily. The studies consisted of an experimental and control condition. In the experimental condition of both studies two gloved cleaners, dressed in a yellow safety vest in study 1 (Figure 5.2) or corporate uniform in study 2 (Figure 5.3), collected waste and performed minor cleaning activities during the journey. More specifically, cleaners were instructed to empty the bins, clean the glass doors of the train compartments, and if possible, clean the non-foldable tables. After the first study, cleaners received hospitality training in which they were instructed to greet the passengers when entering the train, provided travel information if needed, and learned how to interact with different types of passengers through roleplay with a professional actor. Cleaners were, for example, instructed to skip passengers who were

actively engaged in working activities and interact with passengers who were open to it. In the control condition, no cleaning staff was present. Data of the experimental and control conditions were gathered on the same days. Data for the first study were collected in the summer of 2015 (July), data for the second study were collected in the fall of 2015 (September, October). To reduce bias, data for the experimental and control condition were collected in the morning (9 a.m. – 12:30 p.m.) as well as in the afternoon (12:30 p.m. – 16 p.m.).

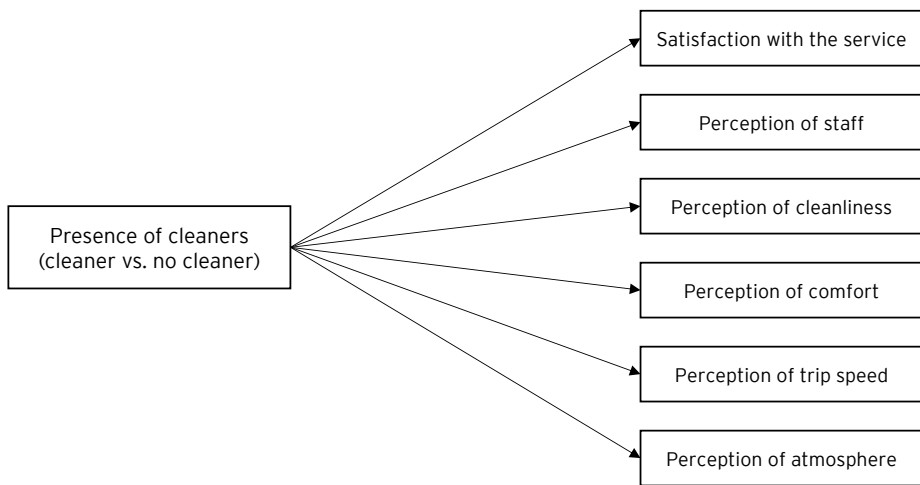


Figure 5.1

Overview of key constructs used in the study

Participants

All participants (study 1, $N = 506$; study 2, $N = 1,113$) were travelling with Netherlands Railways and were either part of the experimental condition (study 1, $n = 265$; study 2, $n = 482$) or control condition (study 1, $n = 241$; study 2, $n = 631$). In the first study, average age was 32 years ($M = 31.9$, $SD = 16.6$); in the second study, average age was 34 years ($M = 34.4$, $SD = 16.9$). See Table 5.1 for a full overview of demographic information.



Figure 5.2
A cleaner who participated in the first study



Figure 5.3
A cleaner who participated in the second study

Table 5.1*Overview demographic information participants*

Variables	% (N) study 1	% (N) study 2
Age		
< 24	53.2 (269)	42.6 (474)
25 - 49	27.9 (141)	34.1 (379)
50 - 64	12.6 (64)	14.7 (161)
65 >	6.1 (31)	7.5 (82)
Missing	.2 (1)	1.5 (17)
Total	100 (506)	100 (1,113)
Gender		
Male	37.5 (190)	35.9 (400)
Female	62.5 (316)	62.6 (697)
Missing	0 (0)	1.4 (16)
Total	100 (506)	100 (1,113)
Travel motive		
Commuting	22.7 (115)	20.4 (227)
Business trip	5.9 (30)	13.7 (153)
School or university	8.7 (44)	26.8 (298)
Visiting family or friends	32.4 (164)	14.3 (159)
Leisure (other than 'visiting family or friends')	20.2 (102)	20.3 (226)
Other	10.1 (51)	4.1 (46)
Missing	0 (0)	.4 (4)
Total	100 (506)	100 (1,113)

Measures

The survey contained 24 items (on a 10 point Likert scale) about passengers' satisfaction with the service and questions about passengers' perceptions of staff, cleanliness, comfort, trip speed, atmosphere, and cleanliness of individual interior elements. The same survey was used in both studies. The aim was to gain a deeper understanding of passengers' perception of cleanliness. Therefore, participants were asked to evaluate the cleanliness of individual interior elements (i.e., floor, seating, table, trash bin, walls, windows, and doors). In addition, background information about the passengers' gender, age, and travel motive was collected. The items about passengers' satisfaction and perception were derived from previous research in this area (Van Hagen & Sauren, 2014). Table 5.2 shows the individual items and Cronbach's alphas of the constructs. Two items were emitted from the 'comfort construct' (i.e., I could easily find a seat on this train, I am able

to spend my time pleasantly in this train) to improve the Cronbach's alpha. Hence, all constructs were considered reliable with a Cronbach's alpha value above 0.7 (Field, 2013) as shown in Table 5.2.

Table 5.2

Scale items and coefficient alpha reliability of study 1 and study 2

Constructs (C) and items (Q)	α study 1	α study 2
C1 Staff	.804	.872
Q1 The staff is visible during the journey		
Q2 I think the staff is attentive		
Q3 I think the staff is professional		
C2 Cleanliness	.851	.858
Q1 I think the interior of the train is clean		
Q2 I think the interior of the train is well maintained		
C3 Comfort	.701	.751
Q1 I experience the comfort of this train as pleasant		
Q2 The train furniture meets my needs		
C4 Trip speed	.818	.807
Q1 My train ride is smooth and without problems		
Q2 This trains brings me quickly to my destination		
Q3 This trains runs right on time		
C5 Atmosphere	.727	.709
Q1 I think this train is colourful		
Q2 I Think it is cosy in this train		
Q3 I think the scent in this train is pleasant		
Q4 I think the exterior of this train looks appealing		

Manipulation check

To determine whether the cleaning staff was indeed perceived as more visible during the experimental condition, a manipulation check was conducted for both studies. One item of the "staff construct" (i.e., the staff is visible during the journey) was used to ascertain if the staff was perceived as more visible during the experimental condition. An analysis of variance revealed that participants in the experimental condition indeed evaluated the cleaning staff as being more visible ($M = 6.1$, $SD = 2.10$) than the participants in the control condition ($M = 5.6$, $SD = 2.19$; $F(1, 455) = 6.94$, $p < .05$) of the first study. Similar findings were obtained in the second study. Participants in the experimental condition evaluated the cleaning staff as being more visible ($M = 5.6$, $SD = 2.29$) than the participants in the control condition ($M = 4.8$, $SD = 2.38$; $F(1, 1035) = 32.44$, $p < .001$).

5.1.4 Results

Multivariate Analysis of Variance (MANOVA) was performed with the condition (experimental or control) as independent variable and all composite variables (Table 5.2) as dependent variables. The models for both studies appeared to be significant ($F(6, 469) = 2.52, p = < .05$; $F(6, 1101) = 11.51, p = < .001$). The presence of cleaning staff positively influenced perceptions of staff, cleanliness, comfort, and satisfaction in the first study, the perception of trip speed and atmosphere were not significantly impacted by the presence of cleaning staff. Similar results were found in the second study. Except for trip speed, significant differences were found for all dependent variables between the control and experimental condition. No significant differences were found between male and female participants in both studies. An overview of the constructs, means for the experimental condition (EC) and control condition (CC), F values, and p -values for study 1 and study 2 are presented in Table 5.3. The physical presence of cleaning staff positively influenced the perception of staff, cleanliness, comfort, and the general satisfaction of passengers in both studies. The perception of atmosphere was only significant in the second study, which might be caused by the intervention (i.e., hospitality training, corporate uniform). Overall, the effects in the second study were considered to be stronger and more robust.

In addition, it was evaluated if the presence of cleaning staff affected the perceived cleanliness of individual interior elements. A similar procedure was followed. The models (MANOVA) appeared to be significant in both studies ($F(7, 498) = 2.37, p = < .05$; $F(7, 1105) = 7.54, p = < .001$), a detailed overview of the results can be found below (Table 5.4). Overall, positive effects of the presence of cleaning staff were found for cleanliness perceptions. Non-significant effects were found for walls (only in study 1) and windows. The expectation is that passengers did not note differences since cleaners were not instructed to clean the walls and windows. In addition, cleaners were obviously not able to clean the windows from the outside during the journey.

Table 5.3

Overview of results: passenger' perceptions and satisfaction in control (CC) and experimental condition (EC) (study 1 & study 2)

	Study 1			
	<i>Mean & (SD) CC</i>	<i>Mean & (SD) EC</i>	<i>F</i>	<i>p</i>
Staff	6.70 (1.33)	6.98 (1.22)	5.81	< .05
Cleanliness	6.37 (1.55)	6.66 (1.49)	4.29	< .05
Comfort	6.70 (1.29)	7.02 (1.20)	8.60	< .05
Trip speed	7.81 (1.41)	7.80 (1.43)	.01	<i>ns</i>
Atmosphere	6.47 (1.04)	6.56 (1.06)	.74	<i>ns</i>
Satisfaction	7.25 (1.06)	7.44 (.99)	4.70	< .05

Table 5.4

Overview of results: passenger' perceptions of cleanliness of individual interior elements in control (CC) and experimental condition (EC) (study 1 & study 2)

	Study 1			
	<i>Mean & (SD) CC</i>	<i>Mean & (SD) EC</i>	<i>F</i>	<i>p</i>
Floor	5.82 (1.77)	5.98 (1.71)	1.09	<i>ns</i>
Seating	5.88 (1.75)	6.32 (1.66)	8.10	< .05
Table	6.21 (1.59)	6.52 (1.59)	4.60	< .05
Trash bin	5.19 (1.93)	5.76 (2.11)	9.93	< .05
Walls	6.49 (1.54)	6.66 (1.64)	1.48	<i>ns</i>
Windows	6.04 (1.63)	6.22 (1.68)	1.45	<i>ns</i>
Doors	6.47 (1.55)	6.74 (1.52)	3.87	< .05

5.1.5 Discussion

Two experimental field studies were performed to evaluate the effect of the visible presence of cleaning staff on customer experience of train passengers. Based on the “*halo effect*” (Eagly et al., 1991), it was expected that the physical presence of cleaning-staff would positively influence customer experience (i.e., perception of cleanliness, staff, comfort, trip speed, and atmosphere) and the general satisfaction of passengers. The “*halo effect*” suggests that people tend to assume that one positive trait (i.e., presence of friendly and helpful cleaning staff) implies the presence of other positive traits (e.g., comfortable seating, shorter travel time, positive perception of atmosphere). Between the two studies, cleaners received hospitality training and corporate uniforms as opposed to traditional cleaning uniforms in the first study. It was expected that the training and corporate uniforms would strengthen the positive effects of the visible presence of the cleaners. This was confirmed by the findings of study 2.

Study 2			
Mean & (SD) CC	Mean & (SD) EC	F	p
5.99 (1.59)	6.45 (1.47)	24.76	< .001
6.16 (1.25)	6.49 (1.19)	19.79	< .001
6.70 (1.51)	7.23 (1.28)	37.63	< .001
7.80 (1.51)	7.69 (1.76)	1.08	ns
6.13 (1.16)	6.29 (1.16)	5.46	< .05
7.09 (1.06)	7.35 (.94)	17.47	< .001

Study 2			
Mean & (SD) CC	Mean & (SD) EC	F	p
5.56 (1.77)	5.86 (1.75)	7.84	< .05
5.96 (1.68)	6.22 (1.61)	6.48	< .05
6.25 (1.63)	6.74 (1.45)	26.92	< .001
5.25 (2.00)	5.93 (1.93)	31.77	< .001
6.38 (1.61)	6.72 (1.57)	12.42	< .001
5.72 (1.83)	5.81 (2.01)	0.64	ns
6.28 (1.69)	6.65 (1.67)	13.46	< .001

The presence of cleaners positively influenced satisfaction, perceptions of staff, cleanliness, and comfort in both studies. The perception of atmosphere was only significant in the second study, perceived trip speed was non-significant in both studies. Interestingly, differences between control and experimental condition increased and the presence of cleaners was significantly related to the perception of atmosphere after the intervention (i.e., hospitality training, corporate uniform). Suggesting, the training and corporate uniforms indeed strengthened the effects of the visible presence of the cleaners. When it comes to individual interior elements, it was expected that the elements touched by the cleaners (regardless of the level of cleanliness) would be perceived as cleaner. It appeared that the presence and cleaning activities of the cleaning staff indeed positively influenced the perceived cleanliness of the seating, table, trash bin, and doors in both studies.

Although not the main aim of the current study, day-time cleaners indicated to feel healthier and have more fun at work since they were openly appreciated by train passengers. This finding was supported by Ueno et al. (1984), who evaluated the effect of consecutive night-time work on health conditions among cleaners of the “Bullet trains” in Japan. Gastrointestinal disorder, general fatigue, and depression was more common among cleaners working night-time hours compared to cleaners who worked during day-time. The expectation is that day-time cleaning reduces the experience of the dirty-work stigma by cleaners, as outlined by Van Vlijmen (2017). Since cleaners are part of the primary service delivery process they feel probably more respected and valued by end-users who directly benefit from their efforts. The introduction of day-time cleaning alone will not eliminate the experience of the dirty-work stigma by cleaners. Many more measures, such as reduction of work-pressure, increase of salary, and recognition are needed to reduce the experience of the dirty-work stigma.

Moreover, facility management research on cleaning or cleanliness appeared to be limited and mostly qualitative, as noted by Klungseth and Olsson (2013) and Van Vlijmen (2017). Facility management research seldom focusses on cleaning or the role of cleaning staff. This can be considered as peculiar in a market which employs millions of people worldwide and heavily depends on their daily efforts. This study took a first step by evaluating the effect of cleaning staff on end-user perceptions and satisfaction.

The present study is limited because of several reasons. The focus on train passengers and environment might reduce reproducibility of the findings to different settings. For most train passengers, a train journey typically has an obligatory character and passengers tend to be task oriented (Van Hagen et al., 2014). End-users in other service environments such as hotels or offices might be involved in other activities and pursue less task oriented goals. Moreover, multiple cleaners were employed in the two different studies. Thus, the stimulus (cleaning staff) was therefore probably not identical

5.1.6 Conclusions and implications

The studies demonstrated that perceptions and satisfaction of train passengers can be influenced by introducing daytime work: cleaners work during daytime making their bodies, uniforms, and work visible to customers, with possible influences on affective responses of both customers and employees. Insights were derived through two experimental field studies performed on trains of Netherlands Railways (NS). The findings of this study carry several important implications.

Future research should consider the effect of day-time cleaning on health, social well-being, and job satisfaction of cleaning staff. It would be interesting and relevant to determine if cleaners who work during daytime experience less stress and are more satisfied with their jobs. Moreover, it would be interesting to further unravel the concept of cleanliness by performing experimental field studies on antecedents of end-user perceptions of cleanliness (e.g., scent, use of materials).

This study carries several important implications for the facility management industry. The results allow in-house and corporate facility managers to better understand the effect of their cleaning staff on end-user perceptions and satisfaction. This understanding might lead to better decision making. Instead of improving end-user perceptions of cleanliness by investing in additional cleaning services, in-house and corporate facility managers might decide to invest in different ways of cleaning. For example by focussing on individual interior elements perceived as most important by end-users. In this study, cleanliness of the seating area and table (direct surroundings) were most strongly correlated with the overall perception of cleanliness. Interestingly, cleaners were instructed to only clean unoccupied seats. Suggesting that effects might be even larger when occupied seats are cleaned during the journey, if desired by the customer. The personal service to the passenger will probably positively influence customer experience.

In brief, this chapter provides insights into the effects of increasing the visibility of cleaning staff on perceptions and satisfaction of end-users, offering several directions for future research. Hopefully, this study encourage in-house and corporate facility managers to take their cleaning staff out of the shadows, into the light and thereby positively influence the perceptions and satisfaction of their end-users.

5.2 Study 2: effects of enhanced visibility of cleaning staff in a train station

5.2.1 Introduction

Research strongly supports the idea that customers' perceptions of cleanliness strongly influences their perception and behaviour in service settings (Baker et al., 2020; Pizam & Tasci, 2019) and may serve as an accurate indicator of actual cleanliness and hygiene (Durant, 2020). Many studies have considered perceived cleanliness as a key determinant of customer satisfaction (Park & Almanza, 2020; Wakefield & Blodgett, 1996), revisit intentions (Lockyer, 2005), customer loyalty (Barber & Scarcelli, 2010), and customer delight (Magnini et al., 2011). However, scholars have rarely examined perceived cleanliness as a stand-alone factor, for example, by evaluating the effects of determinants such as architectural design and staff behaviour on perceived cleanliness (Baker et al., 2020).

Research on this topic is pertinent and timely given the ongoing COVID-19 pandemic. As (un)cleanliness has generally been considered as a culprit of disease in pandemics (Alan et al., 2016), customers will be more susceptible to cues that inform them about the cleanliness of service environments (Magnini & Zehrer, 2021; Yu et al., 2021). Although most interventions to positively influence perceived cleanliness, focus on services to clean premises, it has been increasingly recognized that other environmental cues may also be effective (Vos et al., 2018a; Whitehead et al., 2007).

An example of such a cue is the physical (in)visibility of cleaning staff (Whitehead et al., 2007). Most service environments, such as restaurants and offices, are cleaned after opening hours when customers or employees are not present. This is primarily driven by cost efficiency and the idea that customers and employees may be hindered by cleaning activities and the presence of cleaning staff (Vlijmen, 2019). However, a recent study showed that increased exposure of cleaning staff to customers may positively influence perceived service quality (Vos et al., 2019b, Chapter 5.1). This study departs from this previous study by solely focusing on dimensions of perceived cleanliness and using a measurement instrument that was specifically developed to measure perceived cleanliness in service environments (Vos et al., 2019a).

This chapter contributes to an improved understanding of perceived cleanliness in service environments with an application in the context of public transport, as the study takes place on train stations. This setting was selected for two main reasons. Firstly, cleanliness carries special relevance in public transport, it is one of

the key predictors of overall service quality, a critical measure for public transport organisations (e.g., Beck & Rose, 2016; Cascetta & Cartenì, 2014; Eboli et al., 2018). Secondly, public transport organisations are among the largest utilizers of cleaning services with the majority of cleaning taking place during night-time (Vlijmen, 2019). Despite its importance in public transport, insight into the concept of perceived cleanliness and its determinants is lacking. Hence, this study aims to examine the effects of increased physical visibility of cleaning staff on perceived cleanliness. More specifically, the aim is to investigate if customers' perceptions are affected by the number of cleaning employees present. This will be investigated by performing field experiments in a train station in which the effects of more visible cleaning on perceived cleanliness were evaluated.

5.2.2 Theoretical framework

Perceived cleanliness

Scholarly interest for customers' perceptions of cleanliness as an integral element of service environments is a recent development. Traditionally, perceived cleanliness has been considered as a hygiene factor (Vilnai-Yavetz & Gilboa, 2010): an element of the service environment that should be managed to maintain sales and avoid customer dissatisfaction. However, in more recent research, perceived cleanliness has been shown to have a noteworthy positive influence on internal and external customer responses such as customer satisfaction and revisiting intentions (Almanza, 2019; Pizam & Tasci, 2019)

Customers' perceptions of cleanliness in service environments may be defined and operationalized in two distinct approaches. The first approach mainly focusses on the catering industries, such as hotels and restaurants, and examines how customers perceive the cleanliness of specific spatial elements of the service environment; for example, the exterior of a restaurant or hotel (i.e., garden and driveway, parking lot), restroom appearance (e.g., dirty or soiled sink, trash in toilet), and the interior of a restaurant or hotel (i.e., seat cushion, windows) (Barber & Scarcelli, 2010; Lockyer, 2003). The second approach was specially designed for applications in different service settings, consisting of three distinct dimensions: *cleaned*, *fresh*, and *uncluttered* (Vos et al., 2019a). *Cleaned* refers to visual evidence of the cleaning process (i.e., neat, dust-free), *fresh* to olfactory evidence (i.e., it smells fresh), and *uncluttered* to the order and consistency of the architecture of the built environment (i.e., ordered, organized). The latter approach seems better suited for studies outside catering industries, in this case in the public transport sector.

Effects of cleaning staff on perceived cleanliness

Determinants of perceived cleanliness may be well categorized using Bitner's (1992) servicescapes framework. The framework comprises three environmental dimensions: ambient conditions (i.e., temperature, cleanliness), space/function (i.e., equipment, layout of space), and signs, symbols, and artefacts (i.e., staff appearance, style of décor). These dimensions are undeniably important determinants of the perceived servicescape (i.e., perceived service quality) and are also frequently mentioned as key determinants of perceived cleanliness (Vos et al., 2018a; Whitehead et al., 2007). Although emphasis in the servicescapes framework is on interior and exterior factors, such as interior design and ambient scents, the visible presence of staff members was included as well. Staff members are an integral part of the holistic visual landscape and their presence may affect interpretation of environmental stimuli at customers, such as cleanliness. The physical presence of employees has two distinct functions in the servicescapes framework. Firstly, their embodied presence, uniformed appearance, and related work activities as a sub-system of the perceived servicescape, including perceived cleanliness and perceived service quality. Secondly, their presence enables and influences the nature (i.e., duration, quality) of social interactions taking place with customers.

Typically, the activities of employees of service environments can be divided in two general categories: front- and backstage activities (Zomerdijs & Voss, 2010). Opposed to frontstage activities (i.e., customer service), backstage activities are aimed at maximizing efficiency by performing them out of sight of the customer or when the customer is not present (Safizadeh et al., 2003). This is fuelled by the ideas that the presence of customers reduces the efficiency of backstage activities and that customers experience discomfort when activities are carried out in their presence (Chase & Hayes, 1991). This 'closed system philosophy' overlooks the positive effects to both the customer and service organisation by exposing the customer to the backstage activities, even though the job is traditionally performed in customers' absence.

Evidence shows that the greater the links between customer and producer, the easier it is to understand and respond to the customer's need (Zomerdijs & Voss, 2010). Chase and Hayes (1991) suggested a number of strategies to improve the backstage connection to the frontstage experience, one of them is creating 'show-off jobs' (also: performative labour) in which behind-the-scenes production workers are brought on stage to do their job visibly in front of the customer.

Since the introduction of the concept of 'show-off jobs', this idea has been evaluated empirically in the context of hospitality. Several scholars, for example, explored the idea of open kitchen restaurants where customers can see and hear chefs working (Agrawal & Mittal, 2019; Alonso & O'Neill, 2010; Byun & Jang, 2018; Chow et al., 2010). For instance, Agrawal & Mittal (2019) found that customers in an open kitchen restaurant rated the restaurant as being more reliable and assuring. Customers also experienced higher levels of satisfaction. Similarly, Chow et al. (2010) demonstrated that open kitchen restaurants were perceived as more clean compared to traditional closed-kitchen restaurants. These findings support the notion that enhancing visibility of backstage activities contribute to a more positive perception of the service environment (cleanliness). Another discipline that started exploring visibility of staff as a strategy to enhance customer experience, is the cleaning industry. Traditionally, cleaning is considered to be a commodity; a backstage process that has a strong focus on creating efficiency which does not directly contribute to the success of the frontstage experience (Toffolutti et al., 2017; Van Vlijmen, 2019). Although, most cleaning activities take place along the edges of the day (i.e., early morning, evening, night), facility service providers introduced 'performative cleaning' during daytime as a strategy to improve customer experience. As part of this strategy, cleaners perform their cleaning activities during the day and are encouraged to interact with customers. Empirical studies on this topic indicate that the visible presence of cleaning staff and more specifically their appearance, behaviour, and attitude positively influence customer satisfaction and experience (Vos et al., 2019b; Whatley, Jackson & Taylor, 2012; Whitehead et al., 2007). Thus the following hypothesis was proposed:

H1: Customers' perceptions of the service environment's cleanliness will be more positive (predominantly: cleaned dimension) when cleaners are visibly present than when no cleaners are present.

Effects of number of employees present

In uncontrolled, real-life settings - such as a service environment - environmental stimuli have to compete for customers' attention. The intensity of a stimulus appears to be an important determinant of its saliency and effectiveness (Higgins, 1996). More specifically, several studies show that moderately intense stimuli are most effective (e.g., Doucé & Janssens, 2013; Leenders et al., 2019). Customers are generally not able to perceive low intensity stimuli and high intensity stimuli are often associated with negative reactions, that may provoke avoidance behaviours. Social stimuli - including presence of cleaning staff - mainly vary in their 'intensity' by increasing or decreasing the number of individuals present (Kim & Kim, 2012). Although Baker et al. (2020) and Argo & Dahl (2020) noted that research on effects of number of employees on

customers' perceptions in service environments should be expanded, some previous evidence was found. Research shows that perceptions of service quality (Mazursky & Jacoby, 1986), purchase intentions (Sharma & Stafford, 2000) and perceptions of hospitality and waiting time (Baker & Cameron, 1996) increase as the number of employees present increases. Following this line of reasoning, it is hypothesized that the 'intensity' of cleaning staff – more specifically, the number of cleaners present – is of importance to the effectiveness of the stimulus. This idea has not been explored in previous studies. Hence, the following hypothesis was formulated:

H2: Customers' perceptions of the service environment's cleanliness will be more positive (predominantly: cleaned dimension) when four cleaners are present than when one cleaner is present.

Associative network theory

Why do customers evaluate service environments as more clean when staff is more visible? It is expected that these effects may be interpreted using the cognitive psychology theory of associative networks. This theory is also known as the human associative memory model, the spreading activation model, and the connectionist model (Till et al., 2011; Van Osselaer & Janiszewski, 2001). The general assumption of these models is that semantic and declarative knowledge is represented in the brain as a network of nodes connected by associative links. The links between the nodes are strengthened each time two concepts co-occur (Till et al., 2011). Concepts are activated when information is recalled through a process of spreading activation. This process involves the activation of one concept, which, if this activation passes a threshold, can lead to the activation of the linked concept (Keller, 1993; Henderson et al., 1998). The more frequent individuals are exposed to two or more concepts, the stronger and more accessible the association will be. To illustrate: the scent of citrus is typical for cleaning detergents and is, obviously, very often present when cleaning taking place (De Lange et al., 2012). As a result, the association between the smell of citrus and the concept of cleanliness is strong for most individuals. Based on the preceding evidence, it is hypothesized that the visible presence of cleaning staff will activate the association to the concept of cleanliness.

This hypothesis is tested by including customers' general satisfaction as a measure that is not primarily related to more visible cleaning and the concept of cleanliness. Following the associative network theory and process of spreading activation, it is expected that more visible cleaning influences customers' perceptions of cleanliness but have no effect on customers' general satisfaction. If general satisfaction is affected by the more visible cleaning, the underlying processes are likely to be more affective (e.g., Halo effect), as suggested by Vos et al. (2019b). The following hypothesis was formulated:

H3: More visible cleaning (one or four) will have no effect on customers' general satisfaction compared to when no cleaner is present.

5.2.3 Method

Hypotheses were tested in a train station using a one factor between subjects design with three different conditions: four visible cleaners, one visible cleaner and no visible cleaners present. All three conditions differed in the visibility of cleaners but were identical in levels of actual cleanliness.

Procedure and participants

The experiment took place on three Thursdays in 2019 (one day for each condition) between 12 p.m. and 7 p.m. Because of high crowding levels the morning rush was excluded. Cleaners participated voluntarily. On the train platform of Amsterdam Central Station, waiting passengers were randomly approached and asked to participate in a study on their experience of the train station. Participants filled out the paper questionnaire while waiting, participation took about 5 minutes. In the two conditions with cleaners, one or four gloved cleaner(s) dressed in a corporate uniform, collected waste, and performed cleaning activities on the train platform (Figure 5.4). More specifically, the cleaners were instructed to empty the bins, clean benches, and sweep the flooring of the platforms. The cleaners used a cleaning trolley to transport their equipment and demarcated their workplace using yellow signage. In the third condition, no cleaning staff was present. To control for possible effects of 'actual' cleanliness, cleaning quality of the platforms was restored to the highest level before start of data collection in all conditions. During data collection, cleaning quality was visually inspected at 3:30 p.m. and 6 p.m. by professional inspectors who were unaware of the aim of the study (Lewis et al., 2008). Inspectors reported no differences between or within the two conditions.

An a priori power analysis using the software G*Power (Faul et al., 2007) calculated a minimal sample size of 203 participants to detect a medium effect size ($f = .25$) and a power of $1 - \beta = .90$. Waiting train passengers on Amsterdam Central Station ($N = 709$) voluntarily participated and were either part of the condition with no cleaner ($n = 227$), one cleaner ($n = 242$), or four cleaners ($n = 240$). A total of 392 participants were female (296 male, 21 other), average age was 36.91 years ($SD = 18.45$).

Data were analysed using IBM SPSS Statistics 27 with each condition (i.e., no cleaner, one cleaner, four cleaners) as independent variable and the three dimensions of perceived cleanliness (Vos et al., 2019a) and general satisfaction with the train platform as dependent variables. Analysis of variance (ANOVA) was utilized to examine the relationship between independent and dependent variables.



Figure 5.4

Photo taken during the experimental condition with four cleaners (three of four cleaners clearly visible on the photo)

Measures

The questionnaire consisted of four main constructs, background information items, and a manipulation check. Table 5.5 provides an overview of constructs, items, and response scales. A manipulation check was performed to verify if the operationalizations of more visible cleaning staff were strong enough to produce variations in the dependent variables. Analysis of the internal consistency of composite variables showed that Cronbach's alpha's and Spearman-Brown coefficient (for two item constructs) were all well above the minimum value of .7, ranging from .93 to .97 (Field, 2013), indicating sufficient internal consistency.

5.2.4 Results

Manipulation check

To verify if the perceived visibility of cleaning staff differs between the three conditions, a manipulation check was performed. Statistically significant differences were found between the conditions ($\chi^2(4, N = 695) = 185.05, p < .001$). More specifically, participants in the conditions with cleaning staff reported seeing a cleaner more

frequently compared to participants in the condition without cleaners (Table 5.6). Also, participants reported seeing a cleaner more frequently in the condition with four cleaners compared to the condition with one cleaner. Based on these results, the operationalization and manipulation of more visible cleaning was considered as successful.

Table 5.5

Overview constructs, items and response scale used

Construct	Item(s)	Response
Cleaned dimension of perceived cleanliness (Vos et al., 2019a)	I think this platform is neat	1-7 Likert scale
	I think this platform is clean	1-7 Likert scale
	I think this platform is hygienic	1-7 Likert scale
	I think this platform is well swept	1-7 Likert scale
	I think this platform is well maintained	1-7 Likert scale
	I think this platform is well looked after	1-7 Likert scale
	I think this platform is dust-free	1-7 Likert scale
Fresh dimension of perceived cleanliness (Vos et al., 2019a)	I think it smells clean on this platform	1-7 Likert scale
	I think it smells hygienic on this platform	1-7 Likert scale
	I think it smells fresh on this platform	1-7 Likert scale
Uncluttered dimension of perceived cleanliness (Vos et al., 2019a)	I think this platform is organized	1-7 Likert scale
	I think this platform is orderly	1-7 Likert scale
General satisfaction (Danaher & Haddrell, 1996)	How is your overall satisfaction level with regard to this train platform?	1-10 scale
Background information	Age	Number
	Gender	Male, female, other
	Dominant travel motive	Commuting to work, business trip, commuting to school, visiting family or friends, shopping, holiday, I have not been travelling, other
	Visiting frequency	Once a week or more, one to three days a month, less than once a month, this is my first time visiting
Manipulation check (Vos et al., 2019b)	Have you seen cleaning staff on this platform?	yes/no

Table 5.6*Reported visibility of cleaning staff in different conditions of the experiment*

Have you seen a cleaner?	Four cleaners		One cleaner		No cleaner	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Yes	168	70.0%	119	49.2%	22	9.7%
No	40	16.7%	97	40.1%	155	68.3%
Do not know	27	11.3%	24	9.9%	43	18.9%
Missing	5	2.0%	2	0.8%	7	3.1%

Results

With the first hypothesis (H1), it was tested whether the presence of one and four cleaners positively influenced customers' perceptions of cleanliness compared to when no cleaner was present, effects were predominantly expected for the *cleaned* dimension of perceived cleanliness. The ANOVA showed that the presence of one cleaner had no significant effect on the *cleaned* dimension compared to the condition without cleaners present ($F(1, 467) = 1.43, p = .22, adjR^2 = .001, 95\% CI(-0.302, 0.070)$). Similarly, no effects were found for more visible cleaning on the *fresh* ($F(1, 467) = .001, p = .97, adjR^2 = -.002, 95\% CI(-0.241, 0.250)$) and *uncluttered* dimensions ($F(1, 467) = .161, p = .68, adjR^2 = -.002, 95\% CI(-0.238, 0.157)$) of perceived cleanliness. The visible presence of four cleaners had a significant effect on the *cleaned* ($F(1, 465) = 21.56, p < .001, adjR^2 = .042, 95\% CI(-0.568, -0.230)$) and *fresh* ($F(1, 465) = 8.42, p < .05, adjR^2 = .018, 95\% CI(-0.596, -0.115)$) dimensions compared to the condition without cleaners present. No effects were found for the *uncluttered* condition ($F(1, 465) = .007, p = .932, adjR^2 = .000, 95\% CI(-0.190, 0.207)$). For an overview of descriptive statistics, see Table 5.7.

Through a similar procedure the second hypothesis (H2) was evaluated stating that the presence of four cleaners has a more positive effect on customers' perceptions of cleanliness compared to the presence of one cleaner. The ANOVA showed that the presence of four cleaners had a significant effect on the *cleaned* dimension compared to the condition with one cleaner present ($F(1, 480) = 11.33, p < .001, adjR^2 = .021, 95\% CI(-0.449, -0.118)$). Also, the presence of four cleaners had a positive significant effect on the *fresh* dimension ($F(1, 480) = 9.16, p < .01, adjR^2 = .017, 95\% CI(-0.593, -0.126)$). No effects were found for the *uncluttered* dimension $F(1, 480) = 0.243, p = .62, adjR^2 = -.002, 95\% CI(-0.146, 0.244)$.

With the third hypothesis (H3) the assumption was tested that more visible cleaning (one or four cleaners) has no effect on customers' general satisfaction compared to the condition without any cleaning staff present. ANOVA's showed no significant

difference between the conditions with one cleaner and no cleaner ($F(1, 467) = 0.963, p = .327, adjR^2 = .000, 95\% CI(-0.105, .315)$) nor between the condition with four cleaners and no cleaner ($F(1, 465) = 0.296, p = .587, adjR^2 = -.002, 95\% CI(-0.251, 0.142)$).

To conclude, data did partly support the first hypothesis (H1); the condition with four cleaners visibly present was associated with more positive perceptions of cleanliness (i.e., *cleaned*, *fresh* dimensions) compared to the condition without cleaners while no differences were found between the conditions with one and no cleaners. The second hypothesis (H2) was supported; the condition with four cleaners resulted in more positive perceptions of cleanliness compared to the condition with one cleaner. Data also supported the third hypothesis (H3); the conditions with one or four cleaner(s) present did not have effect on customers' general satisfaction compared to the condition without cleaners being present.

Table 5.7

Overview descriptive statistics for conditions and constructs

	Four cleaners (<i>n</i> = 240)		One cleaner (<i>n</i> = 242)		No cleaner (<i>n</i> = 227)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Cleaned	5.62	0.81	5.34	1.01	5.23	1.03
Fresh	5.05	1.27	4.69	1.33	4.70	1.37
Uncluttered	5.40	1.09	5.44	1.08	5.40	1.08
General satisfaction	7.35	1.00	7.19	1.15	7.30	1.15

5.2.5 Discussion

Theoretical implications

The present study demonstrated that customers' perceptions of cleanliness in service environments can be influenced by increasing the presence of cleaning staff. Effects of conditions with four, one and no cleaners were compared for perceived cleanliness and general satisfaction. The results for perceived cleanliness showed that quantity matters: no differences were found between the conditions with one and no cleaners, but significant differences were detected between the condition with one and four cleaners. More specifically, for the number of visible cleaning employees influenced the *cleaned* and *fresh* dimensions of cleanliness and not the *uncluttered* dimension. No statistical significant differences were found between the conditions for general satisfaction. This effect may potentially be assigned to the associative network theory and process of spreading activation (Van Osselaer & Janiszewski, 2001) and possibly also explain why no effects were found for the *uncluttered* dimension of perceived

cleanliness. Apparently, the visible presence of cleaners activated associations to the concept of cleanliness and the act of cleaning, including the corresponding fresh smell but not to general satisfaction and the concept of clutteredness.

The current study validates two existing ideas in literature. Firstly, the findings are in line with the core assumptions of 'performative labour' by demonstrating that enhancing the visible presence of typical backstage activities, such as cooking and cleaning, on the frontstage, may positively influence customers' experience of the service environment (e.g., Agrawal & Mittal, 2019; Alonso & O'Neill, 2010; Byun & Jang, 2018; Chow et al., 2010; Vos et al., 2019b). Secondly, the idea was strengthened that customers' perceptions of cleanliness can be influenced by using other determinants than cleaning quality, including visible cleaning (e.g., Whitehead et al., 2007; Vos et al., 2018a).

Besides validating existing ideas, three novel contributions were made to the evidence-base. Firstly, this is probably the first experimental field study that specifically focusses on effects of perceived cleanliness by using an extensive scale including three dimensions of perceived cleanliness, i.e., *cleaned*, *fresh*, and *uncluttered* (Vos et al., 2019a). The study of Vos et al. (2019b) also evaluated effects of more visible cleaning in a field setting but used general service quality scales. Especially adding the *cleaned* and *fresh* dimensions were found to be relevant in the context of visible cleaning staff. Secondly, this study departs from previous studies on 'performative labour' (e.g., Agrawal and Mittal, 2019; Alonso and O'Neill, 2010; Byun & Jang, 2018) by evaluating how the number of employees influences service outcomes. As noted by Baker et al. (2020), effects of gender, physical attractiveness, employee dress and number of employees deserve more attention in hospitality and service research. Thirdly, this study has been performed in a large and public service environment whereas most previous studies have taken place in small and confined service settings such as restaurants and kitchens (e.g., Vos et al., 2019b; Byun and Jang, 2018). That is why this study carries special relevance for customer focused service settings with larger cleaning departments, such as airports, university campuses, and shopping malls.

Practical implications

This study carries multiple implications for the hospitality and facility management industries. The results may allow better decision-making; instead of increasing cleaning frequencies, managers - responsible for larger cleaning operations - may decide to invest in more visible cleaning during daytime to positively influence perceived cleanliness. Moreover, although not necessarily the aim of the current

study; more visible cleaning may have potential benefits for individual cleaning employees as well. Several studies showed that day-time cleaning (as opposed to night-time cleaning) is positively associated with job satisfaction, physical, and social well-being (Ueno et al., 1984; Van Vlijmen, 2019).

The COVID-19 pandemic may improve the general sense of urgency and importance of more visible cleaning services among hospitality and facility managers. As shown; more visible cleaning may not only enhance actual cleanliness, as one of the main culprits of disease in pandemic outbreaks, but also of customers' perceptions of cleanliness.

Limitations and future research opportunities

The present study should be interpreted in the light of several limitations. Firstly, this research has taken place in the context of public transport. Although findings may be generalized to comparable service settings such as airports, university campuses, and shopping malls, future research should address such types of service settings to further increase the generalizability of the results. Secondly, the influence of other environmental stimuli was controlled for as much as possible as the main focus was on effects of more visible cleaning on perceived cleanliness. Future research would benefit from further research into how social factors, including number of employees present, interact with other environmental stimuli, such as number of customers present and spatial layout. Thirdly, the main focus was on the effects of visibility of cleaning staff on customers' perceptions of cleanliness. Future studies may want to explore effects of other characteristics, such as employee dress, gender, and friendliness. It would, for example, be interesting to explore how different dimensions of friendliness (e.g., humorous behaviour), recently revealed by Boninsegni et al. (2020), influence outcomes such as perceived cleanliness. Fourthly and finally, other scholars are encouraged to further empirical research on (perceived) cleanliness. Research on this key element of the service environment is scarce despite being a critical factor in both academic and applied research (Baker et al., 2020; Vos et al., 2018a).

In brief - Chapter 5

Chapter 5 confirmed that the visible presence of cleaning staff positively influenced the *cleaned* and *fresh* dimensions of perceived cleanliness. More specifically, the studies showed that corporate attire (vs. traditional cleaning uniform), hospitality training, and the number of cleaners present can be used to improve the positive effects on perceived cleanliness.

Chapter 5 comprises two separate experiments that were performed in a running train and at a train station. The first study had a more explorative character and was performed before the CP-scale was developed, whereas the CP-scale was used in the second study. Overall, the studies show similar results with positive effects for perceived cleanliness and customer satisfaction. In the first study a general instrument for service quality was used, in this study effects were found for perceptions of comfort, atmosphere, and staff. The second study with the CP-scale provided us with a more refined account of effects for perceived cleanliness by making a distinction between the three dimensions. Depending on the aim of the experiment, scholars may decide to use the general instrument for service quality or the CP-scale.

In the following chapter, it was examined how scent and colour can be used to prime the concept of lightness and influence the *cleaned* and *fresh* dimensions of perceived cleanliness in a virtual train station. This is the first experiment in which congruency between two environmental cues is examined. The results will demonstrate that lighter scent and colour positively influence perceived cleanliness.

Chapter 6

Cleaned and fresh:
the role of scent and colour

6.1 Introduction

People's perception of cleanliness is a key determinant of overall customer satisfaction, perceived service quality (Barber & Scarcelli, 2010; Pizam & Tasci, 2019; Wakefield & Blodgett, 1996), but also on intentions to return to a place (Moon et al., 2017), and littering (Cialdini et al., 1990). Till date, most attention has been paid to understanding how actual cleanliness (i.e., cleaning quality) affects cleanliness perceptions (Park et al., 2019; Vos et al., 2018a). However, it has been widely accepted that other environmental stimuli, such as staff behaviour, the appearance, and condition of the environment, may affect perceived cleanliness as well (Whitehead et al., 2007; Vos et al., 2018a). Yet, evidence in this area is mostly explorative and qualitative. Therefore, controlled experiments are warranted to gain deeper insight into the stimuli that affect perceived cleanliness.

Research has shown that abstract concepts, such as cleanliness, can be influenced by environmental stimuli through the cognitive activation of associations (Elliot et al., 2007). According to these priming techniques, environmental stimuli activate abstract concepts and subsequently lead to activation of behaviours and goals (Custers & Aarts, 2010; Janiszewski & Wyer Jr, 2014). In most situations people are not aware of the influence of the prime on their subsequent responses (Molden, 2014). Empirical studies for example demonstrated that we are willing to help more when primed with the concept of helping (Macrae & Johnson, 1998) and cheat less when primed with religious representations (Randolph-Seng & Nielsen, 2007). In more recent studies, the concept of cleanliness received considerable attention. Scholars showed that people are less likely to litter when exposed to a citrus scent (De Lange et al., 2012; Holland et al., 2007) or shiny material (Broeders et al., 2011). Although the concept of cleanliness has been primed before in these studies, subsequent effects on perceived cleanliness have not been evaluated.

Scent has been used most frequently to prime cleanliness (Vos et al., 2018a). In multisensory research, scent primes have frequently been studied together with colour because of their frequent co-occurrence in food, beverages, and the built environment (Arao et al., 2012; Zellner, 2013). Evidence shows that when experienced simultaneously, colour may both help and hinder the processing of scent (Davis, 1981; Zellner et al., 1991). Matching (congruent) scent and colour stimuli are demonstrated to positively influence people's perceptions and behaviours (Mari & Poggesi, 2013). More insight into (congruency) effects of scent and colour will contribute to the understanding of how environmental stimuli influence perceived cleanliness.

This study will take place in the context of public transport, and more specifically train stations. In this context, cleanliness carries special relevance as one of the key predictors of how passengers experience overall service quality, a critical measure for most public transport organisations (e.g., Beck & Rose, 2016; Cascetta & Carteni, 2014; Eboli et al., 2018). Hence, this study aims to examine the (congruency) effects of scent and colour on perceived cleanliness in train stations.

6.2 Theoretical framework

6.2.1 Priming mechanisms

Literature on scent and colour priming effects distinguishes two main priming mechanisms: affective and cognitive priming (Chebat & Michon, 2003; Zeltner, 1975). Much of the published research on the effects of scent and colour have relied upon the affective mechanism (see for example: Bellizzi et al., 1983; Bellizzi & Hite, 1992; Doucé & Janssens, 2013). This mechanism asserts that scent and colour trigger an overall affective reaction which may transfer to customers' environmental evaluations and their subsequent behaviours (Fazio, 2001; Klauer, 1997). Yet, scent and colour may simultaneously operate through a cognitive priming mechanism as well (e.g., De Lange et al., 2012; Holland et al., 2005; Babin et al., 2003; Chebat & Morrin, 2007). As argued previously, cognitive primes make specific concepts more accessible through cognitive activation of associations (Shiffrin & Schneider, 1977). Exposure to a light and fresh scent or colour may not only be experienced as pleasant but will also activate associations related to the concept of cleanliness. Hence, it is expected that perceived cleanliness can be influenced by using affective and cognitive primes. In the current study, perceived cleanliness was operationalized using the dimensions (i.e., *cleaned*, *fresh*, *uncluttered*) of the cleanliness perceptions scale (Vos et al., 2019a). These dimensions represent different aspects of cleanliness: *cleaned* refers to visual evidence of the cleaning process (i.e., neat, dust-free), *fresh* to olfactory evidence present (i.e., it smells fresh), and *uncluttered* to the order and consistency of architecture (i.e., ordered, organised). The following paragraphs will focus on how scent and colour impact upon these dimensions.

6.2.2 Odour priming effects

Since the emergence of different priming mechanisms, scholars have been interested in priming the concept of cleanliness by using scents. Traditionally, typical cleaning scents (i.e., citrus, Lysol) are used to prime cleanliness (e.g., Birnbach et al., 2013; Holland et al., 2005; King et al., 2016; de Lange et al., 2012; Tobia et al., 2013). Recent evidence, however, shows that clean primes do not necessarily have to be related to the smell of cleaning detergents. Scholars demonstrated that people associate the smell of orange, grass, grapefruit, bergamot, and water lily with cleanliness as well (Dijksterhuis et al., 2013; Doucé et al., 2014). More general, scholars found that scents that people associate with the concept of cleanliness, very often belong to the fresh or light 'family of scent', consisting of citrus, green, water, and fruity 'subfamilies' (Edwards, 2010). Light scents are defined as: scent that are perceived as non-sweet with a dominant fresh note that is often associated with citrus, greens or aldehydes (Green, 1999).

What determines the lightness of a scent? Previous studies mainly relied upon perceptual characteristics of clean scents (Miura & Saito, 2012; Yoshida, 1972) and neglected more objective qualities of scent. This study suggests that perceptual lightness (and thus cleanliness) is strongly related to a scent's substantivity or tenacity. Substantivity refers to the lasting properties of a scent when evaporated in a space or applied to the skin (Appell, 1964). Generally, light scents evaporate in a couple of hours, whereas the smell of heavier scents, such as oriental and animalic scents may last for over weeks. Zarzo (2013) revealed a clear relationship between the substantivity and perceptual lightness of scents, ranging from woody and balsamic scents to citrus and green scents and also introduced the 'substantivity index'. This objective measure ranges from 0 to 100 whereas 0 refers to a low substantivity (i.e., light scent) and 100 to a high substantivity (i.e., heavy scent). Based on the preceding evidence, it is argued that people are more likely to associate lighter scents that have a lower substantivity (i.e., citrus, green, water, and fruity scents) with the concept of cleanliness than heavier scents (i.e., woody, oriental scents) with a higher substantivity level. As scent is conceptually related to the *cleaned* and *fresh* dimensions of perceived cleanliness (Vos et al., 2019a), the effects are predominantly expected for these dimensions (and not for the uncluttered dimension). Leading to the following hypothesis:

H1: Lighter (vs. heavier) scents positively influence the cleaned and fresh dimensions of perceived cleanliness.

6.2.3 Colour priming effects

Although empirical evidence for colour priming effects on cleanliness is fairly scarce, the relationship between colour and cleanliness associations has been reported frequently in scientific literature. Traditionally, white, blue, and green have been mentioned most frequently in the light of cleanliness (Brotherton, 2007; Courtis, 2004; Crozier, 1996; Handyside, 2010; Harutyunyan, 2015; Jacobs et al., 1991; Kauppinen-Räsänen, 2014; Kaya & Crosby, 2006; Manav, 2007; Priluck et al., 1999; Saito, 1996), yellow and gold were also mentioned, but less frequent (Brotherton, 2007). Interestingly, most of these studies solely focus on a colours hue (e.g., red, green, blue) and neglect to investigate or control saturation (i.e., intensity, amount of pigment) and value (i.e., lightness or darkness). Yet, both of these dimensions are just as important, if not more so, than hue (Labrecque & Milne, 2012; Tantanaewin & Inkarojrit, 2018; Valdez & Mehrabian, 1994). It is expected that cleanliness associations are not only driven by a colour's hue but mainly by its value (i.e., lightness, darkness). As demonstrated in previous studies, lighter colours (e.g., white, light green) are automatically associated to perceptual symbols of purity, immaculacy, and cleanliness. Generally, immaculate

concepts such as snow, hospital interiors, and wedding dresses are more often light coloured, while dark colours (e.g., black, dark green) are more often associated with impurity and dirtiness (Epps & Kaya, 2004; Sherman & Clore, 2009; Smith, 2008; Sunaga et al., 2016). Hence, lighter colours may be used to make the concept of cleanliness more easily accessible and subsequently positively influence perceived cleanliness. As colour is conceptually related to the *cleaned* dimension of perceived cleanliness, the effects are predominantly expected for this dimension and not for the *fresh* and *uncluttered* dimensions. Leading to the following hypothesis:

H2: Lighter (vs. darker) colour positively influence the cleaned dimension of perceived cleanliness.

6.2.4 Scent-colour interactions

Because of the co-occurrence of scent and colour primes in the built environment, there is interaction between these cues (Labrecque et al., 2013; Zellner, 2013). Psychologists have known about the existence of such multisensory interactions (also: cross modal correspondences) and congruency effects for many years (see: Jespersen, 1922; Wertheimer, 1958 for early research). Following Spence (2011), multisensory interactions may take place between the features of a cue (e.g., high loudness corresponds to bright colours) or the effect a cue has on its observer (e.g., high arousal scent, high arousal music). More general, multisensory interactions may also be categorized based on their nature. Spence (2011) made a distinction between three types of interactions: structural, statistical, and semantically mediated. Structural interactions are very likely to be innate and occur due to the interplay of neural correlates (e.g., high loudness congruent with bright colours). Statistical interactions are learned, and occur when two cues are routinely correlated in the environment (e.g., high loudness congruent with small object). The interaction between auditory pitch and size is for example learned through exposure to the natural tendency for smaller objects and smaller animals to generate higher pitched sounds (Walker & Walker, 2012). Semantically mediated interactions arise because the same words are used to mark contrasting values on different dimensions of sensory experience (e.g., the words high and low mark contrasting levels of pitch and spatial elevation). As a person becomes familiar with the language of their culture, such interactions are established wherever such shared terminology is encountered. To conclude, Spence's (2011) classification offers a useful theoretical framework for interpreting the nature of multisensory (scent-colour) interactions. It is expected that scent-colour interactions are predominantly mediated by statistical experiences, for example in consumer products (i.e., smell and colour of packaging cleaning detergents) and the built environment (i.e., smell and colour of toilet space).

This study suggests that congruent (vs. incongruent) scent-colour combinations positively influence perceptions of cleanliness. This phenomenon can be usefully interpreted from a (perceptual) fluency perspective. The assumption of this theory is that people unconsciously monitor the ease of performing a mental task, such as processing environmental cues (Oppenheimer, 2008; Winkielman et al., 2003). Processing of congruent cues (i.e., light scent, light colour) is generally easier compared to incongruent cues which translates to enhanced accessibility and a more positive attitude towards the concept of cleanliness (Zellner et al., 1991). In line with the previous hypothesis, the effects are predominantly expected for the *cleaned* and *fresh* dimensions of perceived cleanliness, and not for the uncluttered dimension. Leading to the following hypothesis:

H3: Congruent scent-colour interactions generate more positive perceptions of the *cleaned* and *fresh* dimensions of perceived cleanliness compared to incongruent scent-colour interactions and control conditions.

6.3 Method

6.3.1 Overview of the study

A lab experiment was conducted using a 3 (colour: light, dark, control) x 3 (scent: light, dark, control) between subjects design. This experiment aimed to examine the main and interaction effects of scent and colour on perceived cleanliness and its dimensions. It is expected that lightness (vs. darkness) of scent and colour functions as a cognitive prime of cleanliness. Congruency (vs. incongruency) between the lightness of scent and colour enhances accessibility of the concept of cleanliness and subsequently leads to more positive perceptions of cleanliness. Experimental stimuli were selected through three separate pre-tests.

6.3.2 Development of experimental stimuli

A total of three pre-tests were performed to select (light and dark) scent and colour stimuli to prime the concept of cleanliness in the main study.

Scent selection

A pre-test was conducted to identify scents that participants perceive differently with respect to their lightness, also perceived cleanliness and pleasantness of the scents were controlled for. A total of eight scents were selected, two from each of the four different scent categories: floral, fresh, woody, and oriental notes that differed with respect to their substantivity (Table 6.1). The substantivity index (Zarzo, 2013) was used as a measure to quantify the (objective) lightness of the different scents. This measure ranges from 0 to 100 (0 = low substantivity, light scent; 100 = high substantivity/heavy scent). Based on the preceding evidence it was expected that scents with a low substantivity would be perceived as lighter than scents with a high substantivity, it is also expected that lighter scents would be associated with the concept of cleanliness more often. An a priori power analysis using the software G*Power (Faul et al., 2007) calculated a minimal sample size of 27 participants to detect a medium effect size ($d = 0.50$) and a power of $1 - \beta = .80$.

In the pre-test, undergraduate students ($n = 20$) and teachers ($n = 14$) were invited to smell the different scents (female = 50%, age: $M = 30.68$, $SD = 12.69$). In line with the approach of Doucé et al. (2014) scents were presented (on a cotton ball in a small bottle, similar scent concentration) and participants were instructed to sniff the scent while completing the survey. Between successive scents participants smelled the scent of coffee grounds to restore their palettes, preventing contamination from one odour to the next (Krishna et al., 2010). The participants were instructed to report the lightness, cleanliness, and pleasantness of each scent on a 7-point semantic differential scale (1 = heavy, 7 = light; 1 = unclear, 7 = clean; 1 = unpleasant, 7 = pleasant).

Table 6.1

Substantivity index, means and standard deviations for pre-tested scents (N = 27) (0 = low substantivity, 100 = high substantivity; 1 = low perceived lightness, 7 = high perceived lightness; 1 = low perceived cleanliness, 7 = high perceived cleanliness; 1 = low pleasantness, 7 = high pleasantness)

Lightness	Scent category	Scent	Substantivity index
Light	Floral notes	Lavender	6
		Marjoram	6
	Fresh notes	Citrus	0
		Grapefruit	0
Heavy	Woody notes	Pine	49
		Vetiver	86
	Oriental notes	Sandalwood	88
		Patchouli	83

As depicted in Table 6.1, results show that citrus and sandalwood differ significantly with respect to their perceived lightness ($t(33) = 5.34, p < .001$, 95% CI [1.20, 2.68], Cohen's $d = 1.31$) and cleanliness ($t(33) = 7.68, p < .001$, 95% CI [2.63, 3.77], Cohen's $d = 2.21$) but not with respect to their perceived pleasantness ($t(33) = 1.55, p = .129$, 95% CI [-.14, 1.08], Cohen's $d = 0.35$). Vetiver was not selected (perceived as least light) because it was perceived as (significantly) less pleasant than citrus, sandalwood did not differ in this respect. On the basis of these results, citrus was selected as the lighter scent and sandalwood as the heavier scent.

Scent concentration

A separate pre-test was conducted to determine the optimal scent concentration for the main study. Separate pre-test were performed for the citrus and sandalwood scent. Each scent was diffused in the lab (45 m²) of the main study with a fragrance appliance (marketed as: 'XS stand-alone'). The appliance works according to the principle of warm evaporation (electrical). The liquid scent is heated on a metal plate and then distributed in the room by a fan. Since optimal scent concentrations cannot be measured or predicted accurately, pre-testing using human subjects in a laboratory settings is considered to be most reliable method available (Spengler et al., 2001). To avoid participants being aware of the scent (and the diffusion) during the main study, a scent intensity just above the conscious observation threshold was selected. The fragrance appliance is turned off just before the participants enter the lab, after that the intensity drops gradually. By doing so, it was assured that the scent concentration is optimal (i.e., perceived subconsciously) during the experiment.

Lightness		Cleanliness		Pleasantness	
<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
3.61	1.68	4.24	1.63	3.91	1.50
3.76	1.63	4.15	1.67	3.59	1.74
4.64	1.63	5.38	1.41	5.18	1.05
4.53	1.39	4.68	1.29	4.94	1.32
3.12	1.27	3.59	1.57	3.53	1.44
1.79	0.91	1.59	1.35	1.44	0.78
2.71	1.31	2.18	1.48	4.71	1.58
2.85	1.37	3.62	1.59	2.85	1.35

The optimal concentration was determined using the following steps: (1) for each scent, ten participants (undergraduate students) were invited into the lab (one by one), when participants entered the room, scent was distributed into the lab for ten seconds. (2) participants were asked the question: “did you notice something special in the room?” (Doucé et al., 2014), when participants responded negatively, scent concentration was increased with ten seconds. (3) Scent concentration was increased until respondents noted the scent. The average time to observe each scent was calculated and used as the optimal scent concentration in the main study. The scent concentration was set at 150 seconds for the citrus scent and 90 seconds for the sandalwood scent which appeared to be comparable to earlier results obtained by Doucé et al. (2014).

Colour selection

A final pre-test was conducted to identify colours that participants would perceive as having different lightness levels, perceived cleanliness and pleasantness were controlled for. A total of eight colours were selected that differed with respect to their hue (e.g., red, blue) and value (i.e., lightness), but not with respect to their saturation, in addition three achromatic colours (i.e., white, grey, black) were selected that only differed with respect to their value (Table 6.2). Colours were manipulated in a photo taken on a Dutch train station using Adobe Photoshop (see Appendix B). An a priori power analysis using the software G*Power (Faul et al., 2007) calculated a minimal sample size of 279 to detect a medium effect size of $f = .25$ and a power of $1-\beta = .80$.

In the pre-test, 559 members of an online customer panel of a Dutch railway company evaluated the photo of a train station (female = 54.1%, $M_{age} = 58.08$, $SD_{age} = 16.10$). Participants were randomly assigned to one of the twelve photos (eleven manipulated, one control) and instructed to study the photo. Next, the participants were invited to evaluate the (lightness of) colours, cleanliness and pleasantness of the train station on a 7-point semantic differential scale (1 = dark, 7 = light; 1 = unclean, 7 = clean; 1 = unpleasant, 7 = pleasant).

As depicted in Table 6.3, results show that the light green coloured photo ($M = 4.53$, $SD = 1.81$) was perceived as more light than the dark brown coloured photo ($M = 2.84$, $SD = 1.37$, 95% CI [1.00, 2.37], $t(84) = 4.91$, $p < .001$, Cohen's $d = 1.05$), also as more clean ($M_{lightgreen} = 4.72$, $SD_{lightgreen} = 1.59$, $M_{darkbrown} = 3.74$, $SD_{darkbrown} = 1.42$, 95% CI [.33, 1.63], $t(84) = 2.99$, $p < .05$, Cohen's $d = 0.65$), but not as more pleasant ($M_{lightgreen} = 3.17$, $SD_{lightgreen} = 1.84$, $M_{darkbrown} = 2.76$, $SD_{darkbrown} = 1.61$, 95% CI [-.337, 1.151], $t(84) = 1.08$, $p < .28$, Cohen's $d = 0.23$). Hence, light green was selected as the lighter colour and dark brown as the darker colour.

Due to the relatively high age of the sample, the pre-test was replicated with a smaller but younger sample ($N = 36$, female = 61.1%, $M_{age} = 20.45$, $SD_{age} = 2.09$). In this pre-test, undergraduate students evaluated the (lightness of) colours, cleanliness, and pleasantness of the light green ($n = 16$) and dark brown ($n = 20$) coloured photos. Replication was found for the earlier findings; light green and dark brown differed significantly with respect to their lightness ($M_{lightgreen} = 4.44$, $SD_{lightgreen} = 1.26$, $M_{darkbrown} = 3.45$, $SD_{darkbrown} = 1.46$, 95% CI [.04, 1.92], $t(34) = 2.13$, $p < .05$, Cohen's $d = 0.72$), cleanliness ($M_{lightgreen} = 4.88$, $SD_{lightgreen} = 1.14$, $M_{darkbrown} = 3.80$, $SD_{darkbrown} = 1.39$, 95% CI [.19, 1.95], $t(34) = 2.47$, $p < .05$, Cohen's $d = 0.84$) but not with respect to their perceived pleasantness ($M_{lightgreen} = 5.19$, $SD_{lightgreen} = 1.60$, $M_{darkbrown} = 4.65$, $SD_{darkbrown} = 1.26$, 95% CI [-.43, 1.50], $t(34) = 1.12$, $p = .26$, Cohen's $d = 0.37$).

Table 6.2

Hue, saturation and value for pre-tested colours (N = 559) (hue ranges from 0 to 360; 0% = low saturation [no colour], 100% = high saturation [intense colour]; 0% = low value [dark colours], 100% = high value [light colours])

Colour category	Colour	Hue	Saturation	Value
Chromatic colours	Light blue	209 ⁰	50%	80%
	Dark blue	209 ⁰	50%	20%
	Light green	108 ⁰	50%	80%
	Dark green	108 ⁰	50%	20%
	Light brown	30 ⁰	50%	80%
	Dark brown	30 ⁰	50%	20%
	Light red	0 ⁰	50%	80%
	Dark red	0 ⁰	50%	20%
Achromatic colours	White	0 ⁰	0 ⁰	100%
	Light grey	0 ⁰	0 ⁰	80%
	Dark grey	0 ⁰	0 ⁰	20%

Table 6.3

Means and standard deviations for pre-tested colours (N = 559) (1 = low perceived lightness, 7 = high perceived lightness; 1 = low perceived cleanliness, 7 = high perceived cleanliness; 1 = low pleasantness, 7 high pleasantness)

Colour category	Colour	Lightness (of colours)		Cleanliness		Pleasantness	
		M	SD	M	SD	M	SD
Chromatic colours	Light blue	3.92	1.51	4.98	1.47	3.28	1.67
	Dark blue	3.25	1.66	3.85	1.56	2.73	1.67
	Light green	4.53	1.81	5.10	1.59	3.17	1.84
	Dark green	3.54	1.41	4.47	1.58	3.04	1.73
	Light brown	3.90	1.60	4.57	1.47	3.13	1.63
	Dark brown	2.84	1.37	3.74	1.42	2.76	1.61
	Light red	3.48	1.78	4.20	1.62	3.10	1.58
	Dark red	2.85	1.32	3.94	1.14	2.75	1.38
Achromatic colours	White	2.88	1.72	3.98	1.69	2.53	1.56
	Light grey	3.60	1.78	4.35	1.57	2.79	1.61
	Dark grey	2.67	1.49	4.03	1.51	2.92	1.59



Figure 6.1
Colour manipulation, light green condition



Figure 6.2
Colour manipulation, dark brown condition



Figure 6.3

Colour manipulation, control condition (original photo)

6.3.3 Procedure and participants

For the main study, participants were invited into the research lab that was either scented (citrus or sandalwood) or unscented (no scent added). After being seated, participants received instructions and a printed photo of the train platform, photos (i.e., light green, dark brown, control) were randomly distributed (Figure 6.1, 6.2, 6.3). In the manipulated photos of the train platform, two elevator shafts were coloured using 'Adobe Photoshop'. Participants were instructed to study the photo and imagine that they were waiting on the platform for their train. Next, participants were instructed to fill out the questionnaire. While filling out the questionnaire, participants were allowed to view the picture. Prior to data collection, a minimum sample size of 158 was determined to detect a medium effect size and a power of $1-\beta=.80$.

A total of 176 undergraduate students voluntarily participated in the main study (100 female, 76 male, $M_{\text{age}} = 20.05$ years, $SD = 3.12$). Twenty train travel cards were raffled among the participants. Informed consent was obtained from all individual participants. All procedures were approved by an institutional review board.

6.3.4 Measures

The questionnaire consisted of two main constructs, a manipulation check, and demographic variables. Six items measuring the affective response were included to verify the cognitive (instead of affective) nature of priming effects.

- **Cleanliness perceptions scale** (Vos et al., 2019a): 12 items which cover the three dimensions *cleaned* (7 items: neat, clean, hygienic, well swept, well maintained, well looked after, dust-free, $\alpha = .90$), *fresh* (3 items: it smells clean, hygienic, fresh, $\alpha = .78$), and *uncluttered* (2 items: organised, orderly, Spearman Brown coefficient = .88).
- **Affective response** (Mehrabian & Russell, 1974): 6 items: happy/unhappy, pleased/annoyed, satisfied/dissatisfied, contented/melancholic, hopeful/despairing, relaxed/bored ($\alpha = .86$).
- **Manipulation check**: one item for scent (the smell in this space is light), one items for colour (the colours in the station environment are light).
- **Demographic variables**: age and gender.

6.4 Results

6.4.1 Manipulation checks

Manipulation checks were performed to verify if the manipulations for scent and colour were successful. Replication was found for the pre-test results. The citrus condition was perceived as more light ($M = 4.46$, $SD = 1.55$) than the sandalwood condition ($M = 3.64$, $SD = 1.29$, 95% CI [.28, 1.33], $t(114) = 3.05$, $p < .05$, Cohen's $d = 0.57$). Also, participants rated the light green condition as lighter ($M = 4.90$, $SD = 1.67$) than the dark brown condition ($M = 4.15$, $SD = 1.44$, 95% CI [.17, 1.31], $t(115) = 2.57$, $p < .05$, Cohen's $d = 0.48$).

6.4.2 Experimental findings

Cleanliness perceptions

The hypothesized effects of scent and colour on perceived cleanliness were examined by performing a 3 x 3 MANOVA, see Table 6.4 for exact sample sizes per condition.

For scent the MANOVA was significant (Wilks's $\Lambda = .89$, $F(6, 324) = 2.98$, $p < .05$, $\eta^2 = .052$), see Table 6.5 for an overview of the descriptive statistics. The ANOVA showed that the effect of scent on the *cleaned* dimension approached significance ($F(2, 164) = 2.61$, $p = .07$, $\eta^2 = .031$). It appeared that participants who were exposed to citrus scent, experienced the train station as more *cleaned* ($M = 4.81$, $SD = 1.19$) compared to participants exposed to the sandalwood scent ($M = 4.30$, $SD = 1.32$, $p < .05$, 95% CI[0.0784, 0.9447]). The control condition did not differ significantly from the citrus and sandalwood scented conditions. The effect of scent on the *fresh* dimension was significant ($F(1, 164) = 5.88$, $p < .05$, $\eta^2 = .067$). Participants who were exposed to citrus scent, experienced more freshness ($M = 4.81$, $SD = 1.18$) compared to participants in the control condition ($M = 4.11$, $SD = 1.18$, 95% CI[0.2858, 1.1101]) but not compared to the participants in the sandalwood condition ($M = 4.54$, $SD = 1.02$, 95% CI[-0.1452, 0.6790]). The difference between the sandalwood and control condition was significant (95% CI[0.0207, 0.8414]). Scent had no effect on the *uncluttered* dimension.

For colour the MANOVA approached significance (Wilks's $\Lambda = .92$, $F(6, 324) = 2.06$, $p = .057$, $\eta^2 = .037$), see Table 6.6 for an overview of the descriptive statistics. The univariate ANOVA's showed effects for colour on the *cleaned* dimension only ($F(2, 164) = 3.85$, $p < .05$, $\eta^2 = .045$). The green coloured station environment ($M = 4.90$, $SD = 0.82$) was perceived as more cleaned compared to the brown coloured station environment ($M = 4.30$, $SD = 1.37$, 95% CI[0.1648, 1.0273]) but not compared to the control condition ($M = 4.51$, $SD = 1.29$, 95% CI[-0.0505, 0.8158]). The brown and control condition did not differ significantly (95% CI[-0.6465, 0.2198]).

No interaction was found for the effects between scent and colour on the dimensions of perceived cleanliness (Wilks's $\Lambda = 0.91$, $F(12, 428.9) = 1.23$, $p = .25$, $\eta^2 = .029$). Based on these results, hypothesis 1 was partly confirmed and hypothesis 2 on the main effects of scent and colour on perceived cleanliness was confirmed. Lighter (vs. darker) scents positively influenced the *cleaned* and *fresh* dimensions of perceived cleanliness. Lighter (vs. darker) colours influenced the *cleaned* dimension of perceived cleanliness. The data did not support hypothesis 3 on the congruency effects of scent and colour.

Table 6.4*Sample sizes experimental conditions*

	Citrus scent	Sandalwood scent	Control (no scent added)
Light green colour	19	19	20
Dark brown colour	18	22	19
Control (no colour added)	20	19	20

Table 6.5

Means and standard deviations for dimensions of perceived cleanliness across scents (N = 176) (1 = low perceived cleanliness, 7 = high perceived cleanliness)

	Citrus		Sandalwood		Control (no scent added)	
	M	SD	M	SD	M	SD
Cleaned	4.81	1.19	4.30	1.32	4.61 *	1.29
Freshness	4.81	1.18	4.54	1.02	4.11 **	1.14
Uncluttered	5.10	1.17	5.00	1.38	5.09	0.87

Note. Means with ** and * differ significantly in the row, ** $p < 0.05$, * $p < 0.1$.

Table 6.6

Means and standard deviations for dimensions of perceived cleanliness across colours (N = 176) (1 = low perceived cleanliness, 7 = high perceived cleanliness)

	Light green		Dark brown		Control	
	M	SD	M	SD	M	SD
Cleaned	4.90	0.82	4.30	1.37	4.51 **	1.29
Freshness	4.68	1.04	4.38	1.27	4.39	1.14
Uncluttered	5.09	1.05	5.11	1.17	4.99	1.24

Note. Means with ** and * differ significantly in the row, ** $p < 0.05$, * $p < 0.1$.

Emotional responses

In a final 3 x 3 ANOVA, the effects of scent and colour were evaluated on the affective response of the participants.

The ANOVA showed that the effect of scent on the affective response was significant ($F(2, 164) = 3.86, p < .05, \eta^2 = .045$). Participants in the sandalwood scent condition ($M = 4.52, SD = 1.09$) experienced significantly more pleasure compared to participants in the control condition ($M = 4.03, SD = 0.85, p < .05, 95\% \text{ CI}[0.1283, 0.8504]$) but not compared to participants in the citrus scent condition ($M = 4.26, SD = 0.90, p = .15, 95\% \text{ CI}[-0.1025, 0.6229]$), replicating the pre-test findings. No effects were found for colour ($F(2, 164) = .63, p = .53, \eta^2 = .008$) also no interaction effects were found for scent and colour ($F(4, 164) = 0.121, p = .97, \eta^2 = .003$) on the affective response.

6.5 Discussion

6.5.1 Theoretical implications

The current study aimed to empirically explore the (congruency) effects of scent and colour on perceived cleanliness. Perceived cleanliness was operationalized using the dimensions: *cleaned*, *fresh*, and *uncluttered* (Vos et al., 2019a). Scent positively influenced the *cleaned* and *fresh* dimensions of perceived cleanliness. More specifically, lighter scents, such as citrus and grapefruit, with a lower substantivity were found to be associated with cleanliness. Colour positively influenced the *cleaned* dimension of perceived cleanliness. Colour value appeared to be an important predictor of cleanliness perceptions: lighter colours were consistently associated with the concept of cleanliness across the studies. These insights clearly add to the current knowledge base on scent, colour, and (perceived) cleanliness.

Priming offered an explanatory framework for the effects of scent and colour on perceived cleanliness. The results show that scent and colour not only function as affective primes but also as cognitive primes. Meaning that it is essential to evaluate the (nature of the) associative qualities of environmental cues. The theoretical framework of Spence (2011) appeared to be useful for interpreting these multisensory (cognitive) priming effects. Spence (2011) distinguished three types of interactions: structural (i.e., associations are innate), statistical (i.e., associations are learned through frequent exposure), and semantically mediated (i.e., associations are learned through language). Consisted with the work of Levitan et al. (2014), it was argued that most scent-colour associations are statistically or semantically mediated because they may differ across cultures. The field of environmental psychology may benefit from a more thorough discussion about the possible uses of Spence's (2011) framework. Altogether, the insights of this study clearly add to the current debate on affective and cognitive priming in the built environment (e.g., Smeets & Dijksterhuis, 2014).

In addition to the main effects of scent and colour, the aim was to explore effects of (in)congruency between scent and colour on perceived cleanliness. Unfortunately, the empirical data did not support the initial expectation that congruent cues would lead to more positive perceptions of cleanliness compared to incongruent cues. A possible explanation may be that the effect of scent was more dominant than the effect of colour. Scent was directly dispersed into the room and colour was manipulated in a photograph, moreover, compared to other cues, the sense of smell has a direct link to the hippocampus, not passing through the thalamus as happens with our other senses (including vision) (Herrmann et al., 2013; Herz & Engen, 1996; Zurawicki, 2010).

Besides the effects of scent and colour on perceived cleanliness, it was also evaluated how scent and colour influenced people's affective response. Effects were found for scent and no effects for colour. The heavy scent was perceived as more pleasurable than the control (no scent) condition but not as more pleasurable than the light scent. This finding strengthens the idea that the priming effects of scent are predominantly cognitive, instead of affective. If the effects of scent would have been affective, differences were expected to be detected between the light and heavy scents.

6.5.2 Practical implications

From a practical perspective, the research contributes to a better understanding of the effects of scent and colour on perceptions of the built environment. This study demonstrated that not just any pleasant scent has beneficial effects (on perceived cleanliness). Organisations who wish to use scent and/or colour to influence customer perceptions, should carefully select scents and/or colours that affect the desired outcomes (i.e., perceived hospitality, cleanliness). Moreover, service providers traditionally focus on actual cleanliness when improving customer perceptions of cleanliness (Vos et al., 2018b). The current study demonstrated that it is possible to influence perceived cleanliness by using other (seemingly) unrelated environmental cues, such as colour. Based on the results of this study, service providers might, for example, consider to invest in scent appliance or repainting their built environments instead in order to improve customer perceptions of cleanliness. Such interventions should always be considered in interaction with actual cleanliness; a light scent will probably have opposite effects when the built environment is unclean.

6.5.3 Limitations and future research opportunities

This present study has several limitations. The sample of the main study consisted of students. Future research might consider using non-student samples. Nevertheless, it is expected that results are robust, since comparable studies relied on student samples as well (e.g., Doucé et al., 2014). Also, the results of the colour selection pre-test (with a more representative sample) were replicated by the manipulation check of the main study. As pointed out by Spangenberg et al. (1996), using students as participants mainly poses problems when their knowledge on the research performed differs significantly from the general population.

The current study was performed in a lab setting. The main advantage of testing the effect of colour and scent in a lab setting is that most other environmental cues (e.g., setting, furniture) can be controlled during the experiment. Although, manipulating multisensory cues in a lab setting has been shown to be ecological valid (Bateson & Hui, 1992; Roschk et al., 2017), other scholars might consider performing the current study in a field setting as well.

Other scholars in environmental psychology are invited to further explore the effects of cue-incongruency. Current research mainly focusses on creating environments that are congruent. Yet, many (if not: most) environments function with one or multiple inconsistencies. Environmental psychology literature and practice will greatly benefit from a more thorough understanding of how 'bad' incongruency actually is.

It is also stressed that the influence of perceived cleanliness in the built environment is underestimated and deserves more attention in future research. Traditionally, cleanliness has been considered as a hygiene factor (Brown et al., 1991; Vilnai-Yavetz & Gilboa, 2010). Scholars are encouraged to move beyond this rather limited view and perform more studies on perceived cleanliness to find out how environments can be created that are not only clean but also perceived as clean.

In brief - chapter 6

Chapter 5 demonstrated that perceived cleanliness can be influenced by the physical presence of cleaning staff. Similarly, Chapter 6 showed effects for lighter scent and colours on the cleaned and fresh dimensions of perceived cleanliness in a train station. Besides these main effects, interaction effects between scent and colour were expected on perceived cleanliness as a result of congruency between the environmental cues. Unfortunately, no congruency effects were found in this experiment.

The findings of the first two experimental chapters showed that environmental cues can be used to influence perceived cleanliness. Also, evidence was presented for priming as one of the mechanisms involved.

In the following and final empirical chapter the *cleaned*, *fresh*, and *uncluttered* dimension of perceived cleanliness are central. It is examined if architectural clutter and scent can be used to influence perceived cleanliness in a train station.

Chapter 7

Cleaned, fresh, and
uncluttered: the role of
scent and architectural clutter

7.1 Introduction

Research supports the finding that customers' perceptions about cleanliness strongly influence their perception and behaviour in numerous settings (Vos et al., 2018a). In different service environments, cleanliness perceptions have been shown to impact overall customer satisfaction, perceived service quality, and revisit intentions in restaurants, hotels, airplanes, and train stations (e.g., Baker et al., 2020; Barber & Scarcelli, 2010; Moon et al., 2017; Park & Almanza, 2020; Pizam & Tasci, 2019). In public environments, perceived cleanliness has been shown to negatively influence security perceptions (Amblee, 2015), willingness to ride a taxi (Vilnai-Yavetz & Gilboa, 2010), and littering behaviours (Dur & Vollaard, 2015). Although most solutions to positively influence perceived cleanliness focus on improving cleaning services, especially during and immediately after the COVID-19 pandemic, it has been increasingly recognized that other environmental cues such as architectural design and scent can be utilized as well (Vos et al., 2018a; Whitehead et al., 2007).

Research on environmental cues that complement cleaning services by positively influencing perceived cleanliness, has been dominated by scent (Vos et al., 2018a). It is well known that scents may be used to prime the concept of cleanliness through affective and cognitive processes (Bosmans, 2006; Cupchik et al., 2005; Morrin, 2011). In this context, priming means that pleasant scents generally lead to more affective reactions, which decrease the intensity of environmental annoyances, such as uncleanliness (Herz, 2007). Besides this affective process, scents may also be used to activate semantic and episodic knowledge in the brain (Degel et al., 2001). Exposure to the smell of citrus or pine may activate general associations to the concept of cleanliness or more specific associations with a cleaning detergent or cleaning activities in specific places, such as one's parental house or favourite restaurant (Holland et al., 2005). Such associations do not necessarily result in more positive perceptions of cleanliness; the match or congruence between scent and other environmental cues is crucial, according to Bosman (2006).

Doucé et al. (2014) evaluated the effects of the valence (i.e., pleasantness) match between scent and messiness (i.e., unfolded versus folded clothes) on store evaluations. The results of this study showed that incongruence between scent and messiness (i.e., lemon tangerine scent - messy store) had a more negative impact on store evaluations compared to the congruent (i.e., lemon tangerine - tidy store) and control conditions (no scent - messy store). Demonstrating that (in)congruency between environmental cues matters and should be taken into consideration when measuring scent in service environments (Mari & Poggese, 2013). The study of Doucé et al. (2014)

was followed by examining the congruency effects of scent and architectural clutter. In this study, architectural clutter was defined as the organisation and congestion of architectural features which increases with the number of features and their variance (Olivia et al., 2004; Pieters et al., 2007). Compared to messiness, architectural clutter is less temporary and may make a stronger suggestion of incompetence and poor (cleaning) service (Bitner, 1990). Hence, this study examines the effect of scent in combination with different degrees of architectural clutter in service environments.

This research will take place in the context of public transport for two main reasons. Firstly, cleanliness carries special relevance in public transport. As one of the key predictors of overall service quality it is a critical measure for public transport organisations (e.g., Beck & Rose, 2016; Cascetta & Cartenì, 2014; Eboli et al., 2018). Secondly, the context of public transport, and more specifically of train stations, are known for the ubiquity of architectural clutter not only having impact on perceived cleanliness, but also on security perceptions and the willingness to use public transport (Mand et al., 2017).

7.2 Theoretical framework

As a key concept in the current study, perceived cleanliness was operationalized using the cleanliness perceptions scale and its dimensions: *cleaned*, *fresh*, and *uncluttered* (Vos, Galetzka, Mobach, Van Hagen, & Pruyn, 2019a). The dimensions represent different aspects of perceived cleanliness and also cover environmental cues that are not directly related to the cleaning process. For example, the mere physical presence of cleaning staff is probably related to the *cleaned* dimension and does not influence the *fresh* and *uncluttered* dimensions of perceived cleanliness. In the upcoming paragraphs it will be discussed how scent and architectural clutter may be used to prime these dimensions.

7.2.1 Olfactory priming effects

Literature on olfactory priming effects and cleanliness mainly relies on cognitive (semantic) priming techniques. During the exposure to such semantical scented primes, mental representations related to the prime are activated and made more accessible (Schneider & Shiffrin, 1977). This accessibility spreads to related constructs via an associative network (Anderson, 1983; Collins & Loftus, 1975). Empirical evidence for semantic olfactory priming effects was provided in a study where exposure to a cleaning-agent scent (i.e., citrus) prompted subjects to express more cleaning behaviour compared to the no scent condition (Holland et al., 2005). Similarly, De Lange et al. (2012) demonstrated that subjects are less likely to litter in a citrus scented train compartment than in a train compartment without scent. The authors in both studies claim that citrus scent activates a cleaning concept based on a past learned association of the scent with cleaning, resulting in an increased likelihood of cleaning related behaviour. Given this evidence, it could be argued that scent can be used to prime the concept of cleanliness and influence perceived cleanliness through a cognitive priming process. Previous studies mainly relied on this cognitive process and largely ignored the affective priming process. To further the discussion on this matter, four scents are distinguished that are either related to the concept of cleanliness or not, and are either pleasant or unpleasant. The scents related to the concept of cleanliness are expected to have a more positive effect on perceived cleanliness compared to scents not related to cleanliness. More specifically, effects of these clean scents are predominantly expected for the *cleaned* and *fresh* dimensions of perceived cleanliness. Clean scents contribute to a clean and *fresh* feeling that one normally experiences when a service environment has been *cleaned*. Leading to the following hypothesis:

H1: Scents that prime the concept of cleanliness lead to more positive perceptions of cleanliness as compared to similar scents that do not prime cleanliness.

7.2.2 Visual (architectural) priming effects

Architectural clutter has been defined by the number and the variance (or structure) of architectural features (Olivia et al., 2014; Pieters et al., 2007; Rogers & Hart, 2021; Rosenholtz et al., 2005). An increasing number of architectural features generally decreases the salience of individual features due to increased crowding and diminished ability for visual grouping (i.e., making sense of an environment). However, architectural clutter is not solely defined by quantity, the variance and more specific (dis)similarity of features matters as well. For example, an architectural design containing many features may be perceived as uncluttered due to symmetry and similarity between features through matching colours or surface styles (Feldman 1997; Gilboa & Rafaeli, 2003; Van der Helm, 2000). In previous research, architectural clutter has been used interchangeably with the concepts of messiness and visual complexity, despite of substantial conceptual and operational differences (Orth & Wirtz, 2014). Like architectural clutter, messiness refers to the number and variance of objects but mainly covers movable objects, such as documents (Bitner, 1990), food products (Gupta & Coskun, 2021), and clothing (Doucé et al., 2014). Whereas architectural clutter mainly includes immovable objects or features. Visual complexity shares some characteristics with architectural clutter but is generally considered to be more comprehensive. Together with concepts such as openness and symmetry, (architectural) clutter was identified as a key driver of visual complexity (Olivia et al., 2004).

In service environments, architectural clutter may be approached from an instrumental, aesthetic, and symbolic perspective (Rafaeli & Vilnai-Yavetz, 2004; Vilnai-Yavetz & Rafaeli, 2011). Firstly, the presence or absence of architectural clutter has instrumental, practical importance: uncluttered environments are presumed to support the primary service process, for example, by enhancing wayfinding (Leddy, 1995). Secondly, the concept of architectural clutter may be approached from an aesthetic perspective: an uncluttered service environment is pleasing to the eye, whereas a cluttered one will be perceived as ugly or unpleasant (Vilnai-Yavetz & Rafaeli, 2011). Along these lines, Leddy (1995) suggests that clutteredness (and also cleanliness) should be considered as aesthetic qualities (e.g., 'cluttered space', 'clean lines') in design. In this perspective, architectural clutter serves as an affective prime that triggers an overall affective reaction that subsequently influences outcomes, such as pleasure and aesthetic appreciation. Thirdly, architectural clutter can also serve as a cognitive 'symbolic' prime, in that uncluttered or cluttered service

environments convey values and elicit associations. For instance, Bitner (1990) showed that an organized travel agency was evaluated as more pleasant, beautiful, organized, above average, neat, high quality, well kept, professional, calming, and efficient than a disorganized travel agency (i.e., messy, unclean, cluttered desk). Inspired by the findings in this area, the idea that architectural clutter can be used to prime the concept of cleanliness and influence perceived cleanliness through affective and semantic (cognitive) processes is explored. The expectations were twofold. Firstly, it is expected that uncluttered environments trigger an overall affective response and higher levels of pleasure compared to cluttered environments since customers prefer uncluttered service settings over cluttered ones (Baker et al., 2002). Secondly, it is expected that uncluttered service environments prime cleanliness associations and subsequently lead to more positive perceptions of cleanliness. More specifically, it is expected that uncluttered environments have a positive effect on the *cleaned* and *uncluttered* dimensions and not on the *fresh* dimension when compared to cluttered environments. Leading to the following hypothesis:

H2: An uncluttered service environment will lead to (a) more positive affective responses and (b) more positive perceptions of cleanliness when compared to cluttered environments.

7.2.3 Multisensory congruence

The impact of service environments on customers cannot really be understood on a 'sense-by-sense' basis. Our spatial surroundings and related perceptions are, by nature, multisensory (Spence et al., 2014). In this context, Bitner (1992) refers to a holistic environment. For decades, researchers in the area of multisensory research have been interested in how multiple cues interact and may complement each other and has a long tradition (e.g., Jespersion, 1922; Wertheimer, 1958). This phenomenon has been defined as multisensory congruence (Mari & Poggese, 2013). Multisensory congruence is about the match rather than the mismatch between two environmental cues. Research shows that congruent (vs. incongruent) cue-combinations positively influence customer evaluations and responses (e.g., Cheng et al., 2009; Imschloss & Kuehnl, 2017; Morrison et al., 2011). Generally, congruence occurs as a result of matching affective or cognitive cue-dimensions (Doucé et al., 2014). Affective congruence (also: valence match), in this case, refers to a match between the affective tone of scent (pleasant, unpleasant) and architectural clutter (cluttered or uncluttered environment). Cognitive congruence addresses the match between the associative qualities of scent (related to the concept of cleanliness) and architectural clutter (uncluttered [clean] environment).

As previously noted, scent and architectural clutter can function as implicit affective primes, meaning that scent and architectural clutter may have a positive effect on customer evaluations without evoking conscious feelings of pleasure (Friedman & Förster, 2010). However, a pleasant scent or architectural uncluttered environment does not per definition lead to more positive evaluations. The cues are interdependent, meaning that the reaction to a pleasant scent may depend on the valence (i.e., affective tone) of the physical environment, including architectural clutter (Fazio, 2001). The positive effects of matching affective tones (i.e., pleasant scent, [pleasant] uncluttered environment) on customer evaluations are often interpreted from a fluency perspective (De Bock et al., 2013; Schwarz, 2004). Processing fluency refers to the experienced ease of processing environmental cues; the paradigm suggests that the ease with which a person can process incoming information is concerned primarily with the cue form (Oppenheimer, 2008; Reber et al., 2004). Consistent with this theory, affective congruence leads to a positive affective state in customers which is misattributed to (the cleanliness of) the service environment rather than to the ease of processing (Winkielman et al., 2003). In this line, it is expected that pleasant scents have a more positive effect on perceived cleanliness in uncluttered than cluttered service environments. In addition, it is hypothesized that pleasant scents as compared to unpleasant scents have a more positive effect on perceived cleanliness in uncluttered service environments. Effects are expected for all dimensions of perceived cleanliness as scent is primarily related to the *cleaned* and *fresh* dimensions of perceived cleanliness and architectural clutter to the *cleaned* and *uncluttered* dimensions. Leading to the following hypothesis:

H3: Affective congruency between a pleasant scent and an uncluttered environment will result in more positive perceptions of cleanliness than in affectively incongruent service environments.

Besides the affective effects, scent may also function as a cognitive primer that activates knowledge related to the concept of cleanliness (e.g., cleaning activities, cleaning detergent) and causes customers to be more sensitive to subsequent environmental elements that fit with the activated information (e.g., Holland et al., 2005). Thus, if one unconsciously perceives a clean scent, knowledge related to cleanliness will become more easily accessible and will result in a different response to the subsequent encounter of cues related to the concept of cleanliness (Doucé et al., 2014). As uncluttered environments will be associated with the concept of cleanliness as well (Bitner, 1990; Leddy, 1995), customers experience processing fluency as a result of cognitive congruence between scent and architectural clutter (clean scent, uncluttered environment). The expectations for cognitive priming

effects of scent and architectural clutter are twofold. Firstly, it is expected clean scents to have a more positive effect on perceived cleanliness in uncluttered than cluttered environments. Secondly, as a result of congruence between clean scents and uncluttered environments, it is expected that clean scents have a more positive effect in uncluttered environments compared to scents not associated to the concept of cleanliness. In line with the previous hypothesis, effects of cognitive congruency are expected for all dimensions of perceived cleanliness as scent is primarily related to the *cleaned* and *fresh* dimensions and architectural clutter to the *uncluttered* dimension.

H4: Cognitive congruency between a(n) (un)pleasant scent related to the concept of cleanliness and an uncluttered environment will result in more positive perceptions of cleanliness than in cognitively incongruent service environments.

For the cluttered environment one may argue that the pleasant scent related to the concept of cleanliness (i.e., citrus) has two possible outcomes. On one hand, the citrus scent makes customers more likely to notice the clutter, as citrus evokes an expectation of a neat and well-organized environment, not meeting these expectations may negatively influence perceived cleanliness (Oliver, 1980). On the other hand, exposure to the citrus scent activates the concept of cleanliness and gives the impression that the environment has been cleaned recently, leading customers to think the environment is not so cluttered after all. As Doucé et al. (2014) presented compelling evidence for the latter outcome, the following hypothesis was formulated, in line with the previous hypotheses, effects are expected for all three dimensions of perceived cleanliness:

H5: In a cluttered environment, (un)pleasant scents related to cleanliness will lead to more positive perceptions of cleanliness than (un)pleasant scents not related to cleanliness.

7.3 Pre-tests

7.3.1 Scent selection

The aim of this pre-test was to select four scents (out of eight), differing with respect to their pleasantness (pleasant/unpleasant) and cleanliness association (related to cleanliness, not related to cleanliness). Based on previous research (i.e., Doucé et al., 2013; Doucé et al., 2014; Rolls et al., 2003) two scents were selected for each experimental condition (Table 7.1). An a priori power analysis using the software G*Power (Faul et al., 2007) calculated a minimal sample size of 27 participants to detect a medium effect size ($d = 0.50$) and a power of $1 - \beta = .80$. A total of 30 waiting passengers on Utrecht Central Station (female = 43.3%, age: $M = 41.57$, $SD = 12.70$) were randomly approached and invited to evaluate the eight scents. The participants were instructed to mention spontaneous associations, and evaluate the cleanliness and pleasantness of each scent on a 7-point semantic differential scale (1 = unclean, 7 = clean; 1 = unpleasant, 7 = pleasant). The scents marked with an asterisk were selected for the main study (Table 7.1). When comparing the scents related (citrus vs. Dettol) and not related to cleanliness (anise vs. hexanoic acid), results show that these scents only differ with respect to their pleasantness ($t(29) = 4.49$, $p < .001$, 95% CI [0.89, 2.37], Cohen's $d = 1.51$; $t(29) = 4.00$, $p < .001$, 95% CI [0.75, 2.31], Cohen's $d = 1.19$), but not with respect to their perceived cleanliness ($t(29) = 0.43$, $p = .666$, 95% CI [-0.75, 0.49], Cohen's $d = 0.01$; $t(29) = 1.37$, $p = 0.181$, 95% CI [-1.32, 0.26], Cohen's $d = 0.35$). Similarly, the pleasant (citrus vs. anise) and unpleasant scents (Dettol vs. hexanoic acid), only differ with respect to their perceived cleanliness ($t(29) = 7.48$, $p < .001$, 95% CI [1.69, 2.97], Cohen's $d = 1.74$; $t(29) = 9.93$, $p < .001$, 95% CI [2.17, 3.29], Cohen's $d = 2.04$), but not with respect to their pleasantness ($t(29) = 0.69$, $p = .496$, 95% CI [-0.52, 1.05], Cohen's $d = 0.17$; $t(29) = 0.45$, $p < .654$, 95% CI [-0.92, 0.58], Cohen's $d = 0.11$). Hence, citrus, Dettol, anise, and hexanoic acid were selected.

7.3.2 Architectural clutter

In the main study, architectural clutter was manipulated by wrapping a waiting room with photo foils. Foils were applied to the inner side of the waiting room, immersing waiting passengers into a (photo of a) train platform that was either architecturally cluttered or uncluttered. Photos were selected in a two-step process. In the first step participants evaluated architectural clutter of eight train stations. In the second step, the most uncluttered station was taken, three cluttered versions of this station were created by using elements (i.e., roof, interior elements, floor) of the most cluttered station. The original photo and three manipulated photos were evaluated by (new) participants.

Table 7.1

Means and standard deviations for pre-tested scents (N = 30) (1 = low perceived cleanliness, 7 = high perceived cleanliness; 1 = low pleasantness, 7 = high pleasantness; scents marked with asterisk [] were selected)*

Type of scent	Scent	Evaluation of cleanliness		Evaluation of pleasantness	
		M	SD	M	SD
Pleasant scent related to cleanliness	Citrus*	5.33	1.39	4.60	1.52
	Water lily	4.33	1.47	4.40	1.47
Unpleasant scent related to cleanliness	Dettol*	5.22	0.92	2.97	1.18
	Pine	3.43	1.83	2.72	1.38
Pleasant scent unrelated to cleanliness	Anise*	2.87	1.28	4.33	1.47
	Sandalwood	3.53	1.30	4.63	1.75
Unpleasant scent unrelated to cleanliness	Hexanoic acid (musty smell)*	2.47	1.65	2.80	1.62
	Vetiver	2.27	1.41	1.47	0.81

First step: comparing and selecting train stations

The four highest (M ranging from 7.25 to 7.87 on 10-point scale) and four lowest scoring train stations (M ranging from 5.79 to 6.42 on 10-point scale) were selected in an annual customer satisfaction research of a Dutch railway operator ($N = 83,815$). Identical photos were made on the platform of the train stations. A total of 492 members of an online customer panel of a Dutch railway company evaluated the photos (female = 47.7%, $M_{age} = 56.20$, $SD_{age} = 16.77$). Participants were randomly assigned to one of the eight photos and instructed to study the photo. Next, the participants evaluated the clutteredness (Vos et al., 2019a), environmental quality (Fisher, 1974) and pleasantness (Mehrabian & Russell, 1974) of the train stations' platform. Measures of environmental quality and pleasure were included as control variables. As depicted in Table 7.2, Rotterdam Centraal and Almere Centrum differ with respect to their clutteredness (95% CI[-1.116, -.324], $F(1, 136) = 12.91$, $p < .001$, $\eta^2 = .087$) but not with respect to their environmental quality (95% CI[-.804, .156], $F(1, 136) = 1.78$, $p = .184$, $\eta^2 = .013$) and pleasantness (95% CI[-.908, .039], $F(1, 136) = 3.28$, $p = .072$, $\eta^2 = .024$).

Table 7.2

Means, standard deviations and sample sizes for pre-tested photos (N = 492) (1 = high perceived clutteredness, 7 = low perceived clutteredness; 1 = low perceived environmental quality, 7 = high perceived environmental quality; 1 = low pleasantness, 7 high pleasantness)

Train station	N	Clutteredness		Environmental quality		Pleasure	
		M	SD	M	SD	M	SD
Rotterdam Centraal	64	5.72	0.75	3.79	1.57	3.78	1.44
Arnhem Centraal	55	5.51	0.97	4.50	1.18	4.36	1.08
Utrecht Centraal	52	5.43	0.88	3.69	1.49	3.61	1.43
Amersfoort	60	5.13	0.83	3.30	1.06	3.57	1.28
Ede-Wageningen	58	5.08	1.00	3.35	1.21	3.39	1.41
Zaandam	56	5.51	1.25	3.73	1.53	3.66	1.53
Almere Centrum	74	5.00	1.35	3.47	1.27	3.34	1.37
Arnhem Velperpoort	73	4.48	1.26	2.55	1.40	2.58	1.23

Second step: creating and evaluating stimulus material

Since the hypotheses were tested through an experimental design, two photos were used that only differed with respect to their degree of architectural clutter and were otherwise identical. The photo of Rotterdam Centraal (Figure 7.1) was used as the uncluttered condition, three cluttered conditions were created by adding architectural elements of Almere centrum (Figure 7.5) to the photo of Rotterdam Centraal. The first version (Figure 7.2) contains station Rotterdam Centraal with the roof of Almere Centrum, the second version (Figure 7.3) contains the roof and interior elements (i.e., vending machine, transparent wall, art piece), and the third version (Figure 7.4) contains the roof, interior elements, and flooring of Almere Centrum. A total of 303 members of an online customer panel of a Dutch railway company evaluated the original and three manipulated photos of Rotterdam Centraal (female = 52.5%, $M_{age} = 53.89$, $SD_{age} = 16.57$). Participants were randomly assigned to one of the four photos (Figure 7.1, 7.2, 7.3, 7.4) and instructed to study the photo. Through a similar procedure as in the previous pre-test, participants evaluated the clutteredness (Vos et al., 2019a) of the different platforms. Results show (Table 7.3) that the original version of the photo was rated as significantly less cluttered than the first (95% CI[.113, .877], $F(1, 133) = 6.56$, $p < .05$, $\eta^2 = .047$) and second version of the photo (95% CI[.311, 1.006], $F(1, 146) = 14.01$, $p < .001$, $\eta^2 = .088$). No significant differences were found between the original photo and the third version of the manipulated photo (95% CI[-.168, .500], $F(1, 148) = 0.964$, $p = .328$, $\eta^2 = .006$). Hence, the original photo of Rotterdam Central (Figure 7.1) was used as the uncluttered condition and version 2 (Figure 7.3) as the cluttered condition in the main study.



Figure 7.1
Original photo of the built environment of Rotterdam Central



Figure 7.2
Version 1, photo Rotterdam Centraal with roof construction of Almere Centrum



Figure 7.3

Version 2, photo Rotterdam Centraal with roof construction and interior elements of Almere Centrum



Figure 7.4

Version 3, photo Rotterdam Centraal with roof construction, interior elements, and flooring of Almere Centrum



Figure 7.5
Original photo of the built environment of Almere Centrum

Table 7.3
Description of photo manipulations, sample size, means, and standard deviations for pre-tested photos (1 = high perceived clutteredness, 7 = low perceived clutteredness)

Train station	Manipulations	N	Clutteredness	
			M	SD
Rotterdam Centraal (Figure 7.1)	None, original photo	65	5.73	0.89
Version 1 (Figure 7.2)	Roof construction of Almere Centrum	70	5.23	1.29
Version 2 (Figure 7.3)	Roof construction, interior elements of Almere Centrum	83	5.07	1.17
Version 3 (Figure 7.4)	Roof construction, interior elements, and flooring of Almere Centrum	85	5.56	1.15

7.4 Method main study

A 4 (scent: pleasant related to cleanliness, unpleasant related to cleanliness, pleasant unrelated to cleanliness, unpleasant unrelated to cleanliness) x 3 (clutteredness: uncluttered condition, cluttered condition, control condition) between subjects design was used to test the before mentioned hypotheses in a field setting.

7.4.1 Procedure and participants

The field experiment has taken place on twelve weekdays in January and February 2020 between 09:00h and 17:00h in a waiting room on Arnhem Central station (i.e., 8.40 * 3.56 meter, Figure 7.6). The scents were diffused in the waiting room with an 'XS stand-alone' fragrance appliance device marketed by 'Sense company'. The appliance works according to the principle of warm evaporation. To prevent the different scents from mixing, a different scent was tested each day. Effects of clutter were tested by applying an uncluttered (Figure 7.1) and cluttered (Figure 7.4) photo to the walls of the waiting room by using foils (Figure 7.7, 7.8), marketed and applied by 'Fleetshield'. In the control condition, a blank foil (without photo) was applied to the walls at eye level (Figure 7.9). Waiting train passengers were approached and invited to evaluate their experience of the waiting room through a questionnaire. Prior to data collection, a minimum total sample size of 341 was determined to detect a medium effect size and a power of $1 - \beta = .80$.

The total sample of the main study consisted of 638 train passengers (391 female, 241 male, 6 other, $M_{\text{age}} = 42.15$ years, $SD = 24.63$), which were evenly distributed over the experimental conditions and included frequent and infrequent train passengers (Table 7.4). In exchange for participation, participants received a coffee voucher (i.e., €2.20) after completing the questionnaire. All procedures were approved by an institutional review board.

7.4.2 Measures

The questionnaire consisted of two main constructs, a manipulation check, and demographic variables. Six items measuring the affective response were added to verify the cognitive (instead of affective) nature of priming effects.

- **Cleanliness perceptions scale** (Vos et al., 2019a): 12 items which cover the three dimensions *cleaned* (7 items: neat, clean, hygienic, well swept, well maintained, well looked after, dust-free, $\alpha = .92$), *fresh* (3 items: it smells clean, hygienic, fresh, $\alpha = .95$), and *uncluttered* (2 items: organised, orderly, Spearman Brown coefficient = .88).

- **Affective response** (Mehrabian & Russell, 1974): 6 items: happy/unhappy, pleased/annoyed, satisfied/dissatisfied, contented/melancholic, hopeful/despairing, relaxed/bored ($\alpha = .93$).
- **Processing fluency** (Graf et al., 2017): five items: easy/difficult, disfluent/fluent, incomprehensible/comprehensible, unclear/clear, effortful/effortless ($\alpha = .91$).
- **Manipulation check:** two items for scent (this space smells clean, this space smells pleasant), one item for architectural clutter (the photo foil on the wall looks cluttered).
- **Demographic variables:** age, gender, and visiting frequency.



Figure 7.6

Photo of waiting room on Arnhem Centraal



Figure 7.7

Photo of waiting room on Arnhem Centraal with uncluttered foil applied to the wall



Figure 7.8

Photo of waiting room on Arnhem Centraal with cluttered foil applied to the wall



Figure 7.9
Photo of waiting room on Arnhem Centraal with blank (control) foil applied to the wall

Table 7.4
Sample size for each experimental condition

	Uncluttered environment	Cluttered environment	Control
Citrus (pleasant scent related to cleanliness)	53	52	55
Dettol (unpleasant scent related to cleanliness)	61	52	50
Anise (pleasant scent unrelated to cleanliness)	56	55	54
Hexanoic acid (unpleasant scent unrelated to cleanliness)	50	50	50

7.5 Results main study

7.5.1 Manipulation checks

To verify if the intended manipulations for scent and clutter were successful, a manipulation check was performed. The pleasant scents (i.e., citrus, anise) were perceived as more pleasant ($M = 4.78$, $SD = 1.55$) than the unpleasant scents ($M = 3.92$, $SD = 1.51$, $F(1, 625) = 49.33$, $p < .001$; $\eta^2 = 0.07$; 95% CI [0.62, 1.10]), also the scents related to cleanliness (i.e., citrus, Dettol) were perceived as more clean ($M = 5.40$, $SD = 1.21$) compared to the scents not related to cleanliness scents ($M = 4.72$, $SD = 1.50$; $F(1, 629) = 38.62$, $p < .001$; $\eta^2 = 0.05$; 95% CI [0.46, 0.89]). Moreover, it was demonstrated that the uncluttered foil was perceived as less cluttered ($M = 2.76$, $SD = 1.46$; reverse code item) than the cluttered foil ($M = 3.82$, $SD = 2.02$, $F(1, 408) = 37.40$, $p < .001$; $\eta^2 = 0.08$; 95% CI [-1.41, -0.72]). Also, after filling out the survey a small sub-sample ($n = 17$) were randomly approached across experimental conditions to verify if participants felt emerged in the cluttered or uncluttered train station (printed on the foil). This was done through short interviews (i.e., how would you describe your view at the moment?). The expectations were confirmed: the majority of the participants felt emerged in the train station on the foil and also concepts related to clutteredness (i.e., messy, littery, untidy) were more often mentioned by participants exposed to the cluttered foil.

7.5.2 Cleanliness perceptions

A two way (4×3) MANOVA with scent and architectural clutter as fixed factors and the three dimensions of perceived cleanliness (i.e., *cleaned*, *fresh*, *uncluttered*) as dependent variables was conducted to examine the hypothesized effects. A significant main effect was found for scent (Wilks's $\Lambda = .81$, $F(9, 1448.224) = 14.51$, $p < .001$, $\eta^2 = .06$). More specifically, univariate ANOVA's revealed that scent had a significant effect on the *cleaned* ($F(3, 597) = 25.37$, $p < .001$, $\eta^2 = .11$) and *fresh* dimensions ($F(3, 597) = 30.74$, $p < .001$, $\eta^2 = .13$) of perceived cleanliness; no significant effects were found for the *uncluttered* dimension. The MANOVA showed a significant main effect for architectural clutter and more specifically for the *cleaned* ($F(2, 597) = 11.62$, $p < .001$, $\eta^2 = .03$) and *uncluttered* dimensions ($F(2, 597) = 16.43$, $p < .001$, $\eta^2 = .05$), no effects were found for the *fresh* dimension. Both the MANOVA and ANOVA showed no significant interaction effect between scent and architectural clutter.

Next, the hypotheses were evaluated by exploring simple effects. Data partly supported **H1** on the main effect of scent on perceived cleanliness (Table 7.5). Citrus and Dettol resulted in significantly more positive perceptions of the *cleaned* dimension as compared

to anise and hexanoic acid. Similarly, citrus and Dettol lead to more positive perceptions of the *fresh* dimension compared to hexanoic acid. However, the perceptions of the *fresh* dimension for citrus and Dettol were not significantly different from anise.

Following **H2b** uncluttered environments would have a more positive effect on the *cleaned* and *uncluttered* dimensions of perceived cleanliness compared to cluttered environments. This hypothesis was supported by the data (Table 7.6). The uncluttered environment resulted in more positive perceptions of the *cleaned* and *uncluttered* dimensions of perceived cleanliness compared to the cluttered service environment. As expected, no meaningful effects were found for the *fresh* dimension.

Next, **H3** was evaluated stating that affective congruency between a pleasant scent and uncluttered environment resulted in more positive perceptions of cleanliness compared to affectively incongruent service environments (Table 7.7). With this hypothesis it was evaluated if (a) a pleasant scent (i.e., anise) would result in more positive perceptions of cleanliness in uncluttered as compared to cluttered service environments and (b) if this pleasant scent would result in more positive perceptions of cleanliness compared to an unpleasant scent (i.e., hexanoic acid), both in uncluttered service environments. The hypothesis was partly supported, it appeared that (a) the pleasant scent resulted in more positive perceptions of *uncluttered* dimension of perceived cleanliness in uncluttered compared to the cluttered condition. In contrast to the expectations, no differences were found for the *cleaned* and *fresh* dimensions. Moreover, it was found that (b) the pleasant scent was associated with more positive perceptions of the *cleaned* and *fresh* dimensions of perceived cleanliness compared to the unpleasant scent (i.e., hexanoic acid). No differences were found for the cluttered dimension.

With **H4** the cognitive congruence effects between scent and architectural clutter were evaluated (Table 7.7). H4 suggests that (a) exposure to clean scents (i.e., citrus and Dettol) would result in more positive perceptions of all dimensions of perceived cleanliness in uncluttered as compared to cluttered service environments. Also, (b) it was expected clean scents to have a more positive effect on all dimensions of perceived cleanliness in uncluttered environments compared to scents not associated to the concept of cleanliness. Data largely supported H4, (a) citrus and Dettol scent were associated with more positive perceptions of the *cleaned*, *fresh* and *uncluttered* dimensions in the uncluttered compared to the cluttered environment. Moreover, (b) in the uncluttered environment citrus and Dettol scent were associated with more positive perceptions of the *cleaned* and *fresh* dimensions compared to the anise and Hexanoic acid scent. No meaningful differences were found for the cluttered dimension.

Following **H5** scents related to cleanliness (i.e., citrus and Dettol) in cluttered environments would lead to more positive perceptions of all dimensions of perceived cleanliness compared to scents not related to cleanliness (i.e., anise, hexanoic acid). H5 was partly confirmed, in the cluttered environment, citrus and Dettol did not result in more positive perceptions of the *cleaned*, *fresh* and *uncluttered* dimensions compared to Anise. However, citrus and Dettol were associated with more positive perceptions of the *cleaned* and *fresh* dimensions as compared to hexanoic acid scent. No differences were found for the *uncluttered* dimension.

Table 7.5

Means and standard deviations for dimensions of perceived cleanliness across scent conditions (1 = low perceived cleanliness, 7 = high perceived cleanliness)

		Cleaned	Fresh	Uncluttered
	<i>Sample size</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Citrus	150	5.36 (0.99) A	5.36 (1.14) A	5.38 (1.03)
Dettol	156	5.46 (0.90) A	5.45 (1.12) A	5.53 (1.04)
Anise	156	5.08 (0.92) B	5.09 (1.27) A	5.41 (1.05)
Hexanoic acid	147	4.55 (1.10) C	4.20 (1.41) B	5.22 (1.04)

Note. Different letters indicate significant differences in the column (ANOVA, $p < .05$)

Table 7.6

Means and standard deviations for dimensions of perceived cleanliness across architectural clutter conditions (1 = low perceived cleanliness, 7 = high perceived cleanliness)

		Cleaned	Fresh	Uncluttered
	<i>Sample size</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Uncluttered	212	5.39 (0.92) A	5.19 (1.36)	5.70 (1.07) A
Cluttered	204	4.99 (1.12) B	4.92 (1.27)	5.08 (1.07) B
Control	206	4.99 (1.02) B	4.97 (1.34)	5.40 (0.95) AB

Note. Different letters indicate significant differences in the column (ANOVA, $p < .05$).

7.5.3 Affective responses

A two way (4 x 3) ANOVA with scent and architectural clutter as fixed factors and affective response as the dependent variable was conducted. Significant main effects were found for scent ($F(3, 605) = 7.98, p < .001, \eta^2 = .03$) and architectural clutter ($F(2, 605) = 8.03, p < .001, \eta^2 = .02$). The interaction between scent and architectural clutter was found to be marginally significant ($F(6, 605) = 1.95, p = .07, \eta^2 = .01$). The hypothesis on the affective response of participants was tested by exploring simple effects.

Table 7.7

Means and standard deviations for dimensions of perceived cleanliness across scent and architectural clutter conditions (N = 624) (1 = low perceived cleanliness, 7 = high perceived cleanliness)

		Cleaned	Fresh	Uncluttered
		<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Uncluttered	Citrus	5.65 (0.80) A	5.57 (1.10) A	5.71 (1.10) A
	Dettol	5.73 (0.76) AB	5.65 (1.03) A	5.75 (1.03) A
	Anise	5.32 (0.86) C	5.12 (1.28) A	5.80 (0.94) A
	Hexanoic acid	4.79 (0.99) D	4.21 (1.57) B	5.39 (1.19) AB
Cluttered	Citrus	5.10 (1.14) CD	5.14 (1.14) A	4.91 (0.91) B
	Dettol	5.26 (1.03) C	5.22 (1.20) A	5.19 (1.19) BC
	Anise	5.15 (0.84) C	5.21 (1.20) AC	5.21 (1.00) BC
	Hexanoic acid	4.39 (1.26) E	4.10 (1.31) C	5.03 (1.04) B
Control	Citrus	5.31 (0.96)	5.32 (1.13)	5.50 (0.93)
	Dettol	5.33 (0.85)	5.46 (1.19)	5.62 (0.78)
	Anise	4.75 (0.98)	4.95 (1.30)	5.21 (1.11)
	Hexanoic acid	4.48 (1.03)	4.30 (1.38)	5.26 (0.88)

Note. Different letters indicate significant differences in the column (ANOVA, $p < .05$).

With H2a the idea was tested that the uncluttered environment afforded more positive affective responses compared to the cluttered service environment. **H2a** was confirmed, the uncluttered environment was associated with more positive affective responses ($M = 5.41$, $SD = 1.09$) than the cluttered environment ($M = 4.96$, $SD = 1.28$, $p < .05$, 95% CI [.15, .73]). The uncluttered environment did not differ significantly from the control condition ($M = 5.28$, $SD = 1.31$, $p = .832$, 95% CI [-.42, .15]) but the cluttered environment did ($p < .05$, 95% CI [.02, .61]).

7.5.4 Processing fluency

Previously, processing fluency was introduced as a possible explanatory mechanism for congruence effects between scent and architectural clutter. As the majority of the hypotheses on congruence effects were confirmed, the role of processing fluency was evaluated. A two way (4 x 3) ANOVA with scent and architectural clutter as fixed factors and processing fluency as the dependent variable was conducted. No main effects were found for scent ($F(3, 566) = 2.03$, $p = .10$, $\eta^2 = .01$) and architectural clutter ($F(2, 566) = 1.55$, $p = .21$, $\eta^2 = .00$), and also no interaction effects were found between scent and architectural clutter ($F(6, 566) = 1.00$, $p = .41$, $\eta^2 = .01$).

7.6 Discussions

7.6.1 Theoretical implications

This work provides several important contributions to literature. Firstly, it was demonstrated that pleasant and unpleasant scents related to the concept of cleanliness (i.e., citrus, Dettol) lead to more positive perceptions of cleanliness compared to pleasant and unpleasant scents not related to cleanliness (i.e., anise, hexanoic acid). These findings support the idea that scent influences perceived cleanliness primarily through a cognitive instead of affective priming process (i.e., any pleasant scent will do). If the process would have been merely affective in nature, one would have expected to detect statistical significant differences between citrus (pleasant, related to cleanliness) and Dettol (unpleasant, related to cleanliness), but not between citrus and anise (pleasant, not related to cleanliness). Whereas several scent studies have relied on this cognitive priming process (e.g., De Lange et al., 2012; Holland et al., 2005), this study provided empirical evidence that details such processes.

Secondly, it was showed that uncluttered service environments are associated with more positive affective responses and perceptions of cleanliness. This study is probably the first to explore effects of architectural clutter on customers' experience of service environments in multiple pre-tests and a field experiment. These findings do not only further the research on perceived cleanliness, but also extend research on design factors (i.e., spatial layout and functionality) in service environments which usually focusses on retailing environments (Orth & Wirtz, 2014) and effects of colour and surface materials (Baker et al., 2020).

Thirdly, this study contributed to the growing knowledge base on how congruency between multiple environmental cues influences customers' responses (Baker et al., 2020; Mari & Poggesi, 2013). In this study, a distinction was made between affective and cognitive congruence and presented evidence for both processes. The pleasant scent not related to cleanliness functioned as a positively valenced prime, exerting a more positive effect on perceived cleanliness in the uncluttered service environments (i.e., pleasant) compared to cluttered service environments (i.e., unpleasant), indicating affective congruence. For cognitive congruence it was found that (pleasant and unpleasant) scents related to cleanliness had a more positive effect on perceived cleanliness in uncluttered compared to cluttered service environments. In uncluttered environments, these scents had a more positive effect on perceived cleanliness compared to (pleasant and unpleasant) scents not related to cleanliness, indicating cognitive congruence. Additionally, when diffused in a cluttered service environment, the (pleasant and unpleasant) scent related to cleanliness only had

a more positive effect on perceived cleanliness compared to the unpleasant scent not related to cleanliness but not compared to the pleasant scent not related to cleanliness; probably because of a mismatch between the clean scent and cluttered environment. These findings are largely in line with an earlier study on this topic (Doucé et al., 2014), this current study departed from previous work by evaluating effects of architectural clutter (instead of messiness) and including four (instead of two) scents. And although this study (partly) confirmed most of the congruence hypotheses, no statistical interactions were found between scent and architectural clutter. Which may indicate that odour and visual are processed through two distinctive (priming) processes.

Finally, research on cleanliness was introduced as a key element of service environments and service marketing in general. As noted by Baker et al. (2020) and Pizam and Tasci (2019): research on (effects of) cleanliness is almost non-existent. Cleanliness is mostly included as a dimension in an overall measure of environmental quality (e.g., Wakefield and Blodgett, 1994; Moon et al., 2017), but seldom empirically tested and influenced as a stand-alone variable. This study contributed to the understanding of how customers' perceptions of cleanliness may be influenced in service environments.

7.6.2 Practical implications

This work is of practical importance to facility- and service managers as it will support them in their efforts to offer service environments that are not only clean but also perceived as such. It was demonstrated that customers' perception of cleanliness not only can be influenced by the quality of cleaning services, but also on the quality and characteristics of other environmental cues.

The current study provides important real-word evidence of olfactory (priming) effects on how customers perceive cleanliness, suggesting that managers should feel confident in using such manipulations in their service environments. Key to successful implementation, however, lies in the type of scent and the intensity of the scent. It was demonstrated that different scents have different effects on perceived cleanliness. As shown, not any pleasant scent will lead to more positive perceptions of cleanliness, scents should be conceptually related to cleanliness in some way to exert a positive effect (e.g., citrus, Dettol, pine). Also, the intensity of the scent should be carefully selected; if too intense, customers will become aware of the scent, and adjust their response, if too subtle, customers will not perceive the scent (Bosmans, 2006).

Several avenues exist for reducing architectural clutter in service environments. Following the previous definition of architectural clutter, managers may consider to reduce architectural clutter by influencing the number and variance of architectural features. For example, by having fewer distinct architectural features (e.g., furniture, lamps, signs), selecting more similar objects with respect to their colour, form, or pattern. Grouping of architectural features was also identified as a possible strategy to reduce customers' perceptions of architectural clutter (Orth & Wirtz, 2014). The type of service environment also plays a role; environments should be designed in conformity with the expected and desired service experience (Bitner, 1992). Hence, in some service environments (e.g., theme park, café), some degree of architectural clutter may be desirable to attract customers or create a cosy atmosphere. Most environments lean toward the middle or lower end of the architectural clutter spectrum. Having a low level of architectural clutter tends to be more important when most customers pursue utilitarian tinted goals.

Concludingly, this study allows facility and service managers to make more deliberate interventions with architecture and scent, which may improve their customers' perceptions of cleanliness. Typically, most interventions that aim to improve perceived cleanliness in the service industry will be related to cleanliness and not to other environmental cues. Yet, such interventions should always be considered in interaction with cleaning (quality); an unclean environment with a clean scent or uncluttered architecture will probably have diametrically effects on perceived cleanliness.

7.6.3 Limitations and Future Research Opportunities

The present study should be interpreted in the light of several limitations. Firstly, this study focused on only one type of service environment in one country. Nonetheless, the sample is probably representative for most (Western) service environments as it consists of customers from different age groups and with both utilitarian and hedonic goals. Other scholars are invited to investigate effects of (multiple) environmental cues in relation to perceived cleanliness in different contexts and countries. Secondly, although it was carefully pretested whether scents were associated with cleanliness, it was not examined whether similar associations were activated in the main study as the aim was to draw no attention to the presence of the scent. More generally, (experimental) service research would benefit from a more thorough understanding of scent may affect customers' associations. This step is often overlooked. Thirdly, one may consider manipulation of architectural clutter through photo foils instead of 'real' interventions in the architectural design of the train station as a limitation. The main consideration for this approach was practical in nature; safety policies are fairly strict

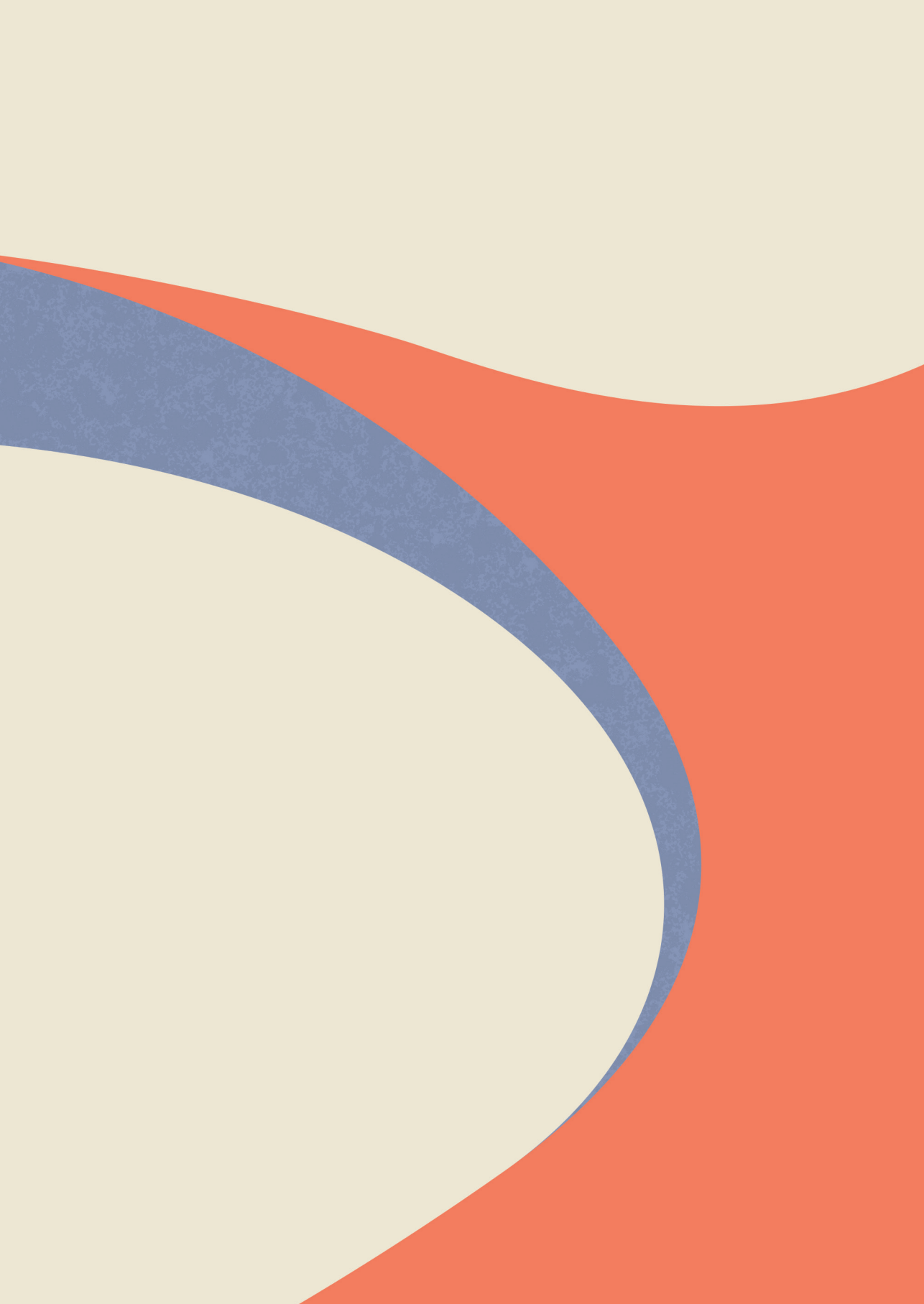
in train stations. To verify if participants would feel immersed in either a cluttered or uncluttered train station printed on the foil, short interviews were performed during the main study. Results showed that participants felt emerged, confirming that the use of foils is a suitable and pragmatic alternative to architectural interventions. For future research, other service researchers are encouraged to further explore effects of architectural clutter on customers' perception and behaviour. More specifically research would benefit from an improved understanding of the determinants of architectural clutter (i.e., quantity, variance, and dissimilarity of features) and their mutual interaction. Fourthly, although it seems that results may be interpreted from a congruence and priming perspective, this has not been verified directly. Future research would benefit from neurological underpinnings of the observed effects by complementing questionnaires with physiological measures such as (mobile) fMRI devices.

In brief - chapter 7

Chapter 7 was the final empirical chapter and final chapter of part two of this dissertation in which effects of environmental cues on perceived cleanliness were addressed. Chapter 5 demonstrated that the visible presence of cleaning staff positively influences perceived cleanliness. Chapter 6 showed effects of scent and colour on perceived cleanliness. Chapter 7 showed that train stations with an uncluttered architectural design positively influence the *cleaned* and *uncluttered* dimensions of perceived cleanliness. Also, it was demonstrated that pleasant and clean scents can be used to influence the *cleaned* and *fresh* dimensions of perceived cleanliness.

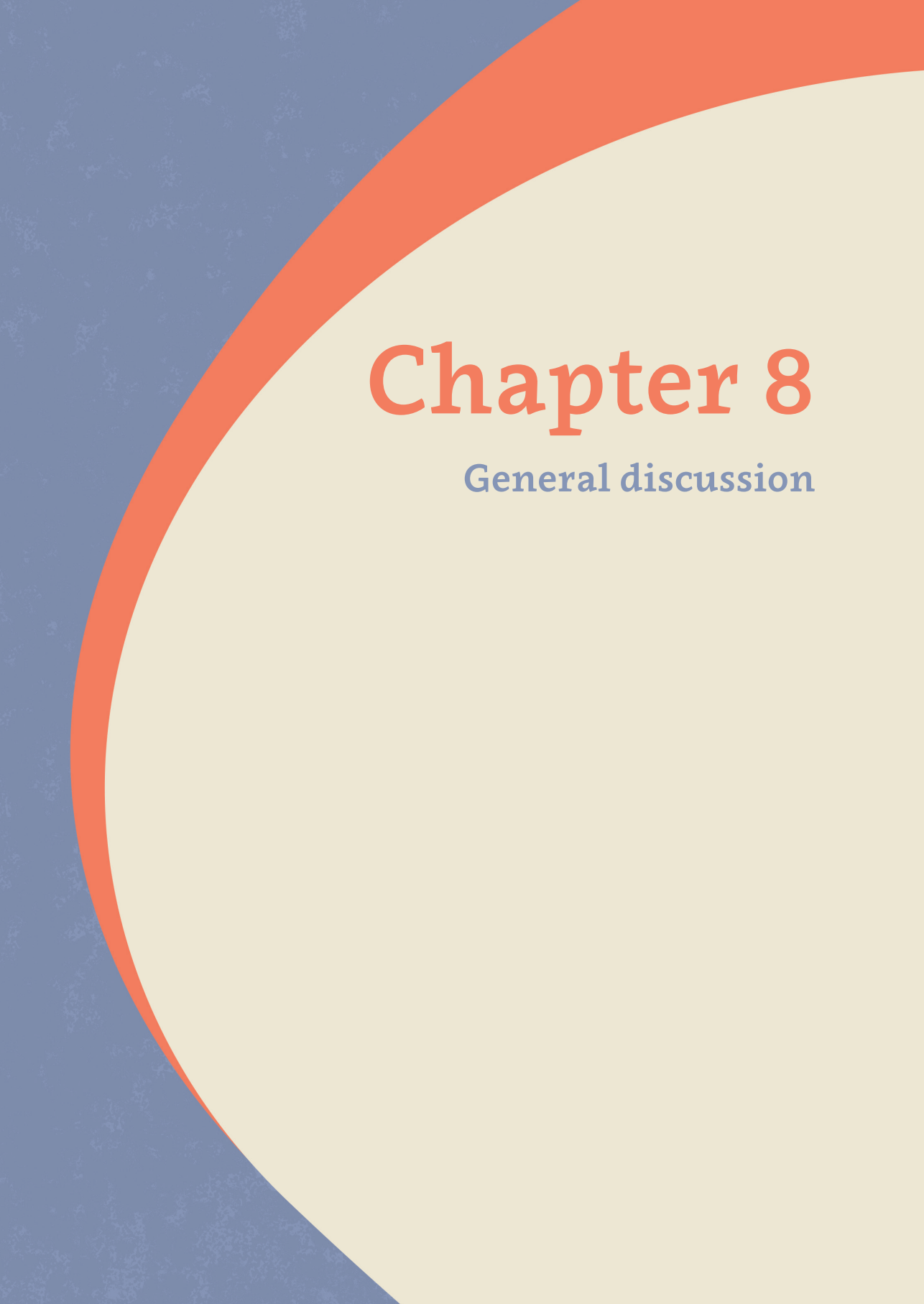
Chapter 7 provided evidence for priming as one of the mechanisms involved in influencing cleanliness. Furthermore, congruency effects of architectural clutter and scent were found on perceived cleanliness.

In the final part three, theoretical and practical contributions of the research are discussed. Chapter 8 discusses the theoretical implications of the research, and Chapter 9 reflects on the implications of the research for practice.



Part 3

Theoretical and
practical contributions



Chapter 8

General discussion

8.1 Introduction

Cleanliness fulfils an important role in our everyday lives. It has social importance in interpersonal dealings and contributes to feelings of safety and trust in service environments. As demonstrated in Chapter 2, service organisations across different industries, acknowledge that importance of perceived cleanliness in the service delivery process (Vos et al., 2018b). However, organisations lack insights and tools to set the scene for positive cleanliness perceptions.

Chapter 1 showed that the knowledge base on perceived cleanliness is mainly explorative but growing in recent decades (Vos et al., 2018a). Despite of this, the concept of perceived cleanliness lacks a clear definition (Baker et al., 2020). More specifically, the understanding of the concept from the viewpoint of the customer is limited. The few studies that defined dimensions of perceived cleanliness were grafted on the catering industries and lack a more general applicable definition of the concept (Barber & Scarcelli, 2010, Lockyer, 2003). Also, the contribution of the design of the physical environment (beyond its cleanliness) has received hardly no attention. This dissertation aims to increase the understanding of the influence of the service environment on perceived cleanliness. A multidisciplinary approach is taken by combining knowledge from the fields of service marketing, facility management, built environment, environmental psychology, and social psychology

The first aim of the dissertation is to understand and measure what customers perceive as clean in service environments. This was addressed in Part 1 of the dissertation, consisting of Chapters 1 to 3. The second aim is to find out if environmental cues can be used to influence perceived cleanliness in service environments and to show whether priming plays a role. Based on the dimensions of the CP-scale, four environmental cues were selected and empirically tested. This was addressed in Part 2 of the dissertation, consisting of chapter 4 to 7.

This chapter provides an overview of the results and discusses the contribution of the thesis to theory. Firstly, the main findings on the definition and measurement of perceived cleanliness are presented and discussed. Secondly, the main results of experimental research on the influence of environmental cues on perceived cleanliness are treated. Special attention is paid to the role of priming in perceived cleanliness. Thirdly, limitations and directions for future research are addressed. Finally, the chapter ends with a general conclusion.

8.2 Defining perceived cleanliness

Attention for perceived cleanliness in literature has grown, specifically over the last decade. As shown in the systematic review of the literature (Chapter 1, Vos et al., 2018a), research may be divided into two streams: the first one consists of large quantitative studies that evaluate how perceived cleanliness (together with other determinants) influences outcomes, such as satisfaction and overall service quality (e.g., Moon et al., 2017; Pizam & Tasci, 2019; Wakefield & Blodgett, 1996). Articles in the second stream comprise of a small number of explorative articles that focus on identifying determinants of perceived cleanliness (Whatley, Jackson, & Taylor, 2012; Whitehead et al., 2007). Despite of the considerable number of articles on perceived cleanliness, there is hardly any empirical study on how perceived cleanliness should be defined from a customer perspective. This was identified as a clear knowledge gap. Before evaluating the effects of environmental cues on perceived cleanliness, it is crucial to understand how the concept of perceived cleanliness should be defined.

From a more practical point of view, this lack of conceptualisation and a knowledge base on influencers of perceived cleanliness may explain why service organisations struggle to look beyond the role of their cleaning services. A second barrier for more customer focused cleaning services was identified in Chapter 2 (Vos et al., 2018b). Following experts in the field of facility management, the cleaning industry is characterised by a strong focus on standardisation and price, which hinders innovation from taking place. Despite of these barriers, Chapter 2 also showed that experts believed that their sector would benefit from applicable knowledge to improve the cleanliness perceptions of customers.

The systematic literature review (Chapter 1, Vos et al., 2018a) and Delphi study with customers and experts (Chapter 2, Vos et al., 2018b) were performed to identify dimensions of perceived cleanliness. The initial expectation was that customers perceive cleanliness through five dimensions: cleaned, fresh, maintained, smooth, uncluttered. Through two subsequent quantitative survey studies (Chapter 3, Vos et al., 2019a), carried out in different service environments, this initial conceptualization of perceived cleanliness was validated. As a result of factor analysis, the number of dimensions were reduced from five to three. The maintained and smooth dimensions were partly removed or merged into the remaining dimensions. To conclude: customers perceive a service environment as clean when it is *cleaned*, *fresh*, and *uncluttered*.

When comparing the findings with earlier conceptualisations of perceived cleanliness, it was found that the *cleaned* and *fresh* dimensions are included in most previous studies. Lockyer (2003), for instance, identified the cleanliness of 'the outside of the hotel or motel', 'the room or unit', 'the kitchen (if available)', 'bathroom/toilet', and 'reception' as key dimensions of perceived cleanliness in hotels. Similarly, Barber and Scarcelli (2010) identified 'exterior of restaurant', 'restroom appearance', 'interior of restaurant', 'restroom personal hygiene', and 'dining room personal health' as dimensions of perceived cleanliness in restaurants. In these studies, most similarities were found with the *cleaned* dimension and to a lesser extent with the *fresh* dimension which only was included as a subdimension (i.e., 'smell or odour' and 'odour in restroom').

The role of the physical environment or more specifically *uncluttered* as a dimension of perceived cleanliness is scarcely mentioned in other empirical studies. The appearance of an environment as a dimension of perceived cleanliness was introduced by Whatley et al. (2012) and Whitehead et al. (2007). The scholars reasoned that visually pleasing environments might impress customers as being clean. This idea was noted in the qualitative Delphi study (Chapter 2) as well, customers and experts mentioned order, balance, symmetry, organisation, and age as architectural variables related to perceived cleanliness. Combined with two subsequent quantitative studies (Chapter 3, Vos et al., 2019a) *uncluttered* was included as the third dimension of perceived cleanliness. Compared to existing definitions of perceived cleanliness that are predominantly based on cleaning quality, this thesis offers a more comprehensive conceptualisation of the concept. Besides the *cleaned* dimension, the *fresh* and *uncluttered* dimensions were added, which go beyond the effects of cleaning services.

To conclude, this dissertation contributes to the conceptualisation and operationalisation of the concept of perceived cleanliness, which appears a multidimensional construct with different dimensions and items. The identification of these dimensions (i.e., *cleaned*, *fresh*, and *uncluttered*) makes the concept better comprehensible for scholars and practitioners. Also, the approach of taking a broad perspective by looking for aspects at a more abstract level of the service environment, which not only includes (effects of) cleaning but also factors related to the physical environment, led to a more complete definition of cleanliness from the perspective of the customer.

8.3 Measuring perceived cleanliness

Defining the concept of perceived cleanliness was a prerequisite for the development of a measurement instrument. An extensive list of items, inspired on the systematic literature review (Chapter 1, Vos et al., 2018a) and Delphi study (Chapter 2, Vos et al., 2018b) served as the foundation for the development of the cleanliness perceptions scale (CP-scale). Chapter 3 described the thorough development process of the CP-scale, which resulted in the validated measurement instrument that evaluates perceived cleanliness in service environments, can be applied in any service environment and is easy for customers and practitioners to understand (Vos et al., 2019a). The final scale consists of 12 items divided over the three dimensions of perceived cleanliness: *cleaned*, *fresh*, and *uncluttered*. The *cleaned* dimension includes items such as: neat, clean, well maintained, dust-free. *Fresh* refers to the aspects: it smells clean, hygienic and fresh. *Uncluttered* is about the experience of organisation and order in service environments. The three factors explained 64% of the variance of the overall perception of service quality, which indicates a sufficient coverage of the concept. The *cleaned* dimension had the largest contribution, followed by the *fresh* and *uncluttered* dimensions. Meaning that the *cleaned* dimension appeared to be the most predictive factor for perceived cleanliness.

The CP-scale differs from other instruments that measure perceived cleanliness, because those scales mainly focus on the catering industries, such as hotels and restaurants, and examine how customers perceive the cleanliness of specific spatial elements of the service environment (i.e., exterior, restroom appearance) (Barber & Scarcelli, 2010; Lockyer, 2003). This approach complicates generalisability to other service settings and does not fully reflect customers' holistic experience of cleanliness, which also comprises smell and architectural clutter. CP-scale has demonstrated to be a useful instrument for scholars and practitioners but was above all a necessary condition to investigate the effects of environmental cues on perceived cleanliness, the second part of this dissertation.

8.4 Influencing perceived cleanliness: effects of environmental cues

With the experimental studies presented in this dissertation, it was demonstrated that ambient conditions, space/function, and signs, symbols, & artefacts can be used to positively influence perceived cleanliness (Bitner, 1992). More specifically, the presence and appearance of cleaning staff (signs, symbols, & artefacts, Chapter 5, Vos et al., 2019b), colour and scent (ambient conditions, Chapter 6), and scent and architectural clutter (ambient conditions and space/function, Chapter 7) were identified as determinants of perceived cleanliness.

Based on previous evidence in literature, it was expected that congruency effects to occur in the experiments with colour and scent (Chapter 6) and with scent and architectural clutter (Chapter 7). Congruency effects were found between scent and architectural clutter in Chapter 7. The study on effects of colour and scent on perceived cleanliness did not provide unequivocal evidence for the idea that congruent colour-scent combinations lead to more positive perceptions of cleanliness compared to incongruent colour-scent combinations. It was expected that hypothesised congruency effects did not occur because of the methodological characteristics of the study. Based on the conclusions of study with colour and scent, it was expected that the effect of scent was more dominant than the effect of colour. Scents were directly dispersed into the room while colour was manipulated in a photograph which participants were instructed to take a good look at before filling out the questionnaire. To further explore the influence of congruency on perceived cleanliness, different cue-combinations, with and without scent, should be tested. Also, these results underline that the operationalisation of the independent variable and the experimental manipulations have to be chosen and pre-tested carefully.

In sum, the experiments showed that ambient conditions, space/function, and signs, symbols, & artefacts can be used to influence perceptions of cleanliness. These environmental cues always have to be complementary to the cleaning quality of a service environment. In fact, a certain level of cleaning quality is a prerequisite for other environmental cues to exercise a positive effect on perceived cleanliness of customers.

8.5 Underlying psychological processes

Central in this dissertation is the question to what extent priming may be used as an explanation for the effects of environmental cues on people's perceptions of cleanliness. The last decades of psychological research produced vast amounts of literature on different priming mechanism. Because of the range and complexity of priming effects presented, effects are hard to comprehend or explain using a single model (Janiszewski & Wyer, 2014). Generally, there is consensus about the idea that priming is an experimental framework in which the processing of an encountered cue influences the response to subsequently encountered stimuli (Bargh, 2006; Janiszewski & Wyer, 2014).

As our spatial surroundings and related perceptions are multisensory, the impact of service environments cannot really be understood on a 'sense-by-sense' basis (Spence et al., 2014). That is why concepts of cue-congruency and processing fluency were added to the theoretical framework in Chapter 4. Congruency is about the match rather than mismatch between two or more environmental cues. Research shows that congruent (vs. incongruent) cue-combinations positively influence customer evaluations and responses (e.g., Imschloss & Kuehnl, 2017; Morrison et al., 2011). Processing fluency is the subjective experience created by how cues are presented or organised (Alter & Oppenheimer, 2009). The general hypothesis is that congruently primed cues related to the concept of cleanliness generate processing fluency and subsequently lead to positive perceptions of cleanliness (conceptual model in Chapter 4).

This dissertation contributes to the priming literature by (1) linking affective and cognitive priming mechanisms to the concept of cleanliness and demonstrating its relevance to customers perceived cleanliness in service environments, (2) by showing that priming mechanisms are not bound to laboratory settings, but also can be used in practice, (3) by introducing lightness as a prime for the concept of cleanliness, (4) by demonstrating that congruence between primes can result in more positive perceptions of cleanliness, and (5) by suggesting that positive effects of congruent primes may be explained by the concept of processing fluency. In the next paragraphs, the results of the experimental studies will be discussed based on the above mentioned five contributions to the field of priming.

Firstly, this dissertation introduced affective and cognitive priming mechanisms in the field of cleanliness research. It was showed that the physical presence of cleaning staff, colour, scent, and architectural clutter served as primes of cleanliness in service environments. It was showed that the physical presence of cleaning

staff and lightness of colour functioned as primes of cleanliness which positively impacted the perception of the *cleaned* dimension (Chapter 5 and 6). Also, it was demonstrated that scent and more specifically the lightness of scent primed and positively influenced the *fresh* dimension of perceived cleanliness and not so much the *cleaned* or *cluttered* dimensions (Chapter 6 and 7). And uncluttered architecture primed cleanliness associations and subsequently increased the perceptions of the *cleaned* and *uncluttered* dimensions and not the *fresh* dimension (Chapter 7). Literature already reported that primes related to the concept of cleanliness have an impact on people's intended behaviour and actual behaviour (De Lange et al., 2012; Doucé et al., 2014; Holland et al., 2005) but the impact of environmental primes on perceived cleanliness in service environments is new.

The studies also focussed on how people make environmental inferences based on environmental primes that subsequently influence their perceptions of cleanliness. Two mechanisms were identified that are involved: affective and cognitive priming. Affective primes directly transfer meanings or emotions to how cleanliness is perceived. The halo-effect (Thorndike, 1920) is an example of this type of inference in which people transfer their feeling about one attribute to other, (seemingly) unrelated attributes. Alternatively, inferences can also be based on cognitive primes and the associative network theory (Anderson, 1983). Whereas affective primes relate to the direct projection of environmental characteristics onto service outcomes, associative processes are the result of activating connections between concepts that are linked in memory based on innate and learned associations. The general assumption is that the links between concepts in the brain (i.e., nodes) are strengthened each time two concepts co-occur (Till et al., 2011). In the experimental studies (Chapter 5, 6, and 7) evidence was provided for affective and cognitive priming. This dissertation contributed to the priming literature by demonstrating that environmental primes may influence perceived cleanliness through affective and cognitive priming mechanisms. In the studies on the effects of the physical presence of cleaning staff, evidence was provided for the affective and cognitive process (Chapter 5, Vos et al., 2019b). In Chapter 7 positive effects on perceived cleanliness were reported for affective (i.e., anise scent) and cognitive scent primes (i.e., citrus and Dettol scent) with more pronounced effects for cognitive primes. Priming literature seems to rely on cognitive priming primarily (e.g., De Lange et al., 2012; Doucé et al., 2014; Holland et al., 2005) while attention for affective priming and its co-existence with cognitive priming is limited.

Secondly, this dissertation contributed to the evidence-base for the functioning of priming mechanisms in practice. The majority of priming studies that evaluate the effects of environmental cues on affect, cognition and behaviour have been performed

in a laboratory setting (e.g., Doucé et al., 2014; Gaillet et al., 2013; Holland et al., 2005; Spangenberg et al., 2005). This approach has been proven to be very useful for explorative purposes but provides limited understanding of how primes may work (or not) in the real world. The first experimental study on priming effects of scent and colour (Chapter 6) using the CP-scale has been performed in a laboratory setting to explore whether it was possible to use priming mechanisms to influence perceptions of cleanliness. The remaining experiments were performed in real-life settings as this allowed us to get as close as possible to people's everyday experience of the specific service settings used. By doing so, this dissertation adds to the few priming studies performed in real-life settings (e.g., Herrmann et al., 2013; Schifferstein & Blok, 2002) by providing evidence for the functioning of priming mechanisms in real service settings. More specifically, it was demonstrated that the concept of cleanliness can be primed on train stations by increasing the physical presence of cleaning staff and by using light scents and uncluttered architecture.

Thirdly, evidence was provided for the hypothesis that the concept of lightness serves as a general prime for the concept of cleanliness. It was demonstrated that lighter scents such as citrus and grapefruit lead to more positive perceptions of cleanliness compared to heavier scents. In one of the experiments (Chapter 6), the lightness of scent was operationalised using the substantivity index, referring to the lasting qualities of a scent. In line with earlier studies (Sunaga et al., 2016), it was demonstrated that lighter colours (i.e., colour value) also have a positive effect on perceived cleanliness. This raises the question if results can be extended to different environmental cues. There are some indications (e.g., Molenaar & Hu, 2013) that brightly lit service environments are associated with more positive perceptions of cleanliness. Future research is needed to explore the priming effects of other environmental cues, such as sound and design.

Fourthly, contributed to the growing knowledge base on cue-congruency (Baker et al., 2020; Mari & Poggesi, 2013). More specifically, the cue-congruency theory was introduced in the area of facility management research by evaluating how multiple cues affect customers' perceptions of cleanliness in service environments. It was showed that affective and cognitive congruency between scent and architectural clutter positively influenced perceived cleanliness compared to incongruent combinations (Chapter 7). Affective congruence (or: valence match) in the case of this research, refers to the match between the affective tone (i.e., pleasantness) of scent and architectural clutter. Cognitive congruence addresses the match between the associative characteristics of scent and architectural clutter (i.e., associated with the concept of cleanliness). Whereas several cue-congruency studies have mainly relied

on these affective and cognitive processes (e.g., Helmefalk & Hultén, 2017; Imschloss & Kuehnl, 2017) this dissertation provides empirical evidence that details such processes. However, this research also showed some effects that did not support the congruency hypothesis. In the study on the effects of scent and colour main effects were found but no congruency effects were found between the primes (Chapter 6). One possible explanation for the absence of effects may be that the effect of scent was more dominant than the effect of colour as scent was directly dispersed in the room and colour was manipulated in a photograph (Helmefalk & Berndt, 2018).

Fifthly and finally, this dissertation contributed to research on the relationship between cue-congruency and processing fluency. Based on several comparable field studies, the hypothesis was formulated that congruent cues are perceived as more fluent, generate higher levels of processing fluency and subsequently positively influence perceived cleanliness. This hypothesis was not confirmed in the experimental studies (Chapter 6 and 7). Effects of cue-congruency on processing fluency have been detected in field experiments previously. The concept is measured through surveys (Orth & Wirtz, 2014) or more objective outcomes such as time spend in a store (Herrmann et al., 2013). However, in most experimental studies processing fluency is merely used as an explanatory mechanism used to explain positive effects of congruency (e.g., Gmuer et al., 2015; Imschloss & Kuehnl, 2017; Janiszewski & Meyvis, 2001). Hence, more research is needed on how to uncover the effects of processing fluency in practice. As processing fluency is a very delicate process that happens unconsciously, questionnaires seem not the most ideal method. More sophisticated methods such as mobile eye tracking devices may be suitable for measuring processing fluency in the future.

In conclusion, this dissertation introduced priming in the context of perceived cleanliness. This was done by performing a series of experimental studies on how physical presence of cleaning staff, scent, colour and architecture affect perceived cleanliness through priming. Although the data showed some indications for the role of cue-congruency on perceived cleanliness, closing evidence was not presented in this research.

8.6 Methodological considerations

Research in environmental psychology and service marketing in general, and research on outcomes such as perceived cleanliness in particular are characterized by their dependence on subjective measures. Besides research on physiological measures and measures of brain activity, scholars in psychology and marketing mostly gather empirical data by observing human behaviour and presenting questions in interviews or surveys on matters that people are usually not consciously aware of. The influence of environmental cues on people's perceptions of cleanliness is such unconscious process. Experimental methods combined with interviews or surveys were developed for the purpose of uncovering these processes. Hence, the experimental studies in this dissertation allowed us to identify causal relationships between variables without explicitly asking participants about these relationships. People participating in the experiments were encouraged to consciously think of how they perceived the different dimensions of perceived cleanliness. Although participants were instructed to rely on their initial impressions of the service environment, people unavoidably think more explicitly about cues in the service environment that are usually processed unconsciously. Although the questionnaire was carefully composed, wording of questions was tested, and research assistants instructed on how to introduce the questionnaire, formulation of questions may have influenced results. This is an important drawback of questionnaire-based research. Although more advanced techniques to measure physiological responses have become more sophisticated and easy to use in field settings, to date, questionnaires are the most optimal way to examine perceived cleanliness of large groups of customers quantitatively. While direct physiological responses to (service) environments remained outside of the scope of this research, a better understanding of physical experience of service environments may greatly enhance the understanding of how environmental cues (including cleanliness) affect customers.

When conducting experiments on effects of environmental cues on customers' perceptions, one has to decide between using actual or simulated service environments. Most studies in this dissertation were performed in actual service environments using field experiments; and, in addition, one photo experiment. While simulation methods allow for full experimental control, perceived cleanliness in service environments is a phenomenon that is ideally not studied in a laboratory setting. The strength and advantage of field experiments are their external validity: it becomes clear immediately whether an environmental manipulation works in practice. Disadvantages are the limitations in manipulating service environments, the inability to control all environmental variables, the amount of time it takes to organise a field

experiment, and the dependence on (goodwill) of internal and external stakeholders. Results might be influenced by environmental cues that were not controlled for in the experiments, such as the presence of other customers, weather conditions, and in the case of this research: unplanned train disruptions. Although the effects of these cues was controlled for as much as possible, it is impossible to fully exclude these effects. Therefore, the experiments need to be replicated to strengthen credibility of the results found. Each environmental cue was empirically tested once or twice, replication (in a different setting) may expose the cues to different external influences and produce different results.

The exploration of the concept of perceived cleanliness concentrated on the service sector in general and public transport sector specifically. As this dissertation was partly funded by train operating company the Netherlands Railways, experiments were performed in train stations and trains. Therefore, the results are specifically applicable to this context and its visitor population. Although train stations and trains share some characteristics with airports and planes and to a lesser extent with university campuses and shopping malls (i.e., semi-public, large number of visitors), scholars and practitioners should be careful when generalising the findings to other service organisations.

8.7 Directions for future research

Although not the main aim, indications were found for the effects of individual differences on perceived cleanliness in this dissertation. The main purpose of collecting background information on participants was to check the composition of the samples. Yet, it was found in the experimental studies that male participants consistently reported more positive perceptions of cleanliness compared to female participants. As reported in Chapter 1 (Vos et al., 2018a) this phenomenon has been detected in previous studies as well (Barber & Scarcelli, 2010; Wakefield & Blodgett, 1996). Future research is needed on individual and cultural differences in relationship to the dimensions of perceived cleanliness and its determinants. Also, scholars are invited to revalidate the dimensions of perceived cleanliness in different service settings. Although data were collected in different train stations, from customers with utilitarian and hedonic goals and nationalities, replication in different settings will probably result in greater confidence in the dimensions.

In this dissertation, effects of environmental cues on people's perceptions of cleanliness were mainly evaluated through positivistic, quantitative research. Through experiments, it was confirmed that environmental cues can influence perceived cleanliness. However, in future research, it may be valuable to focus onto the complex, interpretative nature of environmental cues and its effects on perceived cleanliness by using more qualitative methods, such as interviews, focus groups and observations in order to improve the understanding of underlying processes. This approach can be used to learn how environmental cues simultaneously make up holistic perceptions of service environments and how specific service context affect the interpretation of individual cues.

As the duration of this PhD project is limited and the preparation of studies is time consuming, a limited number of environmental cues that influence perceived cleanliness have been studied. However, there are more environmental cues outside of the scope of this dissertation that influence people's perceptions of cleanliness. Scholars for example may want to examine the effects of lighting (i.e., intensity, colour), temperature, spatial factors, surface materials, and the presence of other customers. More specifically, the research community would benefit from a better understanding of how cleaning quality interacts with other environmental cues. For example, do effects of scent or physical presence of cleaning staff on perceived cleanliness improve or weaken when participants are exposed to different levels of cleaning quality? More research on determinants of perceived cleanliness is needed to answer these questions.

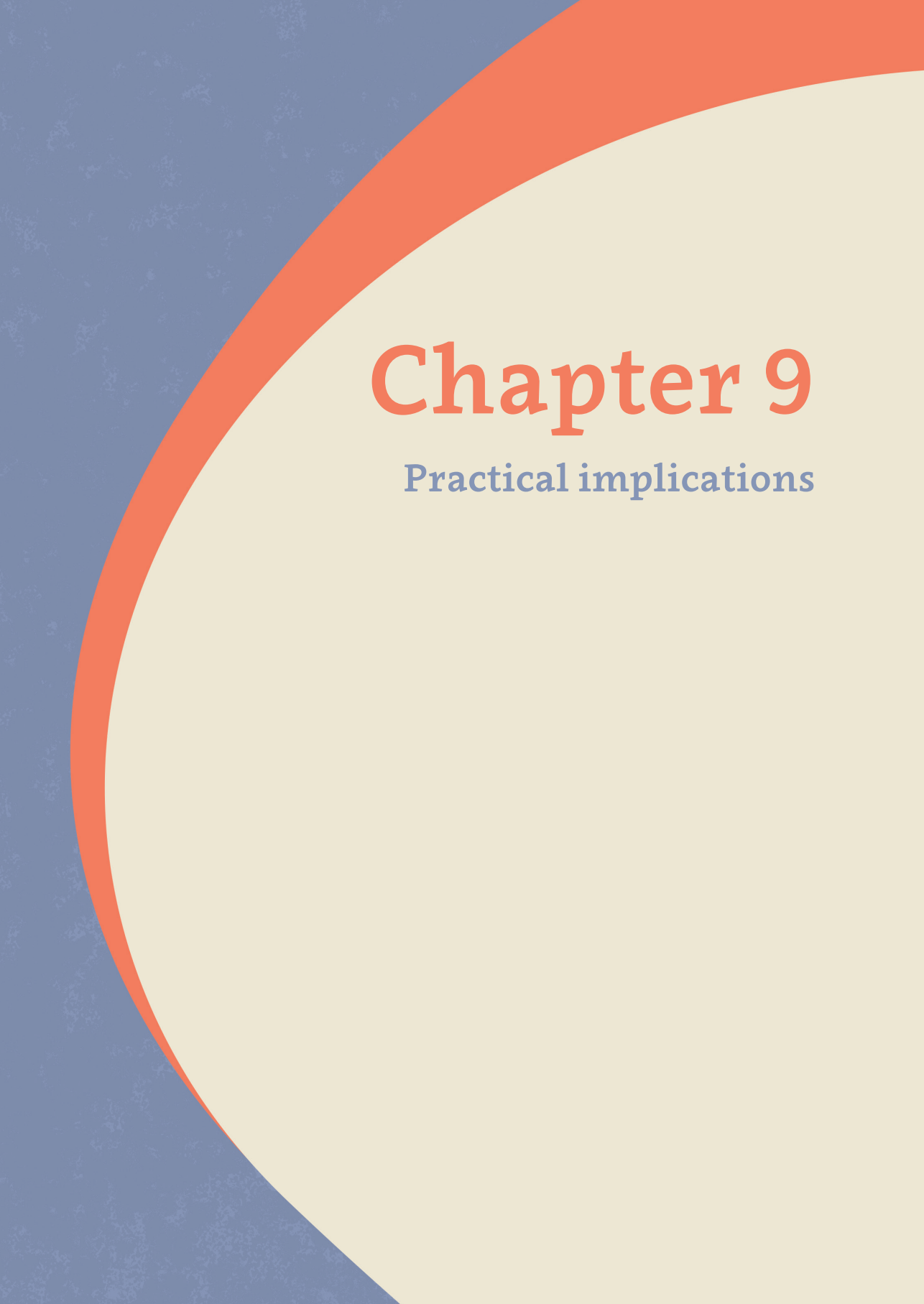
Although the final experiment (Chapter 7) was completed a month before the outbreak of the Covid-19 pandemic, the pandemic raises new questions in the light of how customers perceive cleanliness. It is expected that it is not very likely that the definition of perceived cleanliness will change, perhaps the relative importance of dimensions will change slightly. Recent studies show that the importance of cleanliness and personal hygiene in service environments increased as a result of the pandemic (Magnini & Zehrer, 2021; Shin & Kang, 2020). It would be very interesting to examine whether the importance of other environmental cues increased as well during the pandemic.

Concludingly, this dissertation is a first step in exploring how service environments influence customers' perceptions of cleanliness. The general conclusion is that the physical presence of cleaning staff, scent, colour, and architectural clutter contribute to more positive perceptions of cleanliness in trains and train stations. Hopefully, the studies inspired other scholars to continue exploring determinants of perceived cleanliness in different service settings.

8.8 General conclusions

This dissertation bridges two main gaps: on the one hand in the fields of service marketing and environmental psychology, where the influence of environmental cues is extensively studied but rarely in relation to perceived cleanliness. On the other hand, in the field of facility management, where the relationship between the built environment and perceived cleanliness is seldom addressed. This dissertation contributed to closing these gaps by successfully defining perceived cleanliness. The dimensions *cleaned*, *fresh*, and *uncluttered* not only operationalised the concept of perceived cleanliness but also resulted in the CP-scale that is validated in different service environments. In addition, this dissertation provided evidence for the effects of different environmental cues on perceived cleanliness and the role of priming and the associative network theory as underlying processes. Altogether, this dissertation increases the understanding of perceived cleanliness and enables future research to measure both the concept of perceived cleanliness itself and the effects of environmental cues in service environments.

In following and final chapter, a broader and practical perspective will be taken on perceived cleanliness and the influence of environmental cues. Other environmental cues than the physical presence of cleaning staff, colour, scent, and architectural clutter that may be used to influence customers' perceptions of cleanliness are discussed. It is expected that this chapter carries special relevance for service and facility managers, consultants, architects and students interested in how service environments can be used to influence cleanliness perceptions.



Chapter 9

Practical implications

9.1 Introduction

One of the aims of this dissertation is to inspire service providers, scholars, teachers, and anybody involved or interested in cleanliness, to create environments that are *cleaned*, *fresh*, and *uncluttered* by involving all relevant cues present in the service environment. These dimensions provide us with a more refined account of what customers experience as clean. The corresponding cleanliness perceptions scale (CP-scale) offers scholars and practitioners with an instrument to measure customers' perceived cleanliness in the context of a service environment. Additionally, this dissertation demonstrates how environmental cues can be used to influence customers' perceptions of cleanliness. Besides the effects of cleaning services, other environmental cues can also be used to influence perceived cleanliness. Based on the findings of this research, practitioners may consider using the physical presence of cleaning staff, lighter colours and scents, and uncluttered architecture to complement cleaning services.

In this final chapter, the implications of the findings for practitioners in the field of facility management will be explored. The aim of this chapter is to inspire and encourage practitioners and applied researchers in their quest to (re)design and develop service environments that are experienced as clean. This will be done by presenting five main recommendations that can be applied by client organisations and facility service providers to develop more customer focused cleaning. Practitioners are advised to improve measurement of perceived cleanliness, influence perceived cleanliness using environmental cues, incorporate perceived cleanliness in cleaning contracts, apply a multidisciplinary approach to perceived cleanliness, and make cleaning more visible.

9.2 Measure perceived cleanliness

A positive change of future cleanliness perceptions requires knowledgeability of current perceptions, which supports informed decision making. So, a first step in developing more customer focused cleaning is to improve insight into how customers perceive cleanliness. Measurement of perceived cleanliness is a prerequisite for the development of service environments that are perceived as clean. As was shown in Chapter 2 (Delphi study), practitioners seem to struggle with definitions and measurement of perceived cleanliness coherently. This is because of two main reasons. Firstly, there are no common standards on how cleanliness should be measured. While the service industry is known for standards on measuring actual cleanliness and cleaning quality (e.g., visual inspection, bacteriological methods), such standards do not exist for measuring perceived cleanliness. Secondly, most client organisations and facility service providers do not have the skills or knowledge needed to measure perceived cleanliness and interpret results of such measurements.

Practice is advised to start using the CP-scale for measuring perceived cleanliness in service environments. Chapter 3 showed that, compared to traditional instruments that measure perceived cleanliness, the CP-scale offers a more thorough understanding of the concept of perceived cleanliness by distinguishing between three dimensions: *cleaned*, *fresh*, and *uncluttered*. The service industry may also use CP-scale as a basis for developing new standards on the measurement of perceived cleanliness. Also, educational programmes on service management should include courses on measuring service outcomes, including perceived cleanliness. Alternatively, client organisations and facility service providers may want to attract employees with the skills needed for measuring perceived cleanliness.

9.3 Influence perceived cleanliness using environmental cues

The service environment can bring positive change to cleanliness perceptions. So, when the measurement of perceived cleanliness is put in place, practitioners may want to improve perceived cleanliness by utilizing different environmental cues. In practice, most client organisations and facility service providers focus on effects of cleaning services when improving perceived cleanliness. For example, by changing the cleaning frequency or providing hospitality training to cleaning staff. Although valuable, it is demonstrated that perceived cleanliness in service environments can also be positively influenced by providing a mix of environmental cues, such as with the colour of an environment and the visible presence of cleaning staff.

Although perceived cleanliness can be influenced by different environmental cues, in practice cleaning quality is considered as one of the key determinants of perceived cleanliness. However, cleaning quality especially impacts upon how cleanliness is perceived when excessively bad. The customer will pay little attention to cleaning quality if quality is above a certain level (Stipak, 1979). In some way the 'law of diminishing returns' (Turgot, 1767) applies to the relationship between cleaning quality and perceived cleanliness. So, cleaning services have a larger effect on perceived cleanliness when customers perceive their surroundings as unclean as compared to when they perceive their surroundings as clean. Practitioners may want to identify this tipping point (red cross, Figure 9.1) to identify to which point cleaning services add value to how cleanliness is perceived. This can be done by slowly scaling the cleaning frequency up or down to discover at which point the effects of cleaning quality on perceived cleanliness diminishes. Beyond this point, environmental cues can be added to complement the effects of cleaning quality on perceived cleanliness.

In the experimental studies of this dissertation (Chapters 5, 6, 7), the physical presence of cleaning staff, fresh scents, light colours, and uncluttered architecture were identified as environmental cues that positively influence perceived cleanliness. In the systematic literature review (Chapter 1) and Delphi study (Chapter 2), additional cues were identified, including the condition of the service environment, the use of smooth materials, and ambient lighting. It was shown that the optimal combination of environmental cues that contributes to how cleanliness is perceived depends on factors such as the type of service environment, the moment in the customer journey, and the kind of customer. Therefore, practitioners should be careful when selecting cues for their service environments. For example, the visible presence of cleaning staff was demonstrated to be effective in train stations (Chapter 5), but may be less

effective in hotels or restaurants. Moreover, environmental cues should be carefully tested before fully implemented, for example, by evaluating different forms (e.g., different scent types and/or intensities) through small field experiments and using the CP-scale. This could for example be done following the principles of evidence-based design, a methodology that stems from healthcare and is less frequently used in other service settings (Ulrich et al., 2010; Van Hagen et al., 2017).

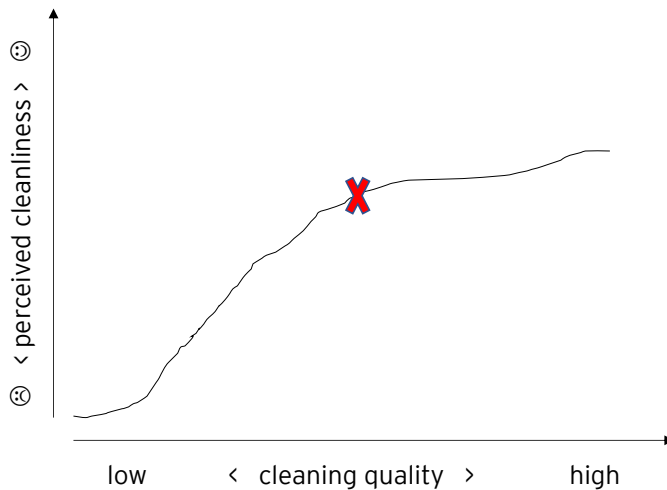


Figure 9.1

Visualisation of the relationship between cleaning quality (low, high) and perceived cleanliness (negative, positive), red cross visualizes the tipping point to which cleaning services add value to perceived cleanliness (Adapted from Stipak, 1979, p. 48, Figure 1)

9.4 Incorporate perceived cleanliness in contracts

Customers' perceptions of cleanliness deserve a prominent place in cleaning contracts. Since the degree of outsourcing in cleaning is relatively high (approximately 95%, Van Diepen-Knegjens & Veenstra, 2017), perceived cleanliness will be included in most cleaning contracts. Roughly speaking, two types of cleaning contracts can be distinguished: prescriptive contracts and performance-based contracts. Prescriptive contracts exactly prescribe the activities to be performed: the frequencies and elements of the service environment that should be cleaned. For example, clean floor X once a week using cleaning detergent Y. Performance-based contracts, very often prescribe the cleaning quality that should be met within a specific period. For example, the average expert-reviewed cleaning quality should be at least good for 88% of service environment X. Performance-based contracts often take cleaning quality as the performance indicator. Performance contracts that merely focus on perceived cleanliness are unique. In the following the implications of such contracts for client organisations and facility service providers are discussed.

The CP-scale enables practitioners to develop cleaning contracts with perceived cleanliness as the main performance indicator. Although several scenarios exist, one could think of an approach in which a client organisation and facility service provider agree on a certain level of perceived cleanliness for the three dimensions of perceived cleanliness, for example: a score of 7.5 on a scale of 0-10 for the *cleaned* dimension, a 7.0 for the *fresh* dimension, and a 6.5 for the *uncluttered* dimension. Depending on the type of organisation, prices can then be based on the level of perceived cleanliness and multiplied by the number of full-time equivalents, square meters, or number of units (i.e., trains, airplanes). Based on their experience, facility service providers determine the optimal combination of environmental cues needed to meet the performance indicators on perceived cleanliness. As a result, facility service providers need to better understand the relation between the (re)design of spaces and services on perceptions. In this context, they need to invest in research and development of (other) environmental cues that are currently and unrightfully not being broadly applied in the cleaning industries. Also creating new possibilities for the participation of facility management in architectural design of the built environment.

Partnership between client organisations and facility service providers is crucial performance-based contract. More specifically, it is expected that financial transparency and a collaborative culture may be important contributing factors.

Traditionally, facility service providers as well as many client organisations are known for their focus on price and efficiency (Chapter 2). An open book construction with fixed profit margins removes this incentive and contributes to mutual trust and a more beneficial focus on added value of facility management. Equality between client organisations and facility service providers contributes to joint decision-making, for example, about how cleaning budgets should be spent.

9.5 Involve relevant stakeholders

Influencing perceived cleanliness in service environments requires a more integral approach. The focus on perceived cleanliness calls for cross-overs between different departments of client organisations and facility service providers. While the facility department of client organisations is primarily responsible for offering cleaning services, other environmental cues that influence perceived cleanliness may be beyond the sphere of influence of the facility department. Therefore, close cooperation is needed between departments responsible for maintenance, engineering, and design of service environments. Also, budgets and responsibilities for cleanliness should be proportionally distributed over departments that influence perceived cleanliness.

These crossovers between different disciplines are illustrated using the case of 'Arnhem Velperpoort' (Figure 9.2). Customers' perceptions of cleanliness at this train station are low when compared with other Dutch train stations (Chapter 7, Table 7.2). Merely improving the quality or frequency of cleaning services would probably not lead to a significant improvement of perceived cleanliness. Let us assume that we have the possibility to improve perceptions based on the findings of this thesis. How would such interventions look like? Firstly, the department of market research is involved to determine customer perceptions of cleanliness. Secondly, the department of facility management and facility service providers are responsible for redesigning maintenance operations and related contracts. Thirdly, the department of real estate explores funding possibilities for (re)design of the train station. Fourthly, 'Bureau Spoorbouwmeester' monitors implications of the (re)design on spatial and design quality. Fifthly, an architectural firm to make a (re)design of the built environment of the train station and finally, the contractor who executes the plans. All these different stakeholders should consider perceived cleanliness in their plans in order to create service environments that are perceived as clean, also in the long term.



Figure 9.2

Photo taken of train station 'Arnhem Velperpoort'

9.6 Make cleaning more visible

We should not forget cleaning professionals. Cleaning as a profession is plagued by the dirty work stigma (Van Vlijmen, 2017). Cleaning jobs are considered as unattractive jobs by society, which influence the way in which the public sees and treats cleaners. The stigma is reinforced by the invisibility of cleaning work that mostly takes place in the evening, night, and early morning according to Van Vlijmen (2017). The lack of appreciation by society was one of the main triggers for multiple cleaning strikes between 2010 and 2014. This dissertation did not primarily focus on cleaning as a profession, but it carries implications in this area.

The cleaner is surrounded by ambiguity (Van Vlijmen, 2019). Due to this social stigma, among other things, cleaners are often low-educated and deployed in the early morning, evening or night. Despite the fact that – in my view quite rightly – they are proud of their work and societal contribution, they are often invisible, social recognition lacks and in some situations their health and well-being are at stake. The research shows that this can be reversed by increasing the cleaner's visibility in service environments: by cleaning during the day and offering additional training on how to have positive interactions with train passengers. This has two advantages: positive effects on perceived cleanliness of train passengers and less ambiguity for the cleaner.

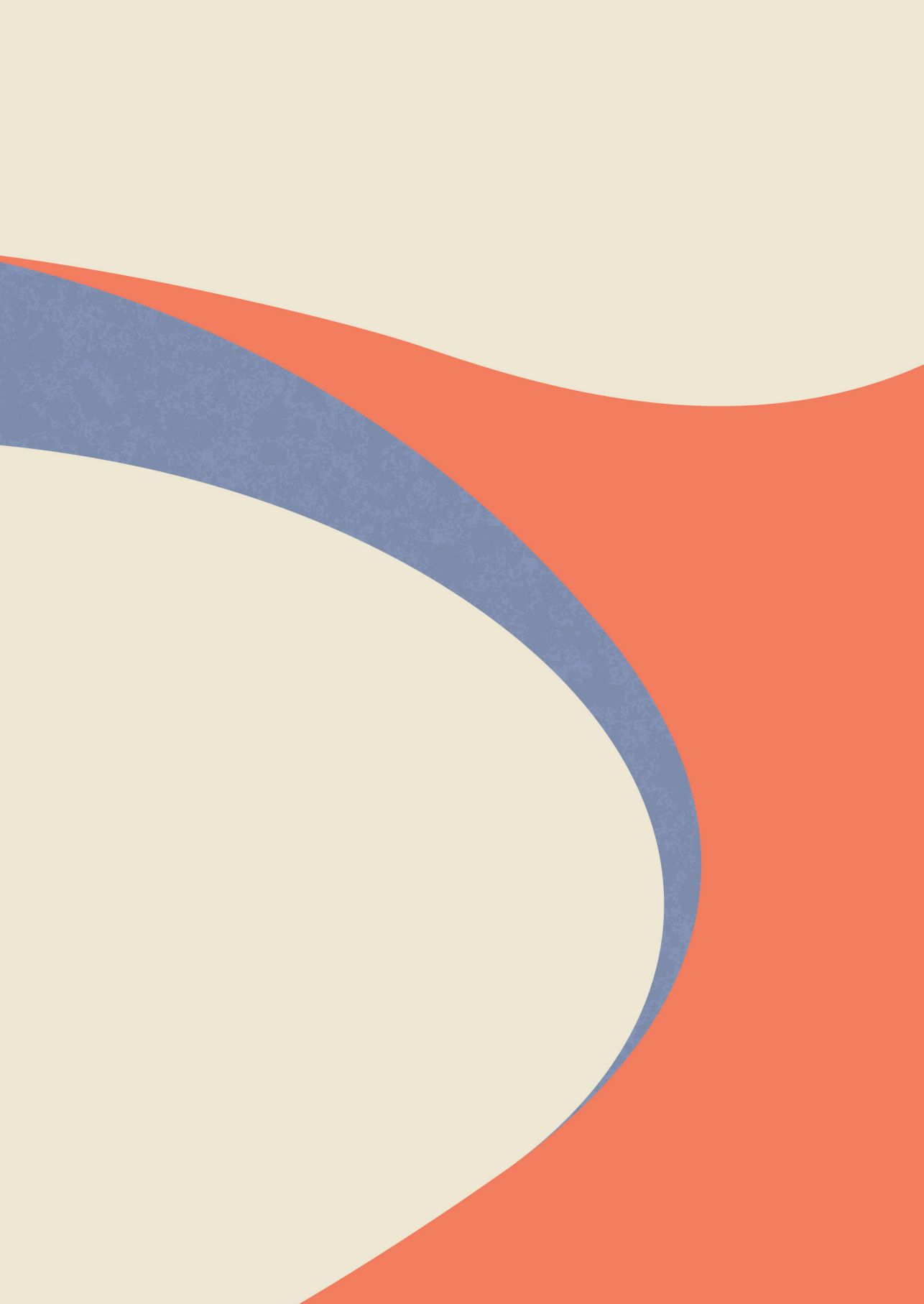
In literature and practice (Chapter 1 and 2), the physical presence of cleaning staff was mentioned frequently as a determinant of perceived cleanliness. In consecutive experiments (Chapter 4), it was demonstrated that more visible cleaning in trains and train stations improved customers' perceptions of cleanliness. More visible cleaning in trains was implemented as a part of the regular cleaning program after the experiments. During some follow-up studies, it was found that cleaners who were part of the experiment indicated to feel healthier and have more fun at work as they were openly appreciated by the customer. Hence, more visible cleaning while the customer is present can not only be used to positively influence perceived cleanliness but possibly also to the wellbeing of individual cleaners and appreciation for cleaning as a profession. To make more daywork possible, facility service providers have to adjust their operations by changing schedules and contracts, offer additional (hospitality) training to cleaners, and measure effects on perceived cleanliness using the CP-scale. There are practical limitations: not all cleaning can be done during the day, but practice is encouraged to introduce visible cleaning during the day as much as possible.

9.7 Concluding

This dissertation offers suggestions to practitioners on how to use the service environment to influence customers' perceptions of cleanliness. Research on the concept of perceived cleanliness, for which this dissertation offers first steps, will help client organisations and facility service providers to involve relevant stakeholders in the provision of cleanliness to customers. In this chapter, five recommendations are presented that will enable practitioners to offer a positive experience of cleanliness to their customers. These recommendations include:

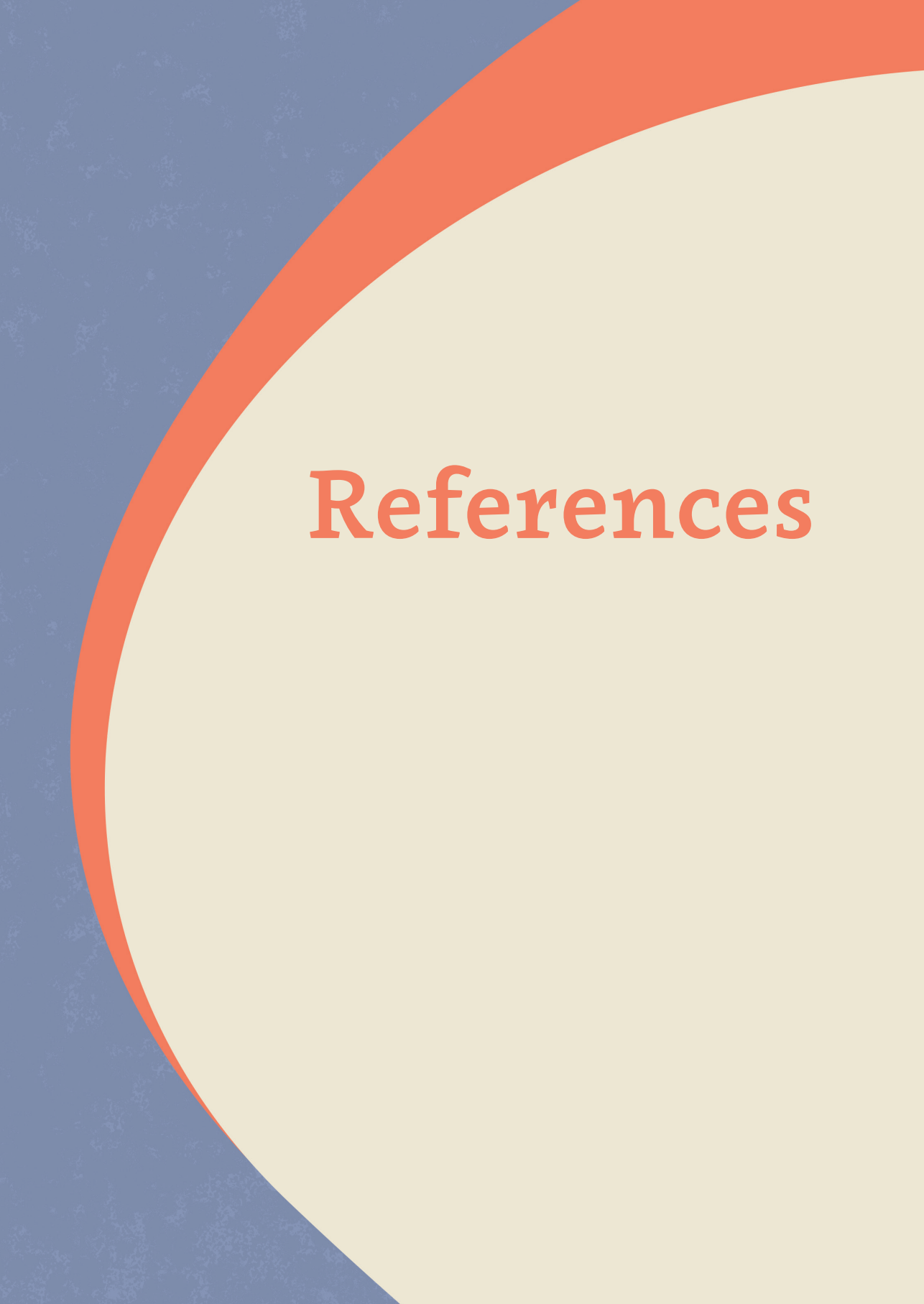
- (1) measure perceived cleanliness using the CP-scale;
- (2) influence perceived cleanliness by using environmental cues;
- (3) prioritise perceived cleanliness in cleaning contracts;
- (4) involve relevant stakeholders when improving perceived cleanliness; and
- (5) let customers and cleaning professionals benefit from the effects of more visible cleaning.

In the coming years, studies should be performed to expand scientific knowledge on how environmental cues can be used to influence perceived cleanliness in different service settings and how to apply these in practice.





Addendum



References

References

- Agrawal, S.R., & Mittal, D. (2019). How does transparency complement customer satisfaction and loyalty in the restaurant business? *Global Business Review*, 20(6), 1423-1444. <https://doi.org/10.1177/0972150919848935>
- Agular, L.L. (2001). Doing cleaning work 'scientifically': the reorganization of work in the contract building cleaning industry. *Economic and Industrial Democracy*, 22(2), 239-269. <https://doi.org/10.1177%2F0143831X01222004>
- Al-Khatib, I.A. (2009). Children's perceptions and behavior with respect to glass littering in developing countries: A case study in Palestine's Nablus district. *Waste Management*, 29(4), 1434-1437. <https://doi.org/10.1016/j.wasman.2008.08.026>
- Alan, C.B., So, S., & Sin, L. (2006). Crisis management and recovery: how restaurants in Hong Kong responded to SARS. *International Journal of Hospitality Management*, 25(1), 3-11. <https://doi.org/10.1016/j.ijhm.2004.12.001>
- Almanza, B.A. (2019). What disgusts consumers in the hospitality industry: the consumer reaction to environmental contamination model. *Journal of Hospitality & Tourism Research*, 43(6), 767-782. <https://doi.org/10.1177/1096348019840790>
- Alonso, A.D., & O'Neill, M.A. (2010). Exploring consumers' images of open restaurant kitchen design. *Journal of Retail & Leisure Property*, 9(3), 247-259. <https://doi.org/10.1057/rlp.2010.5>
- Alter, A.L., & Oppenheimer, D.M. (2009). Uniting the tribes of fluency to form a metacognitive nation. *Personality and Social Psychology Review*, 13(3), 219-235. <https://doi.org/10.1177%2F1088868309341564>
- Amblee, N. (2015). The impact of cleanliness on customer perceptions of security in hostels: A WOM-based approach. *International Journal of Hospitality Management*, 49, 37-39. <https://doi.org/10.1016/j.ijhm.2015.04.011>
- Anderson, C.R., & Zeithaml, C.P. (1984). Stage of the product life cycle, business strategy, and business performance. *Academy of Management Journal*, 27(1), 5-24. <https://doi.org/10.5465/255954>
- Anderson, J.R. (1983). A spreading activation theory of memory. *Journal of Verbal Learning and Verbal Behavior*, 22(3), 261-295. [https://doi.org/10.1016/S0022-5371\(83\)90201-3](https://doi.org/10.1016/S0022-5371(83)90201-3)
- Appell, L. (1968). Physical foundations in perfumery. Part VI. Volatility of the essential oils. *American Perfumer and Cosmetics*, 83, 37-47.
- Arafat, H.A., Al-Khatib, I.A., Daoud, R., & Shwahneh, H. (2007). Influence of socio-economic factors on street litter generation in the Middle East: effects of education level, age, and type of residence. *Waste Management & Research*, 25(4), 363-370. <https://doi.org/10.1177/0734242x07076942>
- Arao, M., Suzuki, M., Katayama, J.I., & Yagi, A. (2012). An odorant congruent with a colour cue is selectively perceived in an odour mixture. *Perception*, 41(4), 474-482. <https://doi.org/10.1068%2Fp7152>
- Aronoff, J., Woike, B.A., & Hyman, L.M. (1992). Which are the stimuli in facial displays of anger and happiness? Configurational bases of emotion recognition. *Journal of Personality and Social Psychology*, 62(6), 1050-1066. <https://doi.org/10.1037/0022-3514.62.6.1050>
- Ashforth, B.E., & Kreiner, G.E. (1999). "How can you do it?": Dirty work and the challenge of constructing a positive identity. *Academy of management Review*, 24(3), 413-434. <https://doi.org/10.5465/amr.1999.2202129>
- Aubert-Gamet, V., & Cova, B. (1999). Servicescapes: From modern non-places to postmodern common places. *Journal of Business Research*, 44(1), 37-45. [https://doi.org/10.1016/S0148-2963\(97\)00176-8](https://doi.org/10.1016/S0148-2963(97)00176-8)

- Augé, M. (1995). *Non-places: introduction to an anthropology of supermodernity*. Verso.
- Babin, B.J., Hardesty, D.M., & Suter, T.A. (2003). Color and shopping intentions: The intervening effect of price fairness and perceived affect. *Journal of Business Research*, 56(7), 541-551. [https://doi.org/10.1016/S0148-2963\(01\)00246-6](https://doi.org/10.1016/S0148-2963(01)00246-6)
- Bagozzi, R.P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, 16(1), 74-94. <https://doi.org/10.1007/bf02723327>
- Baker, J. (1987). The role of the environment in marketing services: the consumer perspective. In J. A. Czepiel, C.A. Congram & J. Shanahan (Eds.), *The services challenge: integrating for competitive advantage* (pp. 79-85). American Marketing Association
- Baker, J. & Cameron, M. (1996). The effects of the service environment on affect and consumer perception of waiting time: An integrative review and research propositions. *Journal of the Academy of Marketing Science*, 24(4), 338-349. <https://doi.org/10.1177/0092070396244005>
- Baker, J., Bentley, K., & Lamb, Jr, C. (2020). Service environment research opportunities. *Journal of Services Marketing*, 34(3), pp. 335-346. <https://doi.org/10.1108/JSM-02-2019-0077>
- Baker, J., Grewal, D., & Parasuraman, A. (1994). The influence of store environment on quality inferences and store image. *Journal of the Academy of Marketing Science*, 22(4), 328-339. <https://doi.org/10.1177/0092070394224002>
- Baker, J., Parasuraman, A., Grewal, D., & Voss, G.B. (2002). The influence of multiple store environment cues on perceived merchandise value and patronage intentions. *Journal of Marketing*, 66(2), 120-141. <https://doi.org/10.1509%2Fjmk.66.2.120.18470>
- Barber, N., & Scarcelli, J.M. (2010). Enhancing the assessment of tangible service quality through the creation of a cleanliness measurement scale. *Managing Service Quality: An International Journal*, 20(1), 70-88. <https://doi.org/10.1108/09604521011011630>
- Bargh, J.A. (2006). What have we been priming all these years? On the development, mechanisms, and ecology of nonconscious social behavior. *European Journal of Social Psychology*, 36(2), 147-168. <https://doi.org/10.1002/ejsp.336>
- Bateson, J.E., and Hui, M.K. (1992). The ecological validity of photographic slides and videotapes in simulating the service setting. *Journal of Consumer Research*, 19(2), 271-281. <https://doi.org/10.1086/209301>
- Bateson, M., Callow, L., Holmes, J.R., Redmond Roche, M.L., & Nettle, D. (2013). Do images of 'watching eyes' induce behaviour that is more pro-social or more normative? A field experiment on littering. *PLoS ONE*, 8(12). <https://doi.org/10.1371/journal.pone.0082055>
- Bator, R.J., Bryan, A.D., & Schultz, P.W. (2011). Who gives a hoot?: Intercept surveys of litterers and disposers. *Environment and Behavior*, 43(3), 295-315. <https://doi.org/10.1177/0013916509356884>
- Beck, M.J., & Rose, J.M. (2016). The best of times and the worst of times: A new best-worst measure of attitudes toward public transport experiences. *Transportation Research Part A: Policy and Practice*, 86, 108-123. <https://doi.org/10.1016/j.tra.2016.02.002>
- Behdioğlu, S., Acar, E., & Burhan, H.A. (2019). Evaluating service quality by fuzzy SERVQUAL: A case study in a physiotherapy and rehabilitation hospital. *Total Quality Management & Business Excellence*, 30(3-4), 301-319. <https://doi.org/10.1080/14783363.2017.1302796>
- Belke, B., Leder, H., Strobach, T., and Carbon, C.C. (2010). Cognitive fluency: High-level processing dynamics in art appreciation. *Psychology of Aesthetics, Creativity, and the Arts*, 4(4), 214-222. <https://doi.org/10.1037/a0019648>
- Bellizzi, J.A., and Hite, R.E. (1992). Environmental color, consumer feelings, and purchase likelihood. *Psychology & Marketing*, 9(5), 347-363. <https://doi.org/10.1002/mar.4220090502>

- Bellizzi, J.A., Crowley, A.E. and Hasty, R.W. (1983). The effects of color in store design. *Journal of Retailing*, 59(1), 21-45.
- Berry, L.L., Wall, E.A., & Carbone, L.P. (2006). Service clues and customer assessment of the service experience: Lessons from marketing. *Academy of Management Perspectives*, 20(2), 43-57. <https://doi.org/10.5465/AMP.2006.20591004>
- Birnbach, D.J., King, D., Vlaev, I., Rosen, L.F., & Harvey, P.D. (2013). Impact of environmental olfactory cues on hand hygiene behaviour in a simulated hospital environment: a randomized study. *Journal of Hospital Infection*, 85(1), 79-81. <https://doi.org/10.1016/j.jhin.2013.06.008>
- Bitner, M.J. (1990). Evaluating Service Encounters: The Effects of Physical Surroundings and Employee Responses. *Journal of Marketing*, 54(2), 69-82. <https://doi.org/10.2307/1251871>
- Bitner, M.J. (1992). Servicescapes: The impact of physical surroundings on customers and employees. *Journal of Marketing*, 56(2), 57-71. <https://doi.org/10.1177/002224299205600205>
- Bitner, M.J., Booms, B.H., & Tetreault, M.S. (1990). The service encounter: diagnosing favorable and unfavorable incidents. *The Journal of Marketing*, 54(1), 71-84. <https://doi.org/10.1177/002224299005400105>
- Boninsegni, M.F., Furrer, O., & Mattila, A.S. (2020). Dimensionality of frontline employee friendliness in service encounters. *Journal of Service Management*, 32(3), 346-382. <https://doi.org/10.1108/JOSM-07-2019-0214>
- Bosmans, A. (2006). Scents and sensibility: when do (in) congruent ambient scents influence product evaluations?. *Journal of Marketing*, 70(3), 32-43. <https://doi.org/10.1509%2Fjmk.70.3.032>
- Bossuyt, S., Van Kenhove, P., & De Bock, T. (2016). A dirty store is a cost forever: The harmful influence of disorderly retail settings on unethical consumer behavior. *International Journal of Research in Marketing*, 33(1), 225-231. <https://doi.org/10.1016/j.ijresmar.2015.12.005>
- Breiter, D., & Milman, A. (2006). Attendees' needs and service priorities in a large convention center: Application of the importance-performance theory. *Tourism Management*, 27(6), 1364-1370. <https://doi.org/10.1016/j.tourman.2005.09.008>
- Broeders, R., Lakens, D., Midden, C., & Ham, J. (2011). *An embodied cognition approach to litter reduction: the grounding of clean in shininess*. Conference paper 9th Biennial Conference on Environmental Psychology, Eindhoven, the Netherlands.
- Brotherton, B., & Wood, R.C. (2007). *Key themes in hospitality management*. The Sage Handbook of Hospitality Management. Sage.
- Brown, S.W., Gummesson, E., Edvardsson, B., & Gustavsson, B. (1991). *Service Quality: Multidisciplinary and Multinational Perspectives*. Lexington Books.
- Byun, J., & Jang, S. (2018). Open kitchen vs closed kitchen: Does kitchen design affect customers' causal attributions of the blame for service failures? *International Journal of Contemporary Hospitality Management*, 30(5), 2214-2229. <https://doi.org/10.1108/IJCHM-03-2016-0167>
- Bywater, L. (1990). Cleaning costs: a case study exercise. *Facilities*, 8(6), 16-18. <https://doi.org/10.1108/EUM0000000002115>
- Campbell, D.T., & Fiske, D.W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2), 81-105. <https://doi.org/10.1037/h0046016>
- Cascetta, E., & Carteni, A. (2014). The hedonic value of railways terminals. A quantitative analysis of the impact of stations quality on travellers behaviour. *Transportation Research Part A: Policy and Practice*, 61, 41-52. <https://doi.org/10.1016/j.tra.2013.12.008>
- Cattell, R.B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, 1(2), 245-276. https://doi.org/10.1207/s15327906mbr0102_10

- Cha, J., & Borchgrevink, C.P. (2018). Customers' perceptions in value and food safety on customer satisfaction and loyalty in restaurant environments: moderating roles of gender and restaurant types. *Journal of Quality Assurance in Hospitality & Tourism*, 20(2), 143-161. <https://doi.org/10.1080/1528008X.2018.1512934>
- Chase, R.B., & Hayes, R.H. (1991). Beefing up operations in service firms. *Sloan Management Review*, 33(1), 15-26. <https://sloanreview.mit.edu/article/beefing-up-operations-in-service-firms/>.
- Chebat, J.C., & Michon, R. (2003). Impact of ambient odors on mall shoppers' emotions, cognition, and spending: A test of competitive causal theories. *Journal of Business Research*, 56(7), 529-539. [https://doi.org/10.1016/S0148-2963\(01\)00247-8](https://doi.org/10.1016/S0148-2963(01)00247-8)
- Chebat, J.C., & Morrin, M. (2007). Colors and cultures: exploring the effects of mall décor on consumer perceptions. *Journal of Business Research*, 60(3), 189-196. <https://doi.org/10.1016/j.jbusres.2006.11.003>
- Cheng, F.F., Wu, C.S., & Yen, D.C. (2009). The effect of online store atmosphere on consumer's emotional responses-an experimental study of music and colour. *Behaviour & Information Technology*, 28(4), 323-334. <https://doi.org/10.1080/01449290701770574>
- Cheng, M. (2016). Sharing economy: A review and agenda for future research. *International Journal of Hospitality Management*, 57, 60-70. <https://doi.org/10.1016/j.ijhm.2016.06.003>
- Chow, A.J., Alonso, A.D., Douglas, A.C., & O'Neill, M.A. (2010). Exploring open kitchens' impact on restaurateurs' cleanliness perceptions. *Journal of Retail & Leisure Property*, 9(2), 93-104. <https://doi.org/10.1057/rlp.2009.26>.
- Chua, B.L., Lee, S., Huffman, L., & Choi, H.S. (2015). The role of physical environment in leisure service consumption: Evidence from a ski resort setting. *International Journal of Hospitality & Tourism Administration*, 16(4), 375-407. <https://doi.org/10.1080/15256480.2015.1090258>
- Chuang, H.M., Chu, C.P., & Lin, Y.T. (2011). *HSR buying behavior modeling-Taiwan High Speed Railway case*. Conference paper International Conference on Industrial Engineering and Engineering Management (IEEE), Singapore.
- Churchill Jr., G.A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research*, 16(1), 64-73. <https://doi.org/10.2307/3150876>
- Cialdini, R.B., Reno, R.R., & Kallgren, C.A. (1990). A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58(6), 1015-1026. <https://doi.org/10.1037/0022-3514.58.6.1015>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (second edition). Lawrence Earlbaum Associates.
- Collins, A.M., & Loftus, E.F. (1975). A spreading-activation theory of semantic processing. *Psychological review*, 82(6), 407-428. <https://doi.org/10.1037/0033-295X.82.6.407>
- Cooper, R.G. (2011). Perspective: The innovation dilemma: How to innovate when the market is mature. *Journal of Product Innovation Management*, 28(s1), 2-27. <https://doi.org/10.1111/j.1540-5885.2011.00858.x>
- Courtis, J.K. (2004). Colour as visual rhetoric in financial reporting. *Accounting Forum*, 28(3), 265-281. <https://doi.org/10.1016/j.accfor.2004.07.003>
- Crozier, W.R. (1996). The psychology of colour preferences. *Review of Progress in Coloration*, 26(1), 63-72. <https://doi.org/10.1111/j.1478-4408.1996.tb00111.x>
- Cupchik, G., Phillips, K., & Truong, H. (2005). Sensitivity to the cognitive and affective qualities of odours. *Cognition & Emotion*, 19(1), 121-131. <https://doi.org/10.1080/0269993044100011>
- Custers, R. and Aarts, H. (2010). The unconscious will: How the pursuit of goals operates outside of conscious awareness. *Science*, 329(5987), 47-50. <https://doi.org/10.1126/science.1188595>

- Da Luz Reis, A.T., & Dias Lay, M.C. (2009). Internal and external aesthetics of housing estates. *Environment and Behavior*, 42(2), 271-294. <https://doi.org/10.1177/0013916509334134>
- Dabholkar, P.A., & Bagozzi, R.P. (2002). An attitudinal model of technology-based self-service: moderating effects of consumer traits and situational factors. *Journal of the academy of marketing science*, 30(3), 184-201. <https://doi.org/10.1177/0092070302303001>
- Danaher, P.J., & Haddrell, V. (1996). A comparison of question scales used for measuring customer satisfaction. *International Journal of Service Industry Management*, 7(4), 4-26. <https://doi.org/10.1108/09564239610129922>
- Davis, R.G. (1981). The role of nonolfactory context cues in odor identification. *Perception & Psychophysics*, 30(1), 83-89. <https://doi.org/10.3758/BF03206139>
- De Bock, T., Pandelaere, M., & Van Kenhove, P. (2013). When colors backfire: The impact of color cues on moral judgment. *Journal of Consumer Psychology*, 23(3), 341-348. <https://doi.org/10.1016/j.jcps.2012.09.003>
- De Casterle, B.D., Gastmans, C., Bryon, E., & Denier, Y. (2012). QUAGOL: a guide for qualitative data analysis. *International Journal of Nursing Studies*, 49(3), 360-371. <https://doi.org/10.1016/j.ijnurstu.2011.09.012>
- De Jong, H.W. (1989). *Dynamische markttheorie (Dynamic Market Theory)*. H.E. Stenfert Kroese.
- De Kort, Y.A.W., McCalley, L.T., & Midden, C.J.H. (2008). Persuasive trash cans activation of littering norms by design. *Environment and Behavior*, 40(6), 870-891. <https://doi.org/10.1177/0013916507311035>
- De Lange, M.A., Debets, L.W., Ruitenburg, K., & Holland, R.W. (2012). Making less of a mess: Scent exposure as a tool for behavioral change. *Social Influence*, 7(2), 90-97. <https://doi.org/10.1080/15534510.2012.659509>
- Degel, J., Piper, D., & Köster, E.P. (2001). Implicit learning and implicit memory for odors: the influence of odor identification and retention time. *Chemical senses*, 26(3), 267-280. <https://doi.org/10.1093/chemse/26.3.267>
- Demoulin, N.T. (2011). Music congruency in a service setting: The mediating role of emotional and cognitive responses. *Journal of Retailing and Consumer Services*, 18(1), 10-18. <https://doi.org/10.1016/j.jretconser.2010.08.007>
- Dijksterhuis, A., Chartrand, T.L., & Aarts, H. (2007). Effects of Priming and Perception on Social Behavior and Goal Pursuit. In J. A. Bargh (Ed.), *Social psychology and the unconscious: The automaticity of higher mental processes* (51-131). Psychology Press.
- Dijksterhuis, A., Smith, P.K., Van Baaren, R.B., & Wigboldus, D.H. (2005). The unconscious consumer: Effects of environment on consumer behavior. *Journal of Consumer Psychology*, 15(3), 193-202. https://doi.org/10.1207/s15327663jcp1503_3
- Dijksterhuis, G.B., Zandstra, E., De Wijk, R. and Smeets, M.A.M. (2013). *Smelly and Dirty: Valence, Not Semantics, of Odours Prompt Cleaning Behaviour*. Poster presentation at Pangborn Sensory Science Conference, Rio de Janeiro, Brasil.
- DiStefano, C., & Hess, B. (2005). Using confirmatory factor analysis for construct validation: An empirical review. *Journal of Psychoeducational Assessment*, 23(3), 225-241. doi: 10.1177/073428290502300303
- Doucé, L., & Janssens, W. (2013). The presence of a pleasant ambient scent in a fashion store: The moderating role of shopping motivation and affect intensity. *Environment and Behavior*, 45(2), 215-238. <https://doi.org/10.1177/0013916511410421>
- Doucé, L., Janssens, W., Swinnen, G., & Van Cleempoel, K. (2014). Influencing consumer reactions towards a tidy versus a messy store using pleasant ambient scents. *Journal of Environmental Psychology*, 40, 351-358. <https://doi.org/10.1016/j.jenvp.2014.09.002>

- Doyen, S., Klein, O., Simons, D. J., & Cleeremans, A. (2014). On the other side of the mirror: Priming in cognitive and social psychology. *Social Cognition*, 32(supplement), 12-32. <https://doi.org/10.1521/soco.2014.32.suppl.12>
- Duncan, M., & Mummery, K. (2005). Psychosocial and environmental factors associated with physical activity among city dwellers in regional Queensland. *Preventive Medicine*, 40(4), 363-372. <https://doi.org/10.1016/j.ypmed.2004.06.017>
- Dur, R., & Vollaard, B. (2015). The Power of a Bad Example: A Field Experiment in Household Garbage Disposal. *Environment and Behavior*, 47(9), 970-1000. <https://doi.org/10.1177/0013916514535085>
- Durant, D.J. (2021). Can patient-reported room cleanliness measures predict hospital-acquired C. difficile infection? A study of acute care facilities in New York state. *American Journal of Infection Control*, 49(4), 452-457. <https://doi.org/10.1016/j.ajic.2020.08.024>
- Eagly, A.H., Ashmore, R.D., Makhijani, M.G., & Longo, L.C. (1991). What is beautiful is good, but...: A meta-analytic review of research on the physical attractiveness stereotype. *Psychological Bulletin*, 110(1), 109-128. <https://doi.org/10.1037/0033-2909.110.1.109>
- Eboli, L., Forciniti, C., & Mazzulla, G. (2018). Spatial variation of the perceived transit service quality at rail stations. *Transportation Research Part A: Policy and Practice*, 114, 67-83. <https://doi.org/10.1016/j.tra.2018.01.032>
- Edwards, B., & Bromfield, L.M. (2009). Neighborhood influences on young children's conduct problems and pro-social behavior: Evidence from an Australian national sample. *Children and Youth Services Review*, 31(3), 317-324. <https://doi.org/10.1016/j.childyouth.2008.08.005>
- Edwards, M. (2010). *Fragrances of the world: Parfums du monde 2010 (26nd ed.)*. Crescent House.
- Eisinga, R., Grotenhuis, M., & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health*, 58(4), 637-642. <https://doi.org/10.1007/s00038-012-0416-3>
- Elliot, A.J., Maier, M.A., Moller, A.C., Friedman, R. and Meinhardt, J. (2007). Color and psychological functioning: The effect of red on performance attainment. *Journal of Experimental Psychology*, 136(1), 154-168. <https://doi.org/10.1037/0096-3445.136.1.154>
- Emir, O., & Saraçlı, S. (2011). Determinants of customer satisfaction with thermal hotels. *Anatolia*, 22(1), 56-68. <https://doi.org/10.1080/13032917.2011.556221>
- EN 13725 (2003). *Air Quality-Determination of Odour Concentration by Dynamic Olfactometry*. European Committee for Standardization (CEN).
- Epps H.H., & Kaya N. (2004). *Color matching from memory*. Conference paper the Interem Meeting of International Color Association, Porto, Portugal.
- Evans, D. (2002). The effectiveness of music as an intervention for hospital patients: a systematic review. *Journal of Advanced Nursing*, 37(1), 8-18. <https://doi.org/10.1046/j.1365-2648.2002.02052.x>
- Farrell, A.M., & Rudd, J.M. (2009). Factor analysis and discriminant validity: A brief review of some practical issues. Conference paper ANZMAC, Melbourne, Australia.
- Faul, F., Erdfelder, E., Lang, A.G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175-191. <https://doi.org/10.3758/BF03193146>
- Fazio, R.H. (2001). On the automatic activation of associated evaluations: An overview. *Cognition & Emotion*, 15(2), 115-141. <https://doi.org/10.1080/02699930125908>
- Feldman, J. (1997) Regularity-based perceptual grouping. *Computational Intelligence*, 13(4), 582-623. <https://doi.org/10.1111/0824-7935.00052>
- Field, A. (2013). *Discovering statistics using SPSS*. Sage Publications.

- Fisher, J.D. (1974). Situation-specific variables as determinants of perceived environmental aesthetic quality and perceived crowdedness. *Journal of Research in Personality*, 8(2), 177-188. [https://doi.org/10.1016/0092-6566\(74\)90019-1](https://doi.org/10.1016/0092-6566(74)90019-1)
- Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2021). The influence of scent on virtual reality experiences: the role of aroma-content congruence. *Journal of Business Research*, 123, 289-301. <https://doi.org/10.1016/j.jbusres.2020.09.036>
- Friedman, R.S., & Förster, J. (2010). Implicit affective cues and attentional tuning: an integrative review. *Psychological bulletin*, 136(5), 875. <https://doi.org/10.1037/a0020495>
- Gaillet, M., Sulmont-Rossé, C., Issanchou, S., Chabanet, C., & Chambaron, S. (2013). Priming effects of an olfactory food cue on subsequent food-related behaviour. *Food Quality and Preference*, 30(2), 274-281. <https://doi.org/10.1016/j.foodqual.2013.06.008>
- Gbadegesin, J.T., & Babatunde, T.O. (2015). Investigating experts' opinion on outsourcing decision in facilities management practice in public Universities in Nigeria. *Journal of Facilities Management*, 13(1), 27-44. <https://doi.org/10.1108/JFM-09-2013-0047>
- Gilboa, S., & Rafaeli, A. (2003). Store environment, emotions and approach behaviour: applying environmental aesthetics to retailing. *The International Review of Retail, Distribution and Consumer Research*, 13(2), 195-211. <https://doi.org/10.1080/0959396032000069568>
- Gmuer, A., Siegrist, M., & Dohle, S. (2015). Does wine label processing fluency influence wine hedonics? *Food Quality and Preference*, 44, 12-16. <https://doi.org/10.1016/j.foodqual.2015.03.007>
- Graf, L.K., Mayer, S., & Landwehr, J.R. (2018). Measuring processing fluency: One versus five items. *Journal of Consumer Psychology*, 28(3), 393-411. <https://doi.org/10.1002/jcpy.1021>
- Green, M. (1999). *Natural perfumes: Simple aromatherapy recipes*. Interweave Press.
- Grönroos, C. (1984). A service quality model and its marketing implications. *European Journal of Marketing*, 18(4), 36-44. <https://doi.org/10.1108/EUM00000000004784>
- Gropp, K.M., Pickett, W., & Janssen, I. (2012). Multi-level examination of correlates of active transportation to school among youth living within 1 mile of their school. *International Journal of Behavioral Nutrition and Physical Activity*, 9,(124). <https://doi.org/10.1186/1479-5868-9-124>
- Gupta, S., & Coskun, M. (2021). The influence of human crowding and store messiness on consumer purchase intention-the role of contamination and scarcity perceptions. *Journal of Retailing and Consumer Services*, 61, 102511. <https://doi.org/10.1016/j.jretconser.2021.102511>
- Guttman, L. (1954). Some necessary conditions for common-factor analysis. *Psychometrika*, 19(2), 149-161. <https://doi.org/10.1007/BF02289162>
- Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., & Tatham, R.L. (1998). *Multivariate Data Analysis*. Prentice hall Upper
- Hancock, P.A., Ross, J.M., & Szalma, J.L. (2007). A meta-analysis of performance response under thermal stressors. *Human Factors*, 49(5), 851-877. <https://doi.org/10.1518/001872007X230226>
- Handyside, F. (2010). Let's make love: Whiteness, cleanliness and sexuality in the French reception of Marilyn Monroe. *European Journal of Cultural Studies*, 13(3), 291-306. <https://doi.org/10.1177%2F1367549410363198>
- Hansmann, R., & Scholz, R.W. (2003). A two-step informational strategy for reducing littering behavior in a cinema. *Environment and Behavior*, 35(6), 752-762. <https://doi.org/10.1177/0013916503254755>
- Harris, L.C., & Ezech, C. (2008). Servicescape and loyalty intentions: an empirical investigation. *European Journal of Marketing*, 42(3/4), 390-422. <https://doi.org/10.1108/03090560810852995>
- Harris, P.B., & Sachau, D. (2005). Is cleanliness next to godliness? The role of housekeeping in impression formation. *Environment and Behavior*, 37(1), 81-101. <https://doi.org/10.1177/0013916504266803>

- Harutyunyan, K. (2015). Colour terms in advertisement. *Armenian Folia Anglistika*, 2(14), 56-67. <https://doi.org/10.46991/AFA/2015.11.2.056>
- Hasse, C., & Weber, R. (2012). Eye movements on facades: the subjective perception of balance in architecture and its link to aesthetic judgment. *Empirical Studies of the Arts*, 30(1), 7-22. <https://doi.org/10.2190%2FEM.30.1.c>
- Haugen, T.B., & Klungseth, N.J. (2017). In-house or outsourcing FM services in the public sector: a review of 25 years research and development. *Journal of Facilities Management*, 15(3). <https://doi.org/10.1108/JFM-06-2016-0022>
- Hayton, J.C., Allen, D.G., & Scarpello, V. (2004). Factor retention decisions in exploratory factor analysis: A tutorial on parallel analysis. *Organizational Research Methods*, 7(2), 191-205. <https://doi.org/10.1177/1094428104263675>
- Helmefalk, M., & Berndt, A. (2018). Shedding light on the use of single and multisensory cues and their effect on consumer behaviours. *International Journal of Retail & Distribution Management*. <https://doi.org/10.1108/IJRDM-03-2018-0057>
- Helmefalk, M., & Hultén, B. (2017). Multi-sensory congruent cues in designing retail store atmosphere: Effects on shoppers' emotions and purchase behavior. *Journal of Retailing and Consumer Services*, 38, 1-11. <https://doi.org/10.1016/j.jretconser.2017.04.007>
- Helms, J.E., Henze, K.T., Sass, T.L., & Mifsud, V.A. (2006). Treating Cronbach's alpha reliability coefficients as data in counseling research. *The Counseling Psychologist*, 34(5), 630-660. <https://doi.org/10.1177/0011000006288308>
- Henderson, G.R., Iacobucci, D., & Calder, B.J. (1998). Brand diagnostics: Mapping branding effects using consumer associative networks. *European Journal of Operational Research*, 111(2), 306-327. [https://doi.org/10.1016/S0377-2217\(98\)00151-9](https://doi.org/10.1016/S0377-2217(98)00151-9)
- Henderson, L.K., Craig, J.C., Willis, N.S., Tovey, D., & Webster, A.C. (2010). How to write a Cochrane systematic review. *Nephrology*, 15(6), 617-624. <https://doi.org/10.1111/j.1440-1797.2010.01380.x>
- Henson, R.K., & Roberts, J.K. (2006). Use of exploratory factor analysis in published research: Common errors and some comment on improved practice. *Educational and Psychological Measurement*, 66(3), 393-416. <https://doi.org/10.1177/0013164405282485>
- Herrmann, A., Zidansek, M., Sprott, D.E., & Spangenberg, E. R. (2013). The power of simplicity: Processing fluency and the effects of olfactory cues on retail sales. *Journal of Retailing*, 89(1), 30-43. <https://doi.org/10.1016/j.jretai.2012.08.002>
- Herz, R. (2007). *The scent of desire: Discovering our enigmatic sense of smell*. William Morrow.
- Herz, R.S., & Engen, T. (1996). Odor memory: Review and analysis. *Psychonomic Bulletin & Review*, 3(3), 300-313. <https://doi.org/10.3758/BF03210754>
- Herzberg, F.I. (1966). *Work and the nature of man*. World Publishing.
- Higgins, E.T. (1996). Knowledge activation: Accessibility, applicability, and salience. In Higgins E.T. & Kruglanski A.W. (Eds.). *Social psychology: Handbook of basic principles* (133-168). Guilford Press.
- Holland, R.W., Hendriks, M., & Aarts, H. (2005). Smells like clean spirit: Nonconscious effects of scent on cognition and behavior. *Psychological Science*, 16(9), 689-693. <https://doi.org/10.1111/j.1467-9280.2005.01597.x>
- Honold, J., Beyer, R., Lakes, T., & Van der Meer, E. (2012). Multiple environmental burdens and neighborhood-related health of city residents. *Journal of Environmental Psychology*, 32(4), 305-317. <https://doi.org/10.1016/j.jenvp.2012.05.002>
- Hood, J.C. (1988). From night to day: Timing and the management of custodial work. *Journal of Contemporary Ethnography*, 17(1), 96-116. <https://doi.org/10.1177%2F0891241688171004>

- Hooper, D., Coughlan, J., & Mullen, M. (2013). The servicescape as an antecedent to service quality and behavioral intentions. *Journal of Services Marketing*, 27(4), 271-280. <https://doi.org/10.1108/08876041311330753>
- Houston, A., & Youngs, G. (1996). Proactive outsourcing-a strategic partnership: Rank Xerox Technical Centre. *Facilities*, 14(7/8), 40-47. <https://doi.org/10.1108/02632779610123371>
- Hu, L.T., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: a Multidisciplinary Journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Huffman, K.T., Grossnickle, W.F., Cope, J.G., & Huffman, K.P. (1995). Litter Reduction: A Review and Integration of the Literature. *Environment and Behavior*, 27(2), 153-183. <https://doi.org/10.1177/0013916595272003>
- Hui, E.C., & Zheng, X. (2010). Measuring customer satisfaction of FM service in housing sector: A structural equation model approach. *Facilities*, 28(5/6), 306-320. <https://doi.org/10.1108/02632771011031538>
- Hui, E.C., Zhang, P.H., & Zheng, X. (2013). Facilities management service and customer satisfaction in shopping mall sector. *Facilities*, 31(5/6), 194-207. <https://doi.org/10.1108/02632771311307070>
- Imschloss, M., & Kuehnl, C. (2017). Don't ignore the floor: Exploring multisensory atmospheric congruence between music and flooring in a retail environment. *Psychology & Marketing*, 34(10), 931-945. <https://doi.org/10.1002/mar.21033>
- Jacobs, L., Keown, C., Worthley, R. and Fghymn, K.I. (1991). Cross-cultural colour comparisons: global marketers beware! *International Marketing Review*, 8(3). <https://doi.org/10.1108/02651339110137279>
- Janiszewski, C., & Meyvis, T. (2001). Effects of brand logo complexity, repetition, and spacing on processing fluency and judgment. *Journal of Consumer Research*, 28(1), 18-32. <https://doi.org/10.1086/321945>
- Janiszewski, C., & Wyer Jr, R.S. (2014). Content and process priming: A review. *Journal of Consumer Psychology*, 24(1), 96-118. <https://doi.org/10.1016/j.jcps.2013.05.006>
- Jespersen, O. (1922). *Language: its Nature, Developments and Origins*. Allen & Unwin.
- Ju, Y., Back, K. J., Choi, Y., & Lee, J.S. (2019). Exploring Airbnb service quality attributes and their asymmetric effects on customer satisfaction. *International Journal of Hospitality Management*, 77, 342-352. <https://doi.org/10.1016/j.ijhm.2018.07.014>
- Kaiser, H.F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, 20(1), 141-151. <https://doi.org/10.1177/001316446002000116>
- Kallgren, C.A., Reno, R.R., & Cialdini, R.B. (2000). A focus theory of normative conduct: When norms do and do not affect behavior. *Personality and Social Psychology Bulletin*, 26(8), 1002-1012. <https://doi.org/10.1177/01461672002610009>
- Kaminakis, K., Karantinou, K., Koritos, C., & Gounaris, S. (2019). Hospitality servicescape effects on customer-employee interactions: A multilevel study. *Tourism Management*, 72, 130-144. <https://doi.org/10.1016/j.tourman.2018.11.013>
- Kamoen, N., Holleman, B., Van den Bergh, H., & Sanders, T. (2013). Positive, negative, and bipolar questions: The effect of question polarity on ratings of text readability. *Survey Research Methods*, 7(3), 181-189. <https://doi.org/10.18148/srm/2013.v7i3.5034>
- Kauppinen-Räsänen, H. (2014). Strategic use of colour in brand packaging. *Packaging Technology and Science*, 27(8), 663-676. <https://doi.org/10.1002/pts.2061>
- Kaya, N. and Crosby, M. (2006). Color associations with different building types: An experimental study on American college students. *Color Research and Application*, 31(1), 67-71. <https://doi.org/10.1002/col.20174>

- Kearney, T., Coughlan, J., & Kennedy, A. (2013). An exploration of the effects of the servicescape on customer and employee responses in a grocery retail context. *Irish Journal of Management*, 32(2), 71-91. <https://doi.org/10.21427/D7620R>
- Keizer, K., Lindenberg, S., & Steg, L. (2008). The spreading of disorder. *Science*, 322(5908), 1681-1685. <https://doi.org/10.1126/science.1161405>
- Keizer, K., Lindenberg, S., & Steg, L. (2011). The reversal effect of prohibition signs. *Group Processes and Intergroup Relations*, 14(5), 681-688. <https://doi.org/10.1177/1368430211398505>
- Keller, K.L. (1993). Conceptualizing, measuring, and managing customer-based brand equity. *Journal of marketing*, 57(1), 1-22. <https://doi.org/10.1177/002224299305700101>
- Kim, J.E. & Kim, J. (2012). Human factors in retail environments: a review. *International Journal of Retail & Distribution Management*, 40(11), 818-841. <https://doi.org/10.1108/09590551211267593>
- King, D., Vlaev, I., Everett-Thomas, R., Fitzpatrick, M., Darzi, A., & Birnbach, D. J. (2016). "Priming" hand hygiene compliance in clinical environments. *Health Psychology*, 35(1), 96-101. <https://doi.apa.org/doi/10.1037/hea0000239>
- Klauer, K.C. (1997). Affective priming. *European Review of Social Psychology*, 8(1), 67-103. <https://doi.org/10.1080/14792779643000083>
- Kline, R. (2005). *Principles and Practice of Structural Equation Modeling*. The Guildford Press.
- Klungseth, N.J.H., & Olsson, N.O.E. (2013). Norwegian cleaning research: an overview and categorization. *Facilities*, 31(7/8), 290-313. <https://doi.org/10.1108/02632771311317457>
- Klungseth, N.J.H. (2014). Organising cleaning in Norwegian public FM. *Journal of Facilities Management*, 12(4), 382-410. <https://doi.org/10.1108/JFM-02-2014-0007>
- Klungseth, N.J.H., & Blakstad, S.H. (2016). Organising in-house cleaning services in public FM. *Facilities*, 34(13/14), 828-854. <https://doi.org/10.1108/F-03-2014-0024>
- Knoeflerle, K.M., Paus, V. C., & Vossen, A. (2017). An upbeat crowd: Fast in-store music alleviates negative effects of high social density on customers' spending. *Journal of Retailing*, 93(4), 541-549. <https://doi.org/10.1016/j.jretai.2017.06.004>
- Koch, D., & Eitzinger, S. (2019). Pitfall benchmarking of cleaning costs in hospitals. *Journal of Facilities Management*, 17(3), 284-300. <https://doi.org/10.1108/JFM-08-2018-0050>
- Kotler, P. (1974). Atmospherics as a Marketing Tool. *Journal of Retailing*, 49(4), 48-64.
- Krishna, A., Elder, R.S., & Caldara, C. (2010). Feminine to smell but masculine to touch? Multisensory congruence and its effect on aesthetic experience. *Journal of Consumer Psychology*, 20(4), 410-418. <https://doi.org/10.1016/j.jcps.2010.06.010>
- Kunz, W.H., & Hogreve, J. (2011). Toward a deeper understanding of service marketing: The past, the present, and the future. *International Journal of Research in Marketing*, 28(3), 231-247. <https://doi.org/10.1016/j.ijresmar.2011.03.002>
- Labrecque, L.I., & Milne, G.R. (2012). Exciting red and competent blue: the importance of color in marketing. *Journal of the Academy of Marketing Science*, 40(5), 711-727. <https://doi.org/10.1007/s11747-010-0245-y>
- Labrecque, L.I., Patrick, V.M., & Milne, G.R. (2013). The Marketers' Prismatic Palette: A Review of Color Research and Future Directions. *Psychology & Marketing*, 30(2), 187-202. <https://doi.org/10.1002/mar.20597>
- Ladhari, R., Souiden, N., & Dufour, B. (2017). The role of emotions in utilitarian service settings: The effects of emotional satisfaction on product perception and behavioral intentions. *Journal of Retailing and Consumer Services*, 34, 10-18. <https://doi.org/10.1016/j.jretconser.2016.09.005>

- Lagrange, R.L., Ferraro, K.F., & Supancic, M. (1992). Perceived Risk and Fear of Crime - Role of Social and Physical Incivilities. *Journal of Research in Crime and Delinquency*, 29(3), 311-334. <https://doi.org/10.1177/0022427892029003004>
- Lam, L.W., Chan, K.W., Fong, D., & Lo, F. (2011). Does the look matter? The impact of casino servicescape on gaming customer satisfaction, intention to revisit, and desire to stay. *International Journal of Hospitality Management*, 30(3), 558-567. <https://doi.org/10.1016/j.ijhm.2010.10.003>
- Landwehr, J.R., Golla, B., & Reber, R. (2017). Processing fluency: An inevitable side effect of evaluative conditioning. *Journal of Experimental Social Psychology*, 70, 124-128. <https://doi.org/10.1016/j.jesp.2017.01.004>
- LeBlanc, G., & Nguyen, N. (1996). Cues used by customers evaluating corporate image in service firms: An empirical study in financial institutions. *International Journal of Service Industry Management*, 13(3/4), 242-262. <https://doi.org/10.1016/j.jesp.2017.01.004>
- Leddy, T. (1995). Everyday surface aesthetic qualities: Neat, messy, clean, dirty. *The Journal of Aesthetics and Art Criticism*, 53(3), 259-268. <https://doi.org/10.2307/431351>
- Lee, C.J., Wang, Y.C., & Cai, D.C. (2015). Physical factors to evaluate the servicescape of theme restaurants. *Journal of Asian Architecture and Building Engineering*, 14(1), 97-104. <https://doi.org/10.3130/jaabe.14.97>
- Lee, R.E., Soltero, E.G., Jauregui, A., Mama, S.K., Barquera, S., Jauregui, E., Taylor, J.L., Hernández, L.L., & Levesque, L. (2016). Disentangling Associations of Neighborhood Street Scale Elements With Physical Activity in Mexican School Children. *Environment and Behavior*, 48(1), 150-171. <https://doi.org/10.1177/0013916515615389>
- Lee, S.Y., & Kim, J.H. (2014). Effects of servicescape on perceived service quality, satisfaction and behavioral outcomes in public service facilities. *Journal of Asian Architecture and Building Engineering*, 13(1), 125-131. <https://doi.org/10.3130/jaabe.13.125>
- Leenders, M.A., Smidts, A., & El Haji, A. (2019). Ambient scent as a mood inducer in supermarkets: The role of scent intensity and time-pressure of shoppers. *Journal of Retailing and Consumer Services*, 48, 270-280. <https://doi.org/10.1016/j.jretconser.2016.05.007>
- Levitan, C.A., Ren, J., Woods, A.T., Boesveldt, S., Chan, J. S., McKenzie, K.J., Dodson, M., Levin, J.A., Leong, C.X.R., & Van den Bosch, J. J. (2014). Cross-cultural color-odor associations. *PloS one*, 9(7): e101651. <https://doi.org/10.1371/journal.pone.0101651>
- Lewis, T., Griffith, C., Gallo, M., & Weinbren, M. (2008). A modified ATP benchmark for evaluating the cleaning of some hospital environmental surfaces. *Journal of Hospital Infection*, 69(2), 156-163. <https://doi.org/10.1016/j.jhin.2008.03.013>
- Lin, I.Y. (2004). Evaluating a servicescape: the effect of cognition and emotion. *International Journal of Hospitality Management*, 23(2), 163-178. <https://doi.org/10.1016/j.ijhm.2003.01.001>
- Lin, I.Y., & Worthley, R. (2012). Servicescape moderation on personality traits, emotions, satisfaction, and behaviors. *International Journal of Hospitality Management*, 31(1), 31-42. <https://doi.org/10.1016/j.ijhm.2011.05.009>
- Line, N.D., Hanks, L., & Kim, W.G. (2018). An expanded servicescape framework as the driver of place attachment and word of mouth. *Journal of Hospitality & Tourism Research*, 42(3), 476-499. <https://doi.org/10.1177%2F1096348015597035>
- Liu, J.H., & Sibley, C.G. (2004). Attitudes and behavior in social space: Public good interventions based on shared representations and environmental influences. *Journal of Environmental Psychology*, 24(3), 373-384. <https://doi.org/10.1016/j.jenvp.2003.12.003>

- Lockyer, T. (2003). Hotel cleanliness—how do guests view it? Let us get specific. A New Zealand study. *International Journal of Hospitality Management*, 22(3), 297-305. [https://doi.org/10.1016/S0278-4319\(03\)00024-0](https://doi.org/10.1016/S0278-4319(03)00024-0)
- Lockyer, T. (2005). Understanding the dynamics of the hotel accommodation purchase decision. *International Journal of Contemporary Hospitality Management*, 17(6), 481-492. <https://doi.org/10.1108/09596110510612121>.
- Lucas, A.F. (2003). The determinants and effects of slot servicescape satisfaction in a Las Vegas hotel casino. *UNLV Gaming Research & Review Journal*, 7(1), 1-19. Retrieved from: <https://digitalscholarship.unlv.edu/grrj/vol7/iss1/1>
- Lunardo, R., Roux, D., & Chaney, D. (2016). The evoking power of servicescapes: Consumers' inferences of manipulative intent following service environment-driven evocations. *Journal of Business Research*, 69(12), 6097-6105. <https://doi.org/10.1016/j.jbusres.2016.06.017>
- Macrae, C.N., & Johnston, L. (1998). Help, I need somebody: Automatic action and inaction. *Social Cognition*, 16(4), 400-417. <https://doi.org/10.1521/soco.1998.16.4.400>
- Magnini, V.P., & Zehrer, A. (2021). Subconscious influences on perceived cleanliness in hospitality settings. *International Journal of Hospitality Management*, 94, 102761. <https://doi.org/10.1016/j.ijhm.2020.102761>
- Magnini, V.P., Crotts, J.C., & Zehrer, A. (2011). Understanding customer delight: An application of travel blog analysis. *Journal of Travel Research*, 50(5), 535-545. <https://doi.org/10.1177/0047287510379162>.
- Manav, B. (2007). Color-emotion associations and color preferences: A case study for residences. *Color Research and Application*, 32(2), 144-150. <https://doi.org/10.1002/col.20294>
- Mand, S., Medhurst, A., & Mand, H. (2017). Wynyard station upgrade customer experience and wayfinding strategies. In *16th Australasian Tunnelling Conference 2017: Challenging Underground Space: Bigger, Better, More* (p. 1015). Engineers Australia.
- Mari, M., & Poggese, S. (2013). Servicescape cues and customer behavior: a systematic literature review and research agenda. *The Service Industries Journal*, 33(2), 171-199. <https://doi.org/10.1080/02642069.2011.613934>
- Matsunaga, M. (2010). How to Factor-Analyze Your Data Right: Do's, Don'ts, and How-To's. *International Journal of Psychological Research*, 3(1). <https://doi.org/10.21500/20112084.854>
- Mattila, A.S., & Wirtz, J. (2001). Congruency of scent and music as a driver of in-store evaluations and behavior. *Journal of Retailing*, 77(2), 273-289. [https://doi.org/10.1016/S0022-4359\(01\)00042-2](https://doi.org/10.1016/S0022-4359(01)00042-2)
- Mazursky, D., & Jacoby, J. (1986). Exploring the development of store images. *Journal of Retailing*, 62(2), pp. 145-165.
- McColl, S.L., & Veitch, J.A. (2001). Full-spectrum fluorescent lighting: a review of its effects on physiology and health. *Psychological Medicine*, 31(6), 949-964. <https://doi.org/10.1017/s0033291701004251>
- Medway, D., Parker, C., & Roper, S. (2016). Litter, gender and brand: The anticipation of incivilities and perceptions of crime prevalence. *Journal of Environmental Psychology*, 45, 135-144. <https://doi.org/10.1016/j.jenvp.2015.12.002>
- Mehrabian, A. and Russell, J.A. (1974). *An approach to environmental psychology*. The MIT Press.
- Mehta, R. (2013). Understanding perceived retail crowding: A critical review and research agenda. *Journal of Retailing and Consumer Services*, 20(6), 642-649. <https://doi.org/10.1016/j.jretconser.2013.06.002>
- Mensah, I., & Mensah, R.D. (2018). Effects of service quality and customer satisfaction on repurchase intention in restaurants on University of Cape Coast campus. *Journal of Tourism, Heritage & Services Marketing*, 4(2), 27-36. <http://dx.doi.org/10.5281/zenodo.1247542>

- Meyers-Levy, J., & Zhu, R. (2007). The Influence of Ceiling Height: The Effect of Priming on the Type of Processing That People Use. *Journal of Consumer Research*, 34(4), 174-186. <https://doi.org/10.1086/519146>
- Mier N., Lee C., Smith M.L., Wang X., Irizarry D., Avila-Rodriguez E.H., Trevino L., & Ory M.G. (2013). Mexican-American Children's Perspectives: Neighborhood Characteristics and Physical Activity in Texas-Mexico Border Colonias. *Journal of Environmental Health*, 76(3), 8-16.
- Miles, P., Miles, G., & Cannon, A. (2012). Linking servicescape to customer satisfaction: exploring the role of competitive strategy. *International Journal of Operations & Production Management*, 32(7), 772-795. <https://doi.org/10.1108/01443571211250077>
- Miller, R.L., Brickman, P., & Bolen, D. (1975). Attribution versus persuasion as a means for modifying behavior. *Journal of Personality and Social Psychology*, 31(3), 430-441. <https://doi.org/10.1037/h0076539>
- Miura, K., & Saito, M. (2012). Harmonious color model with fragrances. *Color Research and Application*, 37(3), 219-232. <https://doi.org/10.1002/col.20678>
- Molden, D.C. (2014). Understanding priming effects in social psychology: What is "social priming" and how does it occur?. *Social Cognition*, 32, 1-11. <https://doi.org/10.1521/soco.2014.32.suppl>
- Molenaar, N., & Hu, J. (2013). Light and the perception of cleanliness in public spaces. *Journal of Man, Machine and Technology*, 2(1), 63-70. <https://doi.org/10.4156/jmmt.vol2.issue1.7>
- Moon, H., Yoon, H.J., & Han, H. (2017). The effect of airport atmospherics on satisfaction and behavioral intentions: testing the moderating role of perceived safety. *Journal of Travel & Tourism Marketing*, 34(6), 749-763. <https://doi.org/10.1080/10548408.2016.1223779>
- Morin, S., Dubé, L., & Chebat, J.C. (2007). The role of pleasant music in servicescapes: A test of the dual model of environmental perception. *Journal of Retailing*, 83(1), 115-130. <https://doi.org/10.1016/j.jretai.2006.10.006>
- Morrin, M. (2011). Scent marketing: An overview. In *Sensory Marketing* (pp. 105-116). Routledge.
- Morrison, M., Gan, S., Dubelaar, C., & Oppewal, H. (2011). In-store music and aroma influences on shopper behavior and satisfaction. *Journal of Business Research*, 64(6), 558-564. <https://doi.org/10.1016/j.jbusres.2010.06.006>
- Murphy, A.K. (2012). "Litterers": How Objects of Physical Disorder Are Used to Construct Subjects of Social Disorder in a Suburb. *Annals of the American Academy of Political and Social Science*, 642(1), 210-227. <https://doi.org/10.1177/0002716212438210>
- Nasar, J.L. (1997). New developments in aesthetics for urban design. In *Toward the Integration of Theory, Methods, Research, and Utilization* (pp. 149-193): Springer.
- Norman, D. (2002). Emotion & design: attractive things work better. *interactions*, 9(4), 36-42. <https://doi.org/10.1145/543434.543435>
- North, A.C., Hargreaves, D.J., & McKendrick, J. (1999). The influence of in-store music on wine selections. *Journal of Applied Psychology*, 84(2), 271. <https://doi.org/10.1037/0021-9010.84.2.271>
- Oliva, A., Mack, M. L., Shrestha, M., & Peeper, A. (2004). Identifying the perceptual dimensions of visual complexity of scenes. In Forbus, K, Gentner, D., & Regier, T. (Eds.). *Proceedings of the 26th Annual Meeting of the Cognitive Science Society Meeting* (pp. 1041-1046). Cognitive Science Society.
- Oliver, R.L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research*, 17(4), 460-469. <https://doi.org/10.1177%2F002224378001700405>
- Oppenheimer, D.M. (2008). The secret life of fluency. *Trends in cognitive sciences*, 12(6), 237-241. <https://doi.org/10.1016/j.tics.2008.02.014>

- Orstad, S.L., McDonough, M.H., Stapleton, S., Altincekic, C., & Troped, P.J. (2016). A Systematic Review of Agreement Between Perceived and Objective Neighborhood Environment Measures and Associations With Physical Activity Outcomes. *Environment and Behavior*, 49(8), 904-932. <https://doi.org/10.1177/0013916516670982>
- Orth, U.R., & Wirtz, J. (2014). Consumer processing of interior service environments: the interplay among visual complexity, processing fluency, and attractiveness. *Journal of Service Research*, 17(3), 296-309. <https://doi.org/10.1177%2F1094670514529606>
- Parasuraman, A., Zeithaml, V.A., & Berry, L.L. (1988). Servqual: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12.
- Parish, J.T., Berry, L.L., & Lam, S.Y. (2008). The effect of the servicescape on service workers. *Journal of Service Research*, 10(3), 220-238. <https://doi.org/10.1177%2F1094670507310770>
- Park, E. (2019). The role of satisfaction on customer reuse to airline services: An application of Big Data approaches. *Journal of Retailing and Consumer Services*, 47, 370-374. <https://doi.org/10.1016/j.jretconser.2019.01.004>
- Park, H., & Almanza, B. (2020). What do airplane travelers think about the cleanliness of airplanes and how do they try to prevent themselves from getting sick? *Journal of Quality Assurance in Hospitality & Tourism*, 21(6), 738-757. <https://doi.org/10.1080/1528008X.2020.1746222>
- Park, H., Kline, S.F., Kim, J., Almanza, B. and Ma, J. (2019). Does hotel cleanliness correlate with surfaces guests contact?. *International Journal of Contemporary Hospitality Management*, 31(7), 2933-2950. <https://doi.org/10.1108/IJCHM-02-2018-0105>
- Parker, C., Roper, S., & Medway, D. (2015). Back to basics in the marketing of place: the impact of litter upon place attitudes. *Journal of Marketing Management*, 31(9-10), 1090-1112. <https://doi.org/10.1080/0267257x.2015.1035307>
- Peter, J.P., & Olson, J.C. (2002). *Consumer behaviour and marketing strategy*. Irwin.
- Pieters, R., Wedel, M., & Zhang, J. (2007). Optimal feature advertising design under competitive clutter. *Management Science*, 53(11), 1815-1828. <https://doi.org/10.1287/mnsc.1070.0732>
- Pijls, R., Groen, B.H., Galetzka, M., & Pruyn, A.T.H. (2017). Measuring the experience of hospitality: Scale development and validation. *International Journal of Hospitality Management* 67, 125-133. <http://doi.org/10.1016/j.ijhm.2017.07.008>
- Pine, B. J., & Gilmore, J. H. (1998). *Welcome to the experience economy*. Harvard Business School Press.
- Pizam, A., & Tasci, A.D. (2019). Experienscape: expanding the concept of servicescape with a multi-stakeholder and multi-disciplinary approach. *International Journal of Hospitality Management*, 76, part B, pp. 25-37. <https://doi.org/10.1016/j.ijhm.2018.06.010>
- Powell-Wiley, T.M., Ayers, C.R., de Lemos, J.A., Lakoski, S.G., Vega, G.L., Grundy, S., Sandeep, R.D., Banks-Richard, K., & Albert, M.A. (2013). Relationship between Perceptions about Neighborhood Environment and Prevalent Obesity: Data from the Dallas Heart Study. *Obesity*, 21(1), E14-E21. <https://doi.org/10.1002/oby.20012>
- Priluck Grossman, R., & Wisenblit, J.Z. (1999). What we know about consumers' color choices. *Journal of Marketing Practice: Applied Marketing Science*, 5(3), 78-88. <https://doi.org/10.1108/EUM0000000004565>
- Raajpoot, N.A. (2002). TANGSERV: A multiple item scale for measuring tangible quality in foodservice industry. *Journal of Foodservice Business Research*, 5(2), 109-127. https://doi.org/10.1300/J369v05n02_08

- Rafaeli, A., & Vilnai-Yavetz, I. (2004). Instrumentality, aesthetics and symbolism of physical artifacts as triggers of emotion. *Theoretical Issues in Ergonomics Science*, 5(1), 91-112. <https://doi.org/10.1080/1463922031000086735>
- Ramlee, N., & Said, I. (2014). Review on Atmospheric Effects of Commercial Environment. *Procedia - Social and Behavioral Sciences*, 153, 426-435. <https://doi.org/10.1016/j.sbspro.2014.10.076>
- Ramos, J., & Torgler, B. (2012). Are academics messy? Testing the broken windows theory with a field experiment in the work environment. *Review of Law and Economics*, 8(3), 563-577. <https://doi.org/10.1515/1555-5879.1617>
- Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience?. *Personality and Social Psychology Review*, 8(4), 364-382. https://doi.org/10.1207%2Fs15327957pspr0804_3
- Reber, R., Wurtz, P., & Zimmermann, T.D. (2004). Exploring "fringe" consciousness: The subjective experience of perceptual fluency and its objective bases. *Consciousness and Cognition*, 13(1), 47-60. [https://doi.org/10.1016/S1053-8100\(03\)00049-7](https://doi.org/10.1016/S1053-8100(03)00049-7)
- Reich, J.W., & Robertson, J.L. (1979). Reactance and Norm Appeal in Anti-Littering Messages. *Journal of Applied Social Psychology*, 9(1), 91-101. <https://doi.org/10.1111/j.1559-1816.1979.tb00796.x>
- Reimer, A., & Kuehn, R. (2005). The impact of servicescape on quality perception. *European Journal of Marketing*, 39(7/8), 785-808. <https://doi.org/10.1108/03090560510601761>
- Reno, R. R., Cialdini, R. B., & Kallgren, C. A. (1993). The Transsituational Influence of Social Norms. *Journal of Personality and Social Psychology*, 64(1), 104-112. <https://doi.org/10.1037/0022-3514.64.1.104>
- Rogers, C. J., & Hart, R. (2021). Home and the extended-self: Exploring associations between clutter and wellbeing. *Journal of Environmental Psychology*, 73, 101553. <https://doi.org/10.1016/j.jenvp.2021.101553>
- Rogier, J.J.H. (1998). *De wisselwerking tussen organisatie en markt: ontwerp van een instrument voor ondernemers die hun besturing willen balanceren* (Ph.D. thesis). Retrieved from: <https://research.rug.nl/nl/publications/de-wisselwerking-tussen-organisatie-en-markt-ontwerp-van-een-inst>
- Rolls, E.T., Kringelbach, M.L., & De Araujo, I.E. (2003). Different representations of pleasant and unpleasant odours in the human brain. *European Journal of Neuroscience*, 18(3), 695-703. <https://doi.org/10.1046/j.1460-9568.2003.02779.x>
- Roschk, H., Loureiro, S.M.C., & Breitsohl, J. (2017). Calibrating 30 years of experimental research: a meta-analysis of the atmospheric effects of music, scent, and color. *Journal of Retailing*, 93(2), 228-240. <https://doi.org/10.1016/j.jretai.2016.10.001>
- Rosenholtz, R., Li, Y., Mansfield, J., & Jin, Z. (2005). Feature congestion: a measure of display clutter. In *Proceedings CHI (Computer Human Interaction) 2005*, (pp. 761-770). Association for Computing Machinery.
- Rowe, G., & Wright, G. (2001). Expert opinions in forecasting: the role of the Delphi technique. In *Principles of forecasting* (pp. 125-144). Springer.
- Roy, S.K., Shekhar, V., Lassar, W.M., & Chen, T. (2018). Customer engagement behaviors: The role of service convenience, fairness and quality. *Journal of Retailing and Consumer Services*, 44, 293-304. <https://doi.org/10.1016/j.jretconser.2018.07.018>
- Rust, R.T., & Chung, T.S. (2006). Marketing models of service and relationships. *Marketing Science*, 25(6), 560-580. <https://doi.org/10.1287/mksc.1050.0139>
- Rychalski, A., & Hudson, S. (2017). Asymmetric effects of customer emotions on satisfaction and loyalty in a utilitarian service context. *Journal of Business Research*, 71, 84-91. <https://doi.org/10.1016/j.jbusres.2016.10.014>

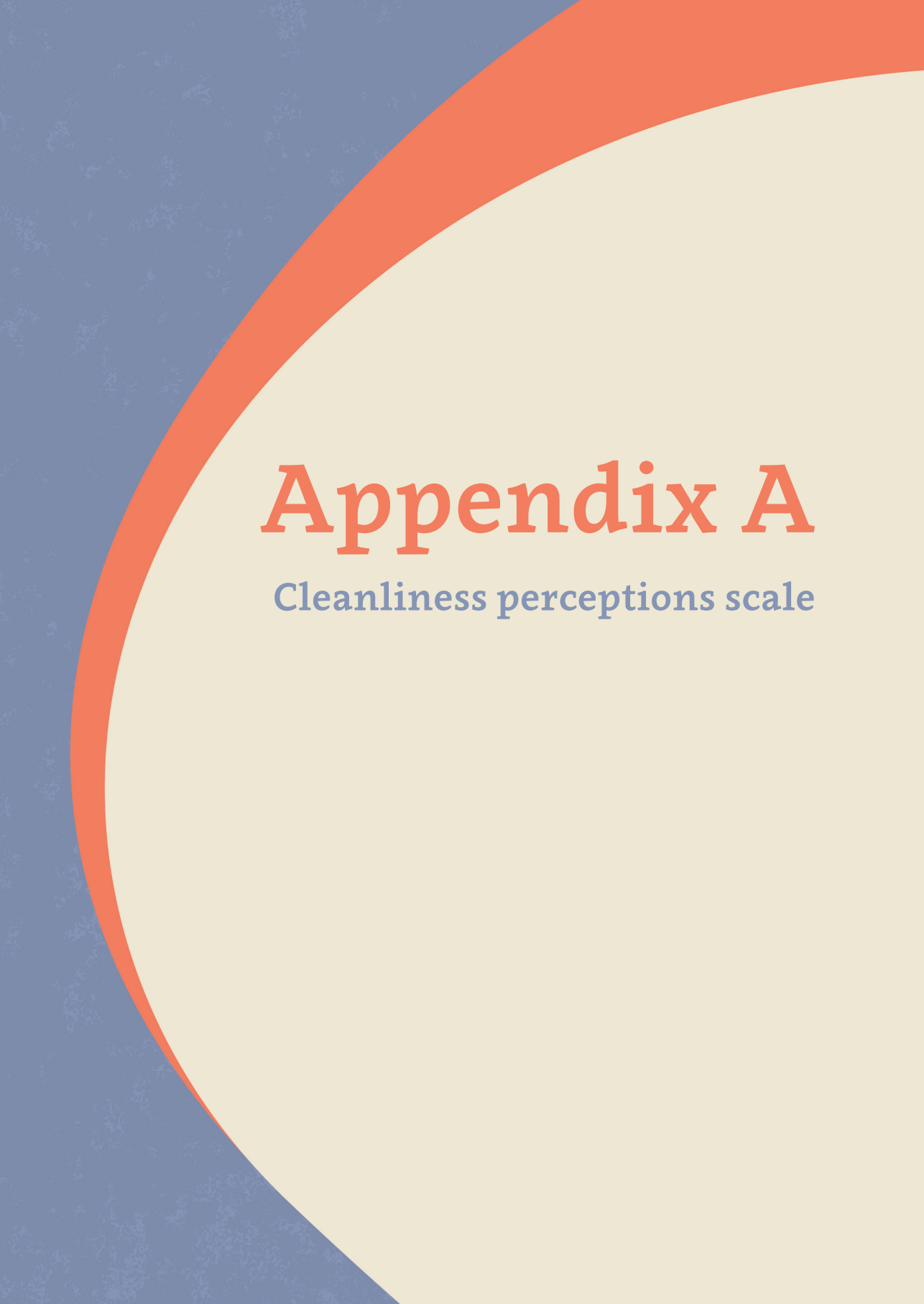
- Ryu, K., & Han, H. (2011). New or repeat customers: How does physical environment influence their restaurant experience?. *International Journal of Hospitality Management*, 30(3), 599-611. <https://doi.org/10.1016/j.ijhm.2010.11.004>
- Safizadeh, M.H., Field, J.M., & Ritzman, L.P. (2003). An empirical analysis of financial services processes with a front-office or back-office orientation. *Journal of Operations Management*, 21(5), 557-576. <https://doi.org/10.1016/j.jom.2003.03.001>
- Saito, M. (1996). Comparative studies on color preference in Japan and other Asian regions, with special emphasis on the preference for white. *Color Research and Application*, 21(1), 35-49. [https://doi.org/10.1002/\(SICI\)1520-6378\(199602\)21:1%3C35::AID-COL4%3E3.0.CO;2-6](https://doi.org/10.1002/(SICI)1520-6378(199602)21:1%3C35::AID-COL4%3E3.0.CO;2-6)
- Santos, I.R., Friedrich, A.C., Wallner-Kersanach, M., & Fillmann, G. (2005). Influence of socio-economic characteristics of beach users on litter generation. *Ocean and Coastal Management*, 48(9-10), 742-752. <https://doi.org/10.1016/j.ocecoaman.2005.08.006>
- Schifferstein, H.N., & Blok, S.T. (2002). The signal function of thematically (in) congruent ambient scents in a retail environment. *Chemical Senses*, 27(6), 539-549. <https://doi.org/10.1093/chemse/27.6.539>
- Schneider, B., Ehrhart, M.G., Mayer, D.M., Saltz, J.L., & Niles-Jolly, K. (2005). Understanding organization-customer links in service settings. *Academy of Management Journal*, 48(6), 1017-1032. <https://psycnet.apa.org/doi/10.5465/AMJ.2005.19573107>
- Schneider, W., & Shiffrin, R.M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological review*, 84(1), 1-66. <https://psycnet.apa.org/doi/10.1037/0033-295X.84.1.1>
- Schriesheim, C.A., Eisenbach, R.J., & Hill, K.D. (1991). The effect of negation and polar opposite item reversals on questionnaire reliability and validity: An experimental investigation. *Educational and Psychological Measurement*, 51(1), 67-78. <https://doi.org/10.1177/0013164491511005>
- Schultz, P.W., Bator, R.J., Large, L.B., Bruni, C.M., & Tabanico, J.J. (2013). Littering in Context: Personal and Environmental Predictors of Littering Behavior. *Environment and Behavior*, 45(1), 35-59. <https://doi.org/10.1177/0013916511412179>
- Schwarz, N. (2004). Metacognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology*, 14(4), 332-348. https://doi.org/10.1207/s15327663jcp1404_2
- Sharma, A., & Stafford, T.F. (2000). The Effect of Retail Atmospherics on Customers' Perceptions of Salespeople and Customer Persuasion: An Empirical Investigation. *Journal of Business Research*, 49(2), 183-191. [https://doi.org/10.1016/S0148-2963\(99\)00004-1](https://doi.org/10.1016/S0148-2963(99)00004-1)
- Shashikala, R., & Suresh, A. (2013). Building consumer loyalty through servicescape in shopping malls. *IOSR Journal of Business and Management*, 10(6), 11-17. <http://dx.doi.org/10.9790/487X-1061117>
- Sherlock, O., O'Connell, N., Creamer, E., & Humphreys, H. (2009). Is it really clean? An evaluation of the efficacy of four methods for determining hospital cleanliness. *Journal of Hospital Infection*, 72(2), 140-146. <https://doi.org/10.1016/j.jhin.2009.02.013>
- Sherman, G. D., & Clore, G. L. (2009). The color of sin: White and black are perceptual symbols of moral purity and pollution. *Psychological Science*, 20(8), 1019-1025. <https://doi.org/10.1111%2Fj.1467-9280.2009.02403.x>
- Shiffrin, R.M., & Schneider, W. (1977). Controlled and automatic human information processing: II. Perceptual learning, automatic attending and a general theory. *Psychological Review*, 84(2), 127-190. <https://doi.org/10.1037/0033-295X.84.2.127>
- Shin, H., & Kang, J. (2020). Reducing perceived health risk to attract hotel customers in the COVID-19 pandemic era: Focused on technology innovation for social distancing and cleanliness. *International Journal of Hospitality Management*, 91, 102664. <https://doi.org/10.1016/j.ijhm.2020.102664>

- Sibley, C.G., & Liu, J.H. (2003). Differentiating active and passive littering - A two-stage process model of littering behavior in public spaces. *Environment and Behavior*, 35(3), 415-433. <https://doi.org/10.1177/0013916503251446>
- Siu, N. Y.-M., Wan, P. Y. K., & Dong, P. (2012). The impact of the servicescape on the desire to stay in convention and exhibition centers: The case of Macao. *International Journal of Hospitality Management*, 31(1), 236-246. <https://doi.org/10.1016/j.ijhm.2011.06.011>
- Smeets, M.A., & Dijksterhuis, G.B. (2014). Smelly primes-when olfactory primes do or do not work. *Frontiers in Psychology*, 5, 96. <https://dx.doi.org/10.3389%2Ffpsyg.2014.00096>
- Smith, V. (2008). *Clean: a history of personal hygiene and purity*. Oxford University Press.
- Solís Salazar, M. (2015). The dilemma of combining positive and negative items in scales. *Psicothema*, 27(2). <https://doi.org/10.7334/psicothema2014.266>
- Spangenberg, E.R., Crowley, A.E., & Henderson, P.W. (1996). Improving the store environment: do olfactory cues affect evaluations and behaviors?. *Journal of Marketing*, 60(2), 67-80. <https://doi.org/10.1177%2F002224299606000205>
- Spangenberg, E.R., Grohmann, B., & Sprott, D.E. (2005). It's beginning to smell (and sound) a lot like Christmas: the interactive effects of ambient scent and music in a retail setting. *Journal of Business Research*, 58(11), 1583-1589. <https://doi.org/10.1016/j.jbusres.2004.09.005>
- Spence, C. (2011). Crossmodal correspondences: A tutorial review. *Attention, Perception, & Psychophysics*, 73(4), 971-995. <https://doi.org/10.3758/s13414-010-0073-7>
- Spence, C., Puccinelli, N.M., Grewal, D., & Roggeveen, A.L. (2014). Store atmospherics: A multisensory perspective. *Psychology & Marketing*, 31(7), 472-488. <https://doi.org/10.1002/mar.20709>
- Spengler, J.D., McCarthy, J.F., & Samet, J.M. (2001). *Indoor Air Quality Handbook*. McGraw-Hill Professional Publishing
- Stipak, B. (1979). Citizen Satisfaction with Urban Services: Potential Misuse as a Performance Indicator. *Public Administration Review*, 39(1), 46-52. <https://doi.org/10.2307/3110378>
- Sunaga, T., Park, J., & Spence, C. (2016). Effects of lightness-location congruency on consumers' purchase decision-making. *Psychology & Marketing*, 33(11), 934-950. <https://doi.org/10.1002/mar.20929>
- Tantanatewin, W., & Inkarojrit, V. (2018). The influence of emotional response to interior color on restaurant entry decision. *International Journal of Hospitality Management*, 69, 124-131. <https://doi.org/10.1016/j.ijhm.2017.09.014>
- Thorndike, E. L. (1920). A constant error in psychological ratings. *Journal of Applied Psychology*, 4, 25-29. <https://doi.org/10.1037/h0071663>
- Till, B.D., Baack, D., & Waterman, B. (2011). Strategic brand association maps: developing brand insight. *Journal of Product & Brand Management*, 20(2), 92-100. <https://doi.org/10.1108/10610421111121080>
- Tobia, K.P., Chapman, G.B., & Stich, S. (2013). Cleanliness is next to morality, even for philosophers. *Journal of Consciousness Studies*, 20(11-12).
- Toffolutti, V., Reeves, A., McKee, M., & Stuckler, D. (2017). Outsourcing cleaning services increases MRSA incidence: evidence from 126 English acute trusts. *Social Science & Medicine*, 174, 64-69. <https://doi.org/10.1016/j.socscimed.2016.12.015>
- Tombs, A., & McColl-Kennedy, J. R. (2003). Social-Servicescape Conceptual Model. *Marketing Theory*, 3(4), 447-475. <https://doi.org/10.1177/1470593103040785>
- Truong, N., Nisar, T., Knox, D., & Prabhakar, G. (2017). The influences of cleanliness and employee attributes on perceived service quality in restaurants in a developing country. *International Journal of Culture, Tourism and Hospitality Research*, 11(4), 608-627. <https://doi.org/10.1108/IJCTHR-11-2016-0111>

- Tudor, D.T., & Williams, A.T. (2006). A rationale for beach selection by the public on the coast of Wales, UK. *Area*, 38(2), 153-164. <https://doi.org/10.1111/j.1475-4762.2006.00684.x>
- Turgot A.R.J. (1767). Observation sur un Mémoire de M. de Saint-Peravy. In G. Schelle (ed): *Œuvres de Turgot et Documents le Concernant*, 2, 644. Librairie Felix Alcan.
- Turley, L.W., & Milliman, R.E. (2000). Atmospheric Effects on Shopping Behavior: A Review of the Experimental Evidence. *Journal of Business Research*, 49(2), 193-211. [https://doi.org/10.1016/S0148-2963\(99\)00010-7](https://doi.org/10.1016/S0148-2963(99)00010-7)
- Turner, N.E. (1998). The effect of common variance and structure pattern on random data eigenvalues: Implications for the accuracy of parallel analysis. *Educational and Psychological Measurement*, 58(4), 541-568. <https://doi.org/10.1177/0013164498058004001>
- Ueno, M., Nakagiri, S., Taniguchi, T., Arisawa, T., Mino, Y., Kodera, R., Kanazawa, S., Oyama, K., Ogawa, T., & Ohta, T. (1984). Effects of consecutive night-shift work on health conditions among car-cleaners of super-express trains. *Japanese Journal of Industrial Health*, 26(6), 483-491. <https://doi.org/10.1539/joh1959.26.483>
- Ulrich, R.S., Berry, L.L., Quan, X., & Parish, J.T. (2010). A conceptual framework for the domain of evidence-based design. *HERD: Health Environments Research & Design Journal*, 4(1), 95-114. <https://doi.org/10.1177%2F193758671000400107>
- Valdez, P. & Mehrabian, A. (1994). Effects of color on emotions. *Journal of Experimental Psychology*, 123(4), 394-409. <https://psycnet.apa.org/doi/10.1037/0096-3445.123.4.394>
- Van der Helm, P.A. (2000). Simplicity versus likelihood in visual perception: From surprisals to precisals. *Psychological Bulletin*, 126(5), 770-800. <https://doi.org/10.1037/0033-2909.126.5.770>
- Van Diepen-Knegjens, C., & Veenstra, J. (2017). *De Nederlandse Facility Management Markt: een Overzicht van Cijfers, Trends en Ontwikkelingen*. FMN.
- Van Hagen, M., & Sauren, J. (2014). Influencing the Train Experience: Using a Successful Measurement Instrument. *Transportation Research Procedia*, 1(1), 264-275. <http://dx.doi.org/10.1016/j.trpro.2014.07.026>
- Van Hagen, M., Galetzka, M., & Pruyn, A.T. (2014). Waiting experience in railway environments. *Journal of Motivation*, 2(2), 41-55. <https://doi.org/10.12689/jmep.2014.305>
- Van Hagen, M., Martens, H., & Pruyn, A.T. (2017). Maatwerk in het publieke domein: de inrichting van stations en luchthavens. *Tijdschrift voor Management & Organisatie*, 3/4. <https://www.tijdschriftmeno.nl/artikel/15447/Maatwerk-in-het-publieke-domein-De-inrichting-van-stations-en-luchthavens>
- Van Lierop, D., Badami, M. G., & El-Geneidy, A. M. (2017). What influences satisfaction and loyalty in public transport? A review of the literature. *Transport Reviews*, 38(1), 52-72. <https://doi.org/10.1080/01441647.2017.1298683>
- Van Osselaer, S.M., & Janiszewski, C. (2001). Two ways of learning brand associations. *Journal of Consumer Research*, 28(2), 202-223. <https://doi.org/10.1086/322898>
- Van Ryzin, G.G., Immerwahr, S., & Altman, S. (2008). Measuring street cleanliness: A comparison of New York City's scorecard and results from a citizen survey. *Public Administration Review*, 68(2), 295-303. <https://doi.org/10.1111/j.1540-6210.2007.00863.x>
- Van Vlijmen, J. (2017). *Ik zie, ik zie, wat jij niet ziet. Een publiektheologische analyse van de onzichtbare schoonmaker*. (Ph.D. Thesis). Retrieved from: <https://repository.ubn.ru.nl/bitstream/handle/2066/169216/169216.pdf?sequence=1>
- Van Vlijmen, J. (2019). Being a cleaner in The Netherlands: Coping with the dirty work stigma. *Facilities*, 37(5/6), 280-291. <https://doi.org/10.1108/F-03-2018-0038>

- Van Vlijmen, J., & Van den Hoogen, T. (2013). Reconstructing the image of the cleaner. In *Proceedings of 12th EuroFM research symposium 2013* (pp. 66-73). European Facility Management Network.
- Verhoef, P.C., Lemon, K.N., Parasuraman, A., Roggeveen, A., Tsiros, M., & Schlesinger, L. A. (2009). Customer experience creation: Determinants, dynamics and management strategies. *Journal of Retailing*, 85(1), 31-41. <https://doi.org/10.1016/j.jretai.2008.11.001>
- Verhoeven, J.W.M. (2010). Keeping up appearances: service environments as symbolic communication (Doctoral dissertation). Retrieved from: <https://research.utwente.nl/en/publications/keeping-up-appearances-service-environments-as-symbolic-communic>
- Vilnai-Yavetz, I. & Gilboa, S. (2010). The effect of servicescape cleanliness on customer reactions. *Services Marketing Quarterly*, 31(2), 213-234. <https://doi.org/10.1080/15332961003604386>.
- Vilnai-Yavetz, I., & Rafaeli, A. (2011). The effects of a service provider's messy appearance on customer reactions. *Services Marketing Quarterly*, 32(3), 161-180. <https://doi.org/10.1080/15332969.2011.581890>
- Vos, M.C., Sauren, J., & Knoop, O. (2017). Out of the Shadows: Influencing Train Passengers' Perceptions and Satisfaction by Increasing Visibility of Cleaning Staff. In *Presentation at EUROFM's 16th Research Symposium (EFMC 2017), April 26-27, 2017, Madrid, Spain*.
- Vos, M.C., Galetzka, M., Mobach, M.P., van Hagen, M., & Pruyn, A.T. (2018a). Cleanliness unravelled: a review and integration of literature. *Journal of Facilities Management*, 16(4), 429-451. <https://doi.org/10.1108/JFM-06-2017-0025>
- Vos, M.C., Galetzka, M., Mobach, M.P., Van Hagen, M., & Pruyn, A.T. (2018b). Exploring cleanliness in the Dutch facilities management industry: a Delphi approach. *Facilities*, 36, (9/10), 510-524. <https://doi.org/10.1108/F-09-2017-0092>
- Vos, M.C., Galetzka, M., Mobach, M.P., van Hagen, M., & Pruyn, A.T. (2019a). Measuring perceived cleanliness in service environments: Scale development and validation. *International Journal of Hospitality Management*, 83, 11-18. <https://doi.org/10.1016/j.ijhm.2019.04.005>.
- Vos, M.C., Sauren, J., Knoop, O., Galetzka, M., Mobach, M.P. and Pruyn, A.T. (2019b). Into the light: effects of the presence of cleaning staff on customer experience. *Facilities*, 37(1/2), 91-102. <https://doi.org/10.1108/F-10-2017-0105>
- Vos, M.C., & Van Hagen, M. (2019). Objective and subjective predictors of perceived cleanliness in train stations. *Transportation Research Procedia*, 42, 109-117. <https://doi.org/10.1016/j.trpro.2019.12.011>
- Wakefield, K.L., & Blodgett, J.G. (1996). The effect of the servicescape on customers' behavioral intentions in leisure service settings. *Journal of Services Marketing*, 10(6), 45-61. <https://doi.org/10.1108/08876049610148594>
- Walker, P. and Walker, L. (2012). Size-brightness correspondence: Crosstalk and congruity among dimensions of connotative meaning. *Attention, Perception, & Psychophysics*, 74(6), 1226-1240. <https://doi.org/10.3758/s13414-012-0297-9>
- Walsh, G., Shiu, E., Hassan, L.M., Michaelidou, N., & Beatty, S.E. (2011). Emotions, store-environmental cues, store-choice criteria, and marketing outcomes. *Journal of Business Research*, 64(7), 737-744. <https://doi.org/10.1016/j.jbusres.2010.07.008>
- Weaver, R. (2015). Littering in context(s): Using a quasi-natural experiment to explore geographic influences on antisocial behavior. *Applied Geography*, 57, 142-153. <https://doi.org/10.1016/j.apgeog.2015.01.001>
- Weems, G.H., Onwuegbuzie, A.J., & Collins, K.M. (2006). The role of reading comprehension in responses to positively and negatively worded items on rating scales. *Evaluation & Research in Education*, 19(1), 3-20. <https://doi.org/10.1080/09500790608668322>

- Weinstein, R.A., & Hota, B. (2004). Contamination, disinfection, and cross-colonization: are hospital surfaces reservoirs for nosocomial infection? *Clinical infectious diseases*, 39(8), 1182-1189. <https://doi.org/10.1086/424667>
- Wells, V.K., & Daunt, K.L. (2015). Eduscape: The effects of servicescapes and emotions in academic learning environments. *Journal of Further and Higher Education*. <https://doi.org/10.1080/0309877X.2014.984599>
- Wertheimer, M. (1958). The relation between the sound of a word and its meaning. *The American Journal of Psychology*, 71(2), 412-415. <https://doi.org/10.2307/1420089>
- Whatley, V., Jackson, L., & Taylor, J. (2012). Improving public perceptions around cleanliness and health care associated infection in hospitals (service improvement). *Journal of Infection Prevention*, 13(6), 192-199. <https://doi.org/10.1177/1757177412462047>
- Whitehead, H., May, D., & Agahi, H. (2007). An exploratory study into the factors that influence patients' perceptions of cleanliness in an acute NHS trust hospital. *Journal of Facilities Management*, 5(4), 275-289. <https://doi.org/10.1108/14725960710822268>
- Wilson, J.Q., & Kelling, G. (1982). Broken windows: the police and neighborhood safety. *Atlantic*, 127, 29-38
- Winkielman, P., Schwarz, N., Fazendeiro, T., & Reber, R. (2003). The hedonic marking of processing fluency: Implications for evaluative judgment. In Musch, J. & Klauer, K.C. (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion* (189-217). Lawrence Erlbaum Associates, Inc.
- Wunderlich, N.V., Wangenheim, F.V., & Bitner, M.J. (2013). High tech and high touch: A framework for understanding user attitudes and behaviours related to smart interactive services. *Journal of Service Research*, 16(1), 3-20. <http://doi.org/10.1177/1094670512448413>
- Yoshida, M. (1972). Studies in psychometric classification of odors. *Japanese Psychological Research*, 14(3), 101-108. <https://doi.org/10.4992/psycholres1954.14.70>
- Yu, J., Seo, J., & Hyun, S.S. (2021). Perceived hygiene attributes in the hotel industry: customer retention amid the COVID-19 crisis. *International Journal of Hospitality Management*, 93, 102768. <https://doi.org/10.1016/j.ijhm.2020.102768>.
- Zarzo, M. (2013). What is a fresh scent in perfumery? Perceptual freshness is correlated with substantivity. *Sensors*, 13(1), 463-483. <https://doi.org/10.3390/s130100463>
- Zellner, D. A. (2013). Color-odor interactions: A review and model. *Chemosensory Perceptions*, 6(4), 155-169. <https://doi.org/10.1007/s12078-013-9154-z>
- Zellner, D.A., Bartoli, A.M., & Eckard, R. (1991). Influence of color on odor identification and liking ratings. *American Journal of Psychology*, 104(4), 547-561. <https://doi.org/10.2307/1422940>
- Zeltner, P.M. (1975). *John Dewey's aesthetic philosophy*. John Benjamins Publishing Company.
- Zomerdijk, L.G. & Voss, C.A. (2010). Service design for experience-centric services. *Journal of Service Research*, 13(1), 67-82. <https://doi.org/10.1177/1094670509351960>
- Zurawicki, L. (2010). *Neuromarketing: Exploring the brain of the consumer*. Springer Science & Business Media.

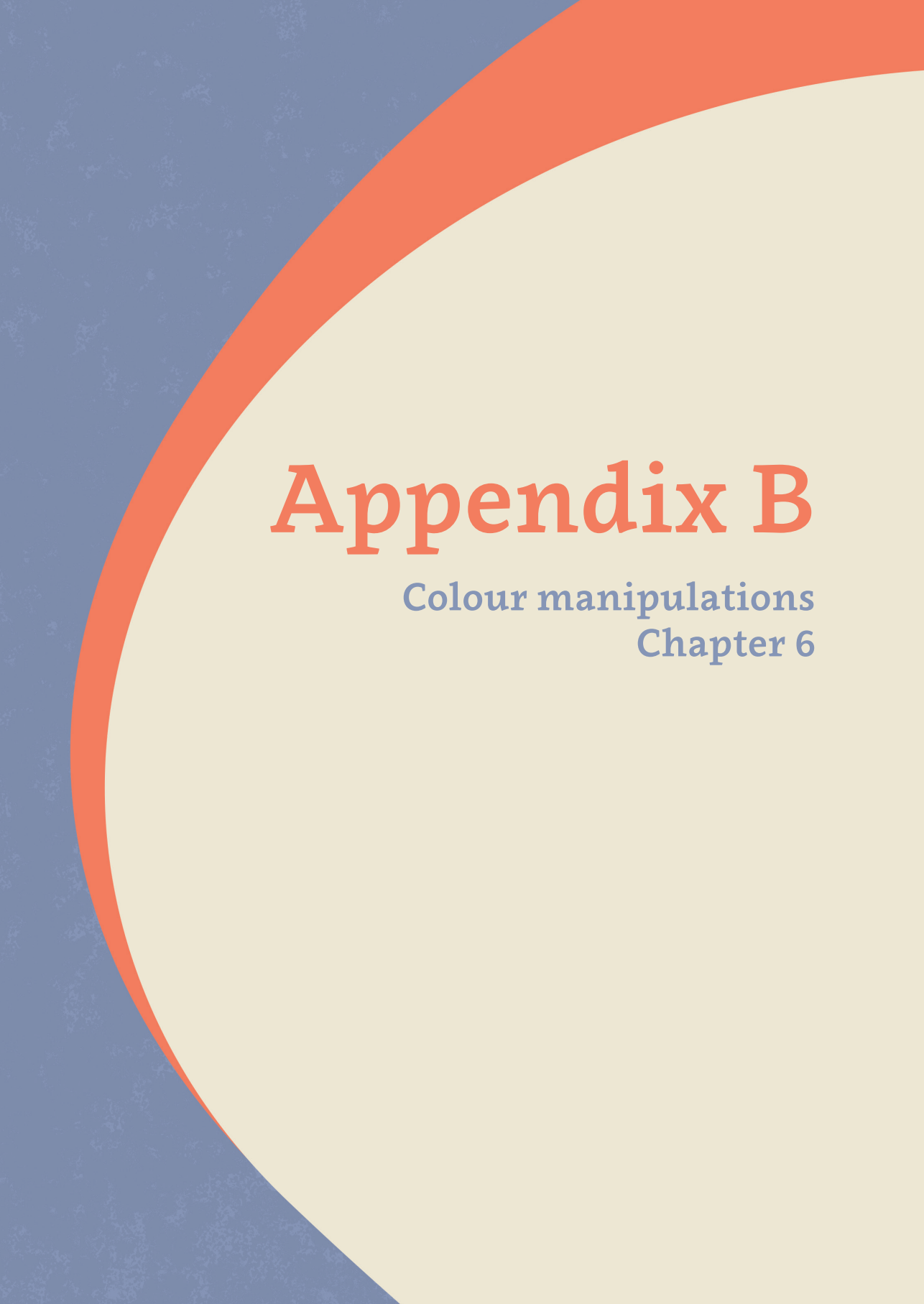


Appendix A

Cleanliness perceptions scale

Appendix A: cleanliness perceptions scale

Items of the cleanliness perceptions scale (CP-scale) after validation	
cleaned	1. it is neat here 2. it is clean here 3. it is hygienic here 4. it is well swept here 5. it is well maintained here 6. it is well looked after here 7. it is dust-free here
fresh	1. it smells clean here 2. it smells hygienic here 3. it smells fresh here
uncluttered	1. it is organised here 2. it is orderly here
perceived service quality	1. what is your general opinion of this [type of service environment]? 2. what is your general opinion of [organisation X] as a company?



Appendix B

Colour manipulations
Chapter 6

Appendix B: colour manipulations Chapter 6



Figure B.1

Colour manipulation, light blue condition



Figure B.2

Colour manipulation, dark blue condition



Figure B.3

Colour manipulation, light green condition



Figure B.4

Colour manipulation, dark green condition



Figure B.5

Colour manipulation, light brown condition



Figure B.6

Colour manipulation, dark brown condition



Figure B.7

Colour manipulation, light red condition



Figure B.8

Colour manipulation, dark red condition



Figure B.9

Colour manipulation, light grey condition



Figure B.10

Colour manipulation, dark grey condition



Figure B.11

Colour manipulation, white condition



Figure B.12

Colour manipulation, control condition (original photo)



Summary

Aim of the research

Cleanliness is an inevitable part of our lives – the act of cleaning and the experience of cleanliness are omnipresent. While the absence of stains, litter, and dust is a prerequisite for cleanliness, people use numerous other indicators to determine the cleanliness of their surroundings. For example, cleaners play an essential role in creating clean environments while other indicators such as their (uniformed) appearance and behaviour are also important in how cleanliness is perceived. Also other indicators, not directly related to the cleaning process, impact upon how cleanliness is perceived. Indicators such as light colours and fresh scents are proven to positively influence how cleanliness is perceived. This dissertation aims to unravel how such cues in service environments are related to perceived cleanliness.

The notion that the service environment affects customers' perception of cleanliness slowly but gradually penetrates the service industry. However, the concept of perceived cleanliness is still ill-defined. Precise definitions of the concept of perceived cleanliness are a prerequisite for understanding of the concept and the development of clean service environments. Although the body of scientific literature on perceived cleanliness is growing steadily, we do not yet understand what customer experience when they experience cleanliness. The sparse studies available mostly focus on specific service settings, such as hotels or restaurants and limit their scope to how cleaning quality affects perceived cleanliness. Although valuable, it is known that customers perceive the surroundings of a service environment holistically (Bitner, 1992), this is also expected when customers evaluate cleanliness. This implies that customers also use other cues (e.g., scent, architectural design) that are not primarily related to the cleaning process when evaluating cleanliness. The influence of such cues on perceived cleanliness has hardly received any scientific attention. Consequently, the service industry lacks knowledge on how to improve perceived cleanliness by using service environment in its entirety.

Customers derive information from service environments through different mechanisms. One of the key mechanisms in this area contends that customers respond to their environment holistically (Bitner, 1992; Harris & Ezech, 2008; Mari & Poggese, 2013). Following this mechanism, customers blend different cues into a unitary (holistic) impression that combines the information of individual cues and their interrelationships (Bitner, 1992). In addition to this holistic approach of the service environment, other mechanisms take a more detailed approach by examining one-to-one relationships between specific environmental cues. Priming mechanisms

assume such one-to-one relationships. Theories in the field of priming state that the exposure to one cue influences the response to a subsequently encountered other cue (Bargh, 2006). Priming served as a starting point for the experimental research in this dissertation.

The research aimed 1) to enhance the definition, operationalisation, and measurement of perceived cleanliness in service environments, 2) to identify environmental cues that influence perceived cleanliness, and 3) to show to what extent the effects of these cues can be explained by priming. The research enriches the field of facility management, which has not yet connected the service environment to the concept of perceived cleanliness, and the fields of service marketing and environmental psychology, where the influence of environmental cues are extensively studied but rarely in relation to perceived cleanliness.

Defining and measuring perceived cleanliness

Part one of the dissertation includes the operationalisation of the concept of perceived cleanliness and the development of an instrument to measure perceived cleanliness. The research starts in Chapter 1 with a systematic review and integration of the scientific literature on the concept of perceived cleanliness. The main focus is on stimulus, organism, and response variables related to actual and perceived cleanliness. Research are categorized into one of the three relationships in which cleanliness is involved: relationship between 1) stimuli and organism variables, 2) stimuli and response variables, and 3) organism and response variables. Despite of the considerable number of articles on perceived cleanliness, there is hardly any empirical study on how perceived cleanliness should be defined from a customer perspective. Most research focuses on how actual cleanliness affects littering behaviour and the relationship between perceived cleanliness and outcomes such as customer satisfaction. Literature includes a couple of explorative studies that offer starting points for the research, empirical research is needed to determine what customer experience as clean in service environments.

Chapter 2 explores what perceived cleanliness means according to practice in a qualitative study with service experts and customers. Qualitative research with the experts showed that the knowledge of service organisations on perceived cleanliness is limited. The two main reasons for this are: a lack of clear definitions of the concept of cleanliness and a lack of innovation due to a focus on efficiency (especially among facility service providers). Experts believed that their sector would benefit from a better understanding of perceived cleanliness to improve perceived cleanliness of customers. Also, the study succeeded in providing a first operationalisation of the concept of perceived cleanliness. Perceived cleanliness can be operationalised using five different dimensions, including: cleaned, fresh, maintained, shiny, smooth, and uncluttered.

These dimensions are used as a starting point for the operationalisation of perceived cleanliness in Chapter 3 through a quantitative study. The chapter shows that the initial five dimensions were reduced to three main dimensions that define perceived cleanliness: *cleaned*, *fresh*, and *uncluttered*. Customer perceive service environments as clean when it is properly *cleaned*, smells *fresh*, and appears to be *uncluttered*. Also, a compact questionnaire is presented to measure perceived cleanliness in service environments. The Cleanliness Perceptions Scale (CP-scale) measures perceptions of three discriminating factors consisting of 12 items that can be used in different service environments. This chapter makes the

concept of perceived cleanliness more concrete by defining its dimensions and it offers the opportunity for improving cleanliness in service environments. The CP-scale is a prerequisite for examining the effects of environmental cues on perceived cleanliness in the second part of this dissertation.

Influencing perceived cleanliness

Part two includes the experimental research on the effects of different environmental cues on perceived cleanliness. The experimental studies aim to evaluate if environmental cues can contribute to how cleanliness is perceived by customers in service environments, and to show to what extent the effects of these environmental cues on perceived cleanliness can be explained by priming.

Chapter 4 contains the theoretical approach by explaining the focus on environmental cues and introducing the concept of priming. Following theories on priming, exposure to one cue influences the response to a subsequently encountered other cue (Bargh, 2006). For example, playing French music, enhances sales of French wine in a supermarket (North et al., 1999) and a high ceiling can be used to prime the concept of freedom (Meyers-Levy & Zhu, 2007). The chapters 5, 6, and 7, each focusses on different dimensions of perceived cleanliness (*cleaned*, *fresh*, and *uncluttered*). Experiments were performed as much as possible in real-life settings, more specifically in trains and train stations. Chapter 5 explores the effects of the visible presence of cleaning staff, specifically on the *cleaned* dimension of perceived cleanliness. Two separate experiments are carried out in a running train and a train station. The first study has a more explorative character and was performed before the development of the CP-scale, the CP-scale is used in the second study. Overall, the studies show similar results with positive effects of the visible presence of cleaning staff on perceived cleanliness. In the second study with the CP-scale, effects are found for the *cleaned* and *fresh* dimensions of perceived cleanliness but not for the *uncluttered* dimension and general satisfaction.

Chapter 6 presents a study on the role of colour and scent on the *fresh* dimension of perceived cleanliness in a lab experiment. The results show that lighter colours and scents influence the *cleaned* and *fresh* dimensions of perceived cleanliness in a train station and not the *uncluttered* dimension. Moreover, no interactions effects between scent and colour on perceived cleanliness are found, implying that no congruency effects are present between scent and colour in this experiment.

Chapter 7 describes an experiment on the influence of scent and architectural clutter on the *cleaned*, *fresh*, and *uncluttered* dimension of perceived cleanliness in a waiting room of a train station. Pleasant and clean scents positively contribute to the *cleaned* and *fresh* dimensions. The waiting room with an uncluttered design positively influence the *cleaned* and *uncluttered* dimensions of perceived cleanliness. In contrast to the previous study, congruency effects are found between scent and architectural clutter in this study. In all three studies, evidence was found for the role of priming as the underlying psychological mechanism.

Theoretical and practical contributions

Part three reflects on the theoretical and practical implications of the dissertation. Chapter 8 discusses the theoretical contributions of the research, including: the novel multidisciplinary approach of combining knowledge from the fields of service marketing, facility management, built environment, environmental psychology, and social psychology, unravelling and defining the concept of perceived cleanliness, and the development of the CP-scale. Moreover, the experimental studies in this dissertation offer empirical support for how environmental cues influence perceived cleanliness. The studies show that the physical presence of cleaning staff, light colours, fresh scents, and uncluttered architecture contribute to perceived cleanliness. Also, the experiments offer empirical support for priming as a possible underlying mechanism.

In Chapter 9, the findings of the dissertation are translated to five practical recommendations for client organisations (including public transport organisations) and facility service providers. Practitioners are recommended to: start measuring perceived cleanliness using the CP-scale, influence perceived cleanliness using environmental cues, incorporate perceived cleanliness in cleaning contracts, approach perceived cleanliness from a multidisciplinary perspective, and to make cleaning more visible.

This dissertation aims to inspire service providers, scholars, teachers, and anybody involved or interested in cleanliness, to create environments that are *cleaned*, *fresh*, and *uncluttered* by involving all relevant cues present in the service environment.



Samenvatting

Doel van het onderzoek

Reinheid is niet weg te denken uit ons leven – schoonmaak als activiteit en de beleving van reinheid zijn alomtegenwoordig. Hoewel de afwezigheid van vlekken, afval, en stof een voorwaarde is voor reinheid, gebruiken mensen tal van andere indicatoren om te bepalen of een omgeving schoon is. Zo dragen schoonmakers met hun werkzaamheden bij aan het creëren van een schone omgeving maar ook hun zichtbare aanwezigheid en gedrag hebben invloed op hoe reinheid wordt ervaren. Ook factoren niet direct gerelateerd aan het schoonmaakproces kunnen invloed hebben op reinheidsbeleving. Een omgeving met lichte kleuren en frisse geuren wordt in de regel als schoner ervaren dan een omgeving met donkere kleuren en muffe geuren. Het doel van dit proefschrift is om het effect van de serviceomgeving op reinheidsbeleving beter te begrijpen.

Het idee dat de serviceomgeving effect heeft op hoe eindgebruikers reinheid ervaren, dringt langzaam maar zeker door in dienstverlenende organisaties. Het concept reinheidsbeleving is echter nog slecht gedefinieerd. Een heldere definitie van reinheidsbeleving is wel een voorwaarde voor algemeen begrip van het concept en de ontwikkeling van een schone serviceomgeving. Ondanks dat de literatuur over reinheidsbeleving gestaag groeit, begrijpen we nog niet wat een eindgebruiker ervaart als hij reinheid ervaart. Het beschikbare onderzoek richt zich voornamelijk op specifieke serviceomgevingen, zoals hotels of restaurants, en beperkt zich tot de effecten van schoonmaak op reinheidsbeleving. Echter, eindgebruikers ervaren de serviceomgeving holistisch, ook wanneer ze reinheid beoordelen. Dit impliceert dat naast schoonmaak ook andere omgevingsfactoren (bijv., geur, architectonisch ontwerp) die niet direct verband houden met het reinigingsproces meewegen in de eindbeoordeling van reinheid door eindgebruikers. Wetenschappelijke aandacht voor deze holistische benadering van reinheidsbeleving is beperkt. Als gevolg hiervan ontbreekt het dienstverlenende organisaties aan kennis over hoe de serviceomgeving ingezet kan worden om reinheidsbeleving positief te beïnvloeden.

Eindgebruikers verwerken informatie uit de serviceomgeving met behulp van verschillende mechanismen. Zij verwerken hun omgeving holistisch, waarbij alle waarnemingen samensmelten tot één algemene indruk (Bitner, 1992; Harris & Ezech, 2008; Mari & Poggesi, 2013). Daarnaast zijn er ook specifieke één-op-één relaties tussen omgevingsstimuli en de ervaring die deze stimuli oproepen. *Priming* is een theorie die gaat over dergelijke één-op-één relaties. Volgens theorieën op het gebied van *priming* kan blootstelling aan één omgevingsfactor de reactie op een tweede omgevingsfactor beïnvloeden (Bargh, 2006). *Priming* staat centraal in de experimentele studies van dit proefschrift.

Het onderzoek in dit proefschrift heeft als doel om 1) bij te dragen aan het begrijpen, operationaliseren, en meten van reinheidsbeleving in dienstverlenende organisaties, 2) aan te tonen dat de serviceomgeving bij kan dragen aan reinheidsbeleving, en 3) te onderzoeken of de effecten van omgevingsfactoren op reinheidsbeleving verklaard kunnen worden met behulp van *priming*. Het onderzoek draagt bij aan de ontwikkeling van het facilitaire vakgebied, dat de serviceomgeving nog niet heeft verbonden met reinheidsbeleving, en de gebieden dienstenmarketing en omgevingspsychologie, waar omgevingsfactoren uitgebreid worden bestudeerd maar zelden in relatie tot reinheidsbeleving.

Het definiëren en meten van reinheidsbeleving

In het eerste deel van het proefschrift staat de operationalisatie van het concept reinheidsbeleving en de ontwikkeling van een meetinstrument om dit te meten centraal. In hoofdstuk 1 beschrijven we de resultaten van een systematische review van de wetenschappelijke literatuur over het concept reinheidsbeleving. Daarin wordt een onderscheid gemaakt tussen stimulus, organisme, en respons variabelen die verband houden met feitelijke reinheid en reinheidsbeleving. De literatuur is gecategoriseerd in één van de drie relaties tussen: 1) stimulus- en organismevariabelen, 2) stimulus- en responsvariabelen, en 3) organisme- en responsvariabelen. Ondanks het aanzienlijke aantal artikelen over reinheidsbeleving, is er nauwelijks empirisch onderzoek gedaan naar reinheidsbeleving vanuit het perspectief van de eindgebruiker. Het beschikbare onderzoek richt zich voornamelijk op de invloed van feitelijke reinheid op vervuilingsgedrag en op de relatie tussen reinheidsbeleving en algemene uitkomsten zoals klanttevredenheid. Een aantal verkennende onderzoeken naar reinheidsbeleving bieden aanknopingspunten voor ons onderzoek. Aanvullend empirisch onderzoek is nodig om beter te begrijpen wat eindgebruikers als schoon beleven.

Hoofdstuk 2 gaat in op de betekenis van reinheidsbeleving volgens experts en eindgebruikers. Uit het kwalitatief onderzoek met experts bleek dat de kennis van dienstverlenende organisaties op gebied van reinheidsbeleving beperkt is. De twee belangrijkste redenen hiervoor zijn: een gebrek aan heldere definities van het begrip reinheidsbeleving en gebrek aan innovatie door focus op efficiëntie (vooral onder facilitaire dienstverleners). Experts waren van mening dat dienstverlenende organisaties baat zouden hebben bij betere definities van reinheidsbeleving om reinheidsbeleving van eindgebruikers te verbeteren. Het onderzoek met experts en eindgebruikers resulteerde in een eerste operationalisering van het concept reinheidsbeleving. Reinheidsbeleving kan worden geoperationaliseerd met behulp van vijf verschillende dimensies, waaronder: schoongemaakt, fris, onderhouden, glimmend, en opgeruimd.

In hoofdstuk 3 werden deze dimensies gebruikt als vertrekpunt voor de operationalisatie van reinheidsbeleving met behulp van een kwantitatieve studie. De vijf initiële dimensies werden teruggebracht tot drie hoofddimensies die reinheidsbeleving definiëren: schoongemaakt, fris, en opgeruimd. Eindgebruikers ervaren een serviceomgeving als schoon als deze goed is schoongemaakt (*cleaned*), fris ruikt (*fresh*), en het ontwerp van de omgeving opgeruimd oogt (*uncluttered*). Op basis van deze drie factoren is een compacte vragenlijst ontwikkeld om de beleving van reinheid in serviceomgevingen te meten. De *Cleanliness Perceptions Scale*

(CP-schaal) meet de beleving van de drie discriminerende factoren met 12 items die in verschillende serviceomgevingen gebruikt kan worden. Het concretiseren en meetbaar maken van het concept reinheidsbeleving zorgt niet alleen voor meer inzicht in reinheidsbeleving, maar biedt ook aanknopingspunten om reinheidsbeleving te verbeteren. De CP-schaal is bovendien een voorwaarde voor het tweede deel van het proefschrift, waarin de effecten van omgevingsfactoren op reinheidsbeleving worden onderzocht.

Het beïnvloeden van reinheidsbeleving

In het tweede deel van dit proefschrift staat het experimentele onderzoek naar de effecten van verschillende omgevingsfactoren op reinheidsbeleving centraal. Het experimentele onderzoek heeft als doel om te onderzoeken hoe omgevingsfactoren bijdragen aan de beleving van reinheid. Daarnaast wordt onderzocht in hoeverre effecten van omgevingsfactoren op reinheidsbeleving kunnen worden verklaard aan de hand van het concept *priming* als bijbehorend psychologisch mechanisme.

Hoofdstuk 4 beschrijft de theoretische benadering van de experimenten door de keuze voor verschillende omgevingsfactoren toe te lichten en het concept *priming* te introduceren. Volgens theorieën op gebied van *priming*, beïnvloedt de blootstelling aan één omgevingsfactor de reactie op een tweede omgevingsfactor (Bargh, 2006). Het spelen van Franse muziek verhoogt bijvoorbeeld de verkoop van Franse wijn in een supermarkt (North et al., 1999) en een hoog plafond kan worden gebruikt om het concept (bewegings)vrijheid te *primen* (Meyers-Levy & Zhu, 2007).

De hoofdstukken 5, 6, en 7 richten zich op de verschillende dimensies van reinheidsbeleving (*cleaned*, *fresh*, en *uncluttered*). De experimenten vinden zoveel mogelijk plaats in de praktijk en meer specifiek in treinen en treinstations. Hoofdstuk 5 beschrijft een onderzoek naar de effecten van de zichtbare aanwezigheid van schoonmaakpersoneel op reinheidsbeleving (*cleaned* dimensie). Er zijn twee afzonderlijke experimenten uitgevoerd in een rijdende trein en een treinstation. Het eerste experiment in de trein heeft een meer exploratief karakter en werd uitgevoerd voor de ontwikkeling van de CP-schaal. In het tweede experiment wordt de CP-schaal gebruikt. Beide experimenten tonen dat de aanwezigheid van schoonmaakpersoneel een positief effect heeft op reinheidsbeleving. In het tweede experiment met de CP-schaal worden effecten gevonden voor de zichtbare aanwezigheid van schoonmaakpersoneel op de *cleaned* en *fresh* dimensies van reinheidsbeleving maar niet voor de *uncluttered* dimensie en algemene klanttevredenheid.

Hoofdstuk 6 beschrijft een studie naar de rol van kleur en geur op de *cleaned* en *fresh* dimensie van reinheidsbeleving in een laboratoriumexperiment. De resultaten laten zien dat lichte kleuren en geuren een positief effect hebben op de *cleaned* en *fresh* dimensies van reinheidsbeleving en niet op de *uncluttered* dimensie. Verder was de verwachting dat congruente (complementaire) kleuren en geuren een positief effect zouden hebben op reinheidsbeleving. Hier is geen bewijs voor gevonden in deze studie.

Hoofdstuk 7 beschrijft een studie naar de effecten van geur en architecturale *clutter* op de *cleaned*, *fresh* en *uncluttered* dimensie van reinheidsbeleving in een wachtruimte van een treinstation. Prettige en schone geuren hebben een positief effect op de *cleaned* en *fresh* dimensies van reinheidsbeleving. De wachtruimte met een *uncluttered* ontwerp heeft een positief effect op de *cleaned* en *uncluttered* dimensies van reinheidsbeleving. In tegenstelling tot de vorige studie, werden er congruentie effecten gevonden tussen geur en architecturale *clutter* op reinheidsbeleving. In alle drie de studies vonden we bewijs voor de rol van *priming* als psychologisch mechanisme.

Theoretische en praktische implicaties

Het derde deel van het proefschrift reflecteert op de theoretische en praktische implicaties van het onderzoek. Hoofdstuk 8 beschrijft de theoretische bijdrage van het onderzoek, te beginnen met het ontrafelen en definiëren van het begrip reinheidsbeleving en de ontwikkeling van de CP-schaal. Een innovatief aspect van dit onderzoek is de multidisciplinaire benadering door kennis op het gebied van facility management, dienstenmarketing, en omgevingspsychologie te combineren. Daarnaast toont het proefschrift met behulp van empirisch onderzoek aan dat omgevingsfactoren een positieve invloed kunnen hebben op reinheidsbeleving van eindgebruikers van dienstverlenende organisaties. Uit de experimentele studies blijkt dat de fysieke aanwezigheid van schoonmaakpersoneel, lichte kleuren, frisse geuren en een opgeruimd ontwerp van de omgeving positief bijdragen aan reinheidsbeleving van eindgebruikers. Daarnaast laat het onderzoek indicaties zien dat het psychologische concept van *priming* ten grondslag ligt aan de geobserveerde effecten.

In hoofdstuk 9 zijn de bevindingen van dit proefschrift vertaald naar vijf praktische aanbevelingen voor dienstverlenende organisaties, waaronder het openbaar vervoer. Service professionals worden aanbevolen om: reinheidsbeleving te gaan meten met behulp van de CP-schaal, reinheidsbeleving te beïnvloeden met behulp van omgevingsfactoren, reinheidsbeleving op te nemen in schoonmaakcontracten, reinheidsbeleving multidisciplinair te benaderen, en schoonmaak zichtbaarder te maken.

We hopen dat we dienstverleners, onderzoekers, docenten en iedereen die betrokken is bij of geïnteresseerd is in reinheidsbeleving te inspireren om schone, frisse, en opgeruimde omgevingen te creëren door alle relevante omgevingsfactoren te gebruiken.



Dankwoord

Dankwoord

Dit proefschrift is het resultaat van 6,5 jaar onderzoek. Dat is op dit moment ruim een vijfde deel van mijn leven, een gek idee. Het was een hele bijzondere en vormende fase van mijn leven. Dit besef zal waarschijnlijk over tijd groeien, als ik er van een afstand naar kan kijken. Dank ben ik verschuldigd aan degene die ervoor hebben gezorgd dat ik mij niet alleen heb gevoeld in dit individuele promotietraject.

Mijn dank gaat uit naar de Hanzehogeschool Groningen en Nederlandse Spoorwegen (NS) die dit onderzoek financieel mogelijk hebben gemaakt. Dankzij de 'jonge promovendiregeling' van de Hanzehogeschool en sponsoring van NS Commercie & Ontwikkeling kreeg ik de kans om een universiteit bij mijn onderzoeksvorstel te zoeken. Dank aan Hans Peters, voormalig commercieel directeur bij NS voor het vertrouwen.

Mijn bijzondere dank gaat uit naar mijn promotor Ad Pruyn en dagelijkse begeleiders Mirjam Galetzka (UT), Mark van Hagen (NS) en Mark Mobach (Hanzehogeschool Groningen). Het was heel fijn om aan mijn onderzoek te werken in dit complementaire team.

Ad, ik ben je dankbaar voor het begeleiden van dit promotietraject! Met jouw ervaring op het gebied van experimenteel onderzoek (bij de NS) met praktische relevantie was jij de aangewezen persoon om dit traject te begeleiden. Je hebt mijn kritische denkvermogen verder gebracht en ervoor gezorgd dat dit proefschrift een logisch en samenhangend geheel is geworden.

Mirjam, jouw creativiteit en enthousiasme voor onderzoek in het algemeen en dit onderzoek in het bijzonder, hebben mij enorm gestimuleerd. Als ik aan onze samenwerking denk, dan denk ik vooral aan de gesprekken in het Cubicus. Ik waardeer het heel erg dat je de tijd voor mij nam om werk te bespreken en nieuwe plannen te maken.

Mark (van Hagen), bedankt voor het vertrouwen dat je in mij hebt gesteld, eerst als afstudeerder, daarna als promovendus en NS collega. Ondanks mijn bijzondere positie, heb ik mij altijd onderdeel gevoeld van de NS organisatie, jij hebt daar een belangrijke rol in gespeeld. Ik heb veel geleerd van jouw rijke onderzoekservaring en je hebt mij alle ruimte gegeven om zelf te ontdekken wat het is om wetenschappelijk onderzoek te doen in de praktijk.

Mark (Mobach), jouw optimisme en vertrouwen in mij als persoon hebben een belangrijke bijdrage geleverd aan waar ik nu sta. Zonder jou was dit project niet van de grond gekomen. Ik bewonder jouw vermogen om kansen te creëren en anderen in de spotlight te zetten. Jouw oog voor detail én de grote lijnen, hebben mij enorm geholpen in dit onderzoek. Ik hoop dat we de komende jaren samen kunnen blijven werken aan de ontwikkeling van ons mooie vakgebied!

De leden van de promotiecommissie wil ik graag bedanken voor het lezen en beoordelen van mijn proefschrift.

Veel dank ben ik verschuldigd aan mijn voormalige collega's van de NS. De NS heeft een plek veroverd in mijn hart en dat komt voor een groot deel door de mensen die er werken. Graag wil ik alle collega's van de (inmiddels opgeheven) afdeling Klant- & Markttadvies bedanken voor de fijne tijd die ik heb gehad. Mijn bijzondere dank gaat uit naar Joost Bosma, Thijs Urlings en alle andere collega's van 'team klant' voor de ruimte die ik heb gekregen om mijn onderzoek te doen. Jessica Sauren bedankt voor je interesse en betrokkenheid.

Het grootste deel van de veldexperimenten heb ik uitgevoerd op trein stations van NS Stations. Do van Elferen, Loes van Stiphout en Jildou van der Sluis, bedankt voor het mogelijk maken van het experimentele onderzoek en de leuke gesprekken die we hebben gehad. Daarnaast wil ik graag het stationsmanagement van Amsterdam Centraal (Irma Winkenius en René Wubs) en Arnhem Centraal (Geoffrey Brookman en Eelco Krakau [ProRail]) bedanken voor hun medewerking aan mijn onderzoek.

Dan wil ik mijn collega's van de Hanzehogeschool Groningen bedanken. Alhoewel niet naast de deur, heb ik me altijd heel erg thuis gevoeld in Groningen. Collega's van het lectoraat Facility Management, Institute of Future Environments (voorheen Institute of Facility Management) en Kenniscentrum NoorderRuimte wil ik graag bedanken voor hun warme betrokkenheid bij mijn onderzoek. Rudolf Kamphuis en Marlies van Hilst in het bijzonder bedankt voor jullie hulp bij het organiseren van onderzoek met studenten.

Ruth Pijls, ik vond het leuk om parallel aan jou heel vergelijkbaar onderzoek te doen. Ik heb daar veel inspiratie uit geput. Bedankt!

Alhoewel maar een klein deel dit zal lezen, wil ik alle 5.941 mensen die hebben deelgenomen aan één van mijn studies bedanken. Zonder deze experts die hun ervaring deelden en reizigers die hun indruk van reinheid hebben gegeven in een vragenlijst, had dit onderzoek niet plaats kunnen vinden.

Vrienden van AMAALROMMEL, bedankt voor onze fijne vriendschap! Alhoewel we weinig spreken over dit onderzoek of werk in het algemeen, kan ik altijd op jullie rekenen. Ik koester geweldige herinneringen aan ons samenzijn in de Achterhoek en alle andere plekken die we hebben aangedaan. Pieter, bedankt dat je tijdens de verdediging aan mijn zijde wil staan als paranimf.

Lieve pap en mam, ik ben heel dankbaar voor het warme nest waar ik in ben opgegroeid. Jullie hebben mij alle vrijheid gegeven om mijn eigen keuzes te maken en mij te ontwikkelen tot de persoon die ik nu ben. Lieve broeders: Jasper, Willem en Julian, ik ben trots op onze band, wat wij samen hebben is geweldig! Japie, bedankt dat je er in juni bij bent als mijn paranimf.

Tot slot, Marjolein. Liefde van mijn leven. Samen met jou promoveren was (meestal) een feestje! Heel bijzonder dat er maar vierentwintig dagen tussen onze verdedigingen zit. Ik ben jou ontzettend dankbaar. Voor de steun als ik er even doorheen zat en het begrip als ik weer een heel weekend aan mijn onderzoek zat te werken. En ook voor de liefde, afleiding en leuke herinneringen de afgelopen jaren. Ik kan niet wachten op wat de toekomst ons brengt. Hou van jou!



About the author

About the author



Martijn Vos (1991, Lichtenvoorde) studied facility management at Saxion University of Applied Sciences (Bachelor of Business Administration) and Wageningen University (Master of Science). He wrote his master thesis on the effects of lighting on passengers' perceptions of safety, cleanliness, and ambiance in train stations. With this thesis, he won the EuroFM student master poster competition at the European Facility Management Conference in Glasgow.

After graduation in 2015, Martijn received a grant for young PhD researchers from Hanze University of Applied Sciences (UAS) that was co-funded by Netherlands Railways (NS). In September 2015 he started his PhD research on perceived cleanliness in service environments at the University of Twente (research group Communication Science), in cooperation with the Hanze UAS (research group of Facility Management), and NS. Until 2020 he combined his position as a PhD researcher with a teaching position at Hanze UAS and a consulting position at NS.

From 2020 Martijn works as a project manager at Hago Rail Services and Vebego, where he specialized in the areas of innovation and customer experience. He likes to operate on the crossroads of research, practice and education. His areas of interest include: perceived cleanliness, space & service design, and customer experience.

