MEDIATING HOTEL EXPERIENCES WITH ONLINE PHOTOS: HOW CONSUMERS ARE ATTRACTED BY A HOTEL THROUGH THE PERCEPTIONS OF MEDIATED SERVICESCAPE

A Dissertation
Submitted to
the Temple University Graduate Board

In Partial Fulfillment
of the Requirements for the Degree
DOCTOR OF PHILOSOPHY

---

by
Zeya He
Diploma Date (August 2020)

Examining Committee Members:

Dr. Laurie Wu, Advisory Chair, School of Sport, Tourism and Hospitality Management
Dr. Xiang (Robert) Li, Advisory Co-chair, School of Sport, Tourism and Hospitality Management
Dr. Yang Yang, School of Sport, Tourism and Hospitality Management
Dr. Yang Wang, External Reader, Fox School of Business, Marketing and Supply Chain Management

ABSTRACT

Online photos as a form of media have risen to prominence in e-commerce and online travel booking contexts. Photos possess superior power in attracting attention and communicating experiences; however, the elements of a hotel photo that render a hotel attractive, and how this initial attraction can translate into consumers' booking-related behavior, remain largely ambiguous. By addressing these research gaps and building upon existing evidence, this study links the visual elements of hotel photos to customers' booking-related behavior through individuals' environmental perceptions. More specifically, this study examines relationships among local content objects and their features and global graphic features of hotel photos, individuals' induced environmental perceptions, and actual consumer behavior in the browsing stage (i.e., hotel property page visitation) and deliberation stage (i.e., clicking on a third-party site for booking). Findings extend Bitner's theoretical servicescape framework to mediated contexts and provide practical implications regarding the curation of hotels' online marketing photos.

ACKNOWLEDGEMENTS

My deepest thanks to Dr. Laurie Wu and Dr. Xiang (Robert) Li, my committee co-chairs and doctoral advisors, for your tremendous support, guidance, and help through this four-year journey; I feel I am the luckiest student in the world. Thank you for pushing my intellectual limits, witnessing each milestone I have achieved, and making me a better person. I have learned how to be a creative researcher, an enthusiastic teacher, and a caring mentor from you.

Also, I would like to thank my outstanding committee members, Dr. Yang Yang and Dr. Yang Wang, for the knowledge and advice you have generously shared with me, which gave me many inspiration for not only this dissertation research but also future possibilities.

I would also like to express my appreciation to faculty in the School of Sport, Tourism, and Hospitality Management and the Fox School of Business at Temple University. My Ph.D. journey would never have been so meaningful and memorable without your support, encouragement, and guidance. Dr. Paul Pavlou, Dr. Sudipta Basu, and Dr. Sunil Wattal, thank you for creating numerous opportunities for us to exchange ideas across departments and obtain feedback and support on our research. Thank you, Dr. Wesley Roehl, Dr. Ceridwyn King, Dr. Chihyung Ok, Dr. Lu Lu, and Dr. Lindsey Lee, for your constant support and care. My special thanks to friends who have studied and grown with me in the Ph.D. program: Dr. Bradley Baker, Dr. Jooa Baek, Dr. Mingsun Kim, Dr. Mi Ae Lee, Dr. Xiaochen Zhou, Dr. Anthony Pizzo, Dr. Yuan Wang, Dr. Hongbo Liu, Dr. Yiran Su, Dr. Moon Sup Hyun, Dr. Xingbao Hu, Heather Kennedy, Karen Tan, Colin Lopez, Koo Yul Kim, Saeed Andajigarmaroudi, Keshav Gupta, Sanggon Lim, Xingyu Huang, and Nataliya Bredikhina.

Lastly, my endless love and thanks to my husband Yanhao and my parents, for your love, care, and trust.

.

LIST OF TABLES

LIST OF FIGURES

Figure Page

CHAPTER 1

INTRODUCTION

1.1 Background

Having witnessed tremendous growth in recent years, online travel and hotel bookings comprise a substantial amount of global market share. In 2019 alone, online travel and hotel bookings generated $434 billion in revenue. These bookings are expected to grow at an annual rate of 6.3%, ultimately reaching $552 billion in total market volume by 2023 (Statista 2018). Hotel bookings account for nearly half of all online booking revenue (Statista 2018). The hotel sector also has the largest number of online users, peaking at 841 million in 2019 with the highest penetration rate (11%) among all online travel booking segments (Statista 2018). Online distribution channels, including online travel agents (OTAs) and other non-brand websites (e.g., Expedia, Priceline, Orbitz, TripAdvisor, and Hotels.com), have become important portals for travelers to initiate searches and consider potential booking options (Noone and Robson 2016).

Using visual information such as photos to stage tourism and hospitality experiences has become a pervasive practice among industry professionals (Trivett 2013; Ye and Tussyadiah 2011). The tourism and hospitality industry has traditionally involved image-driven marketing (MacKay and Fesenmaier 1997; Trivett 2013; Wicks and Schuett 1994). In recent decades, this emphasis on visual content has been further propelled by evolving technologies and mediascapes. Digital visual content, such as online photos, has replaced conventional brochures in helping travel and accommodation suppliers to stage experiences. Studies have suggested that consumers rank visual content as the most memorable aspect of online travel ads, ahead of prices/deals and personalized features

(Phocuswright 2017). Additionally, 60% of consumers are more likely to consider or contact a business whose image appears in local search results (CrowdRiff + Skift 2019). In light of these consumer trends, visual information has become increasingly essential for destinations and firms (CrowdRiff + Skift 2019) to publicize travel and accommodation experiences via numerous channels (Trivett 2013).

Today's consumers also rely heavily on visual content to make decisions about travel products and experiences (Wright 2019). Generally, visual content draws a customer's gaze. For instance, when exploring destination and hotel options, photos are among the top features consumers seek at various travel moments (Think with Google 2016). In addition, consumers are much more engaged with hotel advertisements featuring interior photos compared to those without, resulting in higher booking conversion rates (Shankman 2015).

The prominence of visual information can be attributed to the unique characteristics of visual communication. Scholars have found that visual stimuli are better recalled than textual information (Anderson 2005; Childers and Houston 1984; Laskey, Seaton, and Nicholls 1994) and can contribute to product-related mental imagery (Yoo and Kim 2014). Visual reinforcements, as complements to textual information, can enhance attention (Pan, Zhang, and Law 2013) and lead to superior learning and persuasion (Stewart, Hecker, and Graham 1987), particularly in online shopping contexts (van Rompay, de Vries, and van Venrooij 2010). Given the prevalence and importance of photos in the online marketing and communication of products and experiences, this study aims to examine the roles of hotel photos in consumers' online booking decisions.

1.2 Problem Statement

Among the information attributes displayed on online distribution channels (e.g., OTAs or other non-brand websites), hotel photos have been identified as one of the most crucial factors influencing consumers' booking decisions (Dickinger and Mazanec 2008a; Law and Cheung 2005; Law and Hsu 2005, 2006; Noone and Robson 2014, 2016; Park, Yin, and Son 2019). Despite the pivotal roles of hotel photos in online booking, extant research tends to suffer from two limitations. First, studies on booking decisions have largely focused on how photos shape consumers' behavioral intentions. Second, studies on the roles of photos often consider how photo content and features influence individuals' attention and product evaluations. However, to the best of the author's knowledge, little research has sought to link the content and features of photos to consumers' online behavior with their shared perceptions.

As visuals have become a near necessity in firms' marketing and communication in today's marketplace (Schawbel 2012), investigations into the presence or absence of visuals, or consumers' degree of attention to them, have little relevance for industry practitioners. Therefore, the findings of existing studies may not generate direct implications for current online hotel businesses. As industry practices shift to probing the influences of photo features and content on consumers' online behavior (Dwoskin 2015), a better understanding of how to select and curate photos to attract customer attention (Dwoskin 2015), effectively communicate relevant information (Nichols 2018), and persuade consumers to book is timely for online hotel businesses.

Studies in the generic e-commerce context have begun to focus on the types of product photos that may contribute to users' initial interest and actual purchases (Di et al. 2014). Yet relevant research in tourism and hospitality is lacking. In the e-commerce context, for goods where appearance plays a key role (e.g., clothing, shoes, and accessories), higher-quality photos can increase consumers' interest in products (e.g., adding products to their watch lists). Once a product has received a certain amount of attention, such interest should be converted into actual purchases at a relatively steady conversion rate (Di et al., 2014). In hospitality settings where consumers have high expectations regarding the aesthetics and functionality of a service setting (Baek and Michael Ok 2017), the types of photos that pique consumers' initial interest during the browsing stage and persuade consumers to book during the deliberation stage are largely unexplored. To address this gap in online communication, particularly in the online booking context, understanding how consumers process hotel photos should be the first step.

Evidence from prior research has shown that online hotel photos may activate consumers' thoughts about a hotel's environment. Additionally, theories or models related to environmental appraisal may be insufficient in clarifying the complex nature of online mediated contexts. Studies have implied that the key message consumers seek concerns the experience in the hotel environment. Based on interviews (Noone and Robson 2014, 2016; Pan et al. 2013), information about the hotel environment that is captured in hotel photos might be the same information about which consumers care most. Bitner's (1992) servicescape model provides a potential theoretical framework to contextualize the formation and consequences of environmental perceptions. However, this model largely focuses on on-site experiences. In particular, (a) input conditions that are perceivable and analyzable differ across mediated and on-site contexts; (b) individual perceptions of and responses to environmental conditions differ across mediated and on-site contexts; and (c) how consumers' environmental perceptions and internal responses can be converted into online booking-related behavior is beyond the scope of this framework. Therefore, a new theoretical framework is needed to explain the relationships among consumers' visual input, environmental perceptions, and online behavior.

1.3 Study Goals and Objectives

Despite fruitful findings on the roles of hotel photos, tourism and hospitality scholarship has yet to fully uncover associations between photo characteristics and online customer behavior. Specifically, little is known about the precise elements of a hotel photo that influence consumers' environmental perceptions or the extent to which such perceptions can further influence customers' booking-related behavior.

By addressing these research gaps and building upon existing evidence, this study aims to link the visual elements of hotel photos to consumers' booking-related behavior through individuals' environmental perceptions. More specifically, the current research attempts to (a) examine which features of a hotel photo can induce certain environmental perceptions and (b) assess how these environmental perceptions can influence actual consumer behavior during the browsing stage (i.e., hotel property page visitation) and deliberation stage (i.e., clicking a third-party site for booking).

1.4 Potential Contribution

By examining the relationships among the visual elements of hotel photos, consumers' environmental perceptions elicited by these photos, and consumers' booking-related behavior, this dissertation contributes to the extant body of work in three ways. First, by extending Bitner's (1992) servicescape framework, this research proposes a theoretical framework of a mediated servicescape in the online hotel booking context.

Second, by recognizing the capabilities and constraints of photos as media, this research decomposes individual hotel photos into analyzable content-level elements and graphic-level features and examines how they relate to consumers' perceptions about the hotel environment. Third, using field data from TripAdvisor, this research is the first to investigate how consumers' environmental perceptions, as derived from hotel photos, influence their aggregate behavior at the browsing stage (i.e., hotel property page visitation) and deliberation stage (i.e., meta-clicks: clicking a third-party site for booking).

Empirically, this study sheds light on the online marketing and communication of hotel experiences. Using actual consumer behavior data, findings indicate the importance of appealing photos in influencing online hotel bookings. In addition, results offer practical guidance around the design and staging of hotel experiences by demonstrating how to select and curate photos that present the hotel environment in an attractive way. The implications of this study may be especially practical for independent and boutique hotels, whose design and marketing of hotel experiences are largely unstandardized and whose consumers rely heavily on environmental cues to make booking decisions.

1.5 Organization of the Dissertation

This dissertation is organized into five chapters. Chapter 2 provides a review of relevant literature about (1) the theoretical background and recent developments in the use of visual content in online marketing and communication; (2) how photos mediate the hotel servicescape and how consumers perceive the mediated servicescape; (3) the attractiveness of a hotel option as an experiential product; (4) individuals' potential appraisal processes when using hotel photos to inform their decisions; (5) how individuals' visual attention is allocated when examining visual information in a photo; (6) the role of image appeal at the graphic level; and (7) the theoretical framework guiding this research.

Chapter 3 describes the methodology adopted in this dissertation, including the (1) research design, (2) overview of the two studies, (3) their objectives and procedures, and (4) a general summary. Chapter 4 presents the results of the studies. Based on the overall findings, Chapter 5 offers the conclusions, implications, and limitations of this research.

1.6 Delimitations

This dissertation research is subject to the following delimitations:

1) The research will be delimited to the context of online hotel booking on non-brand channels, including OTAs and meta-search websites (e.g., Expedia, Priceline, Orbitz, TripAdvisor, Hotels.com).
2) The research will use Trip Advisor as a representative of non-brand online booking channels.
3) The hotel photos used to assess consumers' perceptions will be delimited to photos depicting hotels' interior environments.

1.7 Definitions of Terms

Table 1 presents the definitions of terms included in the conceptual model guiding this dissertation research.

Table 1. Definitions of Terms

Term	Definition	Source of reference
Servicescape	The environmental settings of a service venue	Bitner (1992)
Visual input	The material and graphical settings of a hotel photo that communicate the hotel's environment	Tussyadiah and Fesenmaier (2009)
Local content objects	Material settings of a hotel photo, including specific elements captured as contents in the photo, such as the bed, floor, artifacts, window	Developed based on Alfakhri, Harness, Nicholson, and Harness (2018)
Local content object features	Material settings of a hotel photo, including local visual features of specific objects, such as color, size, and material	Developed based on Wolfe (2014)
Global visual quality features	The graphical setting of a hotel photo, including overall visual features such as brightness, contrast, and colorfulness	Developed based on Joshi et al., (2011)
Dimensions of mediated servicescape	Specific aspects of the environmental settings inferred by consumers (as opposed to the environmental components and conditions in-situ)	Developed based on Tussyadiah and Fesenmaier (2009) and Bitner (1992)
Consumers' perception of the mediated servicescape (CPMS)	Consumers' overall impression of the hotel environment based on the information presented by the hotel photos	Developed based on Tussyadiah and Fesenmaier (2009) and Bitner (1992)
Page-view behavior	A user's behavior when visiting a hotel's property page (a webpage listing information about a specific hotel property)	The data source: TripAdvisor
Meta-click behavior	A user's behavior when clicking purchase links and being directed to third-party websites (e.g., OTAs or brand websites)	The data source: TripAdvisor

CHAPTER 2

LITERATURE REVIEW

2.1 Theoretical Background: The Crucial Roles of Visuals in the Marketplace

This chapter reviews relevant literature on the roles of visuals in today's online businesses. Against the backdrop of information explosion, visual content such as photos has demonstrated superior power in learning and persuasion, making such content vital for online businesses. Additionally, because of the unique nature of tourism and hospitality experiences, online hotel bookings may depend especially heavily on pictorial content.

2.1.1 The Use of Visual Content in Online Marketing Communication

In today's era of information explosion, effective communication is key to businesses' success. The exponential growth of the internet continues to contribute to the abundance of online information (Huberman et al. 1998). The rapidly expanding volume of information and participation in online communication worldwide has led to great awareness of what is available, relevant, and effective in communicating about products, services, and experiences. For consumers, processing the extensive amount of information available has become increasingly problematic; information overload can easily create confusion. For firms, providing appealing and accurate information to persuade customers has also become a challenge, as information from various suppliers and sources compete for a limited amount of customer attention (Özmen 2015). Effective marketing and communication are particularly difficult for industrial sectors that provide intangible experiences, such as tourism and hospitality.

Visual communication is vital to product presentation and experience staging (Monsuwé, Dellaert, and Ruyter 2004; Ye and Tussyadiah 2011). Research in advertising, marketing, and communication has revealed that visual stimuli are more likely to be recalled and to influence customer attitudes (Laskey et al. 1994). Visual information can facilitate consumers' evaluations by reducing the set of attributes under consideration (MacInnis and Price 1987) through selective attention. Browsing and decision tasks thus become more entertaining (Pan et al. 2013), leading to superior learning and persuasion (Stewart et al. 1987).

Further, vivid visual presentations, such as product-related photos, can decrease consumers' perceived risk and uncertainty to promote favorable outcomes for online businesses. Shopping for products online carries a certain level of risk (Monsuwé et al. 2004): consumers cannot physically verify product quality (Lee and Turban 2001), which can evoke a sense of powerlessness among online shoppers (Di et al. 2014). Product photos are thus used to provide clear and attractive pictures in a trustworthy manner to inform consumers about products and persuade consumers to purchase (Bland, Black, and Lawrimore 2007; Di et al. 2014; Koehn 2003). Research on different e-commerce product categories (Di et al. 2014) has demonstrated that (1) larger photos, which offer richer information for consumers to inspect product details, can increase sales conversions; (2) a larger number of photos, which showcase different aspects of information about a product, is associated with a higher probability of profit; and (3) products with higher-quality photos are more likely to encourage consumers' "add-to-watch-list" behavior. From a seller perspective, more successful sellers (i.e., those with higher sales volumes and revenue) tend to include higher-quality photos in their product listings. From a buyer perspective, new buyers prefer listings with high-quality photos more than experienced buyers. Studies of e-commerce products have shown that photos and their features (e.g., size, quality, and number) influence online communication, marketing, and sales by reducing consumers' perceived risk and building trust.

2.1.2 The Roles of Hotel Photos in Online Travel Booking

Online travel bookings may rely more on communication via photos due to the nature of tourism and hospitality businesses (Hsu and Lin 2006). Online travel bookings, wherein consumers use online channels to book a destination and accommodations, can induce higher levels of risk and uncertainty compared to purchasing products online. These increased risk perceptions are derived from several factors: (1) travel and accommodation experiences in a tourism destination are distinct from individuals' everyday lives and are therefore somewhat unpredictable (Williams and Baláž 2015); (2) travel is not a frequent purchase for most people, and travel and accommodation experiences are difficult to accumulate (Hsu and Lin 2006); (3) supplier-provided experiences are highly heterogeneous and challenging to standardize, making them difficult for consumers to familiarize themselves with or compare (Lovelock and Gummesson 2004); and (4) purchased unsatisfactory experiences cannot be "tested" and returned because they cannot be inventoried (Lovelock and Gummesson 2004) and compensation cannot recoup customers for lost time and emotional disappointment (Hsu and Lin 2006; Madrigal and Kahle 1994). Such perceived risk and uncertainty may cause consumers to defer a planned holiday or choose a less risky option. As purchasing travel and accommodation experiences online may involve higher risk, consumers may rely on photos to inform their travel and accommodation booking decisions.

What information matters most to customers when booking a hotel? Consumers in the digital age may answer this question differently compared to those in the industrial age. Earlier on, it was believed that hotel products, similar to other manufactured products, consisted of various physical attributes with each providing unique utility to consumers. From a product development perspective, several studies have used different combinations of attributes to investigate customers' hotel attribute preferences. Research has shown that important factors influencing leisure and business travelers' hotel choices include location, service, star rating, security, food and beverage offerings, impression, price, room and hotel features, and leisure facilities (Bell and Morey 1996, 1997; Callan 1998; Lewis 1984; Mccleary, Weaver, and Hutchinson 1993; Mccleary et al. 1993; Richard and Sundaram 1994; Wind et al. 1989).

Previous findings may not hold in today's online booking context, as online channels alter how products and experiences are presented and how customers assess them. Specifically, hotel attributes are largely determined by what an online platform allows, which can greatly influence individuals' information processing and subsequent decisions. Online distribution channels, including OTAs or other non-brand websites (e.g., Expedia, Priceline, Orbitz, TripAdvisor, and Hotels.com), require hotels to present their features using a highly structured format. For instance, when browsing search results on TripAdvisor, only a hotel's name, photo, price(s), promotion(s), review ratings, number of reviews, and limited location and amenities information can be presented within the spatial constraints of a webpage (see Figure 1). How this information is structured and presented strongly influences (1) how consumers make sense of a hotel product/experience, and (2) how they weigh each attribute/piece of information to come to final decisions. For instance, although food and beverage services (including reasonable food and beverage prices, available facilities, food quality, options, and food-service quality) were identified as a key factor in guests' hotel choices (Lewis 1984), this finding may not apply in the online booking context because (1) consumers may not be able to access this information at earlier stages of the decision funnel; and (2) consumers can only make inferences about food and beverage services based on fragmented details from customer reviews, hotel descriptions, and hotel photos. Essentially, how these online channels organize hotel attribute information strongly influences how consumers process such information and make decisions. Therefore, research on online hotel bookings should first consider how hotel attribute information is organized at different stages, and then how consumers assign weights to the presented information. When comparing today's hotel listings (see Figure 1) and property information (see Figure 2) with information from 3 years ago (see pictures in RotaCloud, 2016; Yoo, Sigala, & Gretzel, 2016), visual information—specifically hotel photos—is becoming increasingly prominent.

Figure 1. Example of a Hotel's Search Result on TripAdvisor

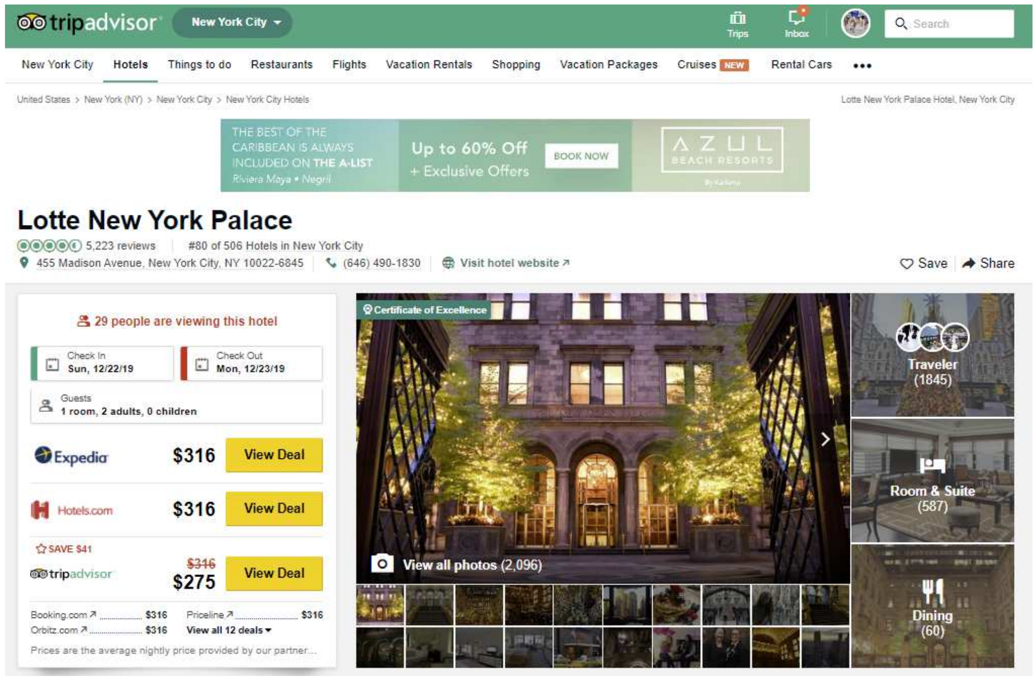

Figure 2. Example of a Hotel’s Individual Property Page on TripAdvisor

Considering the information presented at different online booking stages, researchers (Noone and Robson 2014, 2016) have identified two distinct phases in the online choice process: browsing and deliberation. In an online hotel booking context, browsing occurs when consumers review information about available hotels to screen out options that do not warrant future scrutiny. Deliberation occurs when consumers click a hotel’s link from a list of search results for a more detailed review, which may be followed by booking that hotel (Noone and Robson 2014, 2016). In the browsing stage, consumers rely on a limited amount of information and use mental heuristics to conduct primary screening. During the deliberation stage, consumers use additional available information, seek convergent evidence, and make trade-offs among hotel attributes.

Within the current framework of online hotel choices, scholars have adopted three approaches to consider how consumers assign weights to various hotel information at different stages. The first approach examines the relative weights of hotel attributes by directly asking potential consumers to provide self-reported importance/preference ratings of hotel attributes when making hotel booking decisions online (Crnojevac, Gugić, and Karlovčan 2010; Dickinger and Mazanec 2008b; Law and Cheung 2005; Law and Hsu 2005, 2006). Law and colleagues (Law and Cheung 2005; Law and Hsu 2005, 2006) identified facility information as one of the top dimensions for consumers to consider when making online booking decisions (i.e., customers who had made hotel room reservations online within the past 12 months) and when browsing (i.e., customers who had not made hotel room reservations online within the past 12 months). Among facility-related attributes, "photos of hotel features" were ranked as equally important for purchasers (5.7 out of 7) and browsers (5.9 out of 7) during browsing and actual decisions (Law and Hsu 2006). Particularly, photos including elements of a hotel room (vs. the entire hotel) (Dickinger and Mazanec 2008b) were found to be crucial in customer's online booking. However, in this research stream, consumers evaluated each aspect separately without considering them jointly. In addition, self-reported importance ratings did not necessarily explain the actual importance of each attribute in consumers' attention or decisions, particularly for hotel photos (Noone and Robson 2014).

To reconcile the deficiencies of this research stream, the second approach considers potential determinants jointly to infer their contributions/value to consumers' booking intentions or behavior. Researchers often develop different attribute combinations (e.g., photo, location, and price) and assess the contribution of each to consumers' booking preferences, intentions, or behavior based on surveys or experiments. For instance, Dickinger and Mazanec (2008) applied conjoint analysis and confirmed customers' self-stated rating hotel attribute importance. Their findings suggested that, following a friend's recommendations and favorable reviews, a pleasant picture of a hotel room was a key attribute that customers valued when choosing preferred hotels.

The third method focuses on consumers' attention allocated to each piece of information about hotel attributes and how customers use that information to evaluate each attribute's relative importance. Research featuring this approach often involves non-obtrusive methods such as observation and eye-tracking to measure the extent to which consumers' attention is directed and how emotions are elicited when processing hotel attributes at different stages. For instance, with eye-tracking measurements, Noone and Robson (2014) found that, regardless of how participants rated the importance of the physical appearance of a hotel (depicted by photos), they paid a large amount of attention to hotel photos. Noone and Robson (2014, 2016) further confirmed that pictorial information ranked 3rd among all available information on an OTA webpage during the browsing phase and 1st during the deliberation phase based on participants' average number of eye fixations when looking at each hotel. P. Mobile (2014) adopted eye-tracking techniques to analyze consumers' engagement while using the Hyatt hotel app to make hotel booking decisions. Their eye-tracking heat map highlighted participants' areas of visual focus on photos and prices. Pan et al. (2013) also employed eye-tracking and found that the presence of hotel photos could render the online search and booking processes less boring, therefore increasing the time people spent with text and overall webpages; customers then evaluated more hotels when exposed to a large set of options. Taken together, these small-sample studies indicate that photos constitute a crucial criterion when making decisions at various stages and represent a hedonic experiential element that makes the decision process more entertaining.

Overall, studies have demonstrated that photos play important roles in online hotel bookings. However, research has mainly treated hotel photos as a single and undifferentiated attribute of online hotel products that possess a certain value or utility without delineating the nuances of the effects of such photos. In fact, as visual content has become a necessary component of online sales and marketing, particularly for experiential products, determining how photos can stage the hotel experience as a unique medium is essential.

2.2 Mediating the Hotel Experience with Online Photos

This section discusses, photos, particularly online digital photos, can be used to mediate hotel experiences. Section 2.2.1 uses medium theory to discuss the capabilities and constraints of the chosen medium (i.e., online photos) and how the mediation process influences individuals' perceptions. Section 2.2.2 addresses how individuals stage and perceive a hotel's experience, particularly the servicescape, through photos.

Servicescape, according to Bitner (1992), refers to the "manmade, physical environment" (p. 58) which was found to be a key component of a hotel's experiential offerings. Related literature has mainly focused on the influence of the servicescape in on-site situations. However, how the servicescape is communicated through media, and its influence on consumer behavior in a mediated environment, remains largely unknown (with rare exceptions such as Baek & Michael Ok, 2017; Kirillova & Chan, 2018).

The current dissertation argues that, due to the capabilities and constraints of the chosen medium (e.g., a static image), the servicescape and induced consumer perceptions will be mediated. This mediation process calls for the reconsideration of (1) servicescape input, (2) inferred servicescape dimensions, (3) individuals' internal response processes, and (4) corresponding booking-related behavior. The mediated servicescape and induced consumer perceptions will be structurally distinct from the servicescape and its induced perceptions in-situ. Consequently, subsequent behavior will likely differ from that suggested by the existing framework. The following sub-section reviews the communication literature on photo mediation. Then, original servicescape concepts are reviewed, and the concept of consumers' perceptions of the mediated servicescape (CPMS) is introduced.

2.2.1 The Medium Theory and The Mediation of Online Photos

The medium theory examines the relationship between characteristics (i.e., capabilities and constraints) of a medium used for communication and the senses individuals use to match and adapt to the characteristics of that medium (Littlejohn and Foss 2009). The medium theory also explores the ways in which various forms of mediated communication compare and contrast with "unmediated" face□to□face interaction (Meyrowitz 2019). According to this theory, in many situations, individuals do not experience the world directly but through different communication media. Media function as filters that determine what people know and how they know it (Littlejohn and Foss 2009). At the individual level, medium theorists examine how information encoders' and receivers' senses are activated when using mediated communication (e.g., an employer sending a dismissal message to an employee via email) as opposed to face-to-face communication (e.g., an employer firing an employee by speaking to him/her; see Littlejohn & Foss, 2009).

Similarly, how hotel suppliers use sensory cues to communicate the hotel experience to their consumers, and how consumers use their senses to perceive this experience, depends highly on the nature and characteristics of the medium (e.g., a hotel photo). A photo, as a medium, has its own capabilities and constraints in communicating information (Lundby 2014). Created by light falling on a photosensitive surface through a camera lens, photographs possess the power of a mechanical link that directly connects depicted objects to those in reality (Smith and Lefley 2015). This feature distinguishes photos from traditional types of media (e.g., books, paintings, or sculptures). This mechanical link through a machine (i.e., a camera) seems to lack the photographer's subjective views (Smith and Lefley 2015): that is, a photograph's audience tends to believe that photographs represent an objective record of items rather than a subjective reflection of the photographer's mind. Therefore, photographs can create a sense of realism. Realism, which is connected to phrases such as "lifelike" and "true to life," is defined as the level of resemblance to real scenes (Smith and Lefley 2015). Therefore, the capability of a photograph to mechanically link the represented and the actual can effectively "replicate" objects and their relationships visually in a scene.

First introduced in 1822, photographs were produced via an analog system and distributed in print. Digital photos, which emerged in 1960, gradually replaced analog photographs at the end of the 20th century thanks to their enhanced ability to transfer, save, and restore data without information loss. Digital technologies, with their unique modularity, can decompose information into small pieces (Manovich 2001) and use binary numbers (0s and 1s) to transmit and represent information. Digital photos consist of tiny fractions called pixels. Every pixel can be coded with a unique binary-number value to inform its position and color values. The feature of modularity further enables variation in media representation (Manovich 2001), allowing individuals to heavily modify and manipulate digital photos.

Despite its capabilities, a static photo has two limitations: (1) it is exclusively visual, such that other sensory information is unlikely to be communicated through this medium alone; and (2) its static nature hinders the dissemination of dynamic information that changes over time (Elkins, 2013), which can potentially limit the physiological effects that sensory input can induce. Specifically, photos are discrete snapshots of an episodic experience, and time-related information can be lost. Although photo limitations restrict the reality presented to be visual and static, digital photos can still resemble and “modify” reality while making the audience believe that what is represented through a photo is realistic. Despite these constraints, photos, particularly attractive ones, remain superior in communicating and marketing a hotel’s servicescape.

2.2.2 Servicescape and Consumers’ Perceptions of the Mediated Servicescape

The servicescape has become a pivotal concern in tourism and hospitality experience management (Heide, Lærdal, and Grønhaug 2007). Before the introduction of the servicescape in service contexts, business researchers recognized the importance of ambience, or atmosphere, in these contexts. Kotler (1973) first emphasized the role of the “atmosphere” of a place in the marketing and sales of generic products in a retail context. He found that buyers responded to the total product, not simply the tangible one. For instance, consumers decide to buy a pair of shoes not only because of the shoes themselves; their decisions depend on the service, packaging, advertising, and photos of the shoes. The atmosphere, as another aspect of an environmental setting where consumers buy tangible products, is key to product marketing and communication.

Atmosphere, according to Kotler (1973), refers to “the air surrounding a sphere.” The term is often used colloquially to describe the quality of the surrounding environment. Today, atmosphere can equate to the “vibe” of one’s surroundings: a distinctive feeling or quality communicated by the environment that can be sensed by an individual (Merriam-Webster n.d.). Atmosphere is therefore apprehended through one’s senses, and the careful design of sensory stimuli/input will likely induce certain types of responses. Kotler (1973) further introduced the concept of “atmospherics” to refer to the conscious design of the spatial environment to engender certain expected effects in consumers. The impacts of atmospherics have been found effective in many contexts, including marketing, retailing, and organizational behavior. Thus, senses/perceptions and their effects can go beyond the individual; an atmosphere can be created by manipulating sensory input, and its effect can be predicted to some extent.

According to Kotler (1973), sight, sound, scent, and touch, as the most important senses, are the main channels for atmosphere. The visual dimensions of an atmosphere include color, brightness, size, and shape. Primary aural dimensions are volume and pitch. Main olfactory dimensions incorporate scent and freshness. The main tactile dimensions include softness, smoothness, and temperature. The sense of taste does not directly apply to the atmosphere. Kotler’s conceptualization frames the atmosphere as input conditions that can be used to shape buyers’ behavior. The effect of the atmosphere can function in three ways: attracting attention, communicating a message, and generating affect, suggesting perceptual, cognitive, and affective routes of processing atmospheric input. Kotler’s framework outlines the necessary components that construct an environment’s atmosphere.

Recognizing the value of atmospherics (or sensory input) as a marketing tool, Bitner (1992) introduced the concept of the servicescape. Bitner defined a servicescape as the “manmade, physical environment” (p. 58) and suggested that the influence of the physical environment on behavior is particularly apparent in service businesses. According to Bitner, the servicescape includes a place’s sensory/ambient conditions; layout/function; and signs, symbols, and artifacts. Experiences staged using these materials constitute a form of nonverbal communication (Chronis 2019) or an “object language” (Bitner, 1992, p. 62). Such material staging, which communicates an image or the essence of a servicescape (Sherry 1998), contributes to the meaning and distinctiveness of business offerings (Bitner 1992; Sherry 1998; Wallendorf, Lindsey-Mullikin, and Pimentel 1998).

Individuals’ holistic perceptions of the entire environment can emerge from a purposefully designed, rigorously controlled, and carefully managed setting. In Bitner’s model, physical servicescape conditions evoke consumers’ holistic responses towards the environment (i.e., the perceived servicescape). The perceived servicescape can critically influence consumers’ responses and behavior, particularly in the hospitality service context. Specifically, the hospitality industry’s core offering is an intangible service for which little evidence can communicate the quality (Bitner 1992) and style (Lin 2016; Lin and Mattila 2010; Spielmann, Laroche, and Borges 2012) of a service and differentiate related offerings, especially during an initial encounter.

Bitner's conceptualization of the servicescape is important for two reasons. First, it captures the holistic nature of environmental perceptions; as individuals perceive discrete sensory input, the total configuration of that input determines individuals' responses to the environment (Bell, Fisher, and Loomis 1978; Holahan 1982). Second, in addition to sensory input, Bitner incorporated design elements into the servicescape model. These elements include space/function and signs, symbols, and artifacts.

Bitner's original theoretical model conceptualizes the servicescape as objective environmental input and servicescape perceptions as individuals' subjective environmental perceptions. In empirical studies, researchers have often used individuals' perceptions of servicescape dimensions to represent servicescape input because the servicescape, or environmental input, is difficult to quantify on a large scale. Empirically, scholars have adopted two methods of examining the servicescape/perceived servicescape in the nomological network.

The first stream of research examines the separate influences of individuals' perceptions of servicescape dimensions on their responses. For example, Harris and Ezeh (2008) used a model to evaluate the linear influences of nine servicescape dimensions on customers' loyalty intentions. Similarly, Kearney et al. (2013) tested the effects of servicescape dimensions on customer satisfaction, employee satisfaction, and employee loyalty, respectively.

Another research stream has developed a latent construct of the perceived servicescape, which consists of individuals' perceptions of servicescape dimensions. The latent construct of the perceived servicescape has been further applied to explain consumers'/employees' responses. Dedeoğlu et al. (2015) used the servicescape/perceived servicescape as a latent construct to explain consumers' perceived value and image of a hotel and subsequent emotional responses and behavioral intentions. A summary of the literature on servicescape dimensions and the perceived servicescape appears in Table 2. Dimensions that have been thoroughly investigated and can be visually perceived include lighting, color, layout/space, furnishings, and style.

According to Bitner's original theorization, environmental input is organized through the body via a gestalt process. Gestalt emphasizes the role of the overall structure and the relationships between components in producing perceptual organization (Schiffman 2001). Individuals first organize perceptual cues into overall perceptions through a cognitive process (Lin 2004). Therefore, using a latent construct to examine the role of the perceived servicescape is a logically sound approach.

Table 2. Literature Review on Servicescape Dimensions and Perceived Servicescape

Context	Term used for servicescape settings	Dimension of servicescape	Type of research	Source of reference
Generic service	Servicescape	1. Ambient conditions: sensory input such as color, lighting, etc. 2. Space/functions: layout, equipment, furnishings, etc. 3. Signs, symbols & artifacts: signage, personal artifacts, etc.	Conceptual	Bitner (1992)
Retail	Atmospherics	1. Ambient factor: music, lighting, smell. 2. Design factors: floor covering, wall covering, display/fixtures, color, cleanliness, ceilings, layout, etc. 3. Social factors: salespeople	Empirical (quantitative)	Baker et al. (1994)
Leisure	Servicescape	1. Layout, accessibility 2. Facility aesthetics 3. Seating comfort 4. Electronic equipment/displays 5. Facility cleanliness	Empirical (quantitative)	Wakefield and Blodgett, (1996)
Casino	Casino servicescape	1. Ambient factors 2. Casino layout 3. Cleanliness 4. Interior décor 5. Seating comfort	Empirical (quantitative)	Lucas, (2003)
Generic service	Servicescape	1. Visual cues: color, lighting, space and function, personal artifacts and plants, and layout and design 2. Auditory cues 3. Olfactory cues	Conceptual	Lin (2004)
Hotel lobby	Atmospherics	1. Style 2. Layout 3. Colors 4. Lighting	Empirical (quantitative)	Countryman and Jang (2006)
Restaurant	Dimensions of atmospherics	1. Layout 2. Interior design 3. Lighting 4. Background music	Empirical (quantitative)	Jang and Namkung (2009)

Table 2. Literature Review on Servicescape Dimensions and Perceived Servicescape (Continued)

Context	Term used for servicescape settings	Dimension of servicescape	Type of research	Source of reference
Hotel	Key elements of a hotelscape	1. Color 2. Lighting 3. Furniture 4. Style 5. Layout	Empirical (qualitative)	Alfakhri et al. (2018)
Leisure	Tangible service factors	1. Building design & décor 2. Equipment 3. Ambience	Empirical (quantitative)	Wakefield and Blodgett, (1999)
Restaurant	Dimensions of servicescape	1. Facility aesthetics 2. Layout 3. Electric equipment 4. Seating comfort 5. Ambient conditions	Empirical (quantitative)	Kim and Moon, (2009)
Retail	Dimensions of servicescape	1. Equipment 2. Design 3. Ambience 4. Space 5. Hygiene	Empirical (quantitative)	Hooper et al. (2013)
Restaurant	Dinescape	1. Facility aesthetics 2. Lighting 3. Ambience 4. Layout 5. Table settings 6. Service staff	Empirical (quantitative)	Ryu and Jang (2007)
Restaurant	Servicescape variables	1. Ambient conditions 2. Design factors 3. Staff behavior 4. Staff image	Empirical (quantitative)	Harris and Ezeh (2008)
Generic service	Atmospheric stimuli	1. Exterior 2. General interior 3. Store layout 4. Interior display 5. Human variables	Conceptual	Turley and Milliman (2000)

In online photo-mediated situations, environmental cues are organized by one's perceptual system, contributing to the formation of CPMS. Therefore, CPMS is theorized as a formative latent construct in the current research. In conventional in-situ contexts, individuals' servicescape perceptions develop when they organize different modalities of sensory information collected from different spaces within a service place accumulated over time. However, CPMS is structurally distinct from traditional servicescape perceptions for two reasons. First, the formation of CPMS largely depends on individuals' visual perceptions because the modality of communication through photos is specifically visual. Second, visual information in a photo is selective and static, and CPMS formation can be heavily influenced by a specific moment and scene captured and objects incorporated into the scene at that moment. In other words, CPMS formed based on different photos of the same hotel can differ. The above two characteristics render CPMS structurally different from servicescape perceptions in traditional on-site contexts.

To summarize, a servicescape is mainly purposefully designed and managed through material settings. Consumers tend to form overall perceptions of the servicescape based on the visual information contained within a hotel photo. Such a holistic perception or perceptual image is challenging to measure directly; therefore, CPMS is theorized as a second-order latent construct consisting of dimensions of lighting, color, layout/space, furnishings, and style that individuals can visually perceive through photos.

2.3 How Consumers Are Attracted by Hotels Online: The Role of CPMS

Recognizing that consumers' hotel booking evaluations and decisions largely depend on appealing perceived environments, this chapter adopts a perspective of attractiveness to evaluate how CPMS influences consumers' booking-related behavior at an individual level. Applying this lens will promote a fuller understanding of different mechanisms at different online hotel booking stages.

2.3.1 Attractiveness: What It Is

The verb "attract" is defined as "to cause an approach or adhere" (Merriam-Webster, n.d.). If a person or an object is attractive, then it has the force "to pull to or draw toward oneself or itself" or "to draw by appeal to nature or excited interest, emotion, or aesthetic sense" (Merriam-Webster, n.d.). Attractiveness assesses to what extent someone or something is attractive. According to this definition, attractiveness refers to certain characteristics of a person or an item that induce certain responses from others. Attractiveness is essentially the outcome of the interaction between the evaluated and the evaluator. This operationalization enables researchers to study attractiveness from two perspectives: the focal person/object that possesses certain attributes and the individuals who exhibit certain responses.

From the perspective of the attraction (i.e., the evaluated subject/object), its/his/her attractiveness can be evaluated based on certain objective criteria related to the attributes and characteristics an individual/object possesses. When those criteria are met, the focal person or object will be considered attractive. From the evaluator's perspective, attractiveness can be assessed based on the perceiver's responses at the perceptual, cognitive, emotional, and behavioral levels.

2.3.2 Attractiveness: Lessons Learned from Physical Attractiveness

Discussions of attractiveness originated from judging the attractiveness of human beings. With a focus on what makes some people more attractive than others, the discussion of physical attractiveness spans the sciences, social sciences, and humanities.

Related research has shown that (1) physical attractiveness signals an individual's superior qualities and conditions, thus implying an individual's phenotypic fitness or resourcefulness; (2) shared taste and private taste contribute substantially to the judgment of physical attractiveness; (3) the judgment of attractiveness is mainly derived from a limited number of static cues, although dynamic expressive cues also play important roles; (4) physical attractiveness can create the "beauty-is-good"/"attractiveness halo" effect, such that physically attractive individuals are likely to be associated with high social status; and (5) an individual's physical attractiveness is likely to induce others' approach behavior.

In evolutionary psychology, physical attractiveness signals superior quality. Attractiveness was thought to be a signaling strategy of organisms (Gangestad and Scheyd 2005). Individuals' physical traits that are deemed attractive signal the creature's quality conditions; that is, the signaler possesses signals (attractiveness), and receivers possess the capacity to perceive and act upon (be attracted to) those signals. The signal of physical attractiveness implies individuals' superior quality, namely their ability to interact successfully with the environment to acquire and expand energetic resources (Rowe & Houle, 1996). Specifically, superior quality conditions make a signaler a more appealing mate because these conditions are likely to bring benefit or value (e.g., food, protection, and likelihood of reproduction; see Houle, 1992) and a relative absence of deficiencies (e.g., diseases, see Grammer, Fink, Møller, & Thornhill, 2003) to receivers. In a word, physical attractiveness implies the superior quality and condition of an individual that can benefit those attracted to them.

Researchers have continuously debated the consistency and stability of attractiveness judgments. Shared taste and private taste each contribute significantly to such judgments. Several studies (for a meta-analysis, see Langlois et al., 2000) have demonstrated that "the standards of beauty are widely shared" (Rhodes et al., 2001, p. 31), even across cultures (Langlois et al. 2000). Conversely, some researchers (e.g., Hönekopp, 2006) have indicated that "evaluations that are averaged across judges are highly reliable, whereas agreement between single judges is usually much lower" (p. 207). Hönekopp (2006) pointed out that both shared taste and conditional variations constitute notable aspects of attractiveness judgment. Conditional variations can be caused by socioecological contexts, individual preferences (Brase and Walker 2004; Gangestad and Scheyd 2005; Little et al. 2001), relational contexts (Buss and Schmitt 1993), and other situational factors (Berscheid and Walster 1974). Essentially, a large proportion of attractiveness judgment is shared, whereas a considerable proportion is socially constructed, personally perceived, and situationally conditioned.

The shared aspect of attractiveness judgment can be stably predicted by a limited number of traits, including facial dimorphism (Gangestad and Thornhill 2003), averageness, symmetry (Grammer and Thornhill 1994), and body form (Singh and Luis 1995) and physique (Dixson et al. 2003). These traits can be reliably perceived from static cues, specifically facial cues based on portrait photos. Some studies (e.g., Riggio, Widaman, Tucker, & Salinas, 1991) have suggested that an individual's dynamic features also play key roles in one's overall physical attractiveness. Particularly, expressiveness and nonverbal communication appear strongly correlated to the favorability of evaluators' initial impressions of assessed subjects (Riggio et al. 1991; Riggio and

Throckmorton 1988). Dynamic features combined with static qualities of beauty jointly create an impression of one's attractiveness.

Physical attractiveness is particularly powerful, as it can create the "beauty-is-good"/"attractiveness halo" effect. This effect implies that physically attractive individuals are likely to be associated with high social status and desirability (Berscheid et al. 1971) in an array of aspects (Langlois et al. 2000) such as social competence, potency, adjustment, and intellectual competency (Eagly et al. 1991). These patterns suggest that attractiveness perceptions may be a fundamental dimension underlying social inferences (Umberson and Hughes 1987). As a branch of expectation states theory (Berger et al. 1977; Berger, Cohen, and Zelditch Jr. 1966), status characteristics theory defines a status characteristic as "…any characteristic that has differentially evaluated states that are associated directly or indirectly with expectation states" (Berger et al., 1977, p. 35). An individual who is evaluated as attractive has relatively high expected competency and therefore holds high social status to some extent. According to a review by Webster and Driskell (1983), physical attractiveness (which they considered beauty) meets the criteria for a diffuse characteristic as "there is a general expectation state such that attractive people are seen as more skilled at most tasks" (Webster & Driskell, 1983, p. 147) and "possess almost all types of social advantages that can be measured" (p. 141), including but not limited to greater popularity (Perrin 1921) and, higher competence and influence (Cash and Kehr 1978). Generally, in social psychology, attractiveness is considered a diffuse status characteristic of an individual in that attractive individuals are presumed to be superior to their counterparts in various ways. The above findings on physical attractiveness shed light on product attractiveness in this study.

2.3.3 The Attractiveness of Generic Products

Though attractiveness was first used to describe individual traits, it was later introduced into the marketing and management domain to describe characteristics of objects, particularly products. Studies on product attractiveness have investigated factors that render a product attractive, including visual appeal, quality, and price. Among these, a product's visual appeal has been identified as one of the most important determinants of attractiveness.

In terms of the visual appeal of a product's appearance, scholars have found that design factors can make products more or less attractive, similar to the roles of facial and body features in physical attractiveness. Relevant design factors include color, shape, and features of unity (i.e., congruity among design elements; see Veryzer and Hutchinson, 1998); prototypicality (i.e., the degree to which an object is representative of a product category; see Blijlevens, Carbon, Mugge, & Schoormans, 2012; Veryzer & Hutchinson, 1998); and novelty (Hekkert, Snelders, and Wieringen 2003).

Several studies (e.g., Bloch, 1995; Creusen & Schoormans, 2005) have revealed that, just as people ascribe personal traits such as social competence to others based on physical attractiveness (Dion et al., 1972), consumers make inferences about products based on products' visual appeal. Product appearance has been deemed effective in communicating aesthetic and symbolic values, conveying functional characteristics and value, and drawing attention to and facilitating categorization of a product among consumers. Attractive products thus influence consumers' product choices. The aesthetic and symbolic values communicated through a product's appearance seem to be most influential (Creusen and Schoormans 2005); however, the aesthetic and symbolic values communicated through a product's appearance (which people perceive and react to) are more personal (Creusen and Schoormans 2005).

In addition to product appeal, information about other product features contributes to overall attractiveness evaluations, particularly when consumers evaluate a product option in purchase contexts (Chan, Ip, and Cho 2010). In addition to visual appeal, the elements of quality, price, brand, and word of mouth (Chan et al. 2010; Lee and Youn 2009; Sriram, Chintagunta, and Neelamegham 2006) play important roles in shaping a product's overall attractiveness. Collectively, when considering the attractiveness of a product in decision-making contexts, consumers tend to rely on more than visual appeal and make trade-offs between costs and benefits to inform their decisions. The overall evaluation of product option attractiveness directly influences subsequent purchase behavior.

2.3.4 The Attractiveness of Experiential Tourism and Hospitality Product

In tourism and hospitality, the attractiveness of a tourism product—reflecting an individual's feelings, beliefs, and opinions about a destination—can motivate potential tourists to choose that destination. Mayo and Jarvis (1981) first investigated the attractiveness of a tourism destination by relating its attractiveness to individual tourists' benefits and the perceived ability of the destination to deliver such benefits. Later, Hu and Ritchie (1993) conceptualized destination attractiveness as the perceived ability of a destination to provide satisfaction in relation to an individual's unique vacation needs. Relevant attributes consist of the elements of a third place that draw discretionary travelers from home (first place) and the workplace (second place) (Hu and Ritchie 1993). Studies on the attractiveness of tourism products indicate that (1) attractiveness manifests through travelers' destination choices; (2) attractiveness attributes consist of "common" elements that extend to home settings and "uncommon" elements that differ from home environments; and (3) travelers share certain attractiveness judgments but remain private about others. A tourism product (e.g., a tourism destination) encompasses a package of tourist attractions, facilities, and services composed of several multidimensional attributes that determine its attractiveness to particular tourists (Hu and Ritchie 1993). Travelers' perceived attractiveness of a destination strongly influences their destination decisions. Similar to attractiveness in a generic product purchasing context, destination choice is a behavioral manifestation of travelers' overall perceived attractiveness of the destination package (Mayo and Jarvis 1981). Hu and Ritchie (1993) defined such attributes as including "uncommon" elements that lure tourists away from daily life and "common" services and facilities that cater to their everyday needs.

Research has also revealed two interesting patterns regarding the attributes of tourism destination attractiveness. The first pattern suggests that some attributes are universally important in influencing tourists' evaluations of the attractiveness of any destination, such as a location's natural beauty and climate (Gearing, Swart, and Var 1974; Ritchie and Zins 1978). The second pattern indicates that for different types of destinations offering different vacation experiences, and for different types of visitors, diverse attributes contribute to tourist attractiveness. For instance, sociocultural attributes are some of the most important (Ritchie and Zins 1978) in contributing to Quebec City's overall attractiveness to out-of-province visitors but not to in-province tourists. Similarly, as demonstrated by Kale and Weir (1986), the touristic attribute of culture was identified as a key determinant when individuals assessed a foreign destination instead of a domestic one. Hu and Ritchie (1993) further indicated that a destination's attractiveness dimensions can be perceived significantly differently depending on (1) travelers' familiarity with the destination and (2) situational factors when making judgments.

In the hospitality context, to create memorable and meaningful experiences, the servicescape produced by physical surroundings is a fundamental aspect in attracting and delighting customers (Baek and Michael Ok 2017; Bitner 1992; Breazeale and Ponder 2013; Han and Ryu 2009; Jang and Namkung 2009; Lin 2004; Liu and Jang 2009; Mari and Poggesi 2013). In hospitality, where the main products—services—are relatively intangible compared to manufactured goods, limited information can convey the quality (Bitner 1992) and style of service (Lin 2016; Lin and Mattila 2010; Spielmann et al. 2012), particularly for initial purchases (Bitner 1992). In this case, consumers rely heavily on tangible cues or physical evidence to infer a hotel's quality and style. In addition, experiences staged by hotel companies with digital images remain largely static and material; the information that individual consumers perceive through digital photos is mostly static and visual. Therefore, consumers in online purchasing contexts may rely more on servicescape cues and their perceptions of these cues when evaluating the overall attractiveness of hotel products and making decisions. Positive physical servicescape cues can facilitate consumers' expected service quality (Reimer and Kuehn 2005) and their aesthetics comprehension and appreciation (Lin 2016), which can then inspire customers to make purchases (Baek and Michael Ok 2017; Chan et al. 2010).

Following the original definition of attractiveness and its operationalization in generic purchase contexts, this dissertation takes aggregated purchase-related behavior as a proxy of the attractiveness of a hotel option. In an online booking context, consumers are likely to be attracted initially by a hotel's "look" in photos and to then engage in booking-related behavior upon considering relevant listing information.

2.4 Mental Processes Involved When Attracted by Photos in Online Booking

When individuals are attracted by hotel photos, they are likely to experience internal responses that influence subsequent booking-related behavior. Evidence from the literature suggests that exposure to photos in an online booking context is likely to induce fast and slow thinking processes. Fast thinking processes are driven by emotions, whereas slow thinking processes are likely to involve cognitive evaluation and imagery.

2.4.1 Evidence Supporting Fast Thinking Processes

Studies have indicated that processing a photo tends to be a simple task despite the rich information photos can provide. Images generally facilitate a fast thinking process, which relies on heuristics or emotions (Kahneman 2011). Essentially, appealing graphics can potentially induce a "beauty-is-good" stereotype, a heuristic that reduces the amount of information processed and can make people more aroused and pleased. As a result, people may rely on stereotypes and emotions to screen out options quickly or explore information in which they are interested. This fast thinking process could also be attributed to individuals' perceptual fluency when processing high-quality visual features (Carretié 2014).

The roles of hotel images in a fast thinking process are supported by evidence from (1) individual differences in levels of reliance on hotel images for online booking and (2) eye-tracking results in the e-commerce context. An observational study conducted by Park et al. (2019) revealed three types of decision makers: arbitrary, standard, and comprehensive. Their study indicated that hotel images played a significant role in all three decision makers' purchasing journeys during consideration set formation. While arbitrary decision makers relied heavily on images to make final decisions without a second thought, standard decision makers exhibited slightly less reliance on images. The degree of dependence on images when making decisions was lowest for comprehensive decision makers. The same patterns were observed in the browsing and deliberation stages.

This fast thinking process has also been indirectly supported by eye-tracking results of gazing behavior when participants performed online shopping tasks (in the deliberation stage) on Amazon (Mikalef, Sharma, and Pappas 2018). Two measurements were used to assess thinking processes: peak saccadic velocity and pupil diameter. The human eye cannot travel faster than the biological upper limit of its velocity (Salvucci and Goldberg 2000). The eyes attain their highest velocity at a certain point. Peak saccadic velocity is often denoted as the percentage of saccade length at which maximum velocity is reached (Duchowski 2017). An increase in peak saccadic velocity appears positively related to increased arousal (Di Stasi et al. 2013; Nummenmaa, Hyönä, and Calvo 2009); in particular, highly pleasant or highly unpleasant visual cues can increase peak saccadic velocity (Nummenmaa et al. 2009). Pupil diameter was found to be associated with cognitive activities (Kahneman and Beatty 1966). Theories of attention and working memory typically indicate that cognitive processes deplete a limited pool of mental resources. As cognitive load increases and mental resources are used, pupil diameter grows progressively. According to Mikalef et al.'s study (2018), peak saccadic velocity was relatively high when participants processed visual information compared to other types of information, suggesting potential induced arousal. Yet a significant difference was identified between situations when participants were looking at pages for selected products compared to eliminated products. In particular, peak saccadic velocity in the eliminated product group was significantly higher than in the selected product group, suggesting that images of eliminated products may induce higher arousal. Such arousal may be associated with strong unpleasant emotions (Kurdi, Lozano, and Banaji 2017). The emotions of arousal and pleasantness may each affect the fast processing of image information. Additional indirect evidence suggesting a fast processing mechanism is pupil diameter change values. Pupil diameter change was found to be relatively low when processing image information versus other types of information, suggesting a low mental load. In other words, cognitive elaboration was relatively low when looking at images versus other information types (Mikalef et al. 2018).

P. Mobile (2014) adopted then electroencephalography (EEG) to track consumers' responses when using the Hyatt hotel app along their decision journey. Findings showed that consumers demonstrated relatively high emotional engagement when exposed to the app's opening images and when they selected hotels from a list of options with images. Results also suggested that images used in mobile apps can elicit positive (pleasant) emotions. Similarly, Im, Lennon, and Stoel (2010) found that different levels of perceptual-level features in online images can induce varying degrees of pleasure, leading to diverse purchase intentions among consumers.

2.4.2 Evidence Supporting Slow Thinking Processes

Goodrich (2010) noted that photographs can cause people to pay closer attention to various features of advertised products, which may lead to cognitive elaboration. Such elaboration suggests a slow thinking process that is deliberative and logical (Kahneman

2011). For instance, a banner ad containing a photograph enables customers to observe product features and learn more about a high-involvement product; the ad may also pique consumers' interest in investigating the product further (Edwards 2009; Mitchell and Olson 1981). Additionally, Pan et al.'s (2013) eye-tracking results showed that in general, participants spent 1.6 to 1.7 times the amount of time evaluating hotels with images than those containing text only. These results suggest that images present rich information, and observers adapt their decision making to the amount of information provided (Payne, Bettman, and Johnson 1993). Participants spent more time and engaged in more extensive evaluation when given more information through images (Pan et al., 2013). Collectively, slow thinking processes can potentially involve imagery, quality inferences, consideration of ambience, and confirmation.

Imagery: Product images have been found to evoke different levels of mental imagery (Yoo and Kim 2014) and increased purchase intention. These findings also apply in the online hotel booking context. According to think-aloud interviews (Noone & Robson, 2016), some participants used photos to visualize their hotel stay and make inferences about the type of clientele a hotel attracts. Their descriptions demonstrated this mental imagery process:

> "I always look at pictures. I like to see, if I stayed there, what it would look like. So no surprises and things like that." (Kelly, Millennial, from Noone & Robson, 2016)
>
> "If I could see myself walking in there and saying I'm happy I made this decision" (Alexandra, millennial, from Noone & Robson, 2016).
> "The one [hotel] that said that it was free happy hour? I was like wow, okay then. And when I saw this, I thought the kids can be over here [pointing to one side of the lounge area] and I can be there [pointing to an adjacent area]—create a distance, but not too much." (Nicole, Generation X, from Noone & Robson, 2016)

> "It had a little baby grand piano in there. Not that I play piano, but that just tells me that it's a different clientele that would go there." (Sue, Baby boomer, from Noone & Robson, 2016)

Confirmation/Uncertainty Reduction: Confirmation is another pertinent thinking process. Consumers use images as signals to confirm their anticipated experiences based on a brand or on the textual description of a hotel. For instance, one participant from Noone and Robson (2016) explicitly stated,

> "I guess maybe familiarity would be one [reason to look at photos] to make sure that it is—it looks like—what I've seen in the past with that brand." (Teri, Generation X, from Noone & Robson, 2016)

If consumers find their experiences at branded hotels to be satisfactory, then pictorial information may become unnecessary for uncertainty reduction. For instance, participants in Noone and Robson (2016) indicated,

> "This time I didn't look [at photos] because it was a brand that I am pretty comfortable knowing what to expect there. If it's a brand or a place, or something that I'm not as familiar with, I tend to look more deeply—like what does the room itself look like? What does the lobby look like? The breakfast area?" (Janet, Generation X, from Noone & Robson, 2016)

> "I was familiar with the hotels, because of my past experience. That I knew what to expect, so I didn't look any further. The [brand name] is a [brand name]. They're just always the same." (Leah, Baby boomer, from Noone & Robson, 2016)

Evidence from Pan et al.'s study (2013) also substantiated the roles of images as conformational signals to diminish uncertainty. Without images, participants tended to be less confident in their choices:

> "Since I do not have the pictures, I do not know a lot about them so I will probably just go with Hotel 5" (Participant F from Pan et al., 2013).
> "No pictures at all. Can you tell the difference between 1 and 5?" (Participant G from Pan et al., 2013)

> "[It is] hard to know what I am looking for without pictures." (Participant H from Pan et al., 2013)

The absence of pictures even caused one participant to increase her price range:

> "I am looking at a higher price range than I was before because I have a lot to look for without pictures. I have to read descriptions to compare that way." (Participant I from Pan et al., 2013)

Pan et al. (2013) further concluded that pictures helped to reduce uncertainty and increase consumer confidence when making final decisions.

Processing hotel images during online booking is generally complex because different extents of information are involved, and different processing mechanisms apply across stages. During the browsing stage, consumers' attention tends to be attracted by (a) images as a whole, compared to other types of information; (b) salient information in each hotel image compared to the other parts of an image; and (c) the hotel's overall ambience. Consumers also rely on holistic ambience perceptions of a hotel's environment to narrow down their options. Such information is likely to influence consumers' decision making at the browsing stage by inducing emotional responses. These responses can make consumers quickly choose "turn-on" options rather than "turn-off" options, thus helping them narrow their choice set for deliberation. During the deliberation stage, while consumers may still rely on salient information in images and the overall ambience of hotels to make decisions to some extent, they also consider other types of information such as price, ratings, brand, and reviews. Additionally, consumers are likely to inspect environmental details in each photo, such as lighting, spaces, bedding, and material. When processing environmental details via cognitive elaboration, individuals can (a) identify which elements explain their overall perceptions of a hotel's ambience; (b) develop vivid mental imagery of their hotel experience; and (c) reduce/raise (un)certainty by identifying convergent/divergent evidence from images. In the end, image information is likely to be evaluated alongside other hotel listing information as consumers make trade-offs and come to final decisions. Through such cognitive processes, consumers tend to choose a hotel that provides positive experiences and is thought to be cost-effective and trustworthy. During the browsing stage, consumers are likely to assign more weight to images to screen out unattractive options. During the deliberation stage, while this initial attraction may still be useful, consumers are likely to conduct more complicated mental processes (e.g., using imagery, fact checking, and trade-offs) to choose the most attractive option overall. Yet little is known about (a) why customers perceive certain types of mediated servicescape as attractive and others as unattractive and (b) how customers' perceived attractiveness of the mediated servicescape and other factors jointly influence their judgments of a hotel's overall attractiveness and further influence their online booking behavior.

2.5 Content Elements in a Hotel Photo that Forms Environmental Perceptions

Scholars have discussed the importance/value/utility of photos in online shopping contexts, but the specific information that consumers extract from photos remains ambiguous. In other words, the messages individuals seek have not been examined in detail. Based on the literature on visual attention and processing, individuals can adopt top-down and bottom-up methods to process visual information. In top-down models, individuals use goals to direct their attention. In bottom-up models, individuals' visual attention is drawn to salient signals presented in photos. Studies have also suggested individuals voluntarily seek or are involuntarily attracted to environmental cues in depicted scenes when developing holistic perceptions of a hotel's environment.

2.5.1 Theories of Visual Attention: The Role of Local Features of Objects

Every second, a rich amount of visual information is before one's eyes. Before a person can engage in the complex processing of this visual information via cognition, visual attention helps them select relevant information in the scene and ignore the rest for more efficient processing (Borji and Itti 2013). In recent decades, researchers in disciplines including psychology, neurophysiology, computational neuroscience, and computer vision science have sought to understand the mechanisms of (visual) attention through different approaches.

In general, attention is a selective process that preferentially allocates processing resources to percepts, memories, or tasks (Carrasco 2011). As suggested in feature integration theory, attention can be driven by pop-out visual features through bottom-up processes. In addition, guided search theory posits that visual attention can be directed by processing goals through top-down control processes (Carrasco 2011). Using these selective processes, attention helps individuals tune out complicated details and focus on what is salient in a scene.

Feature integration theory, according to Treisman (1988) and Treisman and Gelade (1980), suggests that individuals process a limited set of basic pre-attentive, visual features in parallel across the visual field. According to this theory, a holistic visual scene is initially coded along with several separable features, such as color, size, shape, gist, texture, and orientation (for a detailed list of attributes, see Wolfe & Horowitz, 2004). These separable visual features are initially processed in a massively parallel manner over the entire visual field. Focal attention provides the "glue" that combines these features into a unified object representation (Treisman & Gelade, 1980, e.g., table, hair, window). However, not every type of visual input can attract one's attention and create a perception. The limited capacity of human information processing has been conceptualized as a bottleneck, which filters out (Broadbent 1958) or attenuates (Treisman 1964) certain sensory input. Object representation can only activate an individual's awareness if its separable features pass through the attentional bottleneck (Treisman & Gelade, 1980).

Feature integration theory was further expanded to feedforward processes (Koch & Ullman, 1987; Nakayama & Mackeben, 1989; Treisman & Gelade, 1980) and bottom-up processing models (Wolfe 2014) centering around the saliency map. The saliency map is a topographic map that encodes for stimulus conspicuity, or salience, at every location in a visual scene. Essentially, locations of interest in a scene that attract one's attention in a bottom-up manner must be sufficiently distinct from surrounding features. Feedforward processes project neural signals from lower to higher levels of processing. In this case, an individual selects the most salient part in a scene to begin "looking," and the focus of attention scans the saliency map in order of declining saliency (Itti, Koch, & Niebur, 1998). Overall, the bottom-up model consists of feedforward, automatic, non-voluntary, and peripherally cued processes (Egeth and Yantis 1997), which rely purely on the saliency of external input that impinge on the retina (Braun and Julesz 1998).

Conversely, guided search theory (Wolfe 1994, 2014; Wolfe, Cave, and Franzel 1989) assumes that one's goals direct their visual searches towards anticipated objects and features. For instance, if observers were asked to search for a red vertical item among red horizontals and green verticals, pre-attentive, basic feature information could be used to guide attention toward red items and vertical items (Wolfe 2014).

Building upon this theory, several top-down models have indicated that attention is determined by cognitive phenomena such as expectations, goals, knowledge, and rewards. The top-down mechanism is thought to be voluntary and task-driven given that visual attention is directed by one's motivational state. Yarbus (1967) first showed that individuals with different search queries demonstrated unique eye movement when viewing the same scene. Later, Pieters and Wedel (2007) demonstrated that the informativeness of objects in a scene is contingent on the specific processing goal that has been activated. Overall, processing goals activate relevant object representations in long-term visual memory. These representations enter working memory and are compared with existing objects in the visual stimuli to which an individual is exposed. Representations of objects that are more associated with/relevant to one's goal will be enhanced, while those less associated/relevant will be inhibited (Yarbus 1967). Subsequent research has indicated that top-down control operates feedback processes (Mehta, Ulbert, and Schroeder 2000; Treue 2001) in which neural signals are projected from higher to lower levels of processing regions. More specifically, top-down control influences how sensory input is perceived by amplifying or modulating neural activation (Itti and Koch 2001; Kanwisher and Wojciulik 2000; McAdams and Maunsell 2000).

Although these two mechanisms were proposed separately, imaging and neurophysiological studies have found neural correlates of both types in certain brain areas, such as the frontal and posterior parietal cortices (Corbetta and Shulman 2002; Kastner and Ungerleider 2000; Schall 2002). Recent work has suggested that feedforward and feedback processes cannot be mechanistically separated into successive stages as they occur concurrently with similar neural mechanisms. Khorsand, Moore, and Soltani

(2015) noted that feedforward and feedback processes interact to direct attention. Buschman and Miller (2007) discovered that top-down and bottom-up signals arise from the frontal and sensory cortex, respectively. The synchrony of neural activities in these two brain regions can be observed in top-down and bottom-up models of attention at varying frequencies. These results further demonstrate that the saliencies of external stimuli and internal goals should both be considered when exploring individuals' attention allocation and information processing.

As implied by feature integration theory and guided search theory, some local features of content objects are pivotal in attracting attention involuntarily and directing visual searches voluntarily. Table 3 lists numerous features found to be effective in directing visual attention to identify and assess objects in a depicted scene. These features are also applicable to this dissertation's focus on static hotel scenes.

Table 3. Local Features of Content Objects that Direct Attention

Local object features that direct attention	**Values/Categories**	**Source of reference**
Color	Hue, saturation, brightness/value	Lindsey et al. (2010); Nagy, Young, and Neriani (2004)
Size	Area Large/small	Cavanagh, Arguin, and Treisman, (1990); Found, Müller and College, (2001)
Closure of outlines	Closed/open	Elder and Zucker (1993)
Depth	Close to observer/distant to observer/in the middle	Found et al. (2001)
Surface material/texture	Gloss/roughness	Maloney and Brainard (2010)

2.5.2 Application in Online Hotel Booking

Corresponding to the top-down and bottom-up visual attention models, the advertising and marketing literature suggests that visual information searches can be categorized as either goal-directed or exploratory (Pieters and Wedel 2007) based on whether the consumer has a particular task in mind (Janiszewski 1998). Further, the informativeness of objects in a scene is contingent upon the activated processing goal (Pieters and Wedel 2007). When viewing online ads for a product (e.g., an advertised product/brand), a key goal is product evaluation (e.g., the advertised product/brand) (Pieters and Wedel 2007). Evaluation goals involve assessing the value or benefit of a target based on certain criteria (e.g., utility) (Hilton and Darley 1991).

In the context of online hotel bookings with the objective of evaluating hotel options, consumers' attention can be attracted/directed by salient object elements and specific object elements that consumers consider important in the depicted scene. On one hand, through a feedforward process, salient areas/objects of a physical environment in a photo are likely to capture consumers' attention instantly and involuntarily, improve memory and learning (Santangelo and Macaluso 2013), and be retained for future evaluation as needed. On the other hand, in parallel to this feedforward process, a feedback process can direct further attention to objective elements that are important to consumers' overall environmental perceptions and decisions.

Ultimately, guided by an evaluation goal, consumers' attention is directed to create overall perceptions about a hotel's environment and ultimately inform their decisions. When evaluating hotel options, the hospitality service experience—unlike goods and products—manifests in the interplay between the customer, the inanimate environment, staff, and other customers (Bitner 1992; Clarke and Schmidt 1995). In a scenario involving limited customer–employee and customer–customer interaction (e.g., staying in a hotel room), the static environment becomes the core service offering. One's experience thus arises mainly from the interaction between consumers and the entire static environment. According to (Bitner 1992), individuals are likely to perceive the environment holistically. Further, holistic perception formation is based on local features of content objects (or discrete environmental stimuli as put by Bitner, 1992). Further evidence to support this argument is presented in Sections 2.5.3 and 2.5.4.

2.5.3 What Attracts Attention: Specific Content Objects

Drawing upon interview studies (Noone and Robson 2016; Pan et al. 2013), this section reviews research suggesting that (1) people's attention is likely to be attracted by specific salient object content involuntarily; and (2) people attend to specific locations/areas.

Specific salient content elements that stand out: Some interviewed participants from Pan et al.'s (2013) study (Table 4) stated they were attracted by salient object contents that stood out from the ground of hotel photos. These details were noticeable mainly because of low-level perceptual features, such as colors, brightness, and contrast. Salient stimuli were likely to attract attention automatically, whereas non-salient stimuli were likely to be neglected. For instance, a window view (Figure 3) can be highly salient when contrasted against an indoor environment; such a view is likely to draw an individual's attention automatically.

Figure 3. Example of a Salient Window View (Arora 2018)

Specific content elements that individuals intentionally care about: In terms of specific content in a photo about which individuals care most when purchasing a hotel product, specific functional and hedonic object elements are clearly effective. In other words, consumers know the specific details to observe because they realize these aspects will strongly influence their hotel stay; such elements include the bed, floor, window, lights, furniture, and carpet. The processing of specific environmental elements often occurs during the deliberation stage.

For instance, in Sivaji et al.'s (2014) study, one participant stated they paid attention to the floor, window, furniture, and lights to judge whether a room was expensive. Some participants said they considered specific content object elements and how these elements could further explain holistic perceptions of a "tidy" environment. The same pattern was observed in Noone and Robson's (2016) study, where some participants stated that their sense of a "nice," "modern," or "outdated" hotel mainly came from content elements (e.g., the carpet, bedspread, and furniture) captured in photos.

Essentially, specific content elements (Table 4) within a photographed hotel scene can draw individuals' attention voluntarily or involuntarily. These salient elements are likely to direct individuals' attention during exploratory searches or evaluations. In addition, individuals rely on the presence, quality, texture, and condition of specific content elements to form holistic perceptions of the hotel environment.

Table 4. Content Objects in a Hotel Photo that Attract or Direct Attention

Specific Content objects	Voluntary or involuntary	Quotes
Window/window view	Involuntary	"Hotel 15 looks appealing; it seems like it has a good [window] view." (One participant from Pan et al., 2013)
Window/window view	Voluntary	"First, I looked at the outside of the window so that I can [know] where the hotel is located at. Maybe the environments of the surrounding [can tell]." (One participant from Sivaji et al., 2014)
Floor	Voluntary	"After that, I concentrated on the floor means I wanted to see what kind of material was used on the floor." (One participant from Sivaji et al., 2014)
Lights, Bed, Other furniture	Voluntary	"Next I looked at the rooms [refer to professional photo 1 and professional photo 2] and at the utilities like lights and sofa and other things like the bed, is it good or tidy or is it in a good condition." (One participant from Sivaji et al., 2014)
Floor/carpet, Bed/Bedspreads	Voluntary	"It just seems cleanly put together. They have double beds and nice carpeting and bedspreads. And sometimes, you look at pictures, and you can tell the quality is just not really there." (Alyssa, millennial, from Noone & Robson, 2016)
Carpet	Voluntary	"Outdated-looking hotels are a turn-off. When I think of outdated, I think of musty smell, worn carpet." (Teri, Generation X, from Noone & Robson, 2016)
Bed/Bedspreads	Voluntary	"For me, that modern look I associate with being clean. And one thing that really drew me to it is they had the duvets. So, I love the white duvet. It's like the most attractive thing to me in a hotel because you know that they wash and bleach it every time, and they change it every time." (Lydia, millennial, from Noone & Robson, 2016)

2.5.4 The Goal Leads Attention to Dimensions of Environmental Perceptions

Drawing upon previous interview studies, this section reviews relevant evidence suggesting that, following an evaluation goal, individuals' attention is directed to form a holistic perception of a hotel's environment. When describing their overall environmental perceptions, previous participants focused on their feelings about lighting, layout, color, furniture, and style (Table 5).

Lighting: In Sivaji et al.'s study (2014), when asked to describe their area of interest, two participants indicated that, when scanning several photos at the same time, photos showing an overall brighter (vs. darker) environment were likely to gain more of their attention. As a result, they exhibited a strong interest in professional photos over traveler photos.

Color: In Sivaji et al.'s study (2014), one participant indicated that professional photos with more striking colors made a scene seem more appealing and expensive than a scene depicted in traveler photos.

Style: When comparing several hotel photos, consumers tended to pay attention to the style of the hotel environment. When describing this impression, participants often used words such as "modern," "trendy," and "stylish" to describe characteristics they perceived in each hotel photo. For instance, three participants in Pan and colleagues' study (2013) emphasized their impressions of modern, conventional, and luxurious hotel environments that caught their eye while browsing. Similarly, in Noone and Robson (2016), participants mentioned their overall impressions of the hotel environment in which "modern" was emphasized during the deliberation stage.

Table 5. Attention is Directed to Form Certain Environmental Perceptions

Dimensions of overall perception	Quotes
Lighting	"These [referring to traveler photo 1 and traveler photo 2] are kind of dark... and when I looked at the bottom [referring to traveler photo 1], it seems a bit average, I guess? That's why I kept focusing more on the top ones [refer to professional photo 1 and professional photo 2] because they appear more pleasing." (One participant from Sivaji et al., 2014) "That picture just caught my eye, I think because it is dark and it [the hotel] was lit up so it just seemed prominent—like almost made a statement. The other one—it was the white building and it just blended right in—just plain." (Alexandra, Millennial, from Noone & Robson, 2016)
Color	"When I'm watching here right [refer to professional photo 1], I actually saw the color is very luxury." (One participant from Sivaji et al., 2014)
Style	"The first one I like because it is kind of modern; looks trendy, clean. The second one, not as good as the first one. The bed and space. The second one looks a little conventional. The third one is just awful. Looks feminine, teddy bear, polyester, and yucky." (One participant from Pan et al., 2013)
Style	"The picture of the room is awesome. It is the style I like. So that means right now I am looking at the styles of the rooms. For me I like modern. It is a cheap price. Customer rating kind of sucks. But it looks cool. Some of these [hotel rooms] I do not like. I am not into elegant design so let's skip them." (One participant from Pan et al., 2013)
Style	"… It makes me feel like it [referring to the hotel] is luxurious and this one [refer to professional photo 2] is also similar." (One participant from Sivaji et al., 2014)
Style	"The one I ended up on felt really modern and stylish, and it felt like they put a lot of thought into design, which I like." (Lydia, Millennial, from Noone & Robson, 2016)
Space & layout	"…but another one [referring to traveler photo 2] appears really small, like only can afford one couple." (One participant from Sivaji et al., 2014)
Space & layout	"Because compared to these three, this [referring to professional photo 1] look a bit bigger and the other ones [refer to traveler photo 1] feels like smaller, but after I read carefully I realized that both of the rooms are super kings room, and then I [was] curious why both of them are same also called super king rooms but the size is totally different." (One participant from Sivaji et al., 2014)

Space/Layout: Consumers' perceptions of the environment in terms of space/layout represent an integral part of value assessments of experiential products. If the benefits provided by the physical environment do not meet consumers' bottom-line value expectations, then consumers will likely screen out the option quickly. For instance, one participant in Sivaji et al.'s (2014) stated that a room seemed small and would not fit more than two people.

In addition, photos as a medium can potentially bias consumers' perceptions. For instance, brighter photos can make hotel lighting appear sufficient, and indoor scenes shot with a wide-angle lens can make a space appear larger than it is (Banks, Cooper, and Piazza 2014). These biased physical perceptions were observed in Sivaji et al.'s (2014) study; three participants took a long time to compare various photos because the photos elicited confusion about room size.

Through a selective process, individuals' attention is directed to form overall perceptions of a hotel's environment. This process can occur in the browsing and deliberation stages (Figure 4). Related perceptions also often have multiple dimensions. Specifically, consumers' overall perceptions of the environment encompass tangible aspects (e.g., lighting, colors, and space/layout) as well as style aspects that are less tangible. Such perceptions can also be biased by photos as a visual medium.

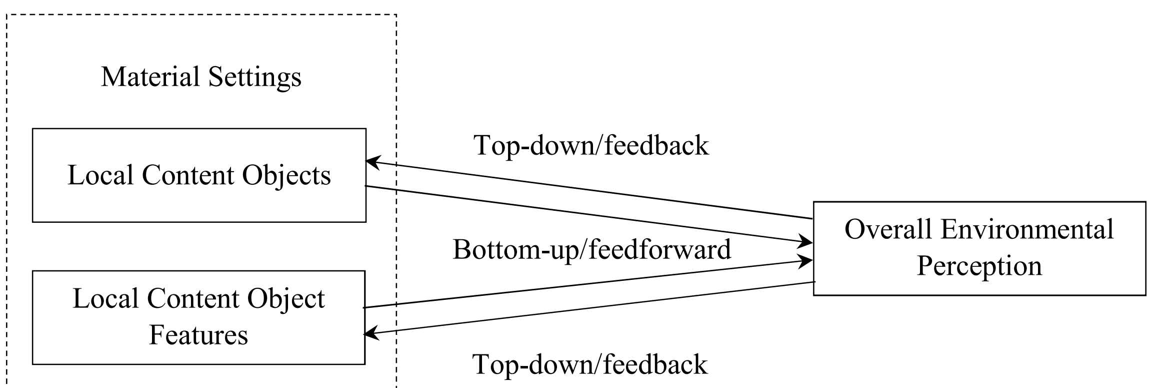

Figure 4. Applying Visual Attention Theories to Viewing Hotel Photos

2.6 Image Appeal: The Role of Graphic Features

Image appeal can be defined by the amount of interest an image/photo generates when viewed by third-party observers (Savakis, Etz, and Loui 2000). Individuals may find a photo appealing because they are attracted by the content of a photo or simply because the graphic quality of the photo enables individuals to process the photo fluently. As reviewed earlier, when individuals are explicitly involved in booking decisions and their evaluation goals are clear, attention is directed to overall perceptions of the mediated servicescape. Because of the characteristics of digital photos—modularity (Manovich 2001) and realism (Smith and Lefley 2015)— graphic features, as another layer of visual input, can influence detected mediated servicescape dimensions and further shape consumers' overall CPMS. When individuals' evaluation goals are not activated, graphic features alone are likely to directly induce individuals' affective responses without leading to environmental perceptions.

2.6.1 Graphic Features Can Influence Mediated Servicescape

Image processing and computer vision researchers have long been interested in the topic of image appeal and have developed several measurements on global graphic quality features (Joshi et al. 2011). Drawing upon information science, ***global graphic quality features*** refer to how the structure of visual information sparks humans' interest. Structural features of visual information include color (Birkhoff 1933) and visual complexity (Li and Vitanyi 1997). Given this theoretical foundation and relevant visual principles in photography, researchers have devised simplified and classical computational measurements to gauge global graphic quality features of hotel photos based on low-level perceptual features (Savakis et al. 2000). These measurements include brightness, saturation, colorfulness, visual intensity, color balance, contrast, and the rule of thirds. These specific features include two main categories: color effects and photo composition. Measurements of color effects are those that assess themes, variations, and impacts of color use at the pixel level. Measurements of photo compositions assess patterns in how elements are organized in a photo.

Such global ***graphic quality features*** are likely to influence ***CPMS*** and subsequent assessment of a hotel's value. Research involving management (professional) and traveler (amateur) photos (Trpkovski 2018; Trpkovski et al. 2018) has shown how global graphic quality features can influence CPMS. In particularly, studies have identified significant differences between management (professional) and traveler (amateur) photos, recent and historic photos, and photos in positive vs. negative reviews according to different measurements of global graphic quality features. Results suggest that firms tend to use better-quality photos (management vs. amateur and recent vs. historic) to stage experiences, whereas unsatisfied consumers tend to post poor-quality photos to convey their dissatisfaction with a service experience. Similarly, Zhang et al. (2017) studied Airbnb photos and found that high-quality photos are likely to generate additional annual revenue of $2,521 on average.

2.6.2 Graphic Features Can Directly Induce Emotional Responses

Studies have also shown that image appeal is closely tied to individuals' emotional responses (Joshi et al. 2011). Certain global graphic quality features (e.g., color tone and complexity) are highly associated with emotions (Solli and Lenz 2009, 2010; Tuch et al. 2011). This affective process can occur when an individual engages in an exploratory search without an explicit goal.

Exploratory search activities (Janiszewski 1998) can serve as (a) a screening process that pinpoints candidates for goal-directed searches or (b) an information-gathering process when goal-directed search routines (e.g., sequential search behavior from browsing to purchasing in the present context) are inadequate. During an exploratory search, which often happens in the browsing stage, visual stimuli compete for individuals' attention (Janiszewski 1998). Evidence suggests that global graphic quality features that are "pleasing" and "draw attention" are unlikely to be screened out and are likely to be retained for further examination (Noone and Robson 2016).

During an exploratory search, emotional responses can have direct effects even in the absence of early environmental appraisals. In this case, attention is not directed to form environmental perceptions but instead focuses on a photo itself. A summary of related evidence is provided in Table 6.

Table 6. Evidence Suggesting Affective Responses Induced by Image Appeal

Stage	**Keywords suggesting potential emotional responses**	**Quotes**
Browsing	"Appealing" (pleasure)	"I usually look and if it looks like the picture is appealing, I'll click it, if it's in my price range." (Deb, Generation X, from Noone & Robson, 2016)
Browsing	"Draws you in" (arousal/curiosity)	"The picture draws you in." (Kelly, Millennial, from Noone & Robson, 2016)
Browsing	"Turn-off" (displeasure)	"Some pictures are just a major turnoff." (Karen, Generation X, from Noone & Robson, 2016)
Browsing	"Got to do something for me" (arousal)	"I'm looking for price. And also, I have to admit that picture—you know the picture's got to do something for me pretty quickly." (Sue, Baby boomer from Noone & Robson, 2016)
Browsing	"Catch my eye" (arousal)	"The price was good, but based on the picture they showed, it didn't really catch my eye." (Alexandra, Millennial, from Noone & Robson, 2016)

As discussed in Sections 2.2 and 2.3, consumers can engage in search behavior either based on evaluation goals or an exploratory search. During goal-directed searches, consumers consider photos as vehicles to communicate a hotel's service experience. Under top-down control, visual input (including material and graphical settings) can be organized into environmental cues and detected by consumers. Material settings in hotel photos include local content objects and local content object features. Graphical settings refer to the photo's global graphic features. Detected environmental cues or mediated servicescape dimensions can further form an overall environmental perception or CPMS. Overall perceptions then influence booking-related behavior.

During an exploratory search, when a goal is unavailable, visual stimuli compete for individuals' attention. Consumers may not necessarily activate environmental appraisal to inform their search behavior. The global graphic features of hotel photos may directly induce emotional appraisal and influence subsequent behavior. These mechanisms could also emerge in the browsing stage. Evidence related to these two response mechanisms was discussed in Section 2.4.

CHAPTER 3

CONCEPTUAL DEVELOPMENT

Based on the preceding literature review, this section conceptualizes focal variables/constructs and their theoretical relationships. The following part addresses consumers' perceptions of mediated servicescape (CPMS), the structural relationships between CPMS and several related constructs, and the role of CPMS when individuals use hotel photos to guide booking-related behavior.

3.1 Theoretical and Empirical Issues of Servicescape and Perceived Servicescape

Based on Bitner's (1992) original conceptualization of the servicescape, researchers have developed various terminologies to describe and operationalize this term. Examples include "atmospherics," "hotelscape," "dinescape," "substantive staging," and "tangible service factors," each of which focuses on different aspects of the service environment (Table 7). These concepts all focus on tangible and physical settings in service environments. When researchers attempted to understand how the servicescape influences individuals' responses, especially in empirical studies, their work began to diverge. Such contradictions are largely due to (1) loose conceptualization of the perceived servicescape and (2) survey approaches adopted to assess the servicescape construct.

According to Bitner's (1992) initial theorization, the perceived servicescape refers to an individual's holistic perception of the entire service environment. In other words, the perceived servicescape is a preliminary impression formed immediately after an individual becomes aware of the environment and before they formulate subsequent responses. The perceived servicescape characterizes how an individual organizes their senses and bodily feelings to experience the environment in full. Development of the perceived servicescape, as an individual's holistic perception of the service environment (Bitner, 1992), is largely an internal process as noted earlier. The servicescape also refers to the physical environment that results in a perceived servicescape (Bitner, 1992). Given this conceptualization, the servicescape is essentially a set of external stimuli. Therefore, the perceived servicescape should be conceptually distinguished from the servicescape that inspires such an internal perception (Lin 2004).

Conceptualized as the holistic perceptual image that an individual forms before developing affective responses, cognitive evaluations, and subsequent behavior (Lin 2004), the perceived servicescape is similar to the concept of "destination image" in tourism research, which is also holistic, Gestalt, multisensory, and quasi-perceptual (Lai and Li 2016). Similar to destination image, the ambiguous conceptualization of perceived servicescape leaves room for interpretation (Types I to IV in Table 7).

Table 7. Four Ways that Servicescape is Conceptualized and Operationalized

Context	Terms used for servicescape settings	Dimensionality of servicescape	Terms used for perceived servicescape	Relationship between settings and perceived servicescape	Type of research	Source of reference
Type I: Servicescape has multiple dimensions; servicescape and perceived servicescape are differentiated; perceived servicescape is caused by servicescape dimensions						
Generic service	Servicescape	Multidimensional	Perceived servicescape	Formative/causal	Conceptual	Bitner (1992)
Retail	Atmospherics	Multidimensional	Store image	Formative/causal	Empirical (quantitative)	Baker et al. (1994)
Leisure	Servicescape	Multidimensional	Perceived quality of servicescape	Formative/causal	Empirical (quantitative)	Wakefield and Blodgett, (1996)
Casino	Casino servicescape	Multidimensional	Satisfaction of casino servicescape	Formative/causal	Empirical (quantitative)	Lucas, (2003)
Generic service	Servicescape	Multidimensional	Perceptual image of servicescape	Formative/causal	Conceptual	Lin (2004)
Hotel lobby	Atmospherics	Multidimensional	Lobby impression	Formative/causal	Empirical (quantitative)	Countryman and Jang (2006)
Restaurant	Dimensions of atmospherics	Multidimensional	Perceived atmospherics	Formative/causal	Empirical (quantitative)	Jang and Namkung (2009)
Hotel	Key elements of a hotelscape	Multidimensional	Customer's holistic perception of the service experience	Formative/causal	Empirical (qualitative)	Alfakhri et al. (2018)

Table 7. Four Ways that Servicescape is Conceptualized and Operationalized (Continued)

Context	**Terms used for servicescape settings**	**Dimension of servicescape**	**Terms used for perceived servicescape**	**Relationship between settings and perceived servicescape**	**Type of research**	**Source of reference**
Type II: Servicescape has multiple dimensions; servicescape and perceived servicescape are differentiated; perceived servicescape is indicated by servicescape dimensions						
Leisure	Tangible service factors	Multidimensional	Tangible environment	Reflective	Empirical (quantitative)	Wakefield and Blodgett, (1999)
Restaurant	Dimensions of servicescape	Multidimensional	Servicescape	Reflective	Empirical (quantitative)	Kim and Moon, (2009)
Retail	Dimensions of servicescape	Multidimensional	Servicescape	Reflective	Empirical (quantitative)	Hooper et al. (2013)
Type III: Servicescape has a single dimension; perceived servicescape is not differentiated with servicescape and is indicated by servicescape items						
Retail banking and restaurant	Servicescape	Unidimensional with items drawing from many different aspects, such as employee, communication materials, architecture, and odor.	Not differentiated from servicescape settings	Reflective	Empirical (quantitative)	Reimer and Kuehn (2005)
Restaurant	Servicescape cues	Unidimensional with items drawing from different aspects, such as music, lighting, temperature, layout, and exterior.	Not differentiated from servicescape settings	Reflective	Empirical (quantitative)	Lin and Mattila (2010)
Hotel	Substantive staging of servicescape	Unidimensional with items drawing from different aspects, such as smell, architecture, and layout.	Not differentiated from servicescape settings	Reflective	Empirical (quantitative)	Durna et al. (2015)
Theme park	Substantive staging of servicescape	Unidimensional with items drawing from different aspects, such as smell, architecture, and layout.	Not differentiated from servicescape settings	Reflective	Empirical (quantitative)	Dong and Siu, (2013)

Table 7. Four Ways that Servicescape is Conceptualized and Operationalized (Continued)

Context	Terms used for servicescape settings	Dimension of servicescape	Terms used for perceived servicescape	Relationship between settings and perceived servicescape	Type of research	Source of reference
Type III: Servicescape has a single dimension; perceived servicescape is not differentiated with servicescape and is indicated by servicescape items (continued)						
Hotel	Servicescape dimensions	Unidimensional with items drawing from the following dimensions: 1. Facility aesthetics 2. Lighting 3. Ambience 4. Layout	Not differentiated from servicescape settings	Reflective	Empirical (quantitative)	Ariffin et al. (2013)
Sport event	Servicescape dimensions	Single dimension with items drawing from different aspects, such as smell, temperature, music, and noise.	Not differentiated from servicescape settings	Reflective	Empirical (quantitative)	Hightower et al (2002)
Type IV: Servicescape has multiple dimensions; perceived servicescape is not conceptualized or measured						
Restaurant	Dinescape	Multidimensional	Absent	Absent	Empirical (quantitative)	Ryu and Jang (2007)
Restaurant	Servicescape variables	Multidimensional	Absent	Absent	Empirical (quantitative)	Harris and Ezeh (2008)
Generic service	Atmospheric stimuli	Multidimensional	Absent	Absent	Conceptual	Turley and Milliman (2000)

3.1.1 Divergence on the Presence of the Perceived Servicescape

Empirical research first diverges on the presence of the perceived servicescape. Although Bitner (1992) initially conceptualized the term, it remains unclear what exactly the perceived servicescape is and how to measure it empirically. The perceived servicescape was also omitted in some studies examining the role of the service environment in individuals' responses. As a result, servicescape dimensions were applied directly to explain subsequent individual responses (Type IV). This operationalization avoids problems in defining and measuring the perceived servicescape. However, an excessive number of paths complicates investigations on the roles of the servicescape in influencing consumers' responses, thus limiting the value of servicescape research within a larger nomological network.

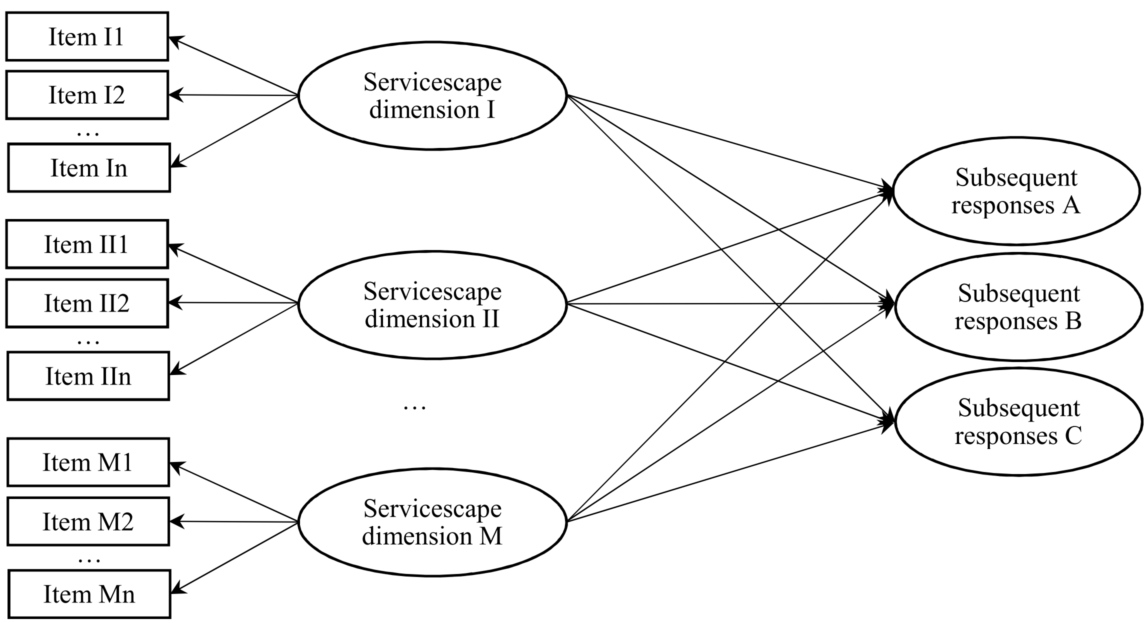

Figure 5. Type IV: Perceived Servicescape is Omitted

3.1.2 Divergence on Differentiation of Servicescape and Perceived Servicescape

Assuming that the perceived servicescape construct exists, research has also diverged on whether to differentiate the perceived servicescape from the actual servicescape. Some empirical studies have used these constructs interchangeably, which can present challenges when using a survey to assess the servicescape. Physical service settings differ across contexts, sectors, brands, scales, and time; as such, it can be nearly impossible to measure the physical servicescape directly. Social scientists have attempted to evaluate the servicescape based on individuals' perceptions of specific aspects such as lighting, music, and space. Individuals' judgments of servicescape aspects are thus taken as indicators of the servicescape. In quantitative studies using survey approaches, when the servicescape and perceived servicescape each involve individual perceptions, it is challenging to differentiate them. When these concepts are not differentiated, the holistic nature of the perceived servicescape has been combined with the reflective nature of servicescape indicators to form a unidimensional scale of the servicescape/perceived servicescape (Type III). Such an operationalization allows researchers to examine the role of the servicescape/perceived servicescape within a larger nomological network. However, it blends characteristics of the servicescape and perceived servicescape. Theoretically, this approach diminishes logical soundness, thus opposing the multidimensional nature of the servicescape. Empirically, this approach can result in low factor loadings for some items and low convergent validity of the perceived servicescape construct in structural equation modeling (e.g., Lin & Mattila, 2010) because items measure different servicescape aspects.

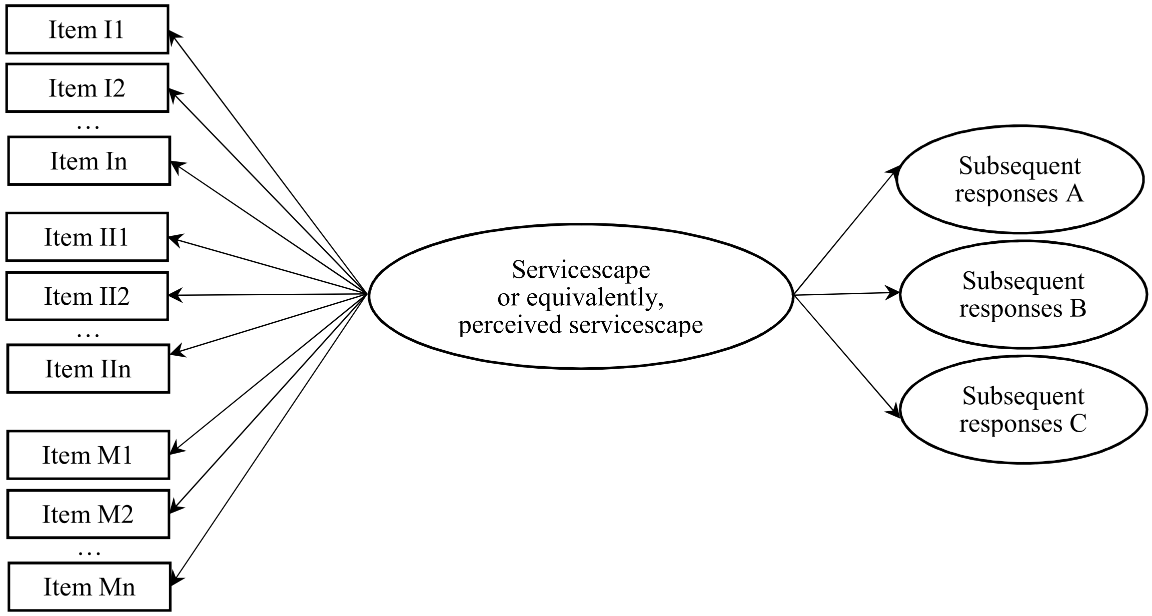

Figure 6. Type III: Perceived Servicescape is not Differentiated from Servicescape

3.1.3 Divergence on the Structure of Perceived Servicescape

In differentiating the perceived servicescape from the conventional servicescape, extensive research has treated the perceived servicescape as a second-order latent variable comprising different servicescape dimensions. However, researchers hold different opinions regarding the formative versus reflective nature of the second-order latent construct (i.e., perceived servicescape).

According to the classical conceptualization, the perceived servicescape is an internal process and should arise from servicescape settings (i.e., external stimuli). The perceived servicescape should therefore be a second-order formative construct. However, when developing a formative structural model, researchers may experience model identification issues that prevent them from using formative models; therefore, reflective models may be adopted instead (Jarvis, MacKenzie, and Podsakoff 2003) to assess the associations between the perceived servicescape and related constructs (Type II). Misspecifications of structural models can bias results and create interpretation problems, thereby limiting studies' empirical implications. For instance, audiences might not be able to assess the direct contributions of certain aspects of the physical environment (e.g., lighting) in individuals' overall perceptions of the service environment and subsequent purchase behavior.

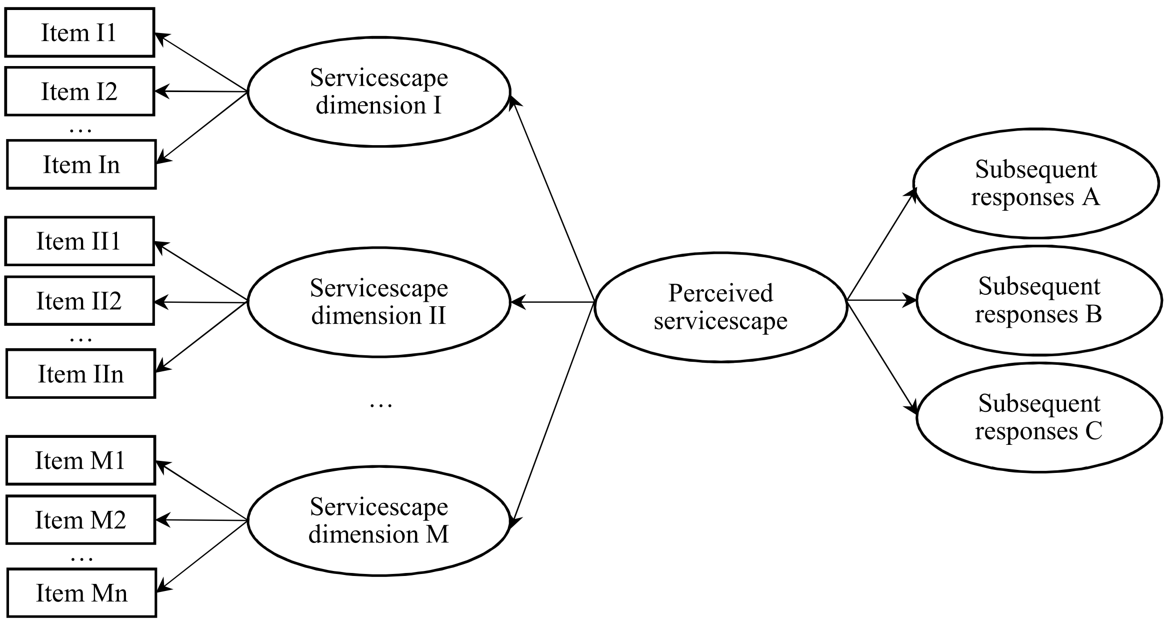

Figure 7. Type II: Perceived Servicescape as a Reflective Second-order Construct

According to the original conceptualization, the servicescape—as the tangible and physical setting of the service environment—is multidimensional. Each dimension can be indicated (i.e., reflectively measured) by individuals' perceptions of specific environmental features. Servicescape dimensions are organized by the senses, leading to one's holistic perceived servicescape: a multisensory and perceptual image of the overall environment. Therefore, the perceived servicescape should be considered a second-order latent variable that is caused (i.e., formatively measured) by servicescape dimensions. Misspecifications of formative models to reflective models can result in inflated estimated coefficients between the focal construct and subsequent variables/constructs (Jarvis et al. 2003).

To resolve practical problems in model identification, one solution is to develop reflective items that indicate overall perceptions of the servicescape environment (Jarvis et al. 2003). For instance, researchers have adopted various reflectively measured constructs such as perceived quality, satisfaction, impression, and image as proxies of the perceived servicescape (Type I). Constructs and measures that capture individuals' holistic image of the environment should therefore be adopted.

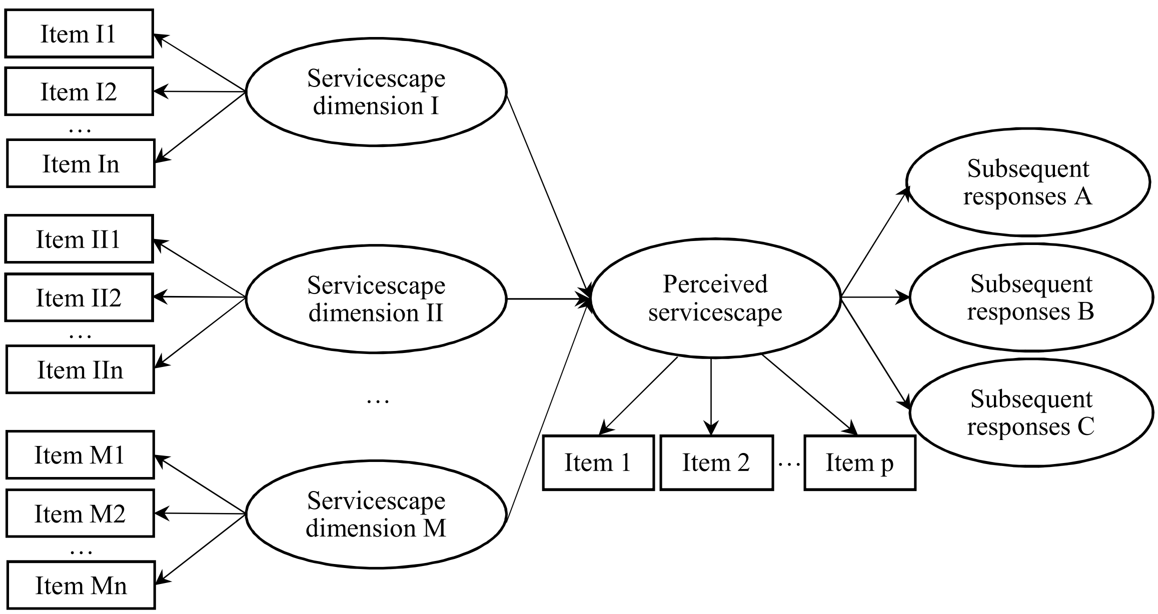

Figure 8. Type I: Perceived Servicescape as a Formative Second-order Construct

To clearly distinguish the measurement of the servicescape and perceived servicescape, which are both evaluated based on perceptions, some scholars have opted to use items with different emphases. For instance, when measuring servicescape dimensions, items can be object-oriented (e.g., "the lighting [certain servicescape aspects] of the place is …”). When measuring the perceived servicescape, items can be subject-oriented (e.g., “I think the environment of the place [certain service venue] is …”).

In summary, diverse theoretical and practical issues can arise when specifying relationships among the servicescape, perceived servicescape, and subsequent variables. To enhance theoretical soundness, this dissertation attempts to theorize the perceived servicescape as a second-order latent variable comprising servicescape dimensions. Servicescape dimensions of which individuals are aware result from the physical setting (i.e., external stimuli). Because the actual physical setting is difficult to measure, servicescape dimensions can be specified as exogenous variables indicated by (i.e., reflectively measured by) individuals’ perceptions of specific aspects, such as lighting, layout, and color. From a practical standpoint, a formative perceived servicescape model can be constructed by adding reflective measures for the second-order latent variable. The prior literature review suggests that measurements capturing individuals’ holistic images of the environment should be adopted to reflectively measure the second-order latent variable of the perceived servicescape.

3.2 The Mediated Servicescape and Consumer Perceptions

After addressing problems related to the servicescape and perceived servicescape in the literature, this section attempts to integrate these concepts in an online photo-mediated context. The next part of this section conceptualizes (1) CPMS; (2) antecedents of CPMS; (3) consequences of CPMS; and (4) two mechanisms that apply when consumers use hotel photos to guide booking-related behavior.

3.2.1 The Mediated Servicescape and Consumer Perceptions

The concept of the mediated servicescape was developed based on the traditional servicescape but is a unique construct. First, the mediated servicescape is inferred based on mediated information; it is not experienced directly. Therefore, consumers' inferences about the mediated servicescape mostly depend on the information presented in a photo. Material settings captured in a photo can strongly influence individuals' inferences about the servicescape. For instance, the time of day when a photo was taken can affect individuals' inferences about hotel lighting.

Second, inferences about the mediated servicescape are largely based on and limited to visual information, which can lead to dimensionality in the mediated servicescape and distinct relationships among mediated servicescape dimensions. Dimensions such as sound and scent cannot be mediated by photos and therefore cannot be inferred. Furthermore, unlike general servicescape dimensions, mediated servicescape dimensions can vary considerably; compared to the multiple senses that organize an experience in on-site contexts, vision is the only sense that organizes a mediated experience in online photo-mediated contexts. Non-negligible correlations thus exist among servicescape dimensions, which may be explained by the graphical settings in photos. For instance, a dark photo could skew individuals' inferences about a hotel's color, lighting, and design and obscure details related to furnishings and the spatial layout.

Based on the concept of the perceived servicescape, CPMS is conceptualized as one's holistic perception of a hotel's environment based on information presented in photos. Similar to the perceived servicescape, CPMS is the result of one's processing of servicescape information. Therefore, CPMS should be a second-order latent construct consisting of mediated servicescape dimensions.

CPMS is the main construct of interest in this dissertation for two reasons. Conceptually, individuals must develop CPMS to organize environmental information before demonstrating subsequent responses. CPMS is a valid construct, and this processing stage cannot be omitted. Empirically, treating the antecedents (i.e., mediated servicescape dimensions) and consequences (i.e., individual responses) of CPMS as focal constructs could present obstacles. For instance, treating mediated servicescape dimensions as a collective focal construct might limit the value of this research to the current photo-mediated context. With the development of online media, servicescape dimensions that can be mediated in the future may be expanded to sound, odor, temperature, and so on. Treating internal responses as the focal construct would be similarly limiting. Compared to environmental appraisal, internal responses tend to be highly personal (Bitner 1992) and are easily influenced by contextual factors in decision making. These responses can thus be inconsistent when assessing and comparing information at the hotel level (rather than the individual level) and may generate little insight. In this dissertation, CPMS is accordingly conceptualized as an overall perception that are caused by the various dimensions of ***mediated servicescape***. This perception involves cognitive evaluation, which in turn inspires behavior, particularly during the deliberation stage. Based on literature review in Section 2.5.4 and following Alfakhri, Harness, Nicholson, and Harness (2018) and Countryman and Jang (2006), this dissertation focuses on the following dimensions: lighting, color, space/layout, furniture, and style.

As reviewed earlier, in an online booking context, when consumers view hotel photos, environmental perceptions are often formed based on evaluation goals, particularly in the deliberation stage. In other words, in the current booking context, and especially in later stages of decision making, individuals rely more on cognition (vs. affect).

3.2.2 Antecedents of CPMS

Following the conceptualizations presented in Sections 2.2 and 2.3, visual input, including material and graphical settings, is considered an antecedent of CPMS. Material settings refer to the actual physical input needed to form a focal depicted scene. Components of material settings include local content objects and local content object features in a hotel photo; such features consist of the objects (e.g., bed, floor, artifacts, and window) captured in a hotel photo.

Local content object features also refer to the visual features of corresponding objects that can be organized by visual attention (e.g., size, color, and material) in a hotel photo. Numerous local content objects are summarized in Table 4 in Section 2.5.3.

Graphical settings refer to the graphic visual input needed to form a focal depicted scene. These settings consist of various global graphic quality features that measure image appeal at the pre-attentive perceptual level; see Table 6 in Section 2.6.1 for a list.

3.2.3 Consequences of CPMS

Bitner's (1992) original model posits that after forming overall environmental perceptions, individuals develop internal responses (i.e., cognitive, emotional, and physiological), and their approach/avoidance behaviors are largely determined by such responses. In an online purchasing context, where individual consumers are attracted by hotel photos and hotel options, the notion of "behavior" often refers to booking-related behavior. Due to data availability, booking-related behavior (i.e., page visitation and meta-click behavior) are taken as manifestations in this dissertation.

3.2.4 Structural Relationships

Bitner's (1992) original servicescape model suggests that individuals form overall environmental perceptions that then induce internal responses, which further influence behavior. This dissertation argues that, because of the context of online hotel searches and booking, consumers can engage in either evaluation goal–directed searches or exploratory searches. Environmental appraisal may not be activated during an exploratory search. Further, appealing photos with high-quality features can directly induce emotions and feelings, leading to prompt booking-related behavior.

Based on such conceptualizations, this research proposes a dual processing model (Figure 9). When individuals are directed by explicit evaluation goals, their environmental appraisal will be activated. Individuals are likely to form overall environmental perceptions based on visual input. Such environmental perceptions will elicit individuals' internal responses (i.e., based on cognition, affect, and imagery) and further influence behavior. When individuals conduct exploratory searches, another processing mechanism may apply: individuals' emotional responses may be directly elicited by visual graphics (photos) with high-quality graphic features, which can then shape behavior without activating individuals' environmental appraisal. By integrating online decision making and Bitner's (1992) original model, the proposed dual processing model extends the theoretical servicescape framework into mediated contexts.

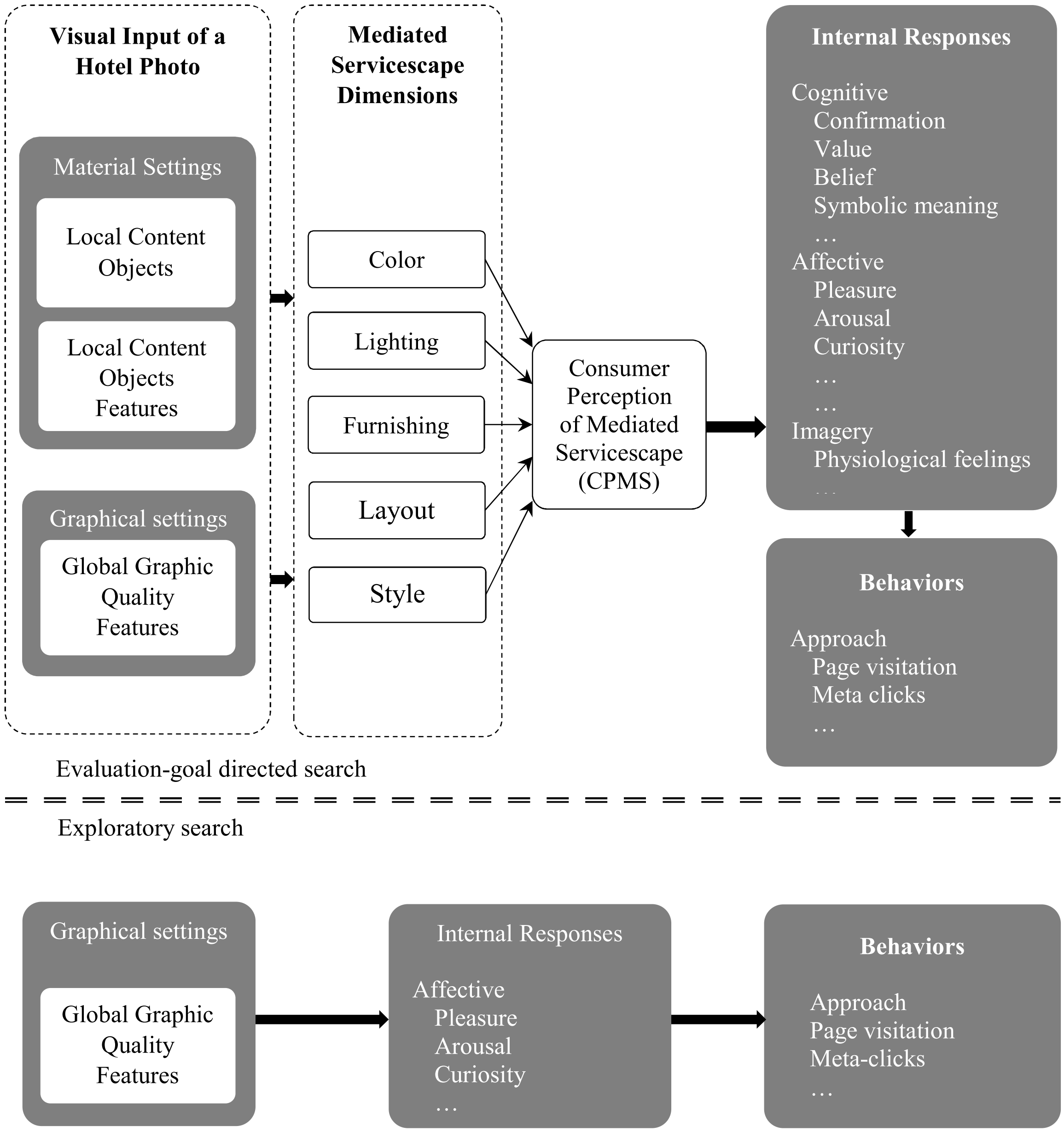

Figure 9. Theoretical Framework of Mediated Servicescape

3.2.5 Hypotheses Development

Based on the above theorization, in an online booking context, CPMS is formed based on individuals' inferences and perceptions of mediated servicescape dimensions: color, lighting, furnishings, layout, and style. Therefore, each mediated servicescape dimension should have a positive effect on CPMS. Upon aggregating individual perceptions at the hotel photo level, it is proposed that

H1a: Individuals' perceptions of a hotel's color positively influence the CPMS of a hotel.

H1b: Individuals' perceptions of a hotel's lighting positively influence the CPMS of a hotel.

H1c: Individuals' perceptions of a hotel's furnishings positively influence the CPMS of a hotel.

H1d: Individuals' perceptions of a hotel's layout positively influence the CPMS of a hotel.

H1e: Individuals' perceptions of a hotel's style positively influence the CPMS of a hotel.

Additionally, as theorized earlier, non-negligible shared variance exists among mediated servicescape dimensions, which may be due to photos' graphical settings. Based on such conceptualizations, it is proposed that:

H2: Dimensions of mediated servicescape are correlated with each other.

CPMS based on hotel photos will likely induce consumers' positive internal responses towards the hotel. Therefore, the consumer will likely consider the hotel option as attractive, visit subsequent pages, and possibly book a reservation. When aggregating each customer's response at the hotel level and controlling other property-level variables, CPMS and its components should be positively associated with aggregated consumer booking-related behavior. Considering the relationship between CPMS and hotel option attractiveness, it is proposed that:

H3a: The CPMS of a hotel's primary photo will be positively correlated with the hotel's aggregated page visitation.

H4a: The CPMS of a hotel's primary photo will be positively correlated with the hotel's aggregated meta-click behavior.

H4b: The average CPMS of a hotel's photos will be positively correlated with the hotel's aggregated meta-click behavior.

Considering the potential direct effect of photo quality on consumers' page-view and meta-click behavior, it is proposed that:

H5a: The quality of a hotel's primary photo will be positively correlated with the hotel's aggregated page-view behavior.

H5b: The quality of a hotel's primary photo will be positively correlated with the hotel's aggregated meta-click behavior.

CHAPTER 4

METHODOLOGY

The main purpose of this dissertation is to explore the relationship between visual input in hotel photos and consumers' booking-related behavior and to examine the roles of CPMS based on the proposed theoretical framework. Specifically, this dissertation aims to uncover (a) how visual input (including local content objects and their features and the global graphic quality features of hotel photos) can explain consumers' servicescape perceptions; (b) how consumers' CPMS can influence consumers' online hotel booking decisions on an aggregated level; and (c) the extent to which graphic features can influence consumers' online hotel booking decisions on an aggregated level. This dissertation adopts a multi-method approach to examine these research questions.

This chapter provides a detailed description of the research methodology in this dissertation. Section 3.1 explains the structure and organization of studies and the rationale of such a design. Section 3.2 introduces the research design of Study 1, which answers research question #1 using crowdsourced quantitative data. Section 3.3 focuses on the research design of Study 2, which aims to answer research questions #2 and #3 using data obtained in Study 1 along with user behavior data from TripAdvisor.

4.1 Research Design and Study Overview

This dissertation presents two integrated and sequential studies intended to link visual information at the photo level to aggregated online consumer behavior at the hotel level through CPMS. By collecting two samples of quantitative data through two consecutive phases, results generally indicate (a) whether CPMS can positively influence consumers' booking-related behavior at an aggregated level; and (b) how to manipulate material and graphical settings to enhance CPMS.

Study 1 aims to explore how a hotel photo's visual input at the material and graphic levels influence individuals' environmental perceptions at the individual level. Specifically, Study 1 attempts to uncover how local content objects and their features, along with global graphic quality features, jointly influence consumers' overall perceptions of a hotel's environment. Using hotel photos provided and gathered from TripAdvisor, Study 1 was executed using human ratings with a crowdsourcing approach and automated content analysis based on a computational approach.

Study 2 aims to examine, while controlling other hotel listing information, (a) the extent to which CPMS can explain the overall attractiveness of a hotel option and drive aggregated consumer behavioral responses at the hotel level; and (b) the extent to which graphic features settings alone can explain the attractiveness of a hotel option. In this dissertation, the attractiveness of a hotel option manifests in two behavioral responses: property page visitation behavior in the browsing stage and meta-click behavior in the deliberation stage. Study 2 presents a quantitative analysis by examining one month of hotel page visitation records (from TripAdvisor), six months of meta-click behavioral data for 400 hotels worldwide (also from TripAdvisor), and individuals' ratings of CPMS and its dimensions for each photo. In sum, Study 2 adopts simple regression, time-series analysis, and propensity score matching to analyze the effect of CPMS and its dimensions on consumers' booking-related behavior.

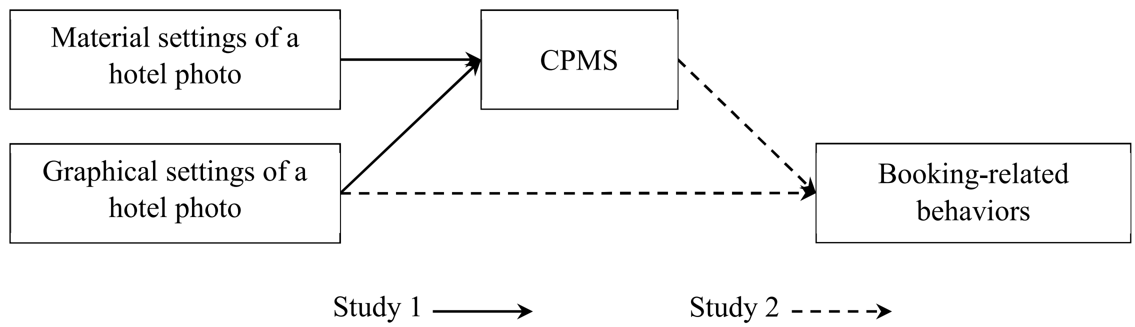

Figure 10. Organization of Two Studies

Study 1 includes a convenience sample from an online panel for large-scale annotation and rating of CPMS and its antecedents for each hotel photo. Study 2 considers participants' ratings of CPMS and its dimensions for each hotel in Study 1 along with a convenience sample of hotels' online visitation and booking metrics from TripAdvisor to evaluate the consequences of CPMS on consumers' aggregated behavior.

4.2 Study 1: CPMS and Its Antecedents

4.2.1 Objectives

Study 1 aims to explore the structure of CPMS and its relationships with visual input from photos. Specifically, by focusing on the interaction of hotel environmental design and graphic features, this study examines (a) the structure and validity of the CPMS construct and (b) how hotel photos' material settings (e.g., local content objects and their features) and graphical settings (i.e., global graphic quality features) can influence CPMS and mediated servicescape dimensions. Findings from Study 1 reveal measures of CPMS and its dimensions in each photo. These measures are then aggregated at the hotel level to explain consumers' aggregated hotel booking decisions in Study 2.

4.2.2 Data

TripAdvisor data included 392 accommodations worldwide, distributed as shown in Table 8. The data encompass accommodations around major tourist cities in America and Europe, most of which were hotels. Additionally, all selected hotels were independent. Independent hotels were chosen as the sample because these hotels' product design and photo management are less standardized compared to branded hotels. Therefore, photos are likely to play a greater role in individuals' booking decisions related to independent hotels than branded hotels.

Table 8. Spatial Distribution of Available Hotel Property Samples

Country	City	Total listings	Type: hotel	Percentage of hotel listings
France	Paris	104	103	25.75%
Germany	Berlin	18	18	4.50%
Italy	Florence	17	16	4.00%
	Milan	13	13	3.25%
	Rome	30	30	7.50%
	Venice	4	4	1.00%
Netherland	Amsterdam	2	2	0.50%
Portugal	Lisbon	12	12	3.00%
Spain	Barcelona	5	5	1.25%
	Madrid	3	3	0.75%
United Kingdom	London	64	63	15.75%
United States	Honolulu	9	5	1.25%
	Las Vegas	14	10	2.50%
	Los Angeles	19	13	3.25%
	Miami Beach	13	11	2.75%
	New York City	24	22	5.50%
	Orlando	9	6	1.50%
	San Francisco	27	15	3.75%
Mexico	Cancun	11	6	1.50%
	Playa del Carmen	2	2	0.50%

4.2.3 Procedures

As depicted in Figure 11, Study 1 consisted of the following five phases: (1) photo selection, (2) automated feature extraction, (3) online annotation and rating, (4) structural equation modeling, and (5) exploratory analyses.

Phase 1: Select interior photos to include: two photos of room view, one photo of lobby/lounge view, one additional photo of featured interior view

↓

Phase 2: Use computational approach to detect some material and graphical settings
Material settings: local content objects and their features
Graphical settings: global graphic quality features

↓

Phase 3: Use crowdsourcing approach to conduct large-scale annotations on CPMS items and the rest of material and graphical settings and ratings

Pilot:
Assessing inter-rater reliability (IRR) with intra-class Correlation (ICC) and Fleiss' Kappa
Drop measurement items with low IRR

Main:
Apply quality control to ensure data quality

↓

Phase 4: Confirmatory factor analysis (CFA) and path analysis to confirm the dimensionality and (convergent, discriminant, and nomological) validity of CPMS

↓

Phase 5: Exploratory analysis of antecedents and CPMS (the construct and its dimensions), including correlational analysis and t-tests.

Figure 11. Execution Steps in Study 1

During Phase 1 (photo selection), for each of the 392 hotels, four management/professional photos capturing interior scenes were selected for further analysis from all photos. In contrast to travel photos taken and uploaded by tourists, management/professional photos are those taken and managed by a hotel's property management team; professional photos are those taken and uploaded by TripAdvisor. Compared to traveler photos, management/professional photos tend to be of higher quality and present richer hotel information (Trpkovski et al. 2018). Compared to professional photos, management photos tend to have greater variations in photographic features because these photos are taken and managed by TripAdvisor Media Group, which uses technical controls to ensure standardized photographs (TripAdvisor 2018).

Table 9 summarizes the three criteria applied when selecting photos for Study 1. The application of these three criteria follows the sequence stated in the above paragraphs and suggested in Table 9. In total, 1,568 interior photos were selected and used for the next stage of analysis.

Table 9. Three Criteria for Photo Selection in Study

The sequence of applying the criteria	Criteria
1	The four selected photos of each hotel property should contain two guestroom views, one lobby/lounge view, and one additional featured interior view (this may include scenes such as restaurant/bar, hallway, indoor pool, gym, studio, conference room, another guestroom view, etc.).
2	If a hotel's primary photo captures an interior scene, the primary photo should be included as one of the four photos for Study 1. If a hotel's primary photo captures an exterior scene, four additional interior photos should be selected for Study 1.
3	Photos were selected from sources in the following order of priority: management photos > professional photos > traveler photos.

An initial survey was conducted to determine the importance of scenes captured in hotel photos. The survey was distributed via Amazon Mechanical Turk (Mturk) to collect opinions from U.S. adults who had used TripAdvisor to search for or book hotels in the past and had used online hotel booking platforms (e.g., Expedia, TripAdvisor, Orbitz, Booking.com, and Priceline) to book hotels within the past 6 months. According to the initial survey results (Figure 12), 69.2% of 311 qualified respondents ranked the guestroom view as the most important scene in hotel photos when searching for a hotel and making booking decisions. Following guestroom photos, interior photos of the lobby/lounge and restaurant views were the next most important. Because not every hotel property provided restaurant/bar photos, this dissertation applied several standards to choose photos for Study 1: the four chosen photos per hotel property contained two guestroom views, one lobby/lounge view, and one additional featured interior view (e.g., restaurant/bar, hallway, indoor pool, gym, studio, conference room, or another guestroom).

Given that the primary photo may be the most important hotel photo for viewers (i.e., the cover page photo shown in TripAdvisor search results; see Figure 13), a second criterion was included for photo selection. If a hotel's primary photo captured an interior scene, the primary photo was included as one of the four photos in Study 1. If a hotel's primary photo captured an exterior scene, four additional interior photos were selected for Study 1.

Because not every hotel property provided management or professional photos, a third criterion applied: photos should be selected from the three sources with management photos given the highest priority, followed by professional photos and traveler photos. As noted, management/professional photos provide richer information about hotels' environment, which individuals rely on most to make decisions. Comparatively, traveler photos contain a large proportion of noise (e.g., people, body parts, room corners, or details) that do not fully showcase the hotel's environment. This study also investigated the influences of photo features in shaping audiences' perceptions. Using professional photos with tightly controlled photographic features can largely reduce the variance caused by such features.

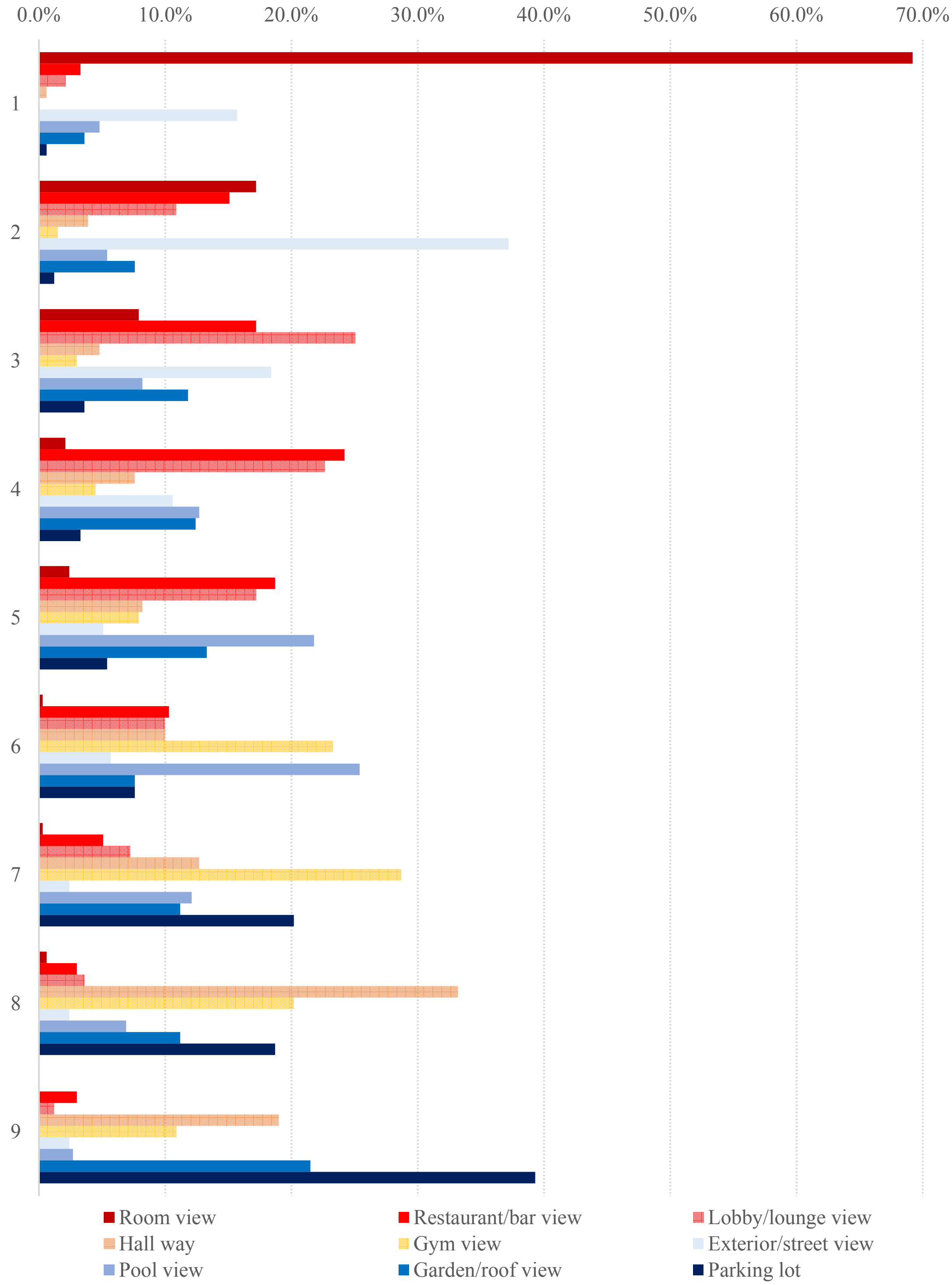

Figure 12. Importance Ranking of Hotel Photo Scenes

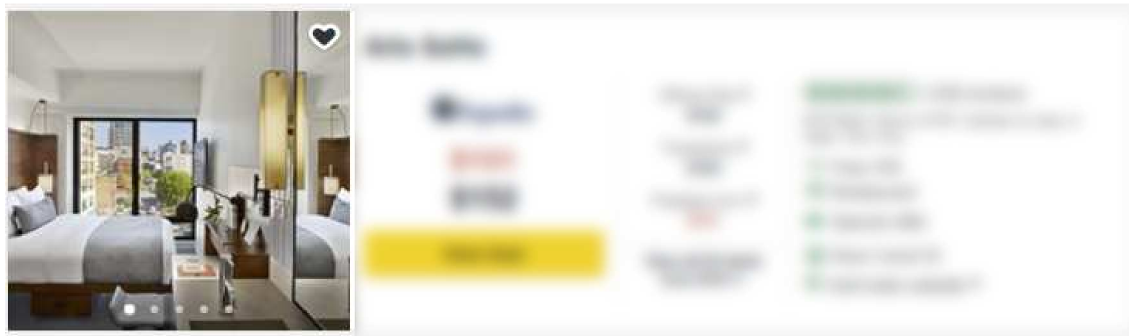

Figure 13. Example of a Primary Photo Displayed on the Search Page

During Phase 2, a computational approach was adopted to detect certain local content object features and assess the global graphic quality features of all photos. Table 10 presents the selected local object features and global graphic features assessed in Study 1. Features were evaluated using computational and crowdsourcing approaches. During this stage, only features that could be processed using the computational approach were considered.

Phase 3 encompassed a large-scale crowdsourced annotation of the remaining local and global features and ratings of measurement items associated with CPMS and related constructs. A pilot study and main study were conducted during this stage. To be eligible to take part, participants needed to meet geographic criteria (U.S.) and have a historical approval rate greater than or equal to 90% on all completed tasks. The pilot study was performed to determine the inter-rater reliability (IRR) of measurement items via a crowdsourcing approach and to identify potential issues for the main study. The main study was used to collect data for subsequent analysis.

In the pilot study, the IRR of numerical variables was assessed based on the intra-class correlation (ICC). The IRR of categorical variables was determined by Fleiss' Kappa, which is a common index to assess IRR in the computer vision and social science fields (Hallgren 2012; Nguyen et al. 2018). The following section summarizes the measurement items of material settings and graphical settings assessed using these two approaches. Mturk workers were recruited to provide annotations on remaining local content object features and global visual quality features and to rate items measuring their perceptions and intentions (i.e., CPMS, mediated servicescape dimensions, and approach intention). After assessing the IRR of measurement items, those with low IRR were dropped from tasks in the main study. In the main study, several criteria/controls (Table 10) were applied based on the pilot study to ensure the quality of data collected via crowdsourcing. Three independent raters scored perceptions, and two other independent raters annotated photo features.

In Phase 4, structural equation modeling was used to confirm the structure and validity of CPMS. CFA was performed to confirm the structure and to test the convergent and discriminant validity of CPMS as conceptualized in Chapter 2. Path analysis was used to test the nomological validity of CPMS.

In Phase 5, exploratory analysis was conducted to assess the relationship between the features of mediated servicescape elements and CPMS. Specifically, the Pearson correlation and *t* statistics were calculated to assess the relationship between (1) local content objects' features and CPMS; (2) local content objects' features and mediated servicescape dimensions; (3) global graphic quality features and CPMS; and (4) global graphic quality features and mediated servicescape dimensions.

Table 10. Data Quality Controls When Using Crowdsourcing to Collect Data

Quality controls	Rationale	Actions
Sample criteria	Select workers with good historical record and who match the study context	- Select participants living in the U.S. - Select participants with HIT approval rate for all requesters' HITs >90% - Select participants with >2,000 approved HITs
Task decomposition	Prevent participants from lacking attention due to survey fatigue	- The feature annotation task was separated from the rating tasks and presented separately. - The rating task was decomposed into 7 parts based on constructs (CPMS; each of the 5 dimensions of mediated servicescape; and approach intention), and each part of the rating task was presented separately.
Attention check	Collect responses from participants who paid sufficient attention	- Use simple math as attention check for each task
Frequency check	Prevent participants from demonstrating speculative behavior	- No more than 5 submissions from a single participant per assignment batch
Worker blacklist	Prevent participants who demonstrated speculative behavior from participating in future tasks	- Participants with speculative behaviors (e.g., survey straight lining, submitting HITs in an extremely short response time, submitting an excessive number of assignments) were flagged and blocked from subsequent HITs
Data recollection	Recollect high-quality data to replace low-quality data	- Assignments from participants who failed attention check, frequency check, and who were flagged as speculative were reposted to collect new responses

4.2.4 Measurements

This section explains the measures and instruments adopted in Study 1. The first part introduces the measures of mediated servicescape dimensions, CPMS, and approach intention. The remainder introduces the instruments used to assess antecedents of servicescape dimensions (i.e., material settings and graphical settings). Table 11 presents the measurements scales used in Study 1 to measure environmental perceptions and approach intention, which were adapted from previous investigations of servicescape dimensions, the perceived servicescape (or proxies thereof), and behavioral intention.

Table 11. Scales and Items on Perceptions Assessed via Crowdsourcing

Construct	Measurement items	Source
Color		Baker et al., (1994); Countryman and Jang (2006); Hightower et al. (2002)
	Color1. The colors of the hotel create a warm atmosphere.	
	Color2. The colors used to create a pleasant atmosphere.	
	Color3. The colors of the hotel are soothing.	
	Color4. The color schemes of the hotel are attractive.	
Lighting		Jang and Namkung, (2009); Ryu and Jang (2007)
	Lighting1. The lighting of the hotel is appropriate.	
	Lighting2. The lighting of the hotel creates an inviting atmosphere.	
	Lighting3. The lighting of the hotel is comfortable.	
	Lighting4. The lighting of the hotel creates a positive atmosphere.	
Furnishings		Countryman and Jang (2006); Hightower et al. (2002)
	Furnishing1. The furniture used by the hotel is of high quality.	
	Furnishing2. The furniture in the hotel looks comfortable.	
	Furnishing3. The furniture in the hotel is in good condition.	
Layout		Jang and Namkung, (2009); Ryu and Jang (2007); Wakefield and Blodgett (1996)
	Layout1. The layout of the hotel seems to allow me to move around easily.	
	Layout2. The spatial layout is proportionate.	
	Layout3. The hotel's layout makes me feel comfortable.	
	Layout4. The hotel's space is uncluttered.	
	Layout5. The layout of the hotel seems spacious.	
Style		Countryman and Jang (2006); Hightower et al., (2002)
	Style1. The style of the hotel is current.	
	Style2. The hotel's style looks refined.	
	Style3. The style of the hotel is aesthetically appealing.	
	Style4. The hotel looks artful.	
	Style5. The style of the hotel is attractive.	
CPMS		Countryman and Jang (2006); Hightower et al. (2002)
	CPMS1. I think this hotel's overall environment is good.	
	CPMS2. The overall environment of this hotel is inviting.	
	CPMS3. I think this hotel's overall environment is comfortable.	
	CPMS4. I think this hotel's overall environment is beautiful.	
Approach intention		Hightower et al., (2002); Nguyen et al. (2018); Ryu and Jan (2007); Wakefield and Blodgett (1996)
	Approach1. I will enjoy spending time at this hotel.	
	Approach2. I want to have a short stay at this hotel.	
	Approach3. I want to have a long stay at this hotel.	
	Approach4. I would like to stay at this hotel as long as possible.	

Table 12 presents the measurements scales used in Study 1 to measure CPMS antecedents (i.e., material settings and graphical settings). The items/variables were measured through two approaches, specifically crowdsourcing and computational approaches.

Based on a literature review, key local content object features that attract individuals' attention and influence individuals' environmental perceptions include the presence of a window, the presence and quality of the view outside the window, and salient features (e.g., materials) that make an object stand out. Three binary variables were used to assess window-related object features (Beckett 2017), including the presence of a window, the view outside the window, and a pleasant view outside the window. Values of these variables were obtained as Mturk participants were instructed to classify each photo into one of two categories (yes = 1, no = 0) for each of the three aspects.

The materials were predicted using a model pre-trained with the Materials in Context Database (MINC) dataset (Bell et al. 2015), which has been found to achieve 85.2% mean class accuracy in recognition and prediction. The 23 material classes included materials such as ceramics, food, bricks, and skin. Seven materials were chosen to suit hotels' interior photo settings: fabric, foliage, glass, leather, mirror, plastic, and wallpaper. Finally, seven binary variables were used to assess the material of the most salient object in the photo.

Further, key global graphic quality features that can influence individuals' environmental appraisal or directly inform individuals' affective and behavioral responses can be classified into three categories: color effects, composition, and overall. Color effect variables referred to the selection and distribution of colors in the color space and the effects they create. These variables were assessed in this research using crowdsourcing and computational approaches, presented in Table 13, as annotated color effects and the statistics of color effects. Following Zhang et al. (2017) and Huang et al. (2006), values of these variables were obtained as Mturk participants were instructed to classify each photo into one of two categories (1,0) per color effect. Additionally, sample photos (Figure 14) were presented to facilitate participants' annotation/classification.

Figure 14. Sample Photos of Annotated Color Effects

As suggested in previous research, color effects can also be evaluated using image statistics or by color channels' color information via a computational approach (Trpkovski et al. 2018). Five representative features were selected in this research (i.e., colorfulness, brightness, contrast, average HSV, and HSV of dominant color clusters), which were identified as influential in driving affective responses and then shaping behavioral responses (Solli and Lenz 2009, 2010; Valdez and Mehrabian 1994).

Colorfulness measures the diversity of color contained in a photo. An efficient and simplified colorfulness metric proposed by Hasler and Suesstrunk (2003) was adopted in this dissertation, as shown in the following equations:

$$rg = R - G \tag{1}$$

$$yb = \frac{1}{2}(R + G) - B \tag{2}$$

$$\sigma_{rgyb} = \sqrt{\sigma_{rg}^2 + \sigma_{yb}^2} \tag{3}$$

$$\mu_{rgyb} = \sqrt{\mu_{rg}^2 + \mu_{yb}^2} \tag{4}$$

$$Colorfulness = \sigma_{rgyb} + 0.3 \times \mu_{rgyb} \tag{5}$$

where *R*, *G*, and *B* respectively denote the value of each pixel in the red, green, and blue channels; σ denotes the standard deviation values of pixels; and μ denotes the mean pixel values.

The brightness metric measures the amplitude of color or luminance intensity in a photo. Following an approach suggested in the literature (Bezryadin, Bourov, and Ilinih 2007; Jiang et al. 2010; San Pedro and Siersdorfer 2009), brightness was measured based on the following metrics. First, each pixel of a color photo was transformed to greyscale, following the ITU-R BT.601 standard (Equation [6]). Then, the arithmetic mean of brightness was calculated for all pixels (Equation [7]):

$$Y_{xy} = 0.299 \times R + 0.587 \times G + 0.114 \times B \tag{6}$$

$$Brightness = \frac{1}{XY} \sum_{x=1}^{X} \sum_{y=1}^{Y} Y_{xy} \tag{7}$$

where x and y respectively denote the location of individual pixels in a photo, and X and Y respectively denote the total number of pixels on the x-axis and y-axis.

The element of contrast measures the difference in objects' color luminance within a photo. Following Obrador (2008) and San Pedro and Siersdorfer (2009), the root mean square (RMS) contrast was adopted:

$$\bar{b} = \frac{1}{XY-1}\sum_{x=1}^{X}\sum_{y=1}^{Y} b_{xy} \tag{8}$$

$$Contrast = \sqrt{\frac{1}{XY-1}\sum_{x=1}^{X}\sum_{y=1}^{Y}(b_{xy} - \bar{b})^2} \tag{9}$$

where b denotes the brightness of each pixel, and $\bar{b}$ denotes the mean brightness of all pixels in a photo. Contrast is the standard deviation of pixel brightness.

Additionally, photos were transformed to the HSV color space, and the mean H (hue), S (saturation), and V (value) were computed for each photo following Machajdik and Hanbury (2010). Further, to retain photos' rich color information, three dominant color clusters were generated using K-means clustering, as recommended by Tse-Wei Chen et al. (2008). Mean HSV values were then calculated for the three dominant color clusters in each photo.

In addition to color effects, photo composition plays an important role in individuals' environmental perceptions and subsequent responses by directing their vision and attention to elements in a photo (Freeman 2007). Key compositional variables assessed in this research included diagonal dominance, symmetrical balance, the rule of thirds, and the use of a wide-angle lens.

Diagonal dominance refers to photographers placing the most salient visual elements close to two diagonal lines and using these lines to create a sense of spatial extension and make a photo more dynamic and interesting (Freeman 2007). Symmetrical balance refers to the balance of visual elements in two halves of an image. Symmetrical balance can draw individuals' visual attention and induce positive emotions (Krages 2005). As a simplified version of the golden mean, the rule of thirds indicates whether main visual elements are placed along the horizontal or vertical third lines or close to the four intersections of these lines. Photos following this rule are aesthetically pleasing and dynamic (Krages 2005). Another common photography technique is the use of a wide-angle lens. A wide-angle lens has substantially smaller focal lengths than a normal lens. Using a wide-angle lens allows more information in the scene to be included in the photo. This technique can make foreground objects more prominent and create a sense of spatial extension (Freeman 2007). Moreover, close-up shots are often used by photographers to shoot objects at close range. This technique enables photographers to capture object details and add emotions to a scene (Freeman 2007). Sample photos exemplifying these compositional features appear in Figure 15.

Based on these criteria, individuals can form an overall judgment of the quality and aesthetics of a photo. Following Zhang et al. (2017), participants in this research were instructed to classify photos as either high- or low-quality. Sample photos depicting each level were again provided (Figure 16) to facilitate participants' annotation/classification.

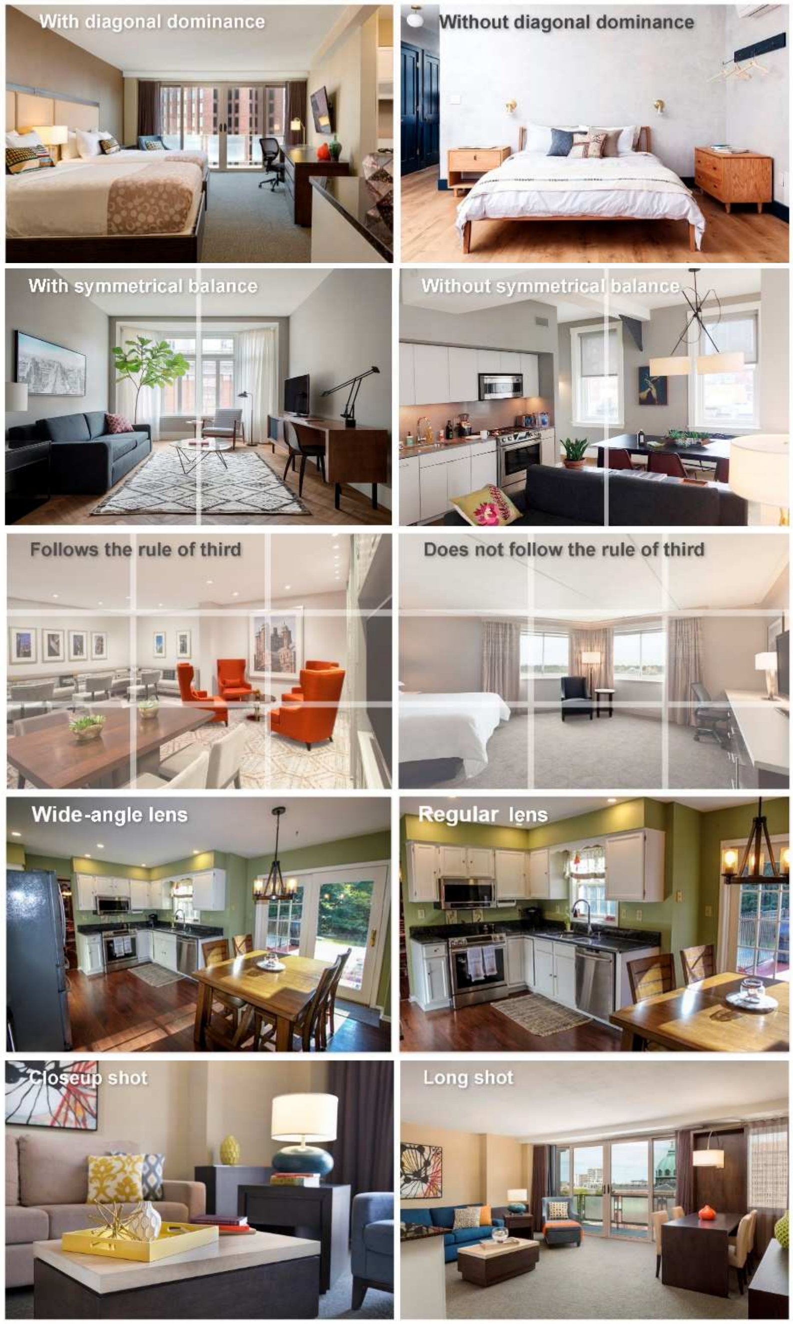

Figure 15. Sample Photos of Compositional Features

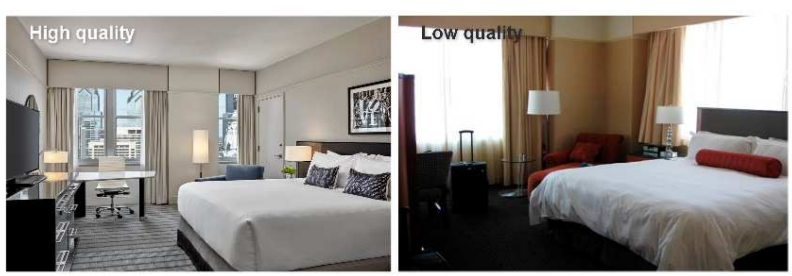

Figure 16. Sample Photos of Overall Photo Quality

Table 12. Antecedents of CPMS Assessed in This Research

Features	# of items	Description	Approach	Sources
		Material Settings: Local content object features		
Window	1	Measures whether the photo contains a window/windows (yes=1, no=0)	Crowdsourcing	Beckett (2017)
A view outside the window	1	Measures whether the photo contains a view outside the window(s) (yes=1, no=0)	Crowdsourcing	Beckett (2017)
A pleasant view outside the window	1	Measures whether the photo contains a pleasant view outside the window(s) (yes=1, no=0)	Crowdsourcing	Beckett (2017)
Material	7	Measures the material of the most salient object, classified by a model pre-trained with the Materials in Context Database (MINC) dataset	Computational	S. Bell et al. (2015)
		Graphical settings: Global graphic quality features		
		Annotated Color Effects		
High saturation	1	Measures whether the photo contains high vs. low saturation (high=1, low=0)	Crowdsourcing	Zhang et al. (2017)
Warm hue	1	Measures whether the photo contains warm vs. cool hues (warm=1, cool=0)	Crowdsourcing	Zhang et al. (2017)
High brightness	1	Measures whether the photo contains high vs. low perceived luminance (high=1, low=0)	Crowdsourcing	Zhang et al. (2017)
Even illumination distribution	1	Measures whether the photo contains even vs. uneven lighting distribution (even=1, uneven=0)	Crowdsourcing	Zhang et al. (2017)
High naturalness	1	Measures whether the photo has a high vs. low degree of correspondence with the real world (high=1, low=0)	Crowdsourcing	Huang et al. (2006)
		Statistics of Color Effects		
Colorfulness	1	Measures the diversity of spectra in the photo	Computational	Hasler and Suesstrunk (2003)
Brightness	1	Measures the amplitude of color or luminance intensity in the photo	Computational	Bezryadin et al., (2007); Jiang et al., (2010); San Pedro and Siersdorfer, (2009);
Contrast	1	Measures the difference in color or luminance in the photo	Computational	Obrador (2008); San Pedro and Siersdorfer (2009)
Average H, S, and V	3	Measures mean values of hue, saturation, and value	Computational	Machajdik & Hanbury (2010)
H, S, V of three dominant clusters	9	Measures mean values of hue, saturation, and value of dominant color clusters (using K-means clustering)	Computational	Tse-Wei Chen et al. (2008)

Table12. Antecedents of CPMS Assessed in This Research (Continued)

Features	# of variables	Description	Approach	Sources
		Composition		
Diagonal dominance	1	Measures whether the most salient visual elements are placed close to the two diagonals of the photo (yes=1, no=0)	Crowdsourcing	Zhang et al. (2017)
Symmetrical balance	1	Measures whether two halves of an image hold the same weight (the extreme case is perfect symmetry) (yes=1, no=0)	Crowdsourcing	Zhang et al. (2017)
Rule of thirds	1	Measures whether the main visual elements are placed along the horizontal or vertical third lines or close to the four intersections of these lines (yes=1, no=0); it is a simplified version of the golden mean.	Crowdsourcing	Zhang et al. (2017)
Wide-angle lens	1	Measures whether the photo was shot with a wide-angle lens (yes=1, no=0)	Crowdsourcing	Freeman (2007)
Close-up shot	1	Measures whether the photo shows objects at close range (yes=1, no=0)		
		Overall		
Photo quality	1	Measures overall perceived photo quality (high=1, low=0)	Crowdsourcing	Zhang et al. (2017)

4.3 Study 2: How CPMS Influences Hotel Search and Booking Behavior

4.3.1 Objectives

This study sought to examine how a hotel's perceivable mediated servicescape can affect a hotel's overall appeal as a marketplace option as evidenced by consumers' aggregated behavioral responses. This study also aimed to uncover the extent to which CPMS and global graphic features explained consumers' online page visitation during the browsing stage and meta-click behavior during the deliberation stage in an aggregated manner while controlling the influence of other hotel listing information.

4.3.2 Available Data

In Study 2, aggregated consumer behavioral data provided by TripAdvisor were used to regress dimensions of the perceived mediated servicescape in Study 1 while considering other hotel listing information (e.g., hotel city, location, review rating, and average daily rate). Consumer behavior data from TripAdvisor included hotel property page visitation and meta-click behavior. Based on information about the traffic source, page visitation can be considered a manifestation of hotel options' attractiveness in the browsing stage. Meta-click behavior, as final-stage user behavior data that TripAdvisor can capture, is a manifestation of hotel options' attractiveness in the deliberation stage and is linked to actual booking behavior. Respective visual examples appear in Figures 17 and 18. TripAdvisor provided archival data on individual consumers' property visitation from June 2 to July 1, 2019 and meta-click data from February 17 to August 14, 2019. Property page visitation data contained information including each user's unique ID, user's origin country, and traffic source. Meta-click data contained each user's unique ID and average daily rate at the time of each meta-click.

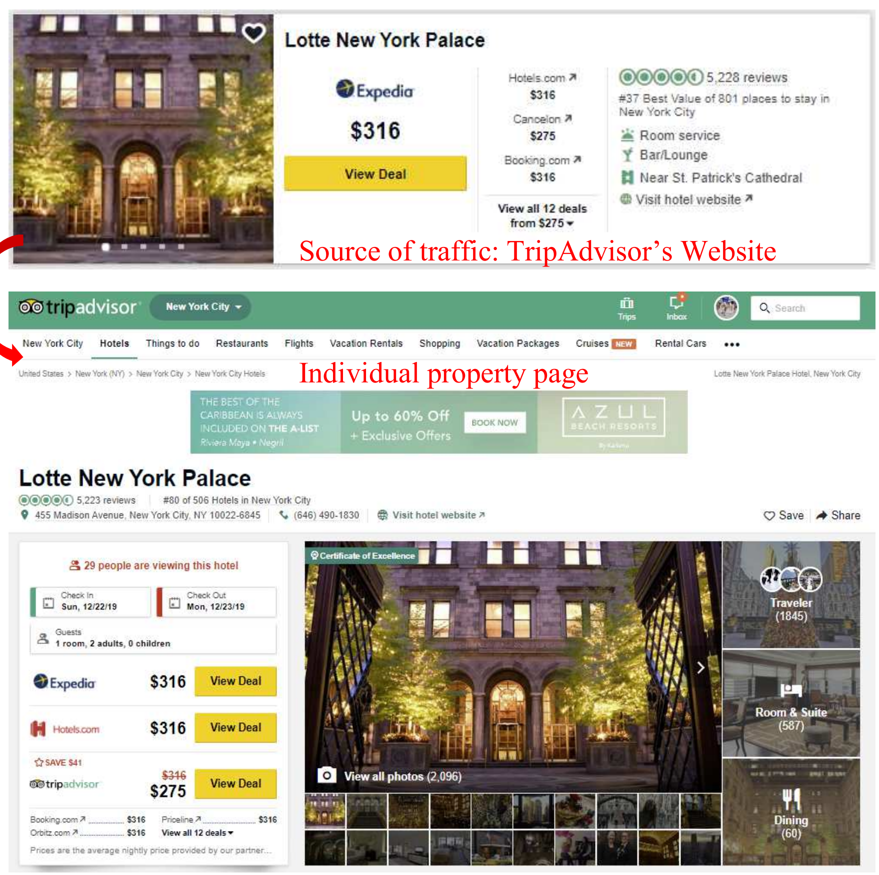

Figure 17. TripAdvisor User Property Page Visitation Behavior

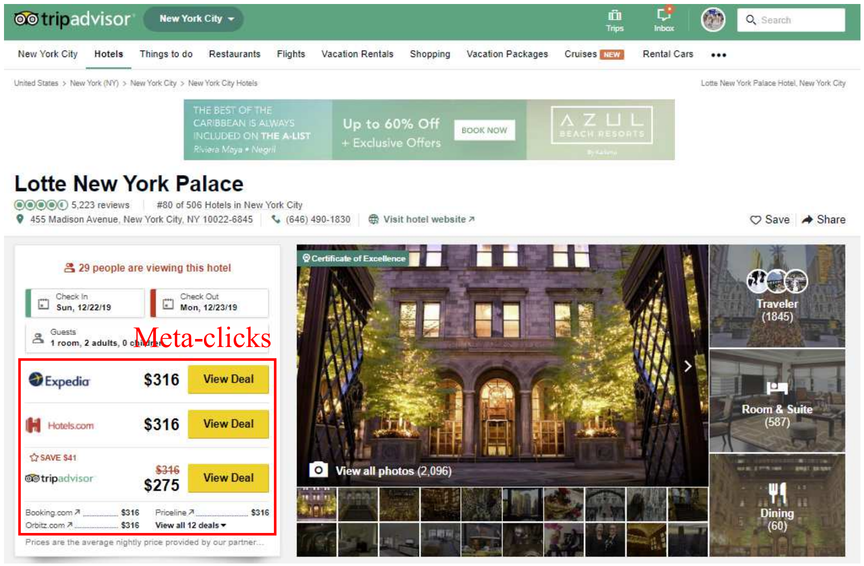

Figure 18. TripAdvisor User Meta-click Behavior

4.3.3 Procedures

The execution of Study 2 proceeded as follows. First, in the data cleaning stage, ambiguous page-view and meta-click data were filtered out of further analysis. Second, one-month page-view and meta-click records were aggregated at each hotel's level for hotels that did not change their primary photos from June 2 to July 1, 2019. CPMS scores for the four interior photos were averaged for each hotel. Third, for hotels that changed their primary photos, historic primary photos were collected. The CPMS scores and photo quality of historic primary photos were collected following the same crowdsourcing approach in Study 1; page-view and meta-click data were aggregated on the daily level and hotel room rates were averaged on the daily level during the one-month period (i.e., June 2, 2019–July 1, 2019). Fourth, other hotel information and city-related data were obtained from TripAdvisor's property pages and other sources, including review ratings, number of reviews, number of photos, and total tourist arrivals at the city level.

For those hotels that did not change their primary photos in the one-month period, generalized linear regression was first conducted on cross-sectional data to determine whether, when controlling for other covariates, the CPMS score of each hotel's primary photo and the average CPMS score (i.e., of the four selected photos) affected consumers' page-view and meta-click behavior across hotels. Second, propensity score matching was conducted to match samples on all covariates to examine the "pure" treatment effect of the primary photo's quality on consumers' aggregated one-month page-view and meta-click behavior.

For hotels that changed their primary photos in the one-month period, regressions with panel-corrected standard errors were performed to examine how changes in the primary photo's CPMS score and changes in the primary photo's photo quality led to changes in consumers' page-view and meta-click behavior at the hotel level on a daily basis. These diverse data analysis methods ensured the robustness of identified effects and reinforced the internal validity of statistical inferences in Study 2.

CHAPTER 5

RESULTS

5.1 Study 1: CPMS and Its Antecedents

5.1.1 Inter-Rater Reliability of Measurements

This section presents findings from a pilot study of 103 photos, including assessments of the IRR of numerical and categorical measurements. Each of the 103 photos were rated by five independent raters for numerical variables (i.e., CPMS, five dimensions of the mediated servicescape, and approach intention) and by three independent raters for categorical variables (i.e., global and local photo features).

The ICC was used to assess IRR for numerical variables. According to Cicchetti (1994), IRR is poor for ICC values below .40, fair for values between 0.40 and 0.59, good for values between 0.60 and 0.74, and excellent for values between 0.75 and 1.0. The results in Tables 14 and 15 show that all measures exhibited a satisfactory IRR with an ICC equal to or greater than 0.50 except for "Approach 2," which could have led to confusion among participants. Most items demonstrated an ICC above 0.6. According to common practice in computer vision research (Nguyen et al. 2018), 0.50 was chosen as the threshold to retain and discard measurement items. Twenty-eight out of 29 items were thus retained for the main study.

Fleiss' Kappa (Fleiss, Levin, and Paik 2003) was adopted to assess IRR for categorical variables. According to Zapf et al. (2016), cut-off values (Landis & Koch, 1977) for Cohen's Kappa can be transferred to Fleiss' Kappa. IRR is poor for Kappa values below 0.00, slight for values between 0.00 and 0.20, fair for values between 0.21 and 0.40, moderate for values between 0.41 and 0.60, substantial for values between 0.61

and 0.80, and almost perfect for values between 0.81 and 1.00. In this study, 0.2 was chosen as the threshold to retain categorical variables.

Table 13. Inter-rater Reliability of Numerical Variables

Dimension and item description	ICC
Color	
Color1. The colors of the hotel create a warm atmosphere.	0.65
Color2. The colors used create a pleasant atmosphere.	0.66
Color3. The colors of the hotel are soothing.	0.63
Color4. The color schemes of the hotel are attractive.	0.64
Lighting	
Lighting1. The lighting of the hotel is appropriate.	0.70
Lighting2. The lighting of the hotel creates an inviting atmosphere.	0.71
Lighting3. The lighting of the hotel is comfortable.	0.71
Lighting4. The lighting of the hotel creates a positive atmosphere.	0.70
Furnishings	
Furnishing1. The furniture used by the hotel is of high quality.	0.65
Furnishing2. The furniture in the hotel looks comfortable.	0.60
Furnishing3. The furniture in the hotel is in good condition.	0.58
Layout	
Layout1. The layout of the hotel seems to allow me to move around easily.	0.64
Layout2. The spatial layout is proportionate.	0.54
Layout3. The hotel’s layout makes me feel comfortable.	0.60
Layout4. The hotel’s space is uncluttered.	0.50
Layout5. The layout of the hotel seems spacious.	0.65
Style	
Style1. The style of the hotel is current.	0.72
Style2. The hotel’s style looks refined.	0.68
Style3. The style of the hotel is aesthetically appealing.	0.69
Style4. The hotel looks artful.	0.72
Style5. The style of the hotel is attractive.	0.67
CPMS	
CPMS1. I think this hotel's overall environment is good.	0.59
CPMS2. The overall environment of this hotel is inviting.	0.65
CPMS3. I think this hotel's overall environment is comfortable.	0.53
CPMS4. I think this hotel's overall environment is beautiful.	0.63
Approach Intention	
Approach1. I will enjoy spending time at this hotel.	0.67
Approach2. I want to have a short stay at this hotel. (Drop)	-0.18
Approach3. I want to have a long stay at this hotel.	0.66
Approach4. I would like to stay at this hotel as long as possible.	0.62

Table 14. Inter-rater Reliability of Categorical Variables

Feature	Fleiss' Kappa
Follows vs. does not follow diagonal dominance (drop)	0.14
Follows vs. does not follow the rule of symmetry	0.24
Follows vs. does not follow the rule of thirds	0.26
Uses wide-angle lens vs. normal lens	0.35
Close-up shot vs. long shot	0.63
High vs. low levels of brightness	0.45
With vs. without even light distribution	0.33
High vs. low saturation	0.22
High vs. low naturalness (drop)	-0.01
Warm vs. cold hue	0.23
With vs. without window	0.64
With vs. without window view	0.57
With vs. without a pleasant window view	0.51
High vs. low photo quality	0.43

5.1.2 Confirmatory Factor Analysis

Ratings on mediated servicescape dimensions and CPMS were collected for the selected photos using crowdsourcing. Ratings for 1,332 photos were obtained. Each photo was rated by three independent Mturk workers on each mediated servicescape dimension and CPMS.

First, convergent and discriminant validity were evaluated by correlating the constructs of mediated servicescape dimensions and CPMS. As Table 15 shows, standardized factor loadings for all items were above the threshold of .70 suggested by Hair et al. (2006). The *t*-values for all factor loadings were greater than the critical value of 2.57 (Netemeyer, Bearden, and Sharma 2003). Average variance extracted (AVE) values for all constructs were greater than .50, indicating convergent validity. Table 16 indicates that discriminant validity was also sufficiently supported, as the square root of the AVE for each factor exceeded its correlations with other factors (Fornell and Larcker

1981; So, King, and Sparks 2014) and the AVEs were greater than the maximum shared variances (MSVs) for all constructs (Alumran et al. 2014).

Figure 19 illustrates the CFA model based on earlier theorization with standardized factor loadings. The factor loadings of all items were satisfactory (above 0.8) for all constructs. Fit indices of the CFA model indicated a satisfactory fit: χ^2/df = 3.16; goodness-of-fit index (GFI) = 0.95; comparative fit index (CFI) = 0.98; normed fit index (NFI) = 0.98; Tucker–Lewis index (TLI) = 0.98; root mean square error of approximation (RMSEA) = 0.04; standardized root mean square residual (SRMR) = 0.03. The data therefore fit the proposed model well.

All mediated servicescape dimensions (e.g., color, lighting, furnishings, layout, and style) contributed significantly to CPMS. Furnishings had the highest standardized regression coefficient, and layout had the lowest. These findings suggest that individuals' perceptions of furnishings based on hotel photos influenced their overall environmental perceptions most, potentially because furnishings are less influenced by graphic photo features compared to other dimensions. Therefore, individuals may rely most on their perceptions of furnishings to make inferences about the actual environment and develop overall environmental perceptions (i.e., CPMS). On the contrary, layout staging and presentation were strongly influenced by photo features (e.g., photo composition and type of lens used). Therefore, individuals may rely less on this aspect to make inferences about the actual environment and form an overall impression. H1a–e were thus supported; that is, mediated servicescape dimensions positively influenced CPMS.

In terms of exogenous variables, mediated servicescape dimensions were significantly correlated. Findings revealed a considerable amount of shared variance among dimensions; this pattern may be due to photo features because dimensional perceptions are formed by visually processing a single photograph. Structural differences were apparent between the perceived servicescape and CPMS: the former was organized by different senses through embodiment while the latter was predominantly organized through vision. Accordingly, H2 was supported.

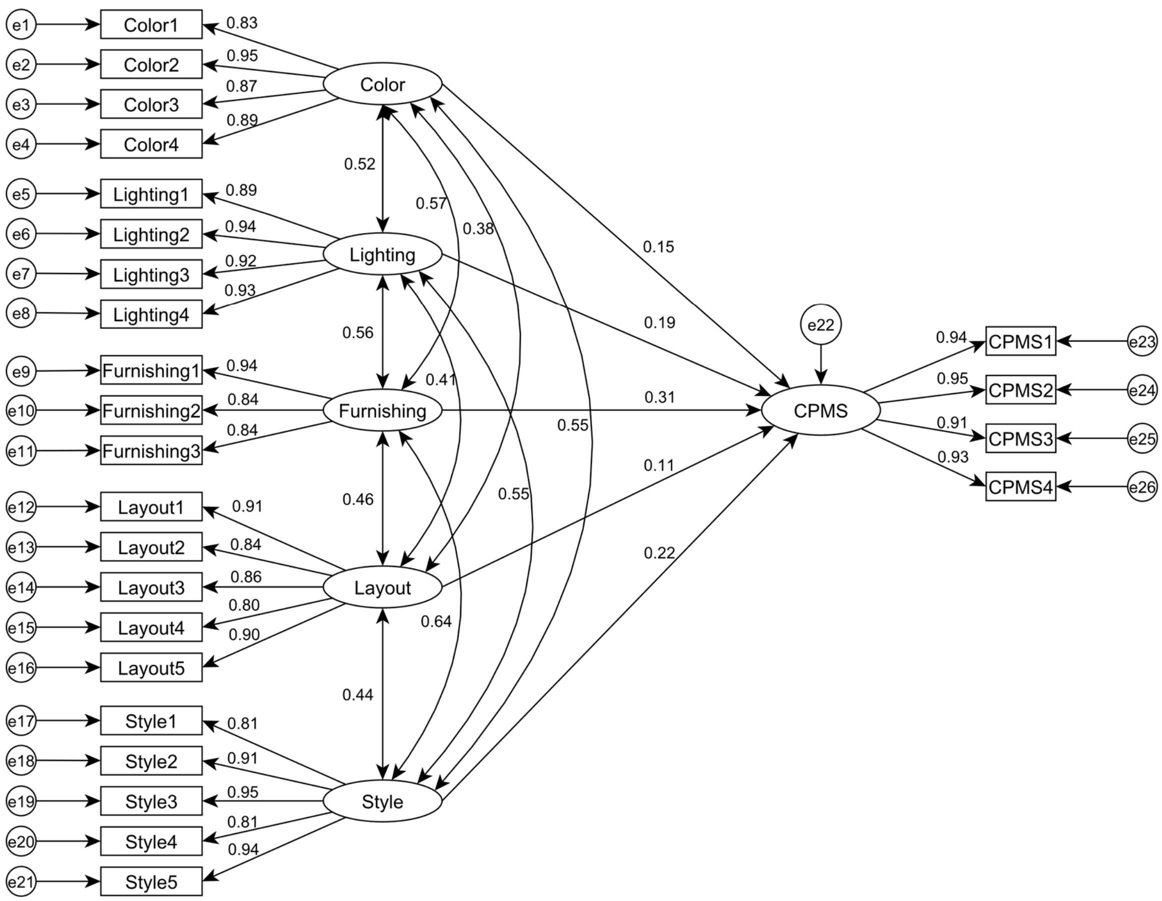

Figure 19. CFA model of CPMS

Table 15. Confirmatory Factor Analysis

Dimension and item description	**SL**	***t*-value**	**AVE**	**CR**	**MaxR(H)**
Color			0.79	0.94	0.95
Color1. The colors of the hotel create a warm atmosphere.	0.83	NA			
Color2. The colors used create a pleasant atmosphere.	0.95	47.30			
Color3. The colors of the hotel are soothing.	0.88	40.85			
Color4. The color schemes of the hotel are attractive.	0.89	41.71			
Lighting			0.85	0.96	0.96
Lighting1. The lighting of the hotel is appropriate.	0.90	NA			
Lighting2. The lighting of the hotel creates an inviting atmosphere.	0.94	57.88			
Lighting3. The lighting of the hotel is comfortable.	0.92	53.43			
Lighting4. The lighting of the hotel creates a positive atmosphere.	0.93	55.98			
Furnishings			0.77	0.91	0.93
Furnishing1. The furniture used by the hotel is of high quality.	0.94	NA			
Furnishing2. The furniture in the hotel looks comfortable.	0.84	44.64			
Furnishing3. The furniture in the hotel is in good condition.	0.84	44.51			
Layout			0.74	0.93	0.94
Layout1. The layout of the hotel seems to allow me to move around easily.	0.91	NA			
Layout2. The spatial layout is proportionate.	0.84	43.12			
Layout3. The hotel’s layout makes me feel comfortable.	0.86	45.06			
Layout4. The hotel’s space is uncluttered.	0.80	39.75			
Layout5. The layout of the hotel seems spacious.	0.89	50.58			
Style			0.79	0.95	0.96
Style1. The style of the hotel is current.	0.81	NA			
Style2. The hotel’s style looks refined.	0.91	41.69			
Style3. The style of the hotel is aesthetically appealing.	0.96	45.12			
Style4. The hotel looks artful.	0.81	34.57			
Style5. The style of the hotel is attractive.	0.94	44.09			

Table 15. Confirmatory Factor Analysis (Continued)

Dimension and item description (continued)	SL	*t*-value	AVE	CR	MaxR(H)
CPMS			0.87	0.96	0.96
CPMS1. I think this hotel's overall environment is good.	0.94	NA			
CPMS2. The overall environment of this hotel is inviting.	0.95	70.77			
CPMS3. I think this hotel's overall environment is comfortable.	0.91	60.92			
CPMS4. I think this hotel's overall environment is beautiful.	0.93	65.80			

Note. χ^2 = 821.029 ($p < .001$, df = 260); χ^2/df = 3.16; GFI (goodness-of-fit index) = 0.95; CFI (comparative fit index) = 0.98; NFI (normed fit index) = 0.98; TLI (Tucker–Lewis index) = 0.98; RMSEA (root mean square error of approximation) = 0.04; SRMR (standardized root mean square residual) = 0.03; SL = standardized loadings; CR = composite reliability; AVE = average variance extracted; NA = not applicable; MaxR(H) = maximum reliability.

Table 16. Discriminant Validity Analysis

	AVE	MSV	Color	Lighting	Furnishings	Layout	Style	CPMS
Color	0.79	0.34	**0.89**					
Lighting	0.85	0.37	0.52	**0.92**				
Furnishings	0.77	0.48	0.57	0.57	**0.88**			
Layout	0.74	0.24	0.38	0.41	0.46	**0.86**		
Style	0.79	0.42	0.55	0.55	0.64	0.44	**0.89**	
CPMS	0.87	0.48	0.58	0.61	0.69	0.49	0.65	**0.93**

Note. Boldfaced diagonal elements are the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations between constructs.

To ensure that CPMS could lead to actual booking-related behavior and achieve nomological validity, a structural model was developed using CPMS to explain consumers' approach intentions (Figure 20). The factor loadings of all items were satisfactory (above 0.8) for all constructs (Table 17). Model fit indices of the CFA model demonstrated a satisfactory global fit ($\chi^2/df = 3.61$, GFI = 0.94, CFI = 0.98, NFI = 0.97, TLI = 0.98, RMSEA = 0.04, SRMR = 0.06) and explained 45% of the variance in approach intention ($R^2 = 0.45$). These results provide preliminary evidence implying that CPMS may play an important role in influencing customers' approach intentions and subsequent booking-related behavior.

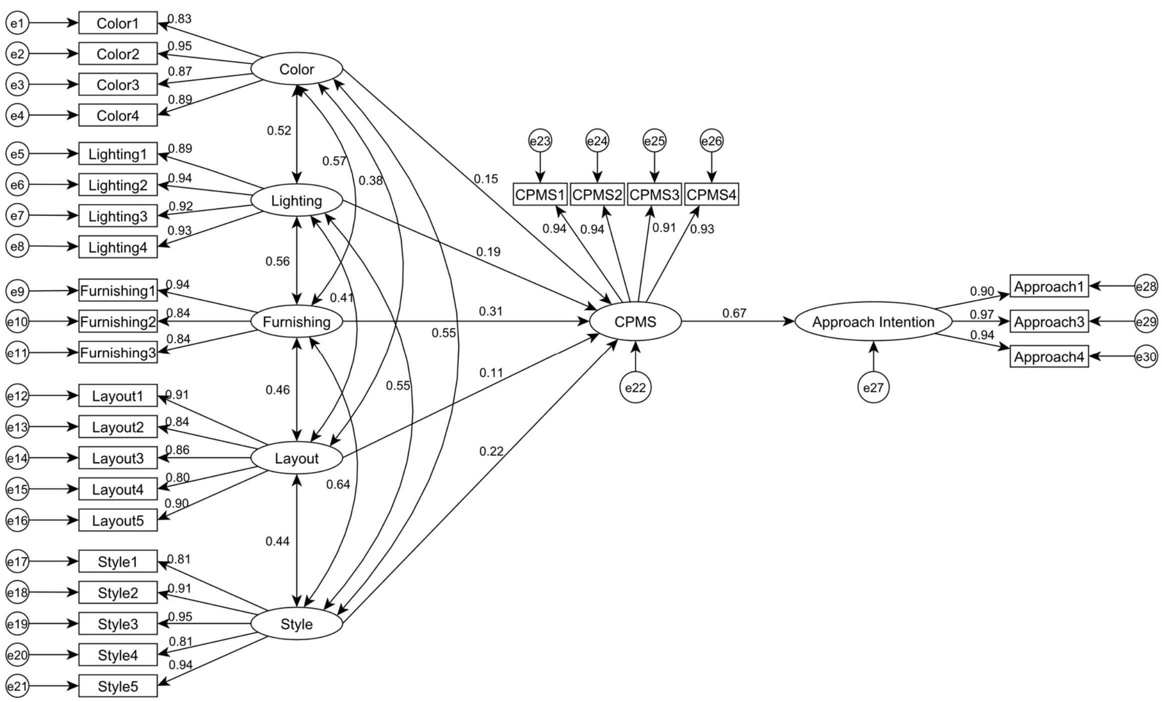

Figure 20. Effect of CPMS on Behavioral Intention

Table 17. Factor Loadings of Path Analysis Results

Dimension and item description	**SL**	***t*-value**	**AVE**	**CR**	**MaxR(H)**
Color			0.79	0.94	0.95
Color1. The colors of the hotel create a warm atmosphere.	0.83	NA			
Color2. The colors used create a pleasant atmosphere.	0.95	47.30			
Color3. The colors of the hotel are soothing.	0.88	40.85			
Color4. The color schemes of the hotel are attractive.	0.89	41.71			
Lighting			0.85	0.96	0.96
Lighting1. The lighting of the hotel is appropriate.	0.90	NA			
Lighting2. The lighting of the hotel creates an inviting atmosphere.	0.94	57.88			
Lighting3. The lighting of the hotel is comfortable.	0.92	53.43			
Lighting4. The lighting of the hotel creates a positive atmosphere.	0.93	55.98			
Furnishings			0.77	0.91	0.93
Furnishing1. The furniture used by the hotel is of high quality.	0.94	NA			
Furnishing2. The furniture in the hotel looks comfortable.	0.84	44.64			
Furnishing3. The furniture in the hotel is in good condition.	0.84	44.51			
Layout			0.74	0.93	0.94
Layout1. The layout of the hotel seems to allow me to move around easily.	0.91	NA			
Layout2. The spatial layout is proportionate.	0.84	43.12			
Layout3. The hotel's layout makes me feel comfortable.	0.86	45.06			
Layout4. The hotel's space is uncluttered.	0.80	39.75			
Layout5. The layout of the hotel seems spacious.	0.89	50.58			
Style			0.79	0.95	0.96
Style1. The style of the hotel is current.	0.81	NA			
Style2. The hotel's style looks refined.	0.91	41.69			
Style3. The style of the hotel is aesthetically appealing.	0.96	45.12			
Style4. The hotel looks artful.	0.81	34.57			
Style5. The style of the hotel is attractive.	0.94	44.09			

Table 1718. Factor Loadings of Path Analysis Results (Continued)

Dimension and item description (continued)	**SL**	***t*-value**	**AVE**	**CR**	**MaxR(H)**
CPMS			0.87	0.96	0.96
CPMS1. I think this hotel's overall environment is good.	0.94	NA			
CPMS2. The overall environment of this hotel is inviting.	0.94	70.77			
CPMS3. I think this hotel's overall environment is comfortable.	0.91	60.92			
CPMS4. I think this hotel's overall environment is beautiful.	0.93	65.80			
Approach intention			0.87	0.95	0.97
Approach1. I will enjoy spending time at this hotel.	0.90	NA			
Approach3. I want to have a long stay at this hotel.	0.97	61.95			
Approach4. I would like to stay at this hotel as long as possible.	0.94	57.69			

Note. χ^2 = 1206.14 (p < .001, df = 334); χ^2/df = 3.61; GFI (goodness-of-fit index) = 0.94; CFI (comparative fit index) = 0.98; NFI (normed fit index) = 0.97; TLI (Tucker–Lewis index) = 0.98; RMSEA (root mean square error of approximation) = 0.04; SRMR (standardized root mean square residual) = 0.06; R^2= 0.45; SL = standardized loading; CR = composite reliability; AVE = average variance extracted; NA = not applicable; MaxR(H) = maximum reliability.

5.1.3 Exploratory Analysis of Antecedents of CPMS

This section explores the relationships between the material and graphical settings of a photo that can influence CPMS and mediated servicescape dimensions. Analyses include correlational analysis and *t*-tests to identify relationships. Descriptive analyses of variables appear in Appendix B.

5.1.3.1 Part I – Antecedents of CPMS: Material Settings

An exploratory correlational analysis was first conducted to identify variables related to material settings that were strongly correlated with CPMS. Results were differentiated by material vs. graphical settings. Tables 19 and 20 list correlation results among CPMS and object materials. As indicated in Section 3.2.4, seven materials were chosen to suit hotels' interior photo settings: fabric, foliage, glass, leather, mirror, plastic, and wallpaper.

Table 19. Correlation among CPMS and Material of the Most Salient Object

	CPMS	fabric	foliage	glass	leather	mirror	plastic	wallpaper
CPMS	1							
fabric	-0.09^{**}	1						
foliage	0.06^{*}	-0.10^{**}	1					
glass	0.23^{**}	-0.30^{**}	-0.14^{**}	1				
leather	-0.05	-0.05	-0.02	-0.07^{**}	1			
mirror	0.02	-0.05	-0.02	-0.07^{**}	-0.01	1		
plastic	-0.08^{**}	-0.14^{**}	-0.07^{**}	-0.20^{**}	-0.03	-0.03	1	
wallpaper	0.01	-0.08^{**}	-0.04	-0.12^{**}	-0.02	-0.02	-0.01^{*}	1

**Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The presence of glass was most strongly correlated with CPMS scores. The presence of foliage was also significantly correlated with these scores. Conversely, fabric and plastic were significantly negatively correlated with CPMS scores. Photos with a high probability of prediction are shown in Figure 21 (photos have been resized for presentation).

Table 20. Correlation among CPMS and Window-related Variables

	CPMS	Window (y/n)	View outside the window (y/n)	A pleasant view outside the window (y/n)
CPMS	1			
Window (y/n)	0.09**	1		
View outside the window (y/n)	0.05	0.46**	1	
A pleasant view outside the window (y/n)	0.14**	0.36**	0.70**	1

**Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Among photos labeled as displaying "glass" and with a high probability, glass doors/windows were commonly observed. An independent sample *t*-test showed that, on average, glass enhanced mediated servicescape dimensions to varying degrees. In terms of color, compared to the group of photos without glass ($M = 3.44$, $N = 921$), photos with glass ($M = 3.73$, $N = 411$) had significantly higher ratings ($t = 6.82$, $p < 0.01$). For lighting, compared to the group of photos without glass ($M = 3.79$), those with glass ($M = 4.09$) also had significantly higher ratings ($t = 7.81$, $p < 0.01$). With respect to furnishings, compared to photos without glass ($M = 3.58$), photos with glass ($M = 3.86$) had significantly higher ratings ($t = 6.77$, $p < 0.01$). Similarly, for the layout dimension, compared to photos without glass ($M = 3.46$), those with glass ($M = 3.75$) had significantly higher ratings ($t = 7.02$, $p < 0.01$). Photos with glass also earned significantly higher ratings ($M = 3.62$) than those without ($M = 3.27$, $t = 7.98$, $p < 0.01$). Enhanced perceptions on all dimensions may have occurred because glass can directly improve lighting conditions. Natural light from the outdoors could harmonize a color scheme and style, show the texture and details of furniture, and connect inner space to the outside to inspire higher evaluations on all dimensions. The results further imply that the presence of glass, likely due to windows in a hotel's interior space, could provide positive environmental cues that improve individuals' perceptions of numerous environmental aspects and thus lead to enhanced overall environmental perceptions of the hotel. Tables 20 and 21 show that a photographed window tended to be correlated with CPMS scores.

Photos with foliage included significant greenery in the captured scene. Subsequent independent sample *t*-tests suggested that, on average, the presence of foliage significantly improved servicescape dimensions of color, lighting, and style. For color, photos containing foliage ($M = 3.72$, $N = 59$) had significantly higher ratings than photos without ($M = 3.52$, $N = 1273$, $t = 2.03$, $p = 0.04$). Regarding lighting, photos with foliage ($M = 4.15$) had significantly higher ratings than those without ($M = 3.87$, $t = 4.10$, $p < 0.01$). Additionally, for style, photos with foliage ($M = 3.60$) had significantly higher ratings than photos without ($M = 3.37$, $t = 2.09$, $p = 0.04$). These relationships suggest that indoor spaces/scenes containing heavy greenery add pleasant colors to scenes and improve interior design. Additionally, planting greenery in indoor spaces may require good lighting to keep the greenery alive. Therefore, lighting conditions can also positively influence individuals' perceptions. The presence of foliage had no significant influence on individuals' perceptions of furnishings or hotel layout.

Correlational results indicated that the presence of fabric was negatively correlated with CPMS scores. Bed fabric often consumed a large part of the original photos: photos in this category predominantly displayed a room's bed/bedding without providing additional information about the room/space. Although core hotel products are the guestroom and bed, consumers expect other products (e.g., basic and additional amenities) to provide a satisfactory experience as well. A photo showcasing the bed may not provide sufficient information for individuals to make inferences about the environment, lowering consumers' overall environmental perceptions. Independent sample t-tests indicated that, on average, the presence of fabric significantly decreased ratings on the following mediated servicescape dimensions: color, lighting, layout, and style. In terms of color, photos with fabric ($M = 3.43$, $N = 227$) had significantly lower ratings than those without ($M = 3.55$, $N = 1105$, $t = 2.27$, $p = 0.04$). For lighting, photos with fabric ($M = 3.73$) had significantly lower ratings than photos without ($M = 3.91$, $t = 3.58$, $p < 0.01$). Regarding style, photos with fabric ($M = 3.20$) had significantly lower ratings than photos without ($M = 3.41$, $t = 4.10$, $p < 0.01$). If fabric (most likely bedding) takes up a large portion of the photo, customers may not obtain additional information about the room's color scheme, lighting, and style. Further, a close distance between the camera and the bed could negatively influence individuals' inferences about the room layout. The presence of fabric had no significant effect on individuals' perceptions of hotel furnishings.

Similarly, the presence of plastic was negatively correlated with CPMS. Photos containing plastic generally showed restaurant and lobby views. Subsequent t-tests revealed that on average, the presence of plastic significantly compromised ratings on color, lighting, furnishings, and style. In terms of color, photos displaying plastic ($M = 3.35$, $N = 111$) had significantly lower ratings than photos without it ($M = 3.55$, $N = 1221$, $t = 2.76$, $p = 0.01$). On the lighting dimension, photos containing plastic ($M = 3.62$) had significantly lower ratings than those without ($M = 3.91$, $t = 3.51$, $p < 0.01$). In terms of furnishings, photos with plastic ($M = 3.39$) had significantly lower ratings than photos without ($M = 3.69$, $t = 3.85$, $p < 0.01$). With respect to style, photos with plastic ($M =$

3.19) had significantly lower ratings than those without ($M = 3.39$, $t = 2.53$, $p = 0.01$). Plastic also exerted no significant effect on individuals' perceptions of the hotel's layout. These findings convey that the presence of cheap plastic material tended to be associated with an economy hotel of relatively low quality. The *t*-test results of material settings on mediated servicescape dimensions are summarized in Table 20.

Material category: glass

0.99 0.97 0.96 0.95

Material category: foliage

0.99 0.99 0.97 0.90

Material category: fabric

0.87 0.81 0.78 0.77

Material category: plastic

0.87 0.81 0.78 0.77

Figure 21. Photos Labeled with Key Materials with High Probability of Recognition

Table 21. T-test Results of Material Settings on Mediated Servicescape Dimensions

Tested relationship	**Mean values**		***t***	***p***
Object material				
Glass (+)				
>>Color	M_{true} = 3.73 *SD* = 0.68	M_{false} = 3.44 *SD* = 0.76	6.82	<0.01
>>Lighting	M_{true} = 4.09 *SD* = 0.60	M_{false} = 3.79 *SD* = 0.75	7.81	<0.01
>>Furnishings	M_{true} = 3.86 *SD* = 0.66	M_{false} = 3.58 *SD* = 0.79	6.77	<0.01
>>Layout	M_{true} = 3.75 *SD* = 0.70	M_{false} = 3.46 *SD* = 0.75	7.02	<0.01
>>Style	M_{true} = 3.62 *SD* = 0.72	M_{false} = 3.27 *SD* = 0.85	7.98	<0.01
Foliage (+)				
>>Color	M_{true} = 3.72 *SD* = 0.64	M_{false} = 3.52 *SD* = 0.75	2.03	0.04
>>Lighting	M_{true} = 4.15 *SD* = 0.50	M_{false} = 3.87 *SD* = 0.73	4.10	<0.01
>>Furnishings	M_{true} = 3.71 *SD* = 0.68	M_{false} = 3.66 *SD* = 0.77	0.49	n.s.
>>Layout	M_{true} = 3.58 *SD* = 0.74	M_{false} = 3.55 *SD* = 0.75	0.30	n.s.
>>Style	M_{true} = 3.60 *SD* = 0.79	M_{false} = 3.37 *SD* = 0.83	2.09	0.04
Fabric (-)				
>>Color	M_{true} = 3.43 *SD* = 0.73	M_{false} = 3.55 *SD* = 0.75	2.27	0.02
>>Lighting	M_{true} = 3.73 *SD* = 0.78	M_{false} = 3.91 *SD* = 0.70	3.58	<0.01
>>Furnishings	M_{true} = 3.64 *SD* = 0.82	M_{false} = 3.67 *SD* = 0.76	0.53	n.s.
>>Layout	M_{true} = 3.40 *SD* = 0.77	M_{false} = 3.58 *SD* = 0.74	3.35	<0.01
>>Style	M_{true} = 3.20 *SD* = 0.82	M_{false} = 3.41 *SD* = 0.82	3.57	<0.01
Plastic (-)				
>>Color	M_{true} = 3.35 *SD* = 0.74	M_{false} = 3.55 *SD* = 0.74	2.76	0.01
>>Lighting	M_{true} = 3.62 *SD* = 0.82	M_{false} = 3.91 *SD* = 0.71	3.51	<0.01
>>Furnishings	M_{true} = 3.39 *SD* = 0.80	M_{false} = 3.69 *SD* = 0.76	4.02	<0.01
>>Layout	M_{true} = 3.50 *SD* = 0.74	M_{false} = 3.55 *SD* = 0.75	0.77	n.s.
>>Style	M_{true} = 3.19 *SD* = 0.85	M_{false} = 3.39 *SD* = 0.82	2.53	0.01
Window and views outside the window				
Window (+)				
>>Color	M_{true} = 3.60 *SD* = 0.73	M_{false} = 3.49 *SD* = 0.74	2.37	0.02
>>Lighting	M_{true} = 3.98 *SD* = 0.68	M_{false} = 3.81 *SD* = 0.74	3.75	<0.01
>>Furnishings	M_{true} = 3.72 *SD* = 0.73	M_{false} = 3.66 *SD* = 0.80	1.23	n.s.
>>Layout	M_{true} = 3.63 *SD* = 0.72	M_{false} = 3.54 *SD* = 0.76	1.91	n.s.
>>Style	M_{true} = 3.43 *SD* = 0.81	M_{false} = 3.36 *SD* = 0.80	1.26	n.s.
Pleasant view outside the window (+)				
>>Color	M_{true} = 3.73 *SD* = 0.71	M_{false} = 3.52 *SD* = 0.74	2.90	<0.01
>>Lighting	M_{true} = 4.17 *SD* = 0.65	M_{false} = 3.86 *SD* = 0.72	4.47	<0.01
>>Furnishings	M_{true} = 3.80 *SD* = 0.74	M_{false} = 3.68 *SD* = 0.77	1.55	n.s.
>>Layout	M_{true} = 3.88 *SD* = 0.66	M_{false} = 3.55 *SD* = 0.77	4.61	<0.01
>>Style	M_{true} = 3.43 *SD* = 0.81	M_{false} = 3.35 *SD* = 0.81	4.22	<0.01

Note: (+) indicates positive effects; (-) indicates negative effects.
n.s. indicates non-significant results

5.1.3.2 Part II – Antecedents of CPMS: Graphical Settings

This section discusses an exploratory analysis of the relationship between graphical settings in hotel photos and CPMS. Based on the earlier literature review, graphical settings include three aspects: overall photo quality, color effects, and photo composition. Overall photo quality refers to the level of accuracy an image captures, stores, compresses, and displays through visual signals. In this research, photo quality was assessed through crowdsourcing. Measurements of color effects reflect the theme, variation, and effect of color use. In this study, measurements of color effects were obtained through crowdsourcing and computational approaches. Measurements of photo composition represent the organization of elements in a photo.

Different color effects (e.g., saturation, hue, and brightness) in photos can influence individuals' perceptions of the environment or objects. A well-known example is the case of the blue or white dress (Weintraub 2018) in which the photo exposure affected individuals' perceptions of the garment's actual color. First, correlational analysis was conducted to assess the relationship between CPMS and subjectively measured photo quality, high saturation, warm hue, high brightness, and light distribution. As indicated in Table 22, photo quality was significantly correlated with CPMS. High-quality photos can thus improve individuals' environmental perceptions in that these photos signal good hotel quality overall, which correlates with CPMS. Additionally, high saturation, high brightness, and even light distribution were significantly positively correlated with CPMS. Correlational analysis among CPMS and image statistics (collected via the computational approach) demonstrated a similar pattern (Table 23): calculated statistics of brightness and average pixel brightness (i.e., v-average) were positively correlated with CPMS scores. However, the average saturation of pixels (i.e., s-average) was negatively correlated with CPMS, contradicting the positive correlation between high saturation and CPMS.

Table 22. Correlations among CPMS and Annotated Color Effects

	1	2	3	4	5	6
1. CPMS	1					
2. Photo quality	0.30**	1				
3. High saturation	0.08*	0.18**	1			
4. Warm hue	-0.01	0.16**	0.37**	1		
5. High brightness	0.13**	0.27**	0.05	-0.06	1	
6. Even light distribution	0.17**	0.36**	0.17**	0.10**	0.26**	1

Note: Variable values were collected with the crowdsourcing approach.
**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 23. Correlations among CPMS and Statistics of Color Effects

	1	2	3	4	5	6	7	8
1. CPMS	1							
2. Photo quality	0.30**	1						
3. Colorfulness	-0.01	-0.03	1					
4. Brightness	0.10**	0.13**	-0.08**	1				
5. Contrast	-0.05	-0.03	-0.04	-0.18**	1			
6. H-average	-0.02	0.01	-0.14**	0.06*	0.07**	1		
7. S-average	-0.07**	-0.14**	0.72**	-0.54**	-0.03	-0.26**	1	
8. V-average	0.09**	0.12**	0.21**	0.94**	-0.21**	0.01	-0.27**	1

Note: Variable values were collected with the computational approach.
**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 24. Correlations among CPMS and Statistics of Color Clusters

	1	2	3	4	5	6	7	8	9	10	11
1. CPMS	1										
2. Photo quality	0.30**	1									
3. H-squared of Cluster 1	-0.02	0.01	1								
4. S-squared of Cluster 1	-0.07**	-0.12**	-0.17**	1							
5. V-squared of Cluster 1	0.03	0.08**	0.02	-0.42**	1						
6. H-squared of Cluster 2	0.02	-0.01	0.23**	-0.12**	-0.02	1					
7. S-squared of Cluster 2	-0.06*	-0.06	-0.15**	0.45**	-0.11**	-0.18**	1				
8. V-squared of Cluster 2	0.05	0.10**	0.03	-0.11**	0.23**	0.01	-0.35**	1			
9. H-squared of Cluster 3	-0.02	0.05	0.14**	-0.10**	0.01	0.19**	-0.06*	-0.02	1		
10. S-squared of Cluster 3	-0.06*	-0.12**	-0.08**	0.28**	-0.01	-0.05*	0.30**	0.01	-0.15**	1	
11. V-squared of Cluster 3	0.03	0.06	-0.03	0.05	0.07**	-0.03	0.09**	0.01	-0.06*	-0.21**	1

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

In light of potential non-linear relationships, further analysis was performed to identify relationships between CPMS and the squared values of H (hue), S (saturation), and V (value/brightness). K-means clustering was used to determine the three most dominant color themes in a photo. The squared values of HSV statistics were then calculated for correlational analysis with CPMS. Table 24 indicates that the squared values of saturation for three dominant colors were negatively and significantly correlated with CPMS, hence the aforementioned contradictory finding. That is, color saturation in photos exhibited a non-linear relationship with CPMS: an optimal level of photo saturation exists that contributes to enhanced environmental perceptions; too little saturation may suggest dullness, whereas excessive saturation may elicit a sense of homeliness or unnaturalness (Figure 22), which can potentially diminish overall environmental evaluations.

Average S value = 18 S value of dominant color = 10	Average S value = 56 S value of dominant color = 49	Average S value = 70 S value of dominant color = 79

Figure 22. Sample Photos with Low, Medium, and High Saturation Values

Subsequent *t*-tests of mediated servicescape dimensions (Table 25) revealed that, on average, photos with relatively high saturation earned significantly higher scores on all dimensions. Brightness was significantly correlated with enhanced levels of color, lighting, and style. Further, photos with even light distribution obtained significantly higher scores on all mediated servicescape dimensions. These results showed that a photo's color parameters play key roles in individuals' visual processing of photographic information when making environmental inferences. Findings also suggest that hotels with a superior environment and facilities are more likely to use photos with pleasing color effects to stage a superior experience.

Table 25. T-test Results of Overall Photo Quality and Color Effect on Mediated Servicescape Dimensions

Tested relationship	**Mean values**		***t***	***p***
High photo quality (+)				
>>Color	M_{true} = 3.40 *SD* = 0.78	M_{false} = 3.69 *SD* = 0.66	9.78	<0.01
>>Lighting	M_{true} = 3.71 *SD* = 0.76	M_{false} = 4.06 *SD* = 0.63	6.24	<0.01
>>Furnishing	M_{true} = 3.51 *SD* = 0.83	M_{false} = 3.87 *SD* = 0.66	7.89	<0.01
>>Layout	M_{true} = 3.43 *SD* = 0.74	M_{false} = 3.73 *SD* = 0.71	7.44	0.04
>>Style	M_{true} = 3.13 *SD* = 0.81	M_{false} = 3.65 *SD* = 0.72	6.41	0.01
High saturation (+)				
>>Color	M_{true} = 3.65 *SD* = 0.69	M_{false} = 3.50 *SD* = 0.75	2.90	<0.01
>>Lighting	M_{true} = 4.01 *SD* = 0.61	M_{false} = 3.84 *SD* = 0.75	3.62	<0.01
>>Furnishing	M_{true} = 3.77 *SD* = 0.71	M_{false} = 3.66 *SD* = 0.79	2.03	0.04
>>Layout	M_{true} = 3.69 *SD* = 0.71	M_{false} = 3.54 *SD* = 0.75	2.73	0.01
>>Style	M_{true} = 3.48 *SD* = 0.80	M_{false} = 3.36 *SD* = 0.81	2.22	0.03
High brightness (+)				
>>Color	M_{true} = 3.62 *SD* = 0.71	M_{false} = 3.44 *SD* = 0.77	3.67	<0.01
>>Lighting	M_{true} = 4.04 *SD* = 0.63	M_{false} = 3.69 *SD* = 0.78	7.48	<0.01
>>Furnishing	M_{true} = 3.73 *SD* = 0.72	M_{false} = 3.64 *SD* = 0.84	1.78	n.s.
>>Layout	M_{true} = 3.62 *SD* = 0.75	M_{false} = 3.53 *SD* = 0.73	1.83	n.s.
>>Style	M_{true} = 3.48 *SD* = 0.80	M_{false} = 3.27 *SD* = 0.81	3.99	<0.01
Even lighting distribution (+)				
>>Color	M_{true} = 3.63 *SD* = 0.68	M_{false} = 3.51 *SD* = 0.76	2.55	0.01
>>Lighting	M_{true} = 4.10 *SD* = 0.62	M_{false} = 3.79 *SD* = 0.74	6.91	<0.01
>>Furnishing	M_{true} = 3.85 *SD* = 0.64	M_{false} = 3.62 *SD* = 0.81	4.87	<0.01
>>Layout	M_{true} = 3.70 *SD* = 0.73	M_{false} = 3.53 *SD* = 0.74	3.36	<0.01
>>Style	M_{true} = 3.61 *SD* = 0.73	M_{false} = 3.29 *SD* = 0.82	6.13	<0.01

Note: (+) indicates positive effects; (-) indicates negative effects; n.s. indicates non-significant results.

Photographic techniques (e.g., the rule of thirds, rule of symmetry, or a wide-angle lens) were next examined to determine whether photo composition can influence CPMS and mediated servicescape dimensions. According to Luo et al. (2011), for different types of content or scenes, photographers adopt unique compositional techniques and apply diverse criteria to capture a “good photo.” For instance, close-up shots can create a sense of intimacy and present the details of an object. This technique is often adopted in photos of natural plants or animals. However, long-range shots are preferred to extend one's sense of space when shooting scenic areas. Subsequent analysis sought to explore these characteristics in a hotel booking context, namely which compositional features contribute to enhanced environmental perceptions.

Table 26. Correlations among CPMS and Variables of Photo Composition

	1	2	3	4	5	6
1. CPMS	1					
2. Photo quality	0.30^{**}	1				
3. Symmetrical balance	0.10^{**}	0.15^{**}	1			
4. Rue of thirds	0.18^{**}	0.32^{**}	0.16^{**}	1		
5. Close-up shot	-0.23^{**}	-0.11^{**}	-0.05	-0.03	1	
6. Wide-angle lens	0.15^{**}	0.08^{*}	0.02	0.13^{**}	-0.22^{**}	1

Note: Variables were collected with the crowdsourcing approach.
**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 27. T-test Results of Photo Composition on Mediated Servicescape Dimensions

Tested relationship	**Mean values**		***t***	***p***
Symmetrical balance (+)				
>>Color	M_{true} = 3.59 *SD* = 0.74	M_{false} = 3.54 *SD* = 0.74	0.79	n.s.
>>Lighting	M_{true} = 3.97 *SD* = 0.72	M_{false} = 3.88 *SD* = 0.72	1.50	n.s.
>>Furnishings	M_{true} = 3.81 *SD* = 0.69	M_{false} = 3.67 *SD* = 0.78	2.20	0.03
>>Layout	M_{true} = 3.78 *SD* = 0.71	M_{false} = 3.55 *SD* = 0.75	3.48	<0.01
>>Style	M_{true} = 3.48 *SD* = 0.68	M_{false} = 3.36 *SD* = 0.74	2.51	0.01
Rule of thirds (+)				
>>Color	M_{true} = 3.71 *SD* = 0.65	M_{false} = 3.47 *SD* = 0.76	5.22	<0.01
>>Lighting	M_{true} = 4.04 *SD* = 0.60	M_{false} = 3.82 *SD* = 0.76	4.91	<0.01
>>Furnishings	M_{true} = 3.90 *SD* = 0.67	M_{false} = 3.59 *SD* = 0.79	6.38	<0.01
>>Layout	M_{true} = 3.77 *SD* = 0.68	M_{false} = 3.49 *SD* = 0.75	5.79	<0.01
>>Style	M_{true} = 3.57 *SD* = 0.75	M_{false} = 3.30 *SD* = 0.82	4.87	<0.01
Close-up shot (-)				
>>Color	M_{true} = 3.39 *SD* = 0.81	M_{false} = 3.58 *SD* = 0.71	-3.10	<0.01
>>Lighting	M_{true} = 3.68 *SD* = 0.81	M_{false} = 3.95 *SD* = 0.68	-4.43	<0.01
>>Furnishings	M_{true} = 3.50 *SD* = 0.83	M_{false} = 3.74 *SD* = 0.74	-4.13	<0.01
>>Layout	M_{true} = 3.11 *SD* = 0.63	M_{false} = 3.71 *SD* = 0.72	-11.70	<0.01
>>Style	M_{true} = 3.14 *SD* = 0.85	M_{false} = 3.46 *SD* = 0.79	-5.03	<0.01
Wide-angle lens (+)				
>>Color	M_{true} = 3.66 *SD* = 0.70	M_{false} = 3.50 *SD* = 0.75	3.11	<0.01
>>Lighting	M_{true} = 4.02 *SD* = 0.64	M_{false} = 3.84 *SD* = 0.74	3.86	<0.01
>>Furnishings	M_{true} = 3.84 *SD* = 0.70	M_{false} = 3.63 *SD* = 0.79	4.09	<0.01
>>Layout	M_{true} = 3.83 *SD* = 0.68	M_{false} = 3.49 *SD* = 0.74	6.62	<0.01
>>Style	M_{true} = 3.49 *SD* = 0.78	M_{false} = 3.35 *SD* = 0.82	2.48	0.01

Note: (+) indicates positive effects; (-) indicates negative effects; n.s. indicates non-significant results.

Correlational analysis was performed first. Table 26 shows that the use of symmetrical composition, the rule of thirds, and a wide-angle lens were each positively correlated with CPMS whereas close-up shots were negatively correlated with this construct. Subsequent *t*-tests revealed that photos abiding by the rule of symmetry obtained significantly higher scores on furnishings, layout, and style. Photos adopting the rule of thirds, long (vs. close-up) shots, and use of a wide-angle lens were assigned higher scores for all mediated servicescape dimensions, especially layout. These results indicate that well-composed hotel photos can present rich information about a hotel's tangible elements and convey details in a familiar, appealing way to enhance individuals' environmental perceptions. These findings also imply that hotels with a superior environment and facilities are more likely to use photos with attractive compositional features to stage a superior experience.

5.2 Study 2: How CPMS and Photo Quality Influence Booking-related Behavior

Study 2 attempted to explore how hotel photos influence search and booking-related behavior, using data provided by TripAdvisor. Specifically, using data aggregated at each hotel level within 30 days, Section 5.2.1 explores how the CPMS score of each hotel's primary photo (*CPMS_primary*) and the average CPMS score of each hotel's four interior photos (*CPM_4interiors*) could influence hotels' property page visitation and meta-clicks at an aggregated level. Section 5.2.2 focuses on a set of hotels that changed their primary photos during the 30-day period and examined how changes in hotels' primary photos on CPMS scores and photo quality could influence consumers' booking-related behavior.

5.2.1 The Role of CPMS: Generalized Linear Regression on Cross-sectional Data

Given that most hotels in the sample did not change their primary photos between June 2 and July 2, 2019, this section first explores the effect of hotel photos across hotels. The effects of two specific variables were evaluated: *CPMS_primary* and *CPMS_4interiors*. *CPMS_primary* refers to consumers' overall perceptions of a hotel's environment based on its primary photo. The latter takes the average of consumers' perceptions based on four photos that are representative of a hotel's interior environment. Compared with *CPMS_primary*, *CPMS_4interiors* provides a more accurate representation of consumers' environmental perceptions about a hotel's environment.

Figure 23 presents a scatter plot matrix between *CPMS_primary, CPMS_4interiors*, *Rating* (i.e., each hotel's rating on TripAdvisor), and *Hotel class* (i.e., star ratings of hotels collected by TripAdvisor from third-party platforms). The plot demonstrates that (1) *CPMS_primary* and *CPMS_4interiors* were strongly correlated and (2) the CPMS scores of each hotel's primary photos and selected four photos were strongly correlated with other quality indicators. These trends suggest that CPMS scores collected via crowdsourcing were valid, the chosen photos were representative of a given hotel's actual environment, and consumers may rely on hotel photos to judge a hotel's quality.

This section explores how the CPMS scores of a hotel's primary photo and selected photos can influence consumers' aggregated booking-related behavior. Before consumers land on each hotel's property page, the primary photo is the most prominent information they see while browsing search results. Therefore, *CPMS-primary* was taken as the focal variable to explain consumers' page visitation. After landing on each hotel's property page, consumers are exposed to rich hotel information. They can also browse additional photos in the hotel's photo gallery and read detailed reviews. Such information may further influence their behavior when clicking meta-links, which will direct them to third-party booking sites such as Expedia, Booking.com, and Agoda. Therefore, *CPMS_4interiors* may play an important role in influencing consumers' meta-click behavior. Given that the number of individuals who click meta-links on a property page depends on the number of individuals who visit that page, *CPMS_primary* was considered an alternative variable to *CPMS_4interiors* in explaining consumers' meta-click behavior.

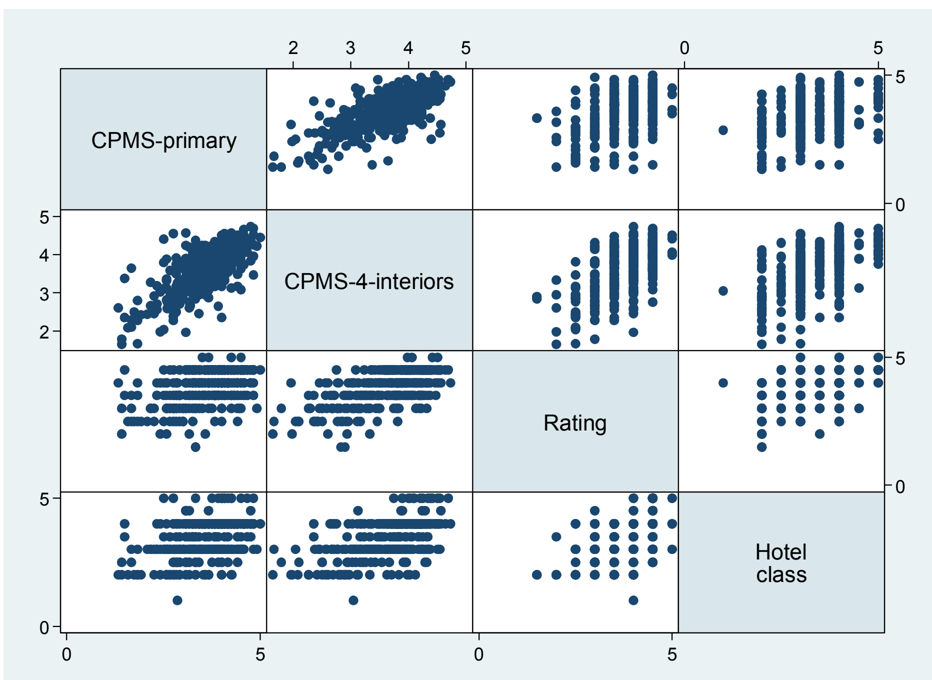

Figure 23. Scatter Plot of CPMS and Related Variables

Table 27 presents variables used in this stage of analysis. Independent variables included those involving the hotel's photo information, basic operational information, and city-level information. The dependent variables of interest were page-view behavior and meta-click behavior. Among dependent variables, page-view behavior

(*TAUniqPagevie*) and meta-click behavior (*UniqMetaclicks*) were count variables describing the frequency of observations. Therefore, generalized linear models were used to estimate the effects of *CPMS_primary* and *CPMS_4interiors* on consumers' aggregated behavior for page views and meta-clicks. Poisson regressions were first tested and rejected for over-dispersion. Negative binomial regression was ultimately adopted and specified as follows:

$$P(TAUniqPageview = y) = \frac{\Gamma(y+1/\alpha)}{\Gamma(y+1)\Gamma(1/\alpha)} \left(\frac{1}{1+\alpha\mu}\right)^{1/\alpha} \left(\frac{\alpha\mu}{1+\alpha\mu}\right)^{y} \tag{10}$$

$$\log\mu = \beta_0 + \beta_1 CPMS\_primary + \beta_2 ADR\_30d + \beta_3 Rating + \beta_4 ReviewNum + \beta_4 LocationRating + \beta_5 TotalRooms + \beta_6 TotalRooms + \beta_7 City + \log TourArrival \tag{11}$$

As indicated in Linear function 11, linear predictors included variables that could influence individuals' page-view behavior when browsing the hotel search page. At this stage, consumers would be exposed to a limited amount of hotel information, including a primary photo, current hotel price, overall rating, and total number of reviews. Further, the presence of each hotel in consumers' search results potentially depends on the hotel's location and supply of available rooms, which was controlled by the rating of the hotel's location and total available rooms in each hotel. Additionally, considering that consumers' search of hotels in a city may be influenced by a heterogeneous supply–demand market, a categorical variable *City* and a scaling (offset) variable *TourArrival* were used to control the heterogeneity effect of cities and the scaling effect of a city's total number of tourists.

Table 28. Descriptions of Variables in Study 2

	Variable	Explanation	*N*	Min	Max	Mean	S.D.	Skewness	Kurtosis
Hotel photo information	*CPMS_primary*	CPMS score of each hotel's primary photo	362	1.333	5.000	3.607	0.739	-0.695	3.306
	CPMS_4interiors	Averaged CPMS score of the selected four interior photos of the hotel property	366	1.646	4.729	3.640	0.596	-0.834	3.351
	NumPhoto	Total numbers of photos in the hotel's photo gallery posted before June 2019, including management, professional, and traveler photos	365	1	8465	543.630	693.752	6.015	58.423
Hotel basic operational information	*ADR_30d*	Average daily rate of the hotel between 6/2/2019 and 7/2/2019	359	36.421	1466.462	213.262	141.733	3.816	25.446
	Rating	Overall review rating of hotel property on TripAdvisor	370	1.5	5	3.792	0.628	-0.823	3.608
	ReviewNum	Number of reviews of hotel property on TripAdvisor	370	2	10896	1283.151	1439.443	2.884	14.086
	LocationRating	Ratings of hotel location on TripAdvisor	370	2	3	4.339	0.509	-1.221	5.668
	TotalRooms	Total available rooms in the hotel, provided by TripAdvisor	371	12	1334	112.356	132.742	4.022	28.436
	NumAmenities	Total number (count) of amenities provided on the hotel property page on TripAdvisor	370	3	69	19.311	8.225	1.512	8.167
	City (categorical)	City where hotel property is located. Observations in cities with sample size less than 5 were not included for analysis.	371	1	20	NA	NA	NA	NA
	Region (categorical)	Geographic region, including Europe and U.S. Observations in South America were not included for analysis.	371	1	2	NA	NA	NA	NA

Table 27. Descriptions of Variables in Study 2 (Continued)

	Variable	Explanation	*N*	Min	Max	Mean	S.D.	Skewness	Kurtosis
City-specific information	*TourArrival*	Tourist arrival (million) of each specific city in 2018, collected through various tourism sources	355	5.2	75	33.302	17.276	0.168	2.389
Consumers' hotel search and booking behavior aggregated at the hotel level	*TAUniqPageview*	Total number of unique individuals who visited the hotel property page from TripAdvisor's website between 6/2/2019 and 7/2/2019	371	1	13848	648.019	1218.183	6.733	61.357
	UniqMetaclicks	Total number of unique individuals who clicked meta-links and were directed to third-party booking sites from TripAdvisor between 6/2/2019 and 7/2/2019	384	0	9365	377.128	798.82	6.535	58.663

Note: Samples of other types of accommodations, including inn/B&Bs and special accommodations, were dropped due to small sample sizes.

Table 28 presents estimation results. First, samples in major European (EU) cities and U.S. cities were pooled in Model (1). As indicated, the effect of *CPMS_primary* was not significant. A further examination of these two samples suggested that the EU sample differed from the U.S. sample in hotel-level distribution. As indicated in Figure 24, most hotels in the EU sample were higher-class, whereas those in the U.S. sample were more evenly distributed by hotel class. Additionally, the two samples further differed in the hotel supply–demand market; cities where the EU samples were located have tended to suffer from over-tourism (Petersen 2019). Considering the heterogeneity of the EU and U.S. samples, data in these regions were split for analysis as shown in Models (3) and (5). Given the heterogeneity of the rating distribution in the EU and U.S. samples, a variable indicating the interaction between *CPMS_primary* and *Rating* was added to Models (2), (4), and (6) to examine the potential interaction effects of these two variables.

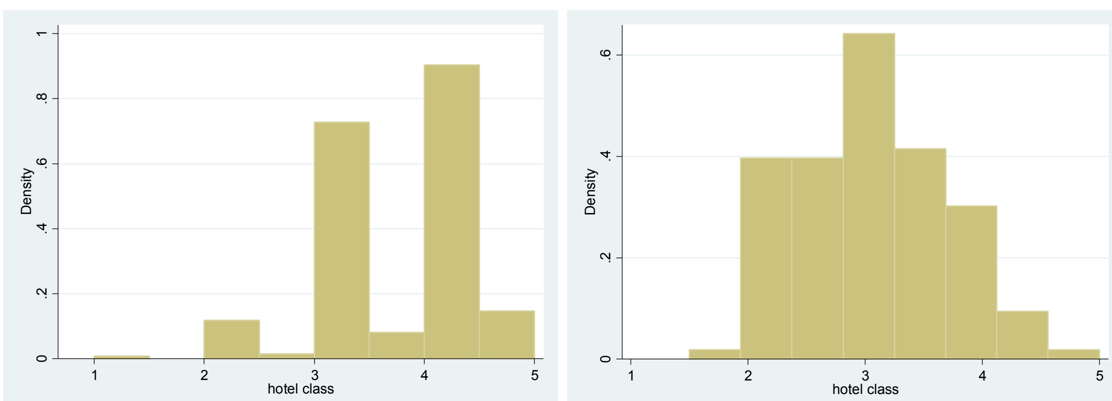

Figure 24. Distribution of Hotel Classes in EU (left) and U.S. (right) Samples

Based on Models (1) – (6), it is clear that the effects of the CPMS score of a hotel's primary photo on consumers' page-view behavior differed across the EU and U.S. samples. For the EU sample, the effect of *CPMS_primary* was not significant. For the U.S. sample, *CPMS_primary* exerted a significant positive effect on consumers' aggregated property page-view behavior with an incidence rate ratio of 1.4 in Models (5) and (6); that is, a one-unit increase in the score of a primary photo could increase consumers' page views by 1.4 times in the U.S. market. Additionally, rating scores and total review numbers played positive and significant roles in consumers' page-view behavior in both markets. Compared to the effect of a high review rating score (Model [5] incidence rate ratio = 2.0; Model [6] incidence rate ratio = 2.1), the effect of an appealing primary photo with a high CPMS score was also quite strong. Further, the effect of *ADR_30d* was significant and positive for the EU sample but significant and negative for the U.S. sample. Additionally, available room supply (*TotalRooms*) had a positive and significant influence on page-view behavior in the EU market only. Such results further indicate that the EU market may differ from the U.S. market, and consumers of a given hotel may tend to rely on more direct cues (e.g., price, rating, and number of reviews) to select hotels of high quality that could offer good experiences. For the chosen U.S. hotels, consumers relied heavily on a hotel's primary photo to narrow down their choices. As suggested by Louviere et al. (2000), "values of rho-squared [McFadden's pseudo R^2] between 0.2-0.4 are considered to be indicative of extremely good model fits" (p. 55). Simulations by Domencich and McFadden (1975) showed the range of McFadden's pseudo R^2 to be 0.7 to 0.9 in linear regression. Negative binomial models demonstrated a good fit, with pseudo R^2 values ranging from 0.122 to 0.134.

Consumers' aggregated meta-click behavior was assessed with the following functions. Linear predictors included variables that may influence individuals' meta-click behavior after reviewing the details of each property. At this stage, consumers had often narrowed their choices and were exposed to more in-depth hotel information (e.g., information on the property page) to guide their decisions (Noone and Robson 2016);

they could browse entire hotel photo galleries and make inferences about the hotel's environment. Further, they could read hotel reviews from other users along with detailed descriptions of the hotel, such as its amenities.

$$P(UniqMetaclicks = y) = \frac{\Gamma(y+1/\alpha)}{\Gamma(y+1)\Gamma(1/\alpha)} \left(\frac{1}{1+\alpha\mu}\right)^{1/\alpha} \left(\frac{\alpha\mu}{1+\alpha\mu}\right)^{y} \tag{12}$$

$$\log \mu = \beta_0 + CPMS\_primary + \beta_2 ADR_{30d} + \beta_3 Rating + \beta_4 ReviewNum + \beta_5 LocationRating + \beta_6 TotalRooms + \beta_7 TotalRooms + \beta_8 TNumPhoto + \beta_9 NumPhoto + \beta_{10} City + \log TourArrival \tag{13}$$

$$\log \mu = \beta_0 + \beta_1 CPMS\_4interiors + \beta_2 ADR_{30d} + \beta_3 Rating + \beta_4 ReviewNum + \beta_5 LocationRating + \beta_6 TotalRooms + \beta_7 TotalRooms + \beta_8 TNumPhoto + \beta_9 NumPhoto + \beta_{10} City + \log TourArrival \tag{14}$$

As indicated in Table 29, Models (7), (9), and (11) were used to test Equation (13). As shown in the results for these models, similar to the effect of *CPMS_primary* on consumers' page-view behavior, the effect of *CPMS_primary* on consumers' meta-click behavior was not significant in either the pooled sample or the EU sample but was significantly positive in the U.S. sample. For the U.S. sample, the incidence rate ratio of *CPMS_primary* was 1.4 (Model [11]), which was comparable to that for *Rating* (=1.7 in Model [12]).

Models (8), (10), and (12) in Table 29 were used to test Equation (14). As indicated in the results, *CPMS_4ineriors* exerted stronger effects on consumers' meta-click behavior. The effect of *CPMS_4ineriors* was significant for the pooled sample and the U.S. sample. In Model (8), the incidence rate ratio of *CPMS_4ineriors* was 1.2, comparable to the value of *Rating* (=1.4). For the U.S. sample (Model [12]), the incidence rate ratio of *CPMS_4ineriors* was 1.7, even stronger than that for *Rating* (=1.6).

This phase of analysis used inter-hotel variance to infer the relative influences of hotel photos on consumers' booking-related behavior. Results demonstrated the utilitarian value of hotel photos. When comparing different hotels, photos reflecting a high-quality hotel environment (with high CPMS scores) could attract more consumers and drive increased online traffic to a hotel. Based on these findings, H3a, H4a, and H4b were partially supported.

Table 29. Negative Binomial Regression on Page View Behavior

DV: *TAUniqPageview*	**(1)**	**(2)**	**(2)**		**(3)**	
	Samples of all major cities		**EU sample**		**US sample**	
ln (TourArrival)	1 (offset)	1 (offset)	1 (offset)	1 (offset)	1 (offset)	1 (offset)
CPMS_primary	0.0684 (0.0474)	0.0866* (0.0472)	-0.0256 (0.0507)	0.0020 (0.0492)	0.3277*** (0.0997)	0.3541*** (-0.1032)
ADR_30d	0.0003 (0.0003)	0.0003 (0.0002)	0.0007** (0.0003)	0.0006** (0.0003)	-0.0015*** (0.0006)	-0.0017*** (-0.0006)
Rating	0.3646*** (0.0734)	0.4113*** (0.0756)	0.2880*** (0.0747)	0.3587*** (-0.0753)	0.7120*** (0.1580)	0.7603*** (0.1657)
ReviewNum	0.0004*** (0.0000)	0.0004*** (0.0000)	0.0004*** (0.0000)	0.0004*** (0.0000)	0.0003*** (0.0000)	0.0003*** (0.0000)
LocationRating	-0.0099 (0.0886)	-0.0098 (0.0879)	-0.0210 (0.0994)	-0.0279 (0.0973)	0.0300 (0.1679)	0.0576 (0.1697)
TotalRooms	0.0012*** (0.0004)	0.0014*** (0.0004)	0.0016*** (0.0006)	0.0020*** (0.0006)	0.0007 (0.0006)	0.0007 (0.0006)
City (EU)						
Barcelona	(baseline)	(baseline)	(baseline)	(baseline)		
Berlin	- 1.3838*** (0.3060)	-1.3684*** (0.3042)	-1.4412*** (0.2666)	-1.4295*** (0.2611)		
Florence	-0.1881 (0.3058)	-0.1888 (0.3039)	-0.1953 (0.2697)	-0.1957 (0.2596)		
Lisbon	-0.6797** (0.3174)	-0.6773** (0.3154)	-0.6732** (0.2766)	-0.6678** (0.2709)		
London	-1.4236*** (0.2810)	-1.4019*** (0.2795)	-1.4984*** (0.2440)	-1.4616*** (0.2395)		
Milan	-0.1661 (0.3121)	-0.1392 (0.3103)	-0.2492 (0.2764)	-0.2122 (0.2650)		
Paris	-2.0623*** (0.2752)	-2.0581*** (0.2735)	-2.1001*** (0.2387)	-2.0885*** (0.2337)		
Rome	-0.6469** (0.2915)	-0.6461** (0.2898)	-0.6691*** (0.2527)	-0.6705*** (0.2476)		
City (US)						
Honolulu	0.3746 (0.3835)	0.3758 (0.3810)			(baseline)	(baseline)
Las Vegas	-2.0795*** (0.3181)	-2.0797*** (0.3162)			-2.4559*** (0.3625)	-2.4417*** (0.3620)
Los Angeles	-1.9481*** (0.3167)	-1.9474*** (0.3050)			-2.0203*** (0.3638)	-2.0303*** (0.3616)
Miami	-0.3034 (0.3200)	-0.3625 (0.3190)			-0.6584* (0.3682)	-0.7230* (0.3740)
New York City	-2.0944*** (0.2967)	-2.0683*** (0.2951)			-2.3842*** (0.3446)	-2.3665*** (0.3440)
Orlando	-2.2364*** (0.3516)	-2.2260*** (0.3492)			-2.5853*** (0.4061)	-2.5671*** (0.4064)
San Francisco	-0.8577*** (0.2952)	-0.8441*** (0.2934)			-1.0706*** (0.3418)	-1.0623*** (0.3403)
Cons	1.8426*** (0.4402)	1.5718*** (0.4571)	2.4313*** (0.4682)	2.0327*** (0.4791)	0.3505 (0.6840)	-0.0288 (0.8016)
/lnalpha	-1.2457 (0.0763)	-1.2584 (0.0764)	-1.5371 (0.0908)	-1.5790 (0.0910)	-0.9982 (0.1442)	-1.0063 (0.1443)
alpha	0.2877 (0.0220)	0.2841 0.0217	0.2150 (0.0195)	0.2062 (0.0188)	0.3685 (0.0531)	0.3656 (0.0527)
N	322	322	234	234	88	88
LR chi-squared	603.45	607.94	451.13	468.80	175.75	176.55
Prob>chi-squared	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.122	0.123	0.131	0.134	0.123	0.124
AIC	4378.602	4376.111	3065.651	3057.285	1277.927	1279.123
BIC	4461.642	4462.926	3117.481	3112.570	1312.609	1316.283

Note: significant level: *<0.1 **<0.05 ***<0.01

Table 30. Negative Binomial Regression on Meta-click Behaviors

DV: *UniqMetaclicks*	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
	Samples of all major cities		**EU sample**		**US sample**	
ln (TourArrival)	1 (offset)	1 (offset)	1 (offset)	1 (offset)	1 (offset)	1 (offset)
CPMS_primary	0.0583		-0.0388		0.3398***	
	(0.0581)		(0.0603)		(0.1295)	
CPMS_4interiors		0.2131**		0.0829		0.5221***
		(0.0842)		(0.0901)		(0.1774)
ADR-30d	-0.00002	-0.0001	0.0004	0.0004	-0.0031***	-0.0030***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0008)	(0.0008)
Rating	0.3772***	0.3004***	0.3622***	0.3004***	0.5265**	0.4503**
	-0.0944	(0.0978)	-0.0951	(0.1015)	-0.2152	(0.2142)
ReviewNum	0.0003***	0.0003***	0.0003***	0.0004***	0.0002***	0.0002*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
LocationRating	-0.0790	-0.0942	-0.0506	-0.0755	0.1475	0.0396
	-0.1091	(0.1077)	-0.1203	(0.1208)	-0.2214	(0.2166)
TotalRooms	0.0024***	0.0020***	0.0032***	0.0027***	0.0004	0.0004
	(0.0006)	(0.0005)	(0.0007)	(0.0007)	(0.0008)	(0.0008)
NumPhoto	0.0003*	0.0002	0.0001	0.0001	0.0006**	0.0006*
	(0.0002)	(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0003)
NumAmenities	-0.0081	-0.0100	-0.0142**	-0.0155**	0.0256	0.0257
	(0.0070)	(0.0070)	(0.0071)	(0.0073)	(0.0163)	(0.0158)
City (EU)						
Barcelona		(baseline)		(baseline)		
Berlin	-1.1963***	-1.1715***	-1.3063***	-1.2563***		
	(0.3655)	(0.3636)	(0.3155)	(0.3182)		
Florence	-0.5730	-0.5486	-0.6066*	-0.6183*		
	(0.3643)	(0.3625)	(0.3140)	(0.3162)		
Lisbon	-0.7564**	-0.7540**	-0.8242**	-0.8253**		
	(0.3805)	(0.3782)	(0.3293)	(0.3316)		
London	-1.5889***	-1.5894***	-1.7126***	-1.7341***		
	(0.3381)	(0.3359)	(0.2931)	(0.2948)		
Milan	-0.2120	-0.1802	-0.3473	-0.3282		
	(0.3726)	(0.3710)	(0.3208)	(0.3232)		
Paris	-2.0161***	-1.9917***	-2.1259***	-2.1296***		
	(0.3329)	(0.3314)	(0.2885)	(0.2906)		
Rome	-0.8409**	-0.8311**	-0.9061***	-0.9117***		
	(0.3474)	(0.3455)	(0.2995)	(0.3016)		
City (US)						
Honolulu	0.5527	0.6877				(baseline)
	-0.4568	(0.4566)				
Las Vegas	-2.0115***	-1.9756***			-2.2855***	-2.5443***
	(0.3840)	(0.3826)			(0.4553)	(0.4529)
Los Angeles	-2.1117***	-2.0831***			-2.2422***	-2.4910***
	(0.3658)	(0.3641)			(0.4467)	(0.4346)
Miami	-0.4695	-0.4426			-0.8883*	-1.0737**
	(0.3802)	(0.3779)			(0.4690)	(0.4646)
New York City	-2.1366***	-2.1365***		-2.2890***		-2.4797***
	(0.3649)	(0.3612)		(0.4584)		(0.4600)
Orlando	-2.2922***	-2.2019***			-2.8813***	-3.1161***
	(0.4172)	(0.4170)			(0.5023)	(0.4854)
San Francisco	-0.8760**	-0.8112**			-0.8298*	-0.9474**
	-0.3625	(0.3614)			-0.4615	(0.4557)
Cons	1.7568***	1.6032***	2.0973***	2.0692***	-0.244	0.0099
	(0.5407)	(0.5380)	(0.5615)	(0.5635)	(0.9251)	(0.8955)
/lnalpha	-0.9077	-0.9183	-1.2182	-1.2027	-0.6133	-0.6280
	(0.0763)	(0.0761)	(0.0909)	(0.0906)	(0.1446)	(0.1439)
alpha	0.4034	0.3992	.2957478	0.3004	0.5416	0.5336
	(0.0308)	(0.0304)	(0.0269)	(0.0272)	(0.0783)	(0.0768)
N	319	321	234	235	85	86
LR chi-squared	511.50	516.95	383.82	380.46	147.90	150.82
Prob>chi-squared	0.0000	0.000	0.0000	0.000	0.0000	0.000
Pseudo R^2	0.113	0.113	0.1190	0.117	0.115	0.116
AIC	4083.589	4107.467	2875.800	2893.774	1175.150	1187.131
BIC	4173.953	4197.982	2934.540	2952.587	1214.232	1226.4

Note: Significance level: *< 0.1 **< 0.05 ***< 0.01.

Table 31. Negative Binomial Regression on Meta-click Behavior (Continued)

DV: *UniqMetaclicks*	**(13)**	**(14)**	**(15)**
	Samples of all major cities	**EU sample**	**U.S. sample**
ln (TourArrival)	1 (offset)	1 (offset)	1 (offset)
CPMS_4interiors	0.2381***	0.1218	0.4492**
	(0.0869)	(0.0883)	(0.19130)
ADR-30d	-0.0001	0.0004	-0.0029***
	(0.0003)	(0.0003)	(0.0008)
Rating	0.3459***	0.3817***	0.4089*
	(0.0997)	(0.0989)	(0.2294)
Interaction of *CPMS_4interiors* and *Rating*	0.1207*	0.2459***	-0.1311
	(0.0702)	(0.0732)	(0.1633)
ReviewNum	0.0003***	0.0003***	0.0002*
	(0.0001)	(0.0001)	(0.0001)
LocationRating	-0.0921	-0.0575	0.0493
	(0.1071)	(0.1171)	(0.2191)
TotalRooms	0.0022***	0.0034***	0.0003
	(0.0006)	(0.0007)	(0.0008)
NumPhoto	0.0002	0.00004	0.0006**
	(0.0002)	(0.0002)	(0.0003)
NumAmenities	-0.0098	-0.0124*	0.0278*
	(0.0069)	(0.0072)	(0.0161)
City (EU)			
Barcelona	(baseline)	(baseline)	
Berlin	-1.1621***	-1.2645***	
	(0.3620)	(0.3089)	
Florence	-0.5391	-0.5809*	
	(0.3608)	(0.3072)	
Lisbon	-0.7514**	-0.8015**	
	(0.3762)	(0.3218)	
London	-1.5531***	-1.6494***	
	(0.3348)	(0.2872)	
Milan	-0.1578	-0.2810	
	(0.3692)	(0.3136)	
Paris	-1.9897***	-2.0982***	
	(0.3296)	(0.2820)	
Rome	-0.8195**	-0.8759***	
	(0.3440)	(0.2929)	
City (US)			
Honolulu	0.6966		(baseline)
	(0.4543)		
Las Vegas	-1.9756***		-2.5093***
	(0.3809)		(0.4540)
Los Angeles	-2.0664***		-2.4644***
	(0.3624)		(0.4366)
Miami	-0.4778		-1.0022**
	(0.3763)		(0.4742)
New York City	-2.0782***		-2.4550***
	(0.3620)		(0.4620)
Orlando	-2.1840***		-3.1127***
	(0.4153)		(0.4852)
San Francisco	-0.7932**		-0.9222**
	(0.3598)		(0.4574)
Cons	1.2900**	1.3748**	0.3156
	(0.5696)	(0.5856)	(1.0031)
/lnalpha	-0.9290	-1.2647	-0.6277
	(0.0764)	(0.0912)	(0.1448)
alpha	-1.078763	0.2823	0.5338
	(0.7793)	(0.0257)	(0.0773)
N	319	234	85
LR chi-squared	518.93	395.33	149.27
Prob>chi-squared	0.0000	0.0000	0.0000
Pseudo R^2	0.114	0.123	0.116
AIC	4078.164	2866.289	1175.786
BIC	4172.294	2928.484	1217.311

Note: Significance level: *< 0.1 **< 0.05 ***< 0.01.

5.2.2 The Role of Photo Quality: Matching on Cross-sectional Data

Using the same cross-sectional data as in Section 5.2.1, this part presents propensity score matching to examine the net effect of the quality of each hotel's primary photo on consumers' page-view and meta-click behavior by matching samples that were similar on other aspects. Covariates used for propensity score matching included covariates in Model (7): *CPMS_primary*, *ADR-30d*, *Rating*, *ReviewNum*, *LocationRating*, *TotalRooms*, *NumbPhoto*, *NumAmenities*, and *City*. Additionally, to improve matching accuracy, samples in cities with less than 10 hotels were dropped. Samples were first pooled and then split by EU and U.S. samples for analysis. As indicated in Figure 25, the density distributions of propensity scores were balanced after matching, and the average treatment effect (ATE) in each population was estimated. As listed in Tables 31–32, photo quality did not have a significant effect on consumers' page-view or meta-click behavior. Accordingly, H5a and H5b were not supported; the quality of a hotel's primary photo had no direct effect on consumers' aggregated page-view or meta-click behavior.

Table 32. ATE of Photo Quality in Population on Page-view Behavior

DV: *TAUniqPageview*	**(16)**			**(17)**			**(18)**		
	Sample of all major cities $N = 124$			**EU sample** $N = 76$			**U.S. sample** $N = 48$		
	Coefficient (AI Robust SE)	*z*	*p*	Coefficient (AI Robust SE)	*z*	*p*	Coefficient (AI Robust SE)	*z*	*p*
Average treatment effect in population	-62.18 (69.14)	-0.90	0.37	-89.11 (78.41)	-1.14	0.26	-39.75 (62.10)	-0.64	0.52

Table 33. ATE of Photo Quality in Population on Meta-click Behavior

DV: *UniqMetaclicks*	**(19)**			**(20)**			**(21)**		
	Sample of all major cities $N = 124$			**EU sample** $N = 76$			**U.S. sample** $N = 48$		
	Coefficient (AI Robust SE)	z	p	Coefficient (AI Robust SE)	z	p	Coefficient (AI Robust SE)	z	p
Average treatment effect in population	-69.41 (52.23)	-1.33	0.18	-82.71 (60.24)	-1.37	0.17	-22.90 (68.30)	-0.34	0.74

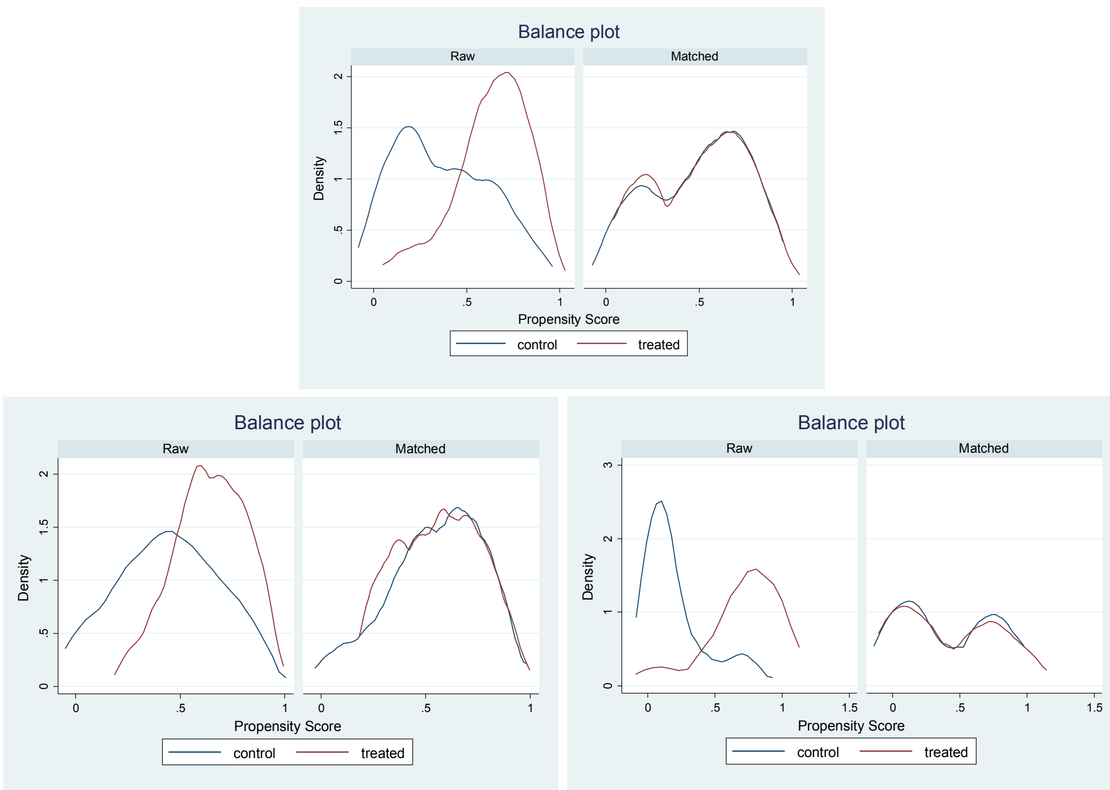

Figure 25. Balance Plot of Propensity Scores Before and After Matching for Samples in All Major Cities (Upper), EU cities (Lower Left), and U.S. cities (Lower Right)

5.2.3 The Roles of CPMS and Photo Quality: Regression on Panel Data

This part of the study focused on a set of hotels ($N = 9$) that changed their primary photos within 30 days to explore the role of hotel photos on consumers' booking-related behavior within each hotel. Data were aggregated at each hotel on a daily basis. Time-varying predictors included the average daily rate (ADR_{it}) and CPMS scores of each hotel's primary photo before and after changes ($CPMS\_primary_{it}$). Time-variant dependent variables included $TAUniqPageview_{it}$ and $UniqMetaclicks_{it}$. For this small sample set, each hotel's primary photos were collected before and after being changed. The photos were each rated by three independent raters based on CPMS and photo quality. Scores were gathered separately from different raters. CPMS scores and photo quality data were collected using the same procedure and scales as in Study 1. After aggregation, data comprised a balanced panel dataset with each hotel containing 31 observations (of daily data for 31 days). In total, 279 data points were subjected to analysis with $TAUniqPageview_{it}$ and $UniqMetaclicks_{it}$ as dependent variables and ADR_{it} and $CPMS\_primary_{it}$ as independent variables.

Table 34. Results of Linear Regression with Panel-corrected Standard Errors

	TAUniqPageview	***UniqMetaclicks***
	Model estimation (with panel-corrected standard errors)	
	(22)	(23)
ADR	-0.0005*** (0.0001)	-0.0006*** (0.0001)
CPMS_primary	26.9955*** (5.5665)	25.63158*** (5.1750)
PhotoQual	5.5071*** (0.9155)	4.1058*** (0.7586)
Cons	-76.2393*** (16.9789)	-72.3191*** (15.4667)
Number of observations	279	279
Number of groups	9	9
R^2	0.2218	0.2446

This portion of analysis included linear regression with panel-corrected standard errors (xtpcse in Stata). This approach assumes disturbances to be heteroskedastic (i.e., each panel has its own variance) and contemporaneously correlated across panels (i.e., each pair of panels has its own covariance). As indicated in the following model, when CPMS scores and photo quality were each included in the model, *CPMS_primary* was positive and significant when explaining page-view and meta-click behavior. However, photo quality (*PhotoQual*) yielded no significant effect on page-view behavior or meta-click behavior. Similar to the findings in Section 5.2.2, the quality of a hotel's primary photo was found to have no direct effect on consumers' page views and meta-click behavior. Therefore, H3a and H4a were supported but H5a and H5b were not.

To summarize, through two studies, this dissertation examined the roles of hotel photos in consumers' online hotel booking behavior. Specifically, the results of Study 1 suggested that specific content object features and global graphic quality features can contribute to individuals' environmental perceptions on aspects informing visitors' overall environmental perceptions (CPMS). Through generalized linear regression and propensity score matching of a set of cross-sectional data and panel regression of a set of panel data, this study also uncovered how CPMS can drive consumers' downstream booking-related behavior and pointed to the additional effect of photo quality on booking-related behavior. Results further suggested that (a) CPMS may fully mediate the relationship between photo quality and consumers' page-view and meta-click behavior and (b) photo quality may have no direct effect on consumers' page-view and meta-click behavior.

CHAPTER 6

CONCLUSION, IMPLICATIONS, LIMITATIONS, AND FUTURE RESEARCH

This chapter summarizes the main findings and conclusions of this research. The theoretical and managerial contributions of this research are next discussed. In addition, limitations regarding the research approach, sampling, and analysis are addressed along with future research directions.

6.1 Conclusions

Through two studies, this dissertation uncovered the roles of online photos in mediating hotel-based environmental experiences and driving online booking-related behavior. The research used insights from environmental psychology, computer vision, image processing theories, and the medium theory to present consumers' perception of the mediated servicescape (CPMS) as the focal variable connecting online hotel photos with customers' booking-related behavior.

Specifically, Study 1 adopted crowdsourcing and computational approaches to uncover the structure and antecedents of CPMS, thus linking local content object features and global graphic quality features of hotel photos to individuals' shared environmental experiences. The results of Study 1 showed that the dimensions of the mediated servicescape, including color, lighting, furnishings, layout, and style, could contribute significantly to CPMS formation. In particular, individuals' environmental perceptions of furnishings had the strongest influences on CPMS while environmental perceptions of layout were weakest. Additionally, non-negligible correlations were identified among mediated servicescape dimensions, indicating that CPMS is structurally distinct from the perceived servicescape in an on-site context: the traditional perceived servicescape refers to one's overall environmental perceptions, organized by different senses and formed based on all environmental stimuli to which individuals are exposed during a certain period; differently, CPMS encompasses environmental perceptions predominantly organized through vision and based on available information (and the quality of that information) conveyed through a single static image. Therefore, the formation of CPMS and its dimensions depends heavily on a photo's material settings (content object features) and graphical settings (graphic quality features).

Exploratory analysis of the antecedents of CPMS indicated that, in terms of material settings, the materials of the most salient object and the presence of windows and window-related aspects each significantly influenced CPMS formation. Glass and foliage had particularly positive effects on CPMS whereas fabric and plastic had negative effects. The positive impact of glass converged with the positive impacts of the presence of windows and a pleasant window view, indicating that windows in a hotel's interior space can provide positive environmental cues that heighten individuals' perceptions of various environmental aspects to lead to enhanced overall environmental perceptions of a hotel. Regarding graphical settings, high-quality photos with bright and even lighting, appropriate saturation, and good composition that follow aesthetic rules and present rich information can further enhance CPMS.

With a sample of cross-sectional data and a sample of panel data, Study 2 uncovered the role of hotel photos in informing individuals' online booking-related behavior. When comparing different hotels based on cross-sectional data, results indicated that, similar to review rating scores, CPMS scores of each hotel's primary photo and the average CPMS score (of four selected interior photos representative of the hotel's environment) are valid indicators of a hotel's quality and performance. A high CPMS score for a hotel's primary photo was related to increased page views in the U.S. market. High average CPMS scores for four selected interior photos were associated with increased meta-click behavior in the EU and U.S. markets. Additionally, photo quality was found to have no direct effect on consumers' page-view and meta-click behavior. In other words, CPMS fully mediated the relationship between photo quality and consumers' page-view and meta-click behavior.

6.2 Theoretical Implications

This research contributes to the extant body of literature in several ways. As the first study to present the CPMS concept, the perceived servicescape is differentiated in an online photo-mediated context and traditional on-site context. Findings demonstrated that CPMS is structurally distinct from the perceived servicescape in traditional on-site settings, as CPMS refers to a perception based on the visual representation of an actual environment. Specifically, CPMS is (a) predominantly organized by and formed through vision, (b) depends largely on available information and how that information is presented through media (e.g., online photos), and (c) connects online hotel photos to consumers' online booking-related behavior.

First, this research identified key mediated servicescape dimensions that can be inferred from visual stimuli and tested the relationships of these dimensions with CPMS. Five visual mediated servicescape dimensions (i.e., color, lighting, furnishings, layout, and style) were then identified and tested following a thorough literature review. These dimensions are visually based and can jointly influence CPMS formation. Using structural equation modeling, this research corrected misspecifications in the relationship between servicescape dimensions and the perceived servicescape in prior literature and confirmed formative/causal relationships between mediated servicescape dimensions and CPMS. Further, individuals were found to assign different weights to the above servicescape dimensions when forming overall environmental perceptions (i.e., CPMS) in an online photo-mediated context. Specifically, individuals gave more weight to dimensions (e.g., furnishings) less likely to be affected by photo mediation and relied less on dimensions (e.g., layout) more likely to be influenced by such mediation.

Second, this research explored key antecedents in hotel photos that can influence individuals' shared environmental experiences. In particular, key local content object features (i.e., the material of salient objects and window-related features) and global graphic quality features (i.e., variables of color effects, composition, and overall graphic quality) were identified that significantly influence individuals' inferences about a hotel's environment and contribute to CPMS formation. The identified relationships between the antecedents and CPMS effectively bridge online and offline contexts and demonstrate the unique capabilities and constraints of media-static photos in storing and staging on-site hotel experiences.

Third, this research linked online hotel photos to consumers' online booking-related behavior via CPMS. With real-world consumer behavior data, hotels were found to potentially attract consumers and boost online traffic by improving visitors' environmental perceptions using appealing hotel photos. Additionally, photo quality may play an additional role in directly explaining online booking-related behavior. This finding implies that different mechanisms may be at play when individuals process online hotel photos in the online booking context.

Last but not least, the discovered nuances of CPMS provide a conceptual basis for related research on mediated experiences. Given that the current research suggests that mediated environments presented through various media can represent actual environments (but are not necessarily equal to that environment) and can be heavily affected by media-based capabilities and constraints, scholars should be cognizant of media characteristics when using certain media representations to evaluate customers' experiences. In particular, unlike direct experiences, mediated experiences can be constrained or enhanced by the media, and the mediated experiences that researchers are aiming to manipulate or measure are bounded by the types of media used.

6.3 Managerial Implications

Managerially, this research contributes to an understanding of online hotel photos in the following ways. First, findings point to specific guidelines for managers in taking and choosing appealing online hotel photos to promote their hotel properties. Unlike photography in the art sphere or other contexts, where aesthetics, mystery, and meaning are emphasized, the key to an effective online hotel photo is to provide rich, relevant information that highlights the best part of a hotel's environment. Results demonstrated that hotels should take and select photos that showcase an entire area/space (vs. a small part of that space) that is open, bright, furnished, or decorated with quality materials. Hotels should also arrange visual elements in photos in an aesthetically pleasing, balanced manner.

Second, by using actual behavioral data, this research demonstrated the value of appealing hotel photos in soliciting online traffic. In certain markets, the value of pleasing hotel photos was comparable to having positive online reviews in terms of soliciting patrons. Given that TripAdvisor and other online booking platforms are increasingly providing photos and other visual representations (e.g., panoramic, video, and virtual 3D views) of hotel properties, the value of effective visuals is only expected to increase for the foreseeable future.

6.4 Limitations and Future Research

The research has several limitations in terms of sampling and data collection. First, because relevant property information was provided by TripAdvisor, the scope of the selected hotels' geographical regions and cities did not allow for further control of potential covariates, which could compromise the explanatory power of statistical models. Future photo-related studies should focus on obtaining higher-quality data by reducing and controlling variance attributable to other aspects such as location, hotel level, and hotel type.

Second, although crowdsourcing is a valid approach to gathering data on shared individual perceptions in computer vision (Nguyen et al. 2018), improved precision of rating values and classification could be obtained by increasing the number of individual raters for each photo. Additional, compared to the single-stimulus approach (e.g., presenting a single photo and asking raters to provide their judgment of an absolute value for that photo), a pair-wise approach (e.g., presenting two photos at a time and asking individuals to select the better one) could make the task easier for participants and improve rating accuracy (Mantiuk, Tomaszewska, and Mantiuk 2012). Even so, this approach is an expensive alternative to obtaining individual perceptions. Future research could adopt a method to collect more accurate values from a crowd to enhance results' validity.

As an exploratory study involving the nature of CPMS and connecting photo content and features to consumers' online behavior through CPMS, the findings of this research deepen our understanding of the role of visual media in online booking contexts. Based on these results, future research can use automated analysis to extract relevant content and graphic features or develop deep learning neural networks to predict CPMS scores for hotel photos and offer suggestions to help hotels improve their online photos. Additionally, as the current research examined CPMS mostly based on static photos, future work could include other visual media (e.g., panoramic, video, or virtual 3D views) to paint a more vivid picture of the mediated experience.

REFERENCES CITED

Alfakhri, Demah, D. Harness, John Nicholson, and Tina Harness. 2018. "The Role of Aesthetics and Design in Hotelscape: A Phenomenological Investigation of Cosmopolitan Consumers." *Journal of Business Research* 85:523–31.

Alumran, Arwa, Xiang-Yu Hou, Jiandong Sun, Abdullah A. Yousef, and Cameron Hurst. 2014. "Assessing the Construct Validity and Reliability of the Parental Perception on Antibiotics (PAPA) Scales." *BMC Public Health* 14:73.

Anderson, John R. 2005. *Cognitive Psychology and Its Implications*. New York, NY: Macmillan.

Ariffin, Ahmad Azmi M., Ehsaneh Nejad Nameghi, and Noor Izyana Zakaria. 2013. "The effect of hospitableness and servicescape on guest satisfaction in the hotel industry." *Canadian Journal of Administrative Sciences / Revue Canadienne des Sciences de l'Administration* 30(2):127–37.

Arora, Paras. 2018. "The Dominick Hotel Debuts in New York City at the Height of Luxury." *That Stunning Guy*. Retrieved October 28, 2019 (https://thatstunningguy.com/dominick-hotel-debuts-new-york-city-height-luxury/).

Baek, Jooa, and Chihyung Michael Ok. 2017. "The Power of Design: How Does Design Affect Consumers' Online Hotel Booking?" *International Journal of Hospitality Management* 65:1–10.

Baker, J., D. Grewal, and A. Parasuraman. 1994. "The Influence of Store Environment on Quality Inferences and Store Image." *Journal of the Academy of Marketing Science* 22(4):328–39.

Banks, Martin S., Emily A. Cooper, and Elise A. Piazza. 2014. “Camera Focal Length and the Perception of Pictures.” *Ecological Psychology* 26(1–2):30–46.

Beckett, Jamie. 2017. “Room with a View: How Expedia Will Pick the Right Hotel Photos for You.” *The Official NVIDIA Blog*. Retrieved June 19, 2020 (https://blogs.nvidia.com/blog/2017/08/28/expedia-deep-learning-picks-hotel-photos/).

Bell, Paul, J. D. Fisher, and R. J. Loomis. 1978. *Environmental Psychology*. Philadelphia, PA: W. B. Saunders Co.

Bell, Russell A., and Richard C. Morey. 1996. “Purchase Situation Modeling: The Case of Hotel Selection Criteria for Corporate Travel Departments.” *Journal of Travel Research* 35(1):57–63.

Bell, Russell A., and Richard C. Morey. 1997. “Are You in the Book?: Hotel Attributes Bundles and Corporate Travel Departments.” *The Cornell Hotel and Restaurant Administration Quarterly* 38(2):55–61.

Bell, Sean, Paul Upchurch, Noah Snavely, and Kavita Bala. 2015. “Material Recognition in the Wild With the Materials in Context Database.” Pp. 3479–87 in.

Berger, Joseph, B., B. P. Cohen, and Morris Zelditch Jr. 1966. “Status Characteristics and Expectation States.” Pp. 29–46 in *Sociological Theories in Progress,*. Vol. 1, edited by J. Berger B., M. Zelditch Jr., and B. Anderson. Boston, MA: Houghton Mifflin.

Berger, Joseph, M. H. Fisek, R. Z. Norman, and M. Zelditch Jr. 1977. *Status Characteristics and Social Interaction: An Expectation States Approach.* New York, NY: Elsevier Scientific Pub. Co., Inc.

Berscheid, Ellen, Karen Dion, Elaine Walster, and G. William Walster. 1971. “Physical Attractiveness and Dating Choice: A Test of the Matching Hypothesis.” *Journal of Experimental Social Psychology* 7(2):173–89.

Berscheid, Ellen, and Elaine Walster. 1974. “Physical Attractiveness11Preparation of This Paper Was Facilitated by National Institute of Health Grant MH 16729, and National Science Foundation Grants GS-35157X and GS-30822X. We Should Also like to Thank Dr. John Arrowood and Dr. Marshall Dermer for Their Helpful Comments.” Pp. 157–215 in *Advances in Experimental Social Psychology*. Vol. 7, edited by L. Berkowitz. Academic Press.

Bezryadin, Sergey, Pavel Bourov, and Dmitry Ilinih. 2007. “Brightness Calculation in Digital Image Processing.” *International Symposium on Technologies for Digital Photo Fulfillment* 2007(1):10–15.

Birkhoff, G. D. 1933. *Aesthetic Measure*. Cambridge, MA: Harvard University Press.

Bitner, Mary Jo. 1992. “Servicescapes: The Impact of Physical Surroundings on Customers and Employees.” *Journal of Marketing* 56(2):57–71.

Bland, Eugene M., Gregory S. Black, and Kay Lawrimore. 2007. “Risk-Reducing And Risk-Enhancing Factors Impacting Online Auction Outcomes: Empirical Evidence From EBay Auctions |.” *Journal of Electronic Commerce Research* 8(4):236–43.

Blijlevens, Janneke, Claus-Christian Carbon, Ruth Mugge, and Jan P. L. Schoormans. 2012. “Aesthetic Appraisal of Product Designs: Independent Effects of Typicality and Arousal.” *British Journal of Psychology* 103(1):44–57.

Bloch, Peter H. 1995. “Seeking the Ideal Form: Product Design and Consumer Response.” *Journal of Marketing* 59(3):16–29.

Borji, A., and L. Itti. 2013. “State-of-the-Art in Visual Attention Modeling.” *IEEE Transactions on Pattern Analysis and Machine Intelligence* 35(1):185–207.

Brase, Gary L., and Gary Walker. 2004. “Male Sexual Strategies Modify Ratings of Female Models with Specific Waist-to-Hip Ratios.” *Human Nature* 15(2):209–24.

Braun, Jochen, and Bela Julesz. 1998. “Withdrawing Attention at Little or No Cost: Detection and Discrimination Tasks.” *Perception & Psychophysics* 60(1):1–23.

Breazeale, Michael, and Nicole Ponder. 2013. “Get the Picture? Visual Servicescapes and Self-Image Congruity.” *Journal of Business Research* 66(7):839–46.

Broadbent, D. E. 1958. *Perception and Communication.* Elmsford, NY: Pergamon Press.

Buschman, Timothy J., and Earl K. Miller. 2007. “Top-Down Versus Bottom-Up Control of Attention in the Prefrontal and Posterior Parietal Cortices.” *Science* 315(5820):1860–62.

Buss, David M., and David P. Schmitt. 1993. “Sexual Strategies Theory: An Evolutionary Perspective on Human Mating.” *Psychological Review* 100(2):204–32.

Callan, Roger J. 1998. “Attributional Analysis of Customers’ Hotel Selection Criteria by U.K. Grading Scheme Categories.” *Journal of Travel Research* 36(3):20–34.

Carrasco, Marisa. 2011. “Visual Attention: The Past 25 Years.” *Vision Research* 51(13):1484–1525.

Carretié, Luis. 2014. “Exogenous (Automatic) Attention to Emotional Stimuli: A Review.” *Cognitive, Affective, & Behavioral Neuroscience* 14(4):1228–58.

Cash, Thomas F., and JoAnne Kehr. 1978. “Influence of Nonprofessional Counselors’ Physical Attractiveness and Sex on Perceptions of Counselor Behavior.” *Journal of Counseling Psychology* 25(4):336–42.

Cavanagh, Patrick, Martin Arguin, and Anne Treisman. 1990. “Effect of Surface Medium on Visual Search for Orientation and Size Features.” *Journal of Experimental Psychology: Human Perception and Performance* 16(3):479–91.

Chan, S. L., W. H. Ip, and V. Cho. 2010. “A Model for Predicting Customer Value from Perspectives of Product Attractiveness and Marketing Strategy.” *Expert Systems with Applications* 37(2):1207–15.

Childers, Terry L., and Michael J. Houston. 1984. “Conditions for a Picture-Superiority Effect on Consumer Memory.” *Journal of Consumer Research* 11(2):643–54.

Chronis, Athinodoros. 2019. “The Staging of Contested Servicescapes.” *Journal of Service Research* 22(4):456–73.

Cicchetti, Domenic V. 1994. “Guidelines, Criteria, and Rules of Thumb for Evaluating Normed and Standardized Assessment Instruments in Psychology.” *Psychological Assessment* 6(4):284–90.

Clarke, Ian, and Ruth A. Schmidt. 1995. “Beyond the Servicescape: The Experience of Place.” *Journal of Retailing and Consumer Services* 2(3):149–62.

Corbetta, Maurizio, and Gordon L. Shulman. 2002. “Control of Goal-Directed and Stimulus-Driven Attention in the Brain.” *Nature Reviews Neuroscience* 3(3):201–15.

Countryman, Cary C., and SooCheong Jang. 2006. “The Effects of Atmospheric Elements on Customer Impression: The Case of Hotel Lobbies.” *International Journal of Contemporary Hospitality Management* 18(7):534–45.

Creusen, Mariëlle E. H., and Jan P. L. Schoormans. 2005. “The Different Roles of Product Appearance in Consumer Choice.” *Journal of Product Innovation Management* 22(1):63–81.

Crnojevac, Igor H., Jadranka Gugić, and Saša Karlovčan. 2010. “ETourism: A Comparison of Online and Offline Bookings and the Importance of Hotel Attributes.” *Journal of Information and Organizational Sciences* 34(1):41–54.

CrowdRiff + Skift. 2019. “Free Email Course: A Guide to Using Visuals for Travel and Tourism Marketers.” *Skift*. Retrieved November 29, 2019 (https://skift.com/2019/06/26/free-email-course-a-guide-to-using-visuals-for-travel-and-tourism-marketers/).

Dedeoğlu, Bekir Bora, Kemal Gürkan Küçükergin, and Sevgi Balıkçıoğlu. 2015. “Understanding the Relationships of Servicescape, Value, Image, Pleasure, and Behavioral Intentions Among Hotel Customers.” *Journal of Travel & Tourism Marketing* 32(sup1):S42–61.

Di Stasi, Leandro L., Andrés Catena, José J. Cañas, Stephen L. Macknik, and Susana Martinez-Conde. 2013. “Saccadic Velocity as an Arousal Index in Naturalistic Tasks.” *Neuroscience & Biobehavioral Reviews* 37(5):968–75.

Di, Wei, Neel Sundaresan, Robinson Piramuthu, and Anurag Bhardwaj. 2014. “Is a Picture Really Worth a Thousand Words?: - On the Role of Images in e-Commerce.” Pp. 633–642 in *Proceedings of the 7th ACM International*

Conference on Web Search and Data Mining, *WSDM '14*. New York, NY, USA: ACM.

Dickinger, Astrid, and Josef Mazanec. 2008a. "Consumers' Preferred Criteria for Hotel Online Booking." Pp. 244–54 in *Information and Communication Technologies in Tourism 2008*, edited by P. O'Connor, W. Höpken, and U. Gretzel. Springer Vienna.

Dickinger, Astrid, and Josef Mazanec. 2008b. "Consumers' Preferred Criteria for Hotel Online Booking." Pp. 244–54 in *Information and Communication Technologies in Tourism 2008*, edited by P. O'Connor, W. Höpken, and U. Gretzel. Springer Vienna.

Dixson, Alan F., Gayle Halliwell, Rebecca East, Praveen Wignarajah, and Matthew J. Anderson. 2003. "Masculine Somatotype and Hirsuteness as Determinants of Sexual Attractiveness to Women." *Archives of Sexual Behavior* 32(1):29–39.

Domencich, Thomas A., and Daniel McFadden. 1975. *Urban Travel Demand : A Behavioral Analysis*. Amsterdam: North-Holland Pub. Co.

Dong, Ping, and Noel Yee-Man Siu. 2013. "Servicescape Elements, Customer Predispositions and Service Experience: The Case of Theme Park Visitors." *Tourism Management* 36:541–51.

Duchowski, Andrew T. 2017. *Eye Tracking Methodology*. Cham: Springer International Publishing.

Durna, Ufuk, Bekir Bora Dedeoglu, and Sevgi Balikçioglu. 2015. "The Role of Servicescape and Image Perceptions of Customers on Behavioral Intentions in the Hotel Industry." *International Journal of Contemporary Hospitality Management*.

Dwoskin, Elizabeth. 2015. "New Software Sifts Photos for the Most Clickable." *Wall Street Journal*, October 1.

Eagly, A. H., R. D. Ashmore, M. G. Makhijani, and L. C. Longo. 1991. "What Is Beautiful Is Good, But…: A Meta-Analytic Review of Research on the Physical Attractiveness Stereotype." *Psychological Bulletin* 110(1):109–128.

Edwards, J. L. 2009. "Visual Rhetoric." Pp. 220–29 in *21st Century communication: A reference handbook*, edited by W. F. Eadie. Thousand Oaks, CA: Sage.

Egeth, Howard E., and Steven Yantis. 1997. "Visual Attention: Control, Representation, and Time Course." *Annual Review of Psychology* 48(1):269–97.

Elder, James, and Steven Zucker. 1993. "The Effect of Contour Closure on the Rapid Discrimination of Two-Dimensional Shapes." *Vision Research* 33(7):981–91.

Elkins, J. 2013. *Photography Theory*. New York, NY: Routledge.

Fleiss, J. L., B. Levin, and M. C. Paik. 2003. *Statistical Methods for Rates and Proportions (3rd Ed.)*. Hoboken, NJ: Wiley.

Fornell, Claes, and David F. Larcker. 1981. "Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics." *Journal of Marketing Research* 18(3):382–88.

Found, Andrew, Hermann J. Müller, and Birkbeck College. 2001. "Efficient Search for Size Targets on a Background Texture Gradient: Is Detection Guided by Discontinuities in the Retinal-Size Gradient of Items?" *Perception* 30(1):21–48.

Freeman, Michael. 2007. *The Photographer's Eye: Composition and Design for Better Digital Photos*. CRC Press.

Gangestad, Steven W., and Glenn J. Scheyd. 2005. "The Evolution of Human Physical Attractiveness." *Annual Review of Anthropology* 34(1):523–48.

Gangestad, Steven W., and Randy Thornhill. 2003. "Facial Masculinity and Fluctuating Asymmetry." *Evolution and Human Behavior* 24(4):231–41.

Gearing, Charles E., William W. Swart, and Turgut Var. 1974. "Establishing a Measure of Touristic Attractiveness." *Journal of Travel Research* 12(4):1–8.

Goodrich, Kendall. 2010. "What's Up?: Exploring Upper and Lower Visual Field Advertising Effects." *Journal of Advertising Research* 50(1):91–106.

Grammer, Karl, Bernhard Fink, Anders P. Møller, and Randy Thornhill. 2003. "Darwinian Aesthetics: Sexual Selection and the Biology of Beauty." *Biological Reviews* 78(3):385–407.

Grammer, Karl, and Randy Thornhill. 1994. "Human (Homo Sapiens) Facial Attractiveness and Sexual Selection: The Role of Symmetry and Averageness." *Journal of Comparative Psychology* 108(3):233–42.

Hair, J. F., W. C. Black, B. J. Babin, R. E. Anderson, and R. L. Tatham. 2006. *Multivariate Data Analysis (6th Ed.)*. Upper Saddle River, NJ: Pearson/Prentice Hall.

Hallgren, Kevin A. 2012. "Computing Inter-Rater Reliability for Observational Data: An Overview and Tutorial." *Tutorials in Quantitative Methods for Psychology* 8(1):23–34.

Han, Heesup, and Kisang Ryu. 2009. "The Roles of the Physical Environment, Price Perception, and Customer Satisfaction in Determining Customer Loyalty in the Restaurant Industry." *Journal of Hospitality & Tourism Research* 33(4):487–510.

Harris, Lloyd C., and Chris Ezeh. 2008. “Servicescape and Loyalty Intentions: An Empirical Investigation.” *European Journal of Marketing* 42(3/4):390–422.

Hasler, David, and Sabine E. Suesstrunk. 2003. “Measuring Colorfulness in Natural Images.” Pp. 87–95 in *Human Vision and Electronic Imaging VIII*. Vol. 5007. International Society for Optics and Photonics.

Heide, Morten, Kirsti Lærdal, and Kjell Grønhaug. 2007. “The Design and Management of Ambience—Implications for Hotel Architecture and Service.” *Tourism Management* 28(5):1315–25.

Hekkert, Paul, Dirk Snelders, and Piet C. W. Van Wieringen. 2003. “‘Most Advanced, yet Acceptable’: Typicality and Novelty as Joint Predictors of Aesthetic Preference in Industrial Design.” *British Journal of Psychology* 94(1):111–24.

Hightower, Roscoe, Michael K. Brady, and Thomas L. Baker. 2002. “Investigating the Role of the Physical Environment in Hedonic Service Consumption: An Exploratory Study of Sporting Events.” *Journal of Business Research* 55(9):697–707.

Hilton, James L., and John M. Darley. 1991. “The Effects of Interaction Goals on Person Perception.” Pp. 235–67 in *Advances in Experimental Social Psychology*. Vol. 24, edited by M. P. Zanna. Academic Press.

Holahan, Charles J. 1982. *Environmental Psychology.* New York, NY: Random House, Inc.

Hönekopp, Johannes. 2006. “Once More: Is Beauty in the Eye of the Beholder? Relative Contributions of Private and Shared Taste to Judgments of Facial Attractiveness.”

Journal of Experimental Psychology: Human Perception and Performance 32(2):199–209.

Hooper, Daire, Joseph Coughlan, and Michael R. Mullen. 2013. “The Servicescape as an Antecedent to Service Quality and Behavioral Intentions.” *Journal of Services Marketing* 27(4):271–80.

Houle, D. 1992. “Comparing Evolvability and Variability of Quantitative Traits.” *Genetics* 130(1):195–204.

Hsu, Tsuen-Ho, and Ling-Zhong Lin. 2006. “Using Fuzzy Set Theoretic Techniques to Analyze Travel Risk: An Empirical Study.” *Tourism Management* 27(5):968–81.

Hu, Yangzhou, and J. R. Brent Ritchie. 1993. “Measuring Destination Attractiveness: A Contextual Approach.” *Journal of Travel Research* 32(2):25–34.

Huang, Kai-Qi, Qiao Wang, and Zhen-Yang Wu. 2006. “Natural Color Image Enhancement and Evaluation Algorithm Based on Human Visual System.” *Computer Vision and Image Understanding* 103(1):52–63.

Huberman, Bernardo A., Peter L. T. Pirolli, James E. Pitkow, and Rajan M. Lukose. 1998. “Strong Regularities in World Wide Web Surfing.” *Science* 280(5360):95–97.

Im, Hyunjoo, Sharron J. Lennon, and Leslie Stoel. 2010. “The Perceptual Fluency Effect on Pleasurable Online Shopping Experience.” *Journal of Research in Interactive Marketing*.

Itti, L., C. Koch, and E. Niebur. 1998. “A Model of Saliency-Based Visual Attention for Rapid Scene Analysis.” *IEEE Transactions on Pattern Analysis and Machine Intelligence* 20(11):1254–59.

Itti, Laurent, and Christof Koch. 2001. “Computational Modelling of Visual Attention.” *Nature Reviews Neuroscience* 2(3):194–203.

Jang, SooCheong (Shawn), and Young Namkung. 2009. “Perceived Quality, Emotions, and Behavioral Intentions: Application of an Extended Mehrabian–Russell Model to Restaurants.” *Journal of Business Research* 62(4):451–60.

Janiszewski, Chris. 1998. “The Influence of Display Characteristics on Visual Exploratory Search Behavior.” *Journal of Consumer Research* 25(3):290–301.

Jarvis, Cheryl Burke, Scott B. MacKenzie, and Philip M. Podsakoff. 2003. “A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research.” *Journal of Consumer Research* 30(2):199–218.

Jiang, Han, Robert L. Browning, Mohammad M. Hossain, Hung-Jue Sue, and Mikihiko Fujiwara. 2010. “Quantitative Evaluation of Scratch Visibility Resistance of Polymers.” *Applied Surface Science* 256(21):6324–29.

Joshi, Dhiraj, Ritendra Datta, Elena Fedorovskaya, Quang-Tuan Luong, James Z. Wang, Jia Li, and Jiebo Luo. 2011. “Aesthetics and Emotions in Images.” *IEEE Signal Processing Magazine* 28(5):94–115.

Kahneman, Daniel. 2011. *Thinking, Fast and Slow*. Macmillan.

Kahneman, Daniel, and Jackson Beatty. 1966. “Pupil Diameter and Load on Memory.” *Science* 154(3756):1583–85.

Kale, Sudhir H., and Katherine M. Weir. 1986. “Marketing Third World Countries to the Western Traveler: The Case of India.” *Journal of Travel Research* 25(2):2–7.

Kanwisher, Nancy, and Ewa Wojciulik. 2000. "Visual Attention: Insights from Brain Imaging." *Nature Reviews Neuroscience* 1(2):91–100.

Kastner, Sabine, and Leslie G. Ungerleider. 2000. "Mechanisms of Visual Attention in the Human Cortex | Annual Review of Neuroscience." *Annual Review of Neuroscience* 23:315–41.

Kearney, Treasa, Joseph C. Coughlan, and Aileen Kennedy. 2013. "An Exploration of the Effects of the Servicescape on Customer and Employee Responses in a Grocery Retail Context." *Irish Journal of Management* 32:71–91.

Khorsand, Peyman, Tirin Moore, and Alireza Soltani. 2015. "Combined Contributions of Feedforward and Feedback Inputs to Bottom-up Attention." *Frontiers in Psychology* 6.

Kim, Woo Gon, and Yun Ji Moon. 2009. "Customers' Cognitive, Emotional, and Actionable Response to the Servicescape: A Test of the Moderating Effect of the Restaurant Type." *International Journal of Hospitality Management* 28(1):144–56.

Kirillova, Ksenia, and Janelle Chan. 2018. "'What Is Beautiful We Book': Hotel Visual Appeal and Expected Service Quality." *International Journal of Contemporary Hospitality Management* 30(3):1788–1807.

Koch, Christof, and Shimon Ullman. 1987. "Shifts in Selective Visual Attention: Towards the Underlying Neural Circuitry." Pp. 115–41 in *Matters of Intelligence*, edited by L. M. Vaina. Dordrecht: Springer Netherlands.

Koehn, Daryl. 2003. "The Nature of and Conditions for Online Trust." *Journal of Business Ethics* 43(1):3–19.

Kotler, Philip. 1973. “Atmospherics as a Marketing Tool.” *Journal of Retailing* 49:48–64.

Krages, B. 2005. *Photography: The Art of Composition*. New York, NY: Allworth Press.

Kurdi, Benedek, Shayn Lozano, and Mahzarin R. Banaji. 2017. “Introducing the Open Affective Standardized Image Set (OASIS).” *Behavior Research Methods* 49(2):457–70.

Lai, Kun, and Xiang (Robert) Li. 2016. “Tourism Destination Image: Conceptual Problems and Definitional Solutions.” *Journal of Travel Research* 55(8):1065–80.

Landis, J. Richard, and Gary G. Koch. 1977. “The Measurement of Observer Agreement for Categorical Data.” *Biometrics* 33(1):159–74.

Langlois, Judith H., Lisa Kalakanis, Adam J. Rubenstein, Andrea Larson, Monica Hallam, and Monica Smoot. 2000. “Maxims or Myths of Beauty? A Meta-Analytic and Theoretical Review.” *Psychological Bulletin* 126(3):390–423.

Laskey, Henry A., Bruce Seaton, and J. A. F. Nicholls. 1994. “Effects of Strategy and Pictures in Travel Agency Advertising.” *Journal of Travel Research* 32(4):13–19.

Law, Rob, and Catherine Cheung. 2005. “Weighing of Hotel Website Dimensions and Attributes.” Pp. 350–59 in *Information and Communication Technologies in Tourism 2005*, edited by A. J. Frew. Springer Vienna.

Law, Rob, and Cathy H. C. Hsu. 2005. “Customers’ Perceptions on the Importance of Hotel Web Site Dimensions and Attributes.” *International Journal of Contemporary Hospitality Management*.

Law, Rob, and Cathy H. C. Hsu. 2006. “Importance of Hotel Website Dimensions and Attributes: Perceptions of Online Browsers and Online Purchasers.” *Journal of Hospitality & Tourism Research* 30(3):295–312.

Lee, Matthew K. O., and Efraim Turban. 2001. “A Trust Model for Consumer Internet Shopping.” *International Journal of Electronic Commerce* 6(1):75–91.

Lee, Mira, and Seounmi Youn. 2009. “Electronic Word of Mouth (EWOM).” *International Journal of Advertising* 28(3):473–99.

Lewis, Robert C. 1984. “Isolating Differences in Hotel Attributes.” *Cornell Hotel and Restaurant Administration Quarterly* 25(3):64–77.

Li, Ming, and Paul Vitanyi. 1997. *An Introduction to Kolmogorov Complexity and Its Applications*. New York, NY: Springer-Verlag.

Lin, Ingrid Y. 2004. “Evaluating a Servicescape: The Effect of Cognition and Emotion.” *International Journal of Hospitality Management* 23(2):163–78.

Lin, Ingrid Y. 2016. “Effects of Visual Servicescape Aesthetics Comprehension and Appreciation on Consumer Experience.” *Journal of Services Marketing* 30(7):692–712.

Lin, Ingrid Y., and Anna S. Mattila. 2010. “Restaurant Servicescape, Service Encounter, and Perceived Congruency on Customers’ Emotions and Satisfaction.” *Journal of Hospitality Marketing & Management* 19(8):819–41.

Lindsey, Delwin T., Angela M. Brown, Ester Reijnen, Anina N. Rich, Yoana I. Kuzmova, and Jeremy M. Wolfe. 2010. “Color Channels, Not Color Appearance or Color Categories, Guide Visual Search for Desaturated Color Targets.” *Psychological Science* 21(9):1208–14.

Little, A. C., D. M. Burt, I. S. Penton-Voak, and D. I. Perrett. 2001. "Self-Perceived Attractiveness Influences Human Female Preferences for Sexual Dimorphism and Symmetry in Male Faces." *Proceedings of the Royal Society of London. Series B: Biological Sciences* 268(1462):39–44.

Littlejohn, Stephen W., and Karen A. Foss. 2009. *Encyclopedia of Communication Theory*. SAGE.

Liu, Yinghua, and SooCheong (Shawn) Jang. 2009. "The Effects of Dining Atmospherics: An Extended Mehrabian–Russell Model." *International Journal of Hospitality Management* 28(4):494–503.

Louviere, JJ, AD Hensher, and DJ. Swait. 2000. *Stated Choice Methods*. New York, NY: Cambridge University Press.

Lovelock, Christopher, and Evert Gummesson. 2004. "Whither Services Marketing?: In Search of a New Paradigm and Fresh Perspectives." *Journal of Service Research* 7(1):20–41.

Lucas, Anthony. 2003. "The Determinants and Effects of Slot Servicescape Satisfaction in a Las Vegas Hotel Casino." *UNLV Gaming Research & Review Journal* 7(1).

Lundby, Knut. 2014. *Mediatization of Communication*. Berlin/Boston, GERMANY: De Gruyter, Inc.

Luo, Wei, Xiaogang Wang, and Xiaoou Tang. 2011. "Content-Based Photo Quality Assessment." Pp. 2206–13 in *2011 International Conference on Computer Vision*.

Machajdik, Jana, and Allan Hanbury. 2010. "Affective Image Classification Using Features Inspired by Psychology and Art Theory." Pp. 83–92 in *Proceedings of* *the 18th ACM international conference on Multimedia*, *MM '10*. Firenze, Italy: Association for Computing Machinery.

MacInnis, Deborah J., and Linda L. Price. 1987. "The Role of Imagery in Information Processing: Review and Extensions." *Journal of Consumer Research* 13(4):473–91.

MacKay, Kelly J., and Daniel R. Fesenmaier. 1997. "Pictorial Element of Destination in Image Formation." *Annals of Tourism Research* 24(3):537–65.

Madrigal, Robert, and Lynn R. Kahle. 1994. "Predicting Vacation Activity Preferences on the Basis of Value-System Segmentation." *Journal of Travel Research* 32(3):22–28.

Maloney, Laurence T., and David H. Brainard. 2010. "Color and Material Perception: Achievements and Challenges." *Journal of Vision* 10(9):19–19.

Manovich, Lev. 2001. *The Language of New Media*. MIT Press.

Mantiuk, Rafał K., Anna Tomaszewska, and Radosław Mantiuk. 2012. "Comparison of Four Subjective Methods for Image Quality Assessment." *Computer Graphics Forum* 31(8):2478–91.

Mari, Michela, and Sara Poggesi. 2013. "Servicescape Cues and Customer Behavior: A Systematic Literature Review and Research Agenda." *The Service Industries Journal* 33(2):171–99.

Mayo, E. J., and L. P. Jarvis. 1981. *The Psychology of Leisure Travel. Effective Marketing and Selling of Travel Services.* Boston, MA: CBI Publishing Company, Inc.

McAdams, Carrie J., and John H. R. Maunsell. 2000. “Attention to Both Space and Feature Modulates Neuronal Responses in Macaque Area V4.” *Journal of Neurophysiology* 83(3):1751–55.

Mccleary, Ken W., Pamela A. Weaver, and Joe C. Hutchinson. 1993. “Hotel Selection Factors as They Relate to Business Travel Situations.” *Journal of Travel Research* 32(2):42–48.

Mehta, Ashesh D., Istvan Ulbert, and Charles E. Schroeder. 2000. “Intermodal Selective Attention in Monkeys. II: Physiological Mechanisms of Modulation.” *Cerebral Cortex* 10(4):359–70.

Merriam-Webster. n.d. “Definition of VIBE.” Retrieved October 30, 2019 (https://www.merriam-webster.com/dictionary/vibe).

Meyrowitz, Joshua. 2019. “Medium Theory.” Pp. 1–7 in *The International Encyclopedia of Media Literacy*. American Cancer Society.

Mikalef, Patrick, Kshitij Sharma, and Ilias Pappas. 2018. “Social Commerce and Consumer Search Behavior: An Eye-Tracking Study.” *AMCIS 2018 Proceedings*.

Mitchell, Andrew A., and Jerry C. Olson. 1981. “Are Product Attribute Beliefs the Only Mediator of Advertising Effects on Brand Attitude?” *Journal of Marketing Research* 18(3):318–32.

Monsuwé, Toñita Perea Y., Benedict G. C. Dellaert, and Ko De Ruyter. 2004. “What Drives Consumers to Shop Online: A Literature Review. International Journal of Service Industry Management.” *Information Systems Res* 102–121.

Nagy, Allen L., Travis Young, and Kelly Neriani. 2004. “Combining Information in Different Color-Coding Mechanisms to Facilitate Visual Search.” *Vision Research* 44(25):2971–80.

Nakayama, Ken, and Manfred Mackeben. 1989. “Sustained and Transient Components of Focal Visual Attention.” *Vision Research* 29(11):1631–47.

Netemeyer, R. G., W. Bearden, and S. Sharma. 2003. *Scaling Procedures: Issues and Applications.* Thousand Oaks, CA: SAGE.

Nguyen, Laurent Son, Salvador Ruiz-Correa, Marianne Schmid Mast, and Daniel Gatica-Perez. 2018. “Check Out This Place: Inferring Ambiance From Airbnb Photos.” *IEEE Transactions on Multimedia* 20(6):1499–1511.

Nichols, Timothy. 2018. “Visuals Are The Key To Creating Great Customer-Brand Connections.” *Forbes*. Retrieved November 14, 2019 (https://www.forbes.com/sites/forbesagencycouncil/2018/04/27/visuals-are-the-key-to-creating-great-customer-brand-connections/).

Noone, Breffni M., and Stephani K. A. Robson. 2014. “Using Eye Tracking to Obtain a Deeper Understanding of What Drives Online Hotel Choice.” *Cornell Hospitality Report* 14(18):6–16.

Noone, Breffni M., and Stephani K. A. Robson. 2016. “Understanding Consumers’ Inferences from Price and Nonprice Information in the Online Lodging Purchase Decision.” *Service Science* 8(2):108–23.

Nummenmaa, Lauri, Jukka Hyönä, and Manuel G. Calvo. 2009. “Emotional Scene Content Drives the Saccade Generation System Reflexively.” *Journal of Experimental Psychology: Human Perception and Performance* 35(2):305–23.

Obrador, Pere. 2008. “Region Based Image Appeal Metric for Consumer Photos.” Pp. 696–701 in *2008 IEEE 10th Workshop on Multimedia Signal Processing*.

Özmen, Mustafa Utku. 2015. “Online Information Retrieval Behaviour and Economics of Attention.” *Online Information Review* 39(6):779–94.

P. Mobile. 2014. “The Science Behind Mobile Design.”

Pan, Bing, Lixuan Zhang, and Rob Law. 2013. “The Complex Matter of Online Hotel Choice.” *Cornell Hospitality Quarterly* 54(1):74–83.

Park, Sangwon, Yizhen Yin, and Byung-Gak Son. 2019. “Understanding of Online Hotel Booking Process: A Multiple Method Approach.” *Journal of Vacation Marketing* 25(3):334–48.

Payne, J. W., J. R. Bettman, and E. J. Johnson. 1993. *The Adaptive Decision Maker.* Cambridge, MA: Cambridge University Press.

Perrin, F. A. C. 1921. “Physical Attractiveness and Repulsiveness.” *Journal of Experimental Psychology* 4(3):203–17.

Petersen, Andrea. 2019. “The Hottest Perk in Tourism: Making the Crowds Disappear.” *The Wall Street Journal*. Retrieved July 3, 2020 (https://www.wsj.com/articles/the-hottest-perk-in-tourism-making-the-crowds-disappear-11565793755).

Phocuswright. 2017. *The Travel Marketer’s Guide to the U.S. Digital Travel Landscape*.

Pieters, Rik, and Michel Wedel. 2007. “Goal Control of Attention to Advertising: The Yarbus Implication.” *Journal of Consumer Research* 34(2):224–33.

Reimer, Anja, and Richard Kuehn. 2005. “The Impact of Servicescape on Quality Perception.” *European Journal of Marketing* 39(7/8):785–808.

Rhodes, Gillian, Leslie A. Zebrowitz, Alison Clark, S. Michael Kalick, Amy Hightower, and Ryan McKay. 2001. “Do Facial Averageness and Symmetry Signal Health?” *Evolution and Human Behavior* 22(1):31–46.

Richard, Michael D., and D. S. Sundaram. 1994. “A Model of Lodging Repeat Choice Intentions.” *Annals of Tourism Research* 21(4):745–55.

Riggio, Ronald E., and Barbara Throckmorton. 1988. “The Relative Effects of Verbal and Nonverbal Behavior, Appearance, and Social Skills on Evaluations Made in Hiring Interviews1.” *Journal of Applied Social Psychology* 18(4):331–48.

Riggio, Ronald E., Keith F. Widaman, Joan S. Tucker, and Charles Salinas. 1991. “Beauty Is More Than Skin Deep: Components of Attractiveness.” *Basic and Applied Social Psychology* 12(4):423–39.

Ritchie, J. R. Brent, and Michel Zins. 1978. “Culture as Determinant of the Attractiveness of a Tourism Region.” *Annals of Tourism Research* 5(2):252–67.

van Rompay, Thomas J. L., Peter W. de Vries, and Xaviera G. van Venrooij. 2010. “More than Words: On the Importance of Picture–Text Congruence in the Online Environment.” *Journal of Interactive Marketing* 24(1):22–30.

RotaCloud. 2016. “Everything You Need to Know About TripAdvisor Instant Booking.” *RotaCloud Blog*. Retrieved December 1, 2019 (https://blog.rotacloud.com/trip-advisor-instant-bookings-guide/).

Ryu, Kisang, and SooCheong Shawn Jang. 2007. “The Effect of Environmental Perceptions on Behavioral Intentions through Emotions: The Case of Upscale Restaurants.” *Journal of Hospitality & Tourism Research* 31(1):56–72.

Salvucci, Dario D., and Joseph H. Goldberg. 2000. "Identifying Fixations and Saccades in Eye-Tracking Protocols." Pp. 71–78 in *Proceedings of the 2000 symposium on Eye tracking research & applications*, *ETRA '00*. Palm Beach Gardens, Florida, USA: Association for Computing Machinery.

San Pedro, Jose, and Stefan Siersdorfer. 2009. "Ranking and Classifying Attractiveness of Photos in Folksonomies." Pp. 771–780 in *Proceedings of the 18th International Conference on World Wide Web*, *WWW '09*. New York, NY, USA: ACM.

Santangelo, Valerio, and Emiliano Macaluso. 2013. "Visual Salience Improves Spatial Working Memory via Enhanced Parieto-Temporal Functional Connectivity." *Journal of Neuroscience* 33(9):4110–17.

Savakis, Andreas E., Stephen P. Etz, and Alexander C. P. Loui. 2000. "Evaluation of Image Appeal in Consumer Photography." Pp. 111–20 in *Human Vision and Electronic Imaging V*. Vol. 3959. International Society for Optics and Photonics.

Schall, Jeffrey D. 2002. "The Neural Selection and Control of Saccades by the Frontal Eye Field." *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences* 357(1424):1073–82.

Schawbel, Dan. 2012. "Why Visual Marketing Is Important for Brands Today." *Why Visual Marketing Is Important for Brands Today*. Retrieved November 14, 2019 (https://www.forbes.com/sites/danschawbel/2012/05/21/why-visual-marketing-is-important-for-brands-today/#56bc205b5b20).

Schiffman, H. R. 2001. *Sensation and Perception, 5th Edition.* New York, NY: Wiley.

Shankman, Samantha. 2015. "Hilton Finds Success With Google's More Visual, Detailed Hotel Ad Product." *Skift*. Retrieved November 29, 2019 (https://skift.com/2015/03/19/hilton-finds-success-with-googles-more-visual-detailed-hotel-ads/).

Sherry, J. F. 1998. "The Soul of the Company Store: Nike Town Chicago and the Emplaced Brandscape." Pp. 109–46 in *Servicescapes: The concept of place in contemporary markets*, edited by J. F. Sherry. Chicago, IL: NTC.

Singh, D., and S. Luis. 1995. "Ethnic and Gender Consensus for the Effect of the Waist-to-Hip Ratio on Judgment of Women's Attractiveness and Desirability for Relationships." *Ethology and Sociobiology* 16:484–507.

Sivaji, Ashok, Soo Shi Tzuaan, Lim Tek Yang, Mufaddal bin Ali Russin, Muthukrishnan Renganathan, and Seraliyev Bagdat. 2014. "Hotel Photo Gallery and Malaysian Travelers: Preliminary Findings." Pp. 258–63 in *2014 3rd International Conference on User Science and Engineering (i-USEr)*.

Smith, Peter, and Carolyn Lefley. 2015. *Rethinking Photography: Histories, Theories and Education*. London, UNITED KINGDOM: Routledge.

So, Kevin Kam Fung, Ceridwyn King, and Beverley Sparks. 2014. "Customer Engagement With Tourism Brands: Scale Development and Validation." *Journal of Hospitality & Tourism Research* 38(3):304–29.

Solli, Martin, and Reiner Lenz. 2009. "Color Based Bags-of-Emotions." Pp. 573–80 in *Computer Analysis of Images and Patterns*, *Lecture Notes in Computer Science*, edited by X. Jiang and N. Petkov. Berlin, Heidelberg: Springer.

Solli, Martin, and Reiner Lenz. 2010. "Emotion Related Structures in Large Image Databases." Pp. 398–405 in *Proceedings of the ACM International Conference on Image and Video Retrieval*, *CIVR '10*. New York, NY, USA: ACM.

Spielmann, Nathalie, Michel Laroche, and Adilson Borges. 2012. "How Service Seasons the Experience: Measuring Hospitality Servicescapes." *International Journal of Hospitality Management* 31(2):360–68.

Sriram, S., Pradeep K. Chintagunta, and Ramya Neelamegham. 2006. "Effects of Brand Preference, Product Attributes, and Marketing Mix Variables in Technology Product Markets." *Marketing Science* 25(5):440–56.

Statista. 2018. "Online Travel Booking: United States | Statista Market Forecast." *Statista*. Retrieved October 8, 2019 (https://www.statista.com/outlook/262/100/online-travel-booking/worldwide).

Stewart, David W., Sid Hecker, and John L. Graham. 1987. "It's More Than What You Say: Assessing the Influence of Nonverbal Communication in Marketing: ABSTRACT." *Psychology & Marketing (1986-1998); New York* 4(4):303.

Think with Google. 2016. "How Micro-Moments Are Reshaping the Travel Customer Journey." Retrieved (https://www.thinkwithgoogle.com/_qs/documents/59/micro-moments-reshaping-travel-customer-journey-b.pdf).

Treisman, A. M. 1988. "Features and Objects: The 14th Bartlett Memorial Lecture." *Quarterly Journal of Experimental Psychology—A* 40:201–237.

Treisman, A. M., and Garry Gelade. 1980. "A Feature-Integration Theory of Attention." *Cognitive Psychology* 12(1):97–136.

Treisman, Anne M. 1964. “Verbal Cues, Language, and Meaning in Selective Attention.” *The American Journal of Psychology* 77(2):206–19.

Treue, Stefan. 2001. “Neural Correlates of Attention in Primate Visual Cortex.” *Trends in Neurosciences* 24(5):295–300.

TripAdvisor. 2018. “Tripadvisor Photos: Six Common Questions from Hoteliers.” *TripAdvisor Insights*. Retrieved June 6, 2020 (https://www.tripadvisor.com/TripAdvisorInsights/w773).

Trivett, Vincent. 2013. “Visuals Are the New Language of Content Marketing in Travel.” *Skift*. Retrieved November 29, 2019 (https://skift.com/2013/10/10/visuals-are-the-new-language-of-content-marketing-in-travel/).

Trpkovski, Aleksandar. 2018. “Tourist Interest Mining From Online Hotel Photos.” rmaster, Victoria University.

Trpkovski, Aleksandar, Huy Quan Vu, Gang Li, Hua Wang, and Rob Law. 2018. “Automatic Hotel Photo Quality Assessment Based on Visual Features.” Pp. 394–406 in *Information and Communication Technologies in Tourism 2018*, edited by B. Stangl and J. Pesonen. Cham: Springer International Publishing.

Tse-Wei Chen, Yi-Ling Chen, and Shao-Yi Chien. 2008. “Fast Image Segmentation Based on K-Means Clustering with Histograms in HSV Color Space.” Pp. 322–25 in *2008 IEEE 10th Workshop on Multimedia Signal Processing*.

Tuch, Alexandre, Sylvia Kreibig, Sandra Roth, Javier Bargas-Avila, Klaus Opwis, and Frank Wilhelm. 2011. “The Role of Visual Complexity in Affective Reactions to Webpages: Subjective, Eye Movement, and Cardiovascular Responses.” *IEEE Transactions on Affective Computing* 2(4):230–36.

Turley, L. W., and Ronald E. Milliman. 2000. “Atmospheric Effects on Shopping Behavior: A Review of the Experimental Evidence.” *Journal of Business Research* 49(2):193–211.

Tussyadiah, Iis P., and Daniel R. Fesenmaier. 2009. “Mediating Tourist Experiences: Access to Places via Shared Videos.” *Annals of Tourism Research* 36(1):24–40.

Umberson, Debra, and Michael Hughes. 1987. “The Impact of Physical Attractiveness on Achievement and Psychological Well-Being.” *Social Psychology Quarterly* 50(3):227–36.

Valdez, Patricia, and Albert Mehrabian. 1994. “Effects of Color on Emotions.” *Journal of Experimental Psychology: General* 123(4):394–409.

Veryzer, Robert W., and J. Wesley Hutchinson. 1998. “The Influence of Unity and Prototypicality on Aesthetic Responses to New Product Designs.” *Journal of Consumer Research* 24(4):374–94.

Wakefield, Kirk L., and Jeffrey G. Blodgett. 1996. “The Effect of the Servicescape on Customers’ Behavioral Intentions in Leisure Service Settings.” *Journal of Services Marketing* 10(6):45–61.

Wakefield, Kirk L., and Jeffrey G. Blodgett. 1999. “Customer Response to Intangible and Tangible Service Factors.” *Psychology & Marketing* 16(1):51–68.

Wallendorf, Melanie, Joan Lindsey-Mullikin, and Ron Pimentel. 1998. “Gorilla Marketing: Customer Animation and Regional Embeddedness of a Toy Store Servicescape.” Pp. 151–198 in *Servicescapes: The Concept of Place in Contemporary Markets*, edited by J. F. Sherry. Chicago, IL: NTC.

Webster, Murray, and James E. Driskell. 1983. “Beauty as Status.” *American Journal of Sociology* 89(1):140–65.

Weintraub, Karen. 2018. “Blue or White Dress? Why We See Colours Differently.” *National Geography*, May 16.

Wicks, Bruce E., and Michael A. Schuett. 1994. “Using Travel Brochures to Target Frequent Travellers and ”Big-Spenders”.” *Journal of Travel & Tourism Marketing* 2(2–3):77–90.

Williams, Allan M., and Vladimír Baláž. 2015. “Tourism Risk and Uncertainty: Theoretical Reflections.” *Journal of Travel Research* 54(3):271–87.

Wind, Jerry, Paul E. Green, Douglas Shifflet, and Marsha Scarbrough. 1989. “Courtyard by Marriott: Designing a Hotel Facility with Consumer-Based Marketing Models.” *INFORMS Journal on Applied Analytics* 19(1):25–47.

Wolfe, J. M. 1994. “Guided Search 2.0: A Revised Model of Visual Search.” *Psychonomic Bulletin and Review* 1(2):202–238.

Wolfe, J. M. 2014. “Approaches to Visual Search.” in *The Oxford Handbook of Attention*, edited by A. C. (Kia) Nobre and S. Kastner.

Wolfe, J. M., K. R. Cave, and S. L. Franzel. 1989. “Guided Search: An Alternative to the Feature Integration Model for Visual Search.” *Journal of Experimental Psychology: Human Perception and Performance* 15:419–433.

Wolfe, J. M., and Todd S. Horowitz. 2004. “What Attributes Guide the Deployment of Visual Attention and How Do They Do It?” *Nature Reviews Neuroscience* 5(6):495–501.

Wright, Mike. 2019. “Instagram Replacing Travel Brochures as Survey Finds Social Media Influencing Half of Holidaymakers’ Choices.” *The Telegraph*, April 26.

Yarbus, A. L. 1967. *Eye Movements and Vision*. Springer.

Ye, Helen, and Iis P. Tussyadiah. 2011. “Destination Visual Image and Expectation of Experiences.” *Journal of Travel & Tourism Marketing* 28(2):129–44.

Yoo, Jungmin, and Minjeong Kim. 2014. “The Effects of Online Product Presentation on Consumer Responses: A Mental Imagery Perspective.” *Journal of Business Research* 67(11):2464–72.

Yoo, Kyung-Hyan, Marianna Sigala, and Ulrike Gretzel. 2016. “Exploring TripAdvisor.” Pp. 239–55 in *Open Tourism: Open Innovation, Crowdsourcing and Co-Creation Challenging the Tourism Industry*, *Tourism on the Verge*, edited by R. Egger, I. Gula, and D. Walcher. Berlin, Heidelberg: Springer.

Zapf, Antonia, Stefanie Castell, Lars Morawietz, and André Karch. 2016. “Measuring Inter-Rater Reliability for Nominal Data – Which Coefficients and Confidence Intervals Are Appropriate?” *BMC Medical Research Methodology* 16(1):1–10.

Zhang, Shunyuan, Dokyun (DK) Lee, Param Vir Singh, and Kannan Srinivasan. 2017. *How Much Is an Image Worth? Airbnb Property Demand Estimation Leveraging Large Scale Image Analytics*. *SSRN Scholarly Paper*. ID 2976021. Rochester, NY: Social Science Research Network.

APPENDICES

A. MEASUREMENT ITEMS IN STRUCTURAL EQUAITON MODELING

Table 35. Descriptive Analysis of Measurement Items in Structural Equation Modeling

Items	*N*	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Color1	1332	1.00	5.00	3.55	0.80	-0.37	-0.34
Color2	1332	1.00	5.00	3.65	0.79	-0.52	-0.18
Color3	1332	1.33	5.00	3.44	0.80	-0.28	-0.43
Color4	1332	1.00	5.00	3.49	0.87	-0.37	-0.50
Lighting1	1332	1.00	5.00	3.96	0.74	-0.82	0.67
Lighting2	1332	1.00	5.00	3.86	0.78	-0.70	0.15
Lighting3	1332	1.00	5.00	3.87	0.75	-0.72	0.38
Lighting4	1332	1.00	5.00	3.84	0.79	-0.67	0.16
Furnishing1	1332	1.00	5.00	3.55	0.89	-0.44	-0.46
Furnishing2	1332	1.33	5.00	3.45	0.84	-0.26	-0.64
Furnishing3	1332	1.00	5.00	4.00	0.78	-0.88	0.46
Layout1	1332	1.00	5.00	3.60	0.88	-0.30	-0.57
Layout2	1332	1.33	5.00	3.64	0.76	-0.38	-0.30
Layout3	1332	1.00	5.00	3.60	0.81	-0.39	-0.32
Layout4	1332	1.00	5.00	3.56	0.83	-0.20	-0.57
Layout5	1332	1.00	5.00	3.34	0.93	-0.06	-0.74
Style1	1332	1.00	5.00	3.42	0.90	-0.27	-0.62
Style2	1332	1.00	5.00	3.41	0.90	-0.36	-0.56
Style3	1332	1.00	5.00	3.44	0.89	-0.34	-0.54
Style4	1332	1.00	5.00	3.22	0.94	-0.15	-0.77
Style5	1332	1.00	5.00	3.39	0.92	-0.27	-0.66
Image1	1332	1.00	5.00	3.69	0.77	-0.71	0.21
Image2	1332	1.00	5.00	3.60	0.80	-0.58	-0.05
Image3	1332	1.33	5.00	3.59	0.75	-0.57	-0.02
Image4	1332	1.00	5.00	3.55	0.84	-0.44	-0.38
Approach1	1332	1.00	5.00	3.62	0.83	-0.49	-0.22
Approach3	1332	1.00	5.00	3.27	0.85	-0.22	-0.57
Approach4	1332	1.00	5.00	3.14	0.85	-0.14	-0.56

Note: The above values were calculated based on mean values rated by three independent raters.

B. MEASUREMENT ITEMS IN EXPLORATORY ANALYSIS

Table 36. Descriptive Analysis of Measurement Items in Exploratory Analysis

Variables	*N*	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
Local content object feature: Material of the Most Salient Object							
Fabric	1568	0	1	0.17	0.38	1.73	1.00
Foliage	1568	0	1	0.05	0.21	4.38	17.19
Glass	1568	0	1	0.30	0.46	0.86	-1.27
Leather	1568	0	1	0.01	0.11	9.18	82.39
Mirror	1568	0	1	0.01	0.11	9.18	82.39
Plastic	1568	0	1	0.08	0.27	3.04	7.27
Wallpaper	1568	0	1	0.03	0.17	5.58	29.21
Local content object feature: Window-related Variables							
Window (y=1, n=0)	999	0	1	0.47	0.50	0.13	-1.99
View outside the window (y=1, n=0)	999	0	1	0.17	0.38	1.72	0.95
A pleasant view outside the window (y=1, n=0)	999	0	1	0.11	0.32	2.45	3.99
Global graphic quality feature: Annotated Color Effect							
Photo quality (high=1, low=0)	999	0	1	0.51	0.50	-0.03	-2.00
High saturation (y=1, n=0)	999	0	1	0.28	0.45	0.97	-1.07
Warm hue (y=1, n=0)	999	0	1	0.49	0.50	0.02	-2.00
High brightness (y=1, n=0)	999	0	1	0.59	0.49	-0.36	-1.87
Even light distribution (y=1, n=0)	999	0	1	0.32	0.47	0.77	-1.41
Global graphic quality feature: Statistics of Color Effect							
Colorfulness	1568	6.28	111.49	41.15	15.17	0.52	0.30
Brightness	1568	42.50	214.92	131.66	26.62	-0.28	-0.06
Contrast	1568	20.88	88.15	62.10	9.32	-0.13	0.13
H-average	1568	0.00	359.00	57.04	87.13	2.63	5.41
S-average	1568	4.00	85.00	32.01	13.64	0.70	0.51
V-average	1568	23.00	90.00	58.98	10.46	-0.32	-0.04
Cluster1-H	1568	1.00	360.00	61.25	81.42	2.36	4.40
Cluster1-S	1568	0.00	92.00	24.69	20.71	0.91	0.08
Cluster1-V	1568	5.00	97.00	63.81	22.75	-0.82	-0.35
Cluster2-H	1568	0.00	360.00	61.83	84.12	2.32	4.11
Cluster2-S	1568	0.00	96.00	28.83	21.79	0.66	-0.47
Cluster2-V	1568	7.00	99.00	58.95	22.40	-0.51	-0.71
Cluster3-H	1568	0.00	360.00	64.79	89.84	2.22	3.60
Cluster3-S	1568	0.00	97.00	33.35	22.17	0.44	-0.70
Cluster3-V	1568	4.00	98.00	53.87	21.95	-0.11	-0.87

Table 36. Descriptive Analysis of Measurement Items in Exploratory Analysis (Continued)

Variables	*N*	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
Photo composition							
Rule of symmetry	990	0	1	0.15	0.36	1.96	1.84
Rue of thirds	990	0	1	0.32	0.47	0.75	-1.44
Close-up shot	990	0	1	0.21	0.41	1.45	0.10
Wide-angle lens	990	0	1	0.28	0.45	0.97	-1.07