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Understanding the captivating power of online scarcity messages: An eye-tracking study

Authors: Anjan Pal[1]*, Snehasish Banerjee[1], Ariadne Beatrice Kapetanaki[1], Theodoros Karapanagiotidis[2], Sanjit Samaddar[3]

[1] School for Business and Society, University of York,
Church Lane Building, York Science Park, York YO10 5ZF, UK
Emails:{anjan.pal; snehasish.banerjee; ariadne.kapetanaki}@york.ac.uk

[2] School of Psychology, University of Sussex
Email: T.Karapanagiotidis@sussex.ac.uk

[3] School of Arts and Creative Technologies, University of York
Email: sanjit.samaddar@york.ac.uk

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* **Corresponding author address:** School for Business and Society, University of York, Church Lane Building, York Science Park, York YO10 5ZF, UK

* **Corresponding author email address:** anjan.pal@york.ac.uk

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Abstract

In the hospitality industry, online scarcity messages (e.g., "20% discount, only 1 room left" or "20% discount, only 1 day left") are often used to increase purchases by capturing consumers' visual attention. Although the fundamental purpose of online scarcity messages is to grab visual attention, most studies have thus far relied on self-reported data. In consequence, the scholarly understanding of the extent to which online scarcity messages captivate consumers is limited. Therefore, the objective of this study is to examine the captivating power of online scarcity messages and their subsequent impact on purchase behaviours through eye-tracking. It additionally considers two pertinent factors: scarcity message type and booking lead-time. A 2 (scarcity type: limited-quantity vs. limited-time) x 2 (booking lead-time: short vs. long) between-participants eye-tracking experiment was conducted. Limited-quantity scarcity messages attracted greater visual attention compared with limited-time scarcity messages. Visual attention was the highest when individuals came across limited-quantity scarcity messages under a long booking lead-time. Moreover, fixating more on the scarcity cue, irrespective of its type, led to higher booking probability under a short booking lead-time and lower booking probability under a long booking lead-time. Theoretically, the study contributes to the hitherto-limited eye-tracking literature on online scarcity marketing communications. On the practical front, it provides actionable insights on ways firms could improve their online scarcity messaging tactics. The implications should, however, be viewed considering the limitation that only the context of budget hotels in a domestic destination was studied. Several future research directions are proposed.

Keywords: booking lead-time; budget hotel; eye-tracking; online scarcity; scarcity marketing promotions; visual attention.

1. Introduction

The popularity of ecommerce continues to soar. With 27% of the world population choosing to shop online, global ecommerce sales are projected to double by 2030 (Fokina, 2024). As impulse purchases usually constitute 40-80% of all online sales, ecommerce platforms utilise a plethora of technology-mediated triggers to draw consumer attention, create a fear of missing out (FOMO), and in turn nudge purchases (Çelik et al., 2023; Collins, 2024; Jabeen et al.; 2023; Khetarpal & Singh; 2024; Mou & Shin, 2018). Such triggers are critical because less than 2% of ecommerce website visits actually convert into purchases (Fokina, 2024).

For services such as hotels that are characterised by fixed capacity, perishable inventory and seasonal sensitivity, the trigger of online scarcity messages is commonly utilised (Chini, 2024; Collins, 2024; Noone & Lin, 2020). These are cues that nudge purchases by creating a sensation of insufficiency and FOMO, and thus constitute a crucial lever of revenue management (Aggarwal et al., 2011; Cengiz & Şenel, 2024; Jang et al., 2015; Khetarpal & Singh, 2024; Ladeira et al., 2023; Neumann et al., 2023). The assumption is that these cues would draw netizens' visual attention, which in turn would translate to downstream consequences such as purchases (Wooley et al., 2022).

However, the scholarly understanding of the extent to which online scarcity messages captivate consumers is limited. This is because even though the fundamental purpose of online scarcity messages is to grab visual attention, most studies have thus far relied on self-reported data (e.g., Nazlan et al., 2024; Noone & Lin, 2020; Song et al., 2019). But visual attention is seldom active and conscious (Wedel et al., 2023). Therefore, compared with self-

reported responses that can be impaired by inaccurate recall and response bias, data on consumers' eye movements can be more reliable for tracing the captivating power of online scarcity messages.

Yet, to the best of our knowledge, only one study on online scarcity messages—albeit not specifically in the context of hospitality—has thus far used eye-tracking (Mou & Shin, 2018). Expectedly, recent research calls for the use of eye-tracking to better understand the extent to which the presentation of deals on ecommerce platforms affects consumers' visual attention (Casado-Aranda et al., 2023; Kim et al., 2018; Wakefield at el., 2023) and consequently purchase decisions (Janiszewski et al., 2013; Bhatnagar & Orquin, 2022). Therefore, the objective of this study is to examine the captivating power of online scarcity messages and their subsequent impact on purchase behaviours through eye-tracking. The study is conducted in the context of hotels, an industry that lends itself readily to revenue management tactics (Chini, 2024).

The study additionally considers two factors that could affect the effectiveness of online scarcity messages: scarcity message type and booking lead-time. Price promotions are usually implemented through two broad types of online scarcity messages, namely limited-quantity and limited-time (Aggarwal et al., 2011; Cengiz & Şenel, 2024; Noone & Lin, 2020). Limited-quantity scarcity messages such as "only 3 rooms left at this price" highlight that the discounted room is available in limited amounts. In contrast, limited-time scarcity messages such as "the discount expires in 3 hours" emphasise the limited duration over which a price promotion is valid (Aggarwal et al., 2011). In the context of hotels, some studies have identified limited-quantity scarcity messages to be superior to their limited-time counterpart (Song et al., 2021). However, the question of whether this is necessarily due to the level of visual attention triggered by these two types of scarcity messages remains unaddressed.

Furthermore, investigating consumer behaviour in response to scarcity messages for hotels would be incomplete if one were to ignore booking lead-time—the interval between making a reservation and the time of the actual stay. This is due to the notion of temporal discounting, which expects individuals to value short-run benefits more highly compared with those in the long-term (Adler & Sarstedt, 2021; Angeletos et al., 2001). Therefore, consumers might value price discounts more when the interval between the point of booking and that of hotel stay is shorter than when it is longer (Park & Jang, 2018). Early bookings are obviously beneficial and profitable for businesses (Rahman et al., 2018). Yet, how temporal discounting affects visual attention and purchases has yet to be studied.

Offering an overview of key journal articles on online scarcity messages in hospitality, Table 1 reflects the originality of this study. Prior works in the field have widely used self-reported data (e.g., Nazlan et al., 2024). Some studies have considered scarcity message type but not booking lead-time (e.g., Song et al., 2021). Others have considered both scarcity message type and booking lead-time (e.g., Noone & Lin, 2020) but their reliance on self-reported data is not ideal to capture the captivating power of scarcity messages.

Advancing this body of literature, the present study sheds light on the joint impact of online scarcity message type and booking lead-time through eye-tracking while also collecting self-reported responses. It is significant for both theory and practice. On the theoretical front, it adds to the scholarly understanding of how online scarcity messages results in purchases. Methodologically, it contributes to the hitherto-limited eye-tracking literature on online scarcity marketing promotions, specifically in the context of hospitality. On the practical front, it provides actionable insights on ways firms could improve their online scarcity messaging tactics.

Table 1: Overview of related studies on online scarcity messages in hospitality.

Article	**Approach (self-reported data or eye-tracking)**	**Focus on scarcity message type**	**Focus on booking lead-time**
Li et al. (2021)	Self-reported data	X	X
Nazlan et al. (2024)	Self-reported data	X	X
Park et al. (2022)	Self-reported data	X	X
Huang et al. (2020)	Self-reported data	✓	X
Kim et al. (2020)	Self-reported data	✓	X
Song et al. (2021)	Self-reported data	✓	X
Noone & Lin (2020)	Self-reported data	✓	✓
Song et al. (2019)	Self-reported data	✓	✓
This article	**Eye-tracking along with self-reported data**	✓	✓

2. Theoretical Perspectives

Two main theoretical perspectives inform this study: cue utilisation theory and cognitive load theory. Cue utilisation theory posits that individuals rely on cues to gather information and make decisions, with the degree to which a cue is used in judgments depending on its perceived diagnosticity (Feldman & Lynch, 1988; Pervan & Martin, 2012). Consumers pay attention to a variety of cues on ecommerce portals ranging from online ratings and volume of ratings available to information about the product as well as scarcity messages (Kakaria et al., in press; Teubner & Graul, 2020). This study specifically seeks to understand how the cues of limited-quantity and limited-time scarcity messages are utilised differently in making purchase decisions while holding the other cues constant.

Consumers are often tempted by attention-grabbing scarcity cues because a product's desirability is amplified when it is presumed to be limited (Aggarwal et al., 2011; Çelik et al.,

2023; Cengiz & Şenel, 2024; Chen et al., 2021). Due to perceptions of FOMO (Khetarpal & Singh, 2024; Ladeira et al., 2023; Neumann et al., 2023), they might fixate on scarcity cues more than other cues prior to making a purchase decision. Thus, greater attention on scarcity cues could be a proxy for heightened sense of FOMO (Cengiz & Şenel, 2024; Khetarpal & Singh, 2024; Neumann et al., 2023). As a result, individuals could be more likely to take swift action such as making a purchase (Teubner & Graul, 2020). Thus, the allure of scarcity cues could transform browsers into buyers on ecommerce platforms. This is consistent with cue utilisation theory, according to which cues at hand play a crucial role in influencing decision-making (Kakaria et al., in press; Visentin & Tuan, 2021).

Cognitive load theory, the second underpinning theoretical perspective, posits that people have limited cognitive capacity to process information and hence can get overwhelmed more easily as the challenge in a task increases (Sweller, 1988). According to the theory, cognitive load can be of three types: germane, intrinsic, and extrinsic. Germane cognitive load involves information consolidation into one's long-term memory and is not relevant in the context of this study. Extrinsic cognitive load depends on the presentation of cues—in this case, the two types of online scarcity messages. Intrinsic cognitive load depends on the degree of challenge involved in the task.

All else being equal, making a booking decision is less challenging when booking lead-time is long vis-à-vis short. A short booking lead-time results in a high level of intrinsic cognitive load that in turn might adversely affect individuals' ability and willingness to pay attention to the available cues (Peng et al., 2019). Due to temporal discounting, when individuals consider near-future options, their focus on securing the booking is likely to be heightened, resulting in high intrinsic cognitive load. However, when individuals are not time-pressed, they could be nonchalant about the risk of missing out because of a delayed decision, thus giving rise to low intrinsic cognitive load (Adler & Sarstedt, 2021; Angeletos

et al., 2001; Noone & Lin, 2020). Thus, guided by cognitive load theory, this study argues that nuances in visual attention and purchase decisions because of scarcity type could be attributed to extrinsic cognitive load while those because of booking lead-time could be vestige of intrinsic cognitive load (Casado-Aranda et al., 2023).

3. Hypotheses Development

3.1. Limited-quantity and limited-time scarcity messages

Much research has been done on limited-quantity and limited-time scarcity messages. Limited quantity scarcity messages are those that place limits on the availability of commodities (Jang et al., 2015). Examples include "15 items left in stock" or "20% discount, only 1 room left." In contrast, limited-time scarcity messages are those that create a sense of urgency by highlighting temporal constraints on deals or offers (Hmurovic et al., 2023). Examples include "sale ends in 15 hours" and "20% discount, only 1 day left."

Limited quantity cues limit the availability of stock, highlighting the possibility of sellouts. This creates the impression that several consumers are interested in the commodity. This feeling of exclusivity and rarity in turn enhances its perceived value, thereby enhancing the likelihood of purchases (Chen et al., 2021; Ladeira et al., 2023). Limited-time cues, on the other hand, limit the temporal duration for which offers are available. This gives rise to a heightened sense of urgency, which in turn entices consumers to act quickly so as not to miss out (Khetarpal & Singh, 2024).

Some studies on offline scarcity messages have revealed that limited-quantity cues work better than limited-time cues in influencing consumer behaviour (Aggarwal et al., 2011; Jang et al., 2015). When a commodity is presented as being limited in terms of quantity, individuals can visualise its scarcity more readily compared to a time-limited offer that simply places a deadline on purchases. Furthermore, a purchase made by an individual for a

commodity with a limited-quantity offer reduces the number of available commodities for others. Thus, a limited-quantity offer makes individuals compete directly against one another to acquire the scarce resource (Kristofferson et al., 2017). In contrast, a limited-time offer does not make prospective buyers view one another as competitive threats (Aggarwal et al., 2011; Song et al., 2021). Therefore, the sense of competitive arousal triggered by a limited-quantity cue exceeds that created by a limited-time cue.

However, in the online hospitality context, the question of whether a limited-quantity scarcity message attracts greater visual attention than a limited-time cue remains unanswered (Noone & Lin, 2020). As visual attention has been associated with processing of information and increased visual attention has been linked to the importance of information for consumers (Ares et al., 2013; Badenes-Rocha et al., 2022), it could be interesting to see how visual attention differs between these two types of scarcity messages. Given that a limited-quantity message creates a greater sense of arousal than a limited-time cue (Aggarwal et al., 2011; Kristofferson et al., 2017), the former cue might require more elaborate information processing. Informed by cue utilisation theory and cognitive load theory (Feldman & Lynch, 1988; Pervan & Martin, 2012; Sweller, 1988), utilisation of a limited-quantity cue could result in greater extrinsic cognitive load and FOMO than that of a limited-time cue. In consequence, a limited-quantity cue might draw consumers' visual attention to a greater degree. Hence, the following hypothesis is posited:

H1: Compared with limited-time scarcity messages, limited-quantity scarcity messages result in greater visual attention.

3.2. Role of booking lead-time

When it comes to hotel booking—the context of our study, booking lead-time refers to the interval between making a reservation and the actual stay. It is an important factor to

consider when making booking decisions (Song et al., 2019). After all, booking hospitality and tourism services several months in advance is a standard practice (Genter & King, 2024). It enables tourists to take advantage of early bird discounts while avoiding the risk of potential unavailability (Rahman et al., 2018). Guided by the notion of temporal discounting, a short booking lead-time is expected to create a perception of immediacy and call for spontaneous decision-making (Adler & Sarstedt, 2021; Angeletos et al., 2001). This is likely to trigger the sense of urgency and FOMO to a greater extent than when booking lead-time is long (Noone & Lin, 2020).

For this reason, when consumers must make a booking decision with a short booking lead-time, they could be particularly eager to process the available information swiftly due to the high intrinsic cognitive load involved (Peng et al., 2019; Sweller, 1988). This can prompt the use of heuristics (Yao & Oppewal, 2016). Preference for heuristics to elaborate information processing could manifest in the form of reduced visual attention.

In contrast, when booking lead-time is long, consumers might not be too keen to rely on heuristics, given the low intrinsic cognitive load of the task (Peng et al., 2019; Sweller, 1988; Yao & Oppewal, 2016). Instead, the relatively greater willingness to invest time and effort in such a situation, compared with short booking lead-time, could manifest as heightened visual attention. Therefore, the following hypothesis is posited:

H2: Compared with a short booking lead-time, a long booking lead-time results in greater visual attention.

Furthermore, the relatively greater effect of limited-quantity (vs. limited-time) scarcity messages—as hypothesised in H1—and that of long (vs. short) booking lead-time—as hypothesised in H2—could create an additive effect. Therefore, when considering the interplay between scarcity message type and booking lead-time, the effect on visual attention

could be most pronounced when one comes across limited-quantity scarcity messages in a long booking lead-time condition. Limited-quantity cues could raise competitive arousal and extrinsic cognitive load (Kristofferson et al., 2017; Sweller, 1988), which in turn is likely to result in greater visual attention. In addition, a long booking lead-time could encourage elaborate information processing due to the low intrinsic cognitive load of the task (Peng et al., 2019; Yao & Oppewal, 2016). This, too, is likely to result in greater visual attention. Therefore, the following hypothesis is posited:

H3: There is a significant interaction effect between scarcity message type and booking lead-time. Visual attention should be the highest when individuals come across limited-quantity scarcity messages under a long booking lead-time.

3.3. Linking visual attention to booking probability

For any marketing stimuli to influence consumer outcomes, it must be visually noticed. According to theorisations related to the eye-mind connection, eye movement patterns offer insights into the cognitive processes that unfold during decision-making processes (Just & Carpenter, 1980). Prior marketing research has often linked visual attention—gauged through eye-tracking—to attitudes, perceptions and behaviours. Barring a few exceptions (e.g., He et al., 2014; Khachatryan et al., 2018; Simmonds et al., 2020), most such studies have found visual attention to predict consumer outcomes (e.g., Aribarg et al., 2010; Badenes-Rocha et al., 2022; Hwang & Lee, 2018; Scarpi et al., 2019; Shen et al., 2020).

Aribarg et al. (2010) established the relationship between visual attention to print ads and ad recognition. Scarpi et al. (2019) found that visual attention to products displayed on a shelf promotes purchases. In the context of hospitality and tourism, Shen et al. (2020) showed how visual attention to travel-related information on visitor guides affect destination

awareness. In the online context, Hwang and Lee (2018) found visual attention to product information to be related to product attitudes. According to Badenes-Rocha et al. (2022), visual attention to online cause-related marketing cues is a positive predictor of attitude toward the cause. Ye et al. (2013) confirmed visual attention to historical sales records on ecommerce platforms to be associated with purchase behaviours. Taken together, these studies suggest that the higher the visual attention attracted by a cue, the greater is its utilisation, and the higher is its likelihood to shape consumer outcomes. This is aligned with cue utilisation theory (Feldman & Lynch, 1988; Pervan & Martin, 2012). Therefore, the following hypothesis is posited:

H4: Visual attention to scarcity messages is positively related to hotel booking probability.

Furthermore, recent research highlights the possibility of visual attention to moderate the relationship between contextual characteristics around a stimulus and consumer outcomes (Badenes-Rocha et al., 2022; Mou & Shin, 2018; Scarpi et al., 2019; Simmonds et al., 2020). Whether visual attention moderates the relationship between scarcity message type and purchase probability in the hospitality context remains to be seen. Nonetheless, such a possibility cannot be ruled out. Given that a limited-quantity scarcity message is likely to result in greater extrinsic cognitive load and draw greater visual attention than a limited-time cue (Aggarwal et al., 2011; Kristofferson et al., 2017; Song et al., 2021), the relationship between the former and booking probability could be stronger. Hence, the following is hypothesised:

H5: Visual attention moderates the relationship between scarcity message type and booking probability.

Similarly, visual attention could moderate the relationship between booking lead-time and purchase probability. When travel time is in the distant future, visual attention could be high due to the low intrinsic cognitive load of the booking task (Peng et al., 2019; Sweller, 1988; Yao & Oppewal, 2016). The lack of time pressure could deter individuals from making swift purchases. Therefore, under a long booking lead-time, visual attention might not readily translate to bookings. In contrast, when travel time is soon, the relationship between visual attention and booking probability could be stronger due to the high intrinsic cognitive load of the booking task (Sweller, 1988). Hence, the following hypothesis is posited:

H6: Visual attention moderates the relationship between booking lead-time and booking probability.

4. Methods

4.1. Research Design

As the objective of this study is to examine the captivating power of online scarcity messages, an eye-tracking study was conducted to capture visual attention in an unobtrusive way. Specifically, the research design includes a 2 (scarcity type: limited-quantity vs. limited-time) x 2 (booking lead-time: short vs. long) between-participants eye-tracking experiment, complemented with an online survey. The study was conducted in the eye-tracking laboratory of a UK university in 2022.

4.2. Experimental Stimuli, Pre-tests and Manipulations

The study was set in the context of a fictitious budget hotel in London. A budget hotel was chosen because some prior studies on online scarcity have examined luxury hotels (e.g., Banerjee & Pal, 2020) while others have considered midscale hotels (e.g., Song et al., 2019; 2021). However, budget hotels have been largely overlooked. Given that the category of a

hotel shapes consumer perceptions (El-Said, 2020; Roy, 2023; Wąsowicz-Zaborek, 2025), findings from luxury or midscale hotels cannot be generalised to budget hotels. A fictitious hotel name was preferred to a real one in the experimental stimuli to control for participants' prior experiences and pre-existing attitudes.

The budget hotel was indicated to be in London, which was 2022's top trending tourist destination (Cunningham, 2022). As the site of data collection was the UK, using a non-UK destination was not an option. This is because manipulating short booking lead-time for hotels outside the UK would have been confounded by participants' individual circumstances and visa requirements. These would have been impossible to control. Therefore, by specifying a city in the UK, a consistent interpretation of short booking lead-time could be fostered among all participants. Also, as the UK is among the top countries in the budget hotels market (GlobalData, 2022), the context of a budget hotel in London holds practical relevance.

Moreover, the budget hotel in the experimental stimuli was indicated to have a mediocre rating of '3 out of 5'. This is because most studies have investigated the effect of online scarcity messages on hotel booking when the rating is largely positive as in '4.5 out of 5' (e.g., Banerjee & Pal, 2020; Song et al., 2019; 2021). Given consumers' increasing reliance on online reviews, an overall positive (negative) rating is expected to attract (hinder) bookings regardless of the presence of scarcity cues. Therefore, a mediocre rating reflects a more interesting context that has yet to be studied.

Manipulating the two types of scarcity messages for the experimental stimuli required determining the levels of quantity and time restrictions. For the limited-quantity version, a restriction of one room was selected, informed by Song et al. (2021). And guided by Noone and Lin (2020), a restriction of one day was selected for the limited-time version. Thereafter, a simulated hotel booking website was created. The limited-quantity scarcity message read

"20% discount, only 1 room left" whereas the limited-time cue read "20% discount, only 1 day left."

In addition, a textual description was developed to manipulate the two conditions of booking lead-time: short (3 days before the hotel stay) and long (6 months before the hotel stay). While the possibility of a short booking lead-time cannot be ruled out for unforeseen circumstances, the practice of booking travel six months in advance is also prevalent (Genter & King, 2024; Rahman et al., 2018).

These stimuli, including the manipulations of scarcity type and booking lead-time, were piloted with five university students. Based on their suggestions, minor changes were made to the wording of the participant introduction and the hotel description for greater clarity. Figure 1 shows the final experimental stimuli.

Insert Figure 1 here.

These were further pre-tested through a survey administered to 20 university students. They were exposed to the four experimental scenarios in a random order. In each case, they had to indicate the type of scarcity message (limited-quantity vs. limited-time) and the type of booking lead-time (short vs. long). There was unanimous agreement, confirming the success of the manipulations.

4.3. Data Collection Procedure

The study invitation was disseminated through multiple channels—both online (e.g., social media) and offline (e.g., campus notice boards). Most eye-tracking studies in hospitality management have been confined to student samples (Shen et al., 2020). To address this limitation in prior research, proactive efforts were made to recruit not only

students at the university but also staff members. Moreover, individuals who completed the study were further requested to snowball the study invitation within their local networks. This helped expand the sample to people outside the university.

The experiment was conducted in an eye-tracking laboratory room, providing an environment conducive to focused engagement. Participants used a wireless keyboard, a wireless mouse, and a 22-inch desktop monitor to navigate the experimental website and answer the questionnaire while a research assistant used a laptop. The eye-tracker infrared camera (SMI Red250 Mobile) was positioned below the participant's monitor and connected to the research assistant's laptop through a USB cable. The viewing distance between the screen and the participant was approximately 60cm. The sampling rate for the camera was set to 60Hz as was the monitor screen refresh rate. Data was recorded using SMI's iViewRed recording software and analysed using SMI Experiment Center and BeGaze. SMI Red250 was the preferred apparatus because it offers participants a natural experience of navigating websites.

The experiment included five steps. In the first step, individuals after arrival to the eye-tracking laboratory were briefed on the study's objectives, how the eye-tracking equipment works, and ethical implications. Participants were required to give their consent before proceeding further.

In the second step, participants were seated in front of the eye-tracking equipment and instructed to find a comfortable position. They were asked to adjust the chair height and the gap between their body and the desk to their preference. Then, calibration and validation of their eye gaze was performed. After successful calibration, participants were informed that the study was about to start. They were advised to spend as much time as they wanted on the experimental website and the accompanied survey. They were requested to minimise head and body movements to ensure precision of the eye-tracking data. They were also informed

that they had to make a booking decision and use the computer mouse to click on their choice.

In the third step, participants were randomly assigned to one of the four experimental conditions. The instructions on the study website asked participants to imagine that they were looking for a two-night budget accommodation in London for leisure. They further imagined that they had searched the internet extensively and had stumbled upon Kayis Hotel as an option. For a short booking lead-time, individuals were told that they were making the booking decision just three days in advance of their stay. In contrast, for a long booking lead-time, they were told that their stay was still about six months away.

In the fourth step, participants were exposed to one of the experimental stimuli (Figure 1). They could click either 'Book Now' or 'Not Interested'. From the time when they started looking at the stimulus until they clicked one of the two options, the eye-tracking equipment captured their eye gaze as well as what they clicked. After clicking one of the two options, participants were redirected to the study questionnaire.

In the final step, participants responded to the questionnaire. Thereafter, they were given the opportunity to ask any questions. Each participant received a £5 Amazon voucher as a token of appreciation.

4.4. Measures

Eye-tracking allows studying individuals' visual attention by analysing their eye fixations on selected parts of a stimulus, called areas of interest (AOI). The promotion box containing either "20% discount, only 1 room left" or "20% discount, only 1 day left" constitutes the AOI in this study (Figure 1). Visual attention on this AOI was operationalised in terms of fixation percentage. Calculated as the ratio of the number of fixations that a cue attracts to the total number of fixations on the screen, this measure provides a comprehensive

overview of the distribution of visual attention across all areas of the screen and tracks the relative importance of the specific AOI (Pozharliev et al., 2022). Booking probability was operationalised in terms of actual clicks on 'Book Now' (Figure 1), as captured by the eye-tracker.

In addition, the questionnaire measured participants' frugality, risk aversion, self-indulgence, self-control, and prudence. These personality traits are known to dictate the extent to which one is susceptible to scarcity temptations and views the offers with scepticism (Christiansen & Snepenger, 2005; Sharma et al., 2011; Song et al., 2019). Frugality was measured using six items such as "*I believe in being careful in how I spend my money*" (Christiansen & Snepenger, 2005). Risk aversion was measured using six items such as "*I do not feel comfortable taking chances*" (Song et al., 2019; Mandrik & Bao, 2005). Self-indulgence was measured using four items such as "*I like to indulge myself*" (Sharma et al., 2011). Self-control was measured using four items such as "*I am often restless*" (Sharma et al., 2011). Prudence was measured using four items such as "*I plan everything in advance*" (Sharma et al., 2011). Each of these items was presented using a seven-point Likert scale (1=strongly disagree, 7=strongly agree). The full questionnaire items are listed in the Appendix.

An attention check question was also inserted in the questionnaire to filter out non-conscientious responses. Participants' demographics including gender and age were also obtained.

4.5. Data Analyses

A total of 80 participants took part in the study. Individuals who failed the attention checkpoint and those who did not complete the study by providing a purchase decision were excluded. The final sample included 60 participants (38 female, 1 non-binary/third gender, 1

prefer not to say, $M_{age(years)}$ = 26.13, $SD_{age(years)}$ = 7.16). The sample size is in line with previous eye-tracking studies in the hospitality management literature (Barcelos et al., 2019; Chen et al., 2020; Eghbal-Azar & Widlok, 2013; Shen et al., 2020).

To capture principal patterns of responses, we ran a Principal Component Analysis (PCA) with varimax rotation and kept the first seven principal components based on the Kaiser rule (components with an eigenvalue > 1) that explained 68.65% of the total variance. Loadings of each component are presented as word clouds in the Appendix. Each participant's responses in this lower-dimensional PCA space were computed and then used as covariates in the subsequent analyses. The presence of multiple components with an eigenvalue greater than 1 also confirms that common method bias was not an issue.

To test H1 through H3, we ran a two-way ANCOVA with scarcity message type and booking lead-time as the independent variables. Visual attention, measured as the fixation percentage on the "Promotion Box" (the AOI), was the dependent variable. The seven PCA components were treated as covariates. A correlation analysis was employed to test H4. For testing H5 and H6, moderation analyses were done using the PROCESS macro of SPSS (Hayes, 2013). The PCA components were once again added as covariates.

5. Results

Figures 2 (a) through (d) reveal the heatmaps for the four experimental conditions. The promotion box with the scarcity message, our AOI, consistently attracted high visual attention as evident from the red colour. A two-way ANCOVA was used to test H1 through H3. There was a significant main effect of scarcity message type on participants' visual attention ($F(1,49)=4.847$, $p=0.032$). Visual attention was higher for limited-quantity scarcity messages (M = 0.081, SD = 0.032) than limited-time scarcity messages (M = 0.064, SD =

0.035). Hence, H1 was supported. The main effect of booking lead-time on visual attention was, however, non-significant. Hence, H2 was not supported.

Insert Figure 2 here.

Results showed a significant interaction between scarcity message type and booking lead-time on visual attention, ($F(1, 49) = 5.411$, $p = .024$). When booking lead-time was short, visual attention was comparable for the two types of scarcity messages (Figure 3). However, when booking lead-time was long, fixation caused by a limited-quantity scarcity message exceeded that triggered by limited-time scarcity messages. Simple main effects analysis showed that participants were fixating significantly more when they saw the limited-quantity cue ($M = 0.095$, $SD = 0.038$) vis-à-vis the limited-time cue ($M = 0.058$, $SD = 0.036$) in the long booking lead-time condition ($p = .004$). However, there were no differences between fixation percentage on the limited-quantity cue ($M = 0.069$, $SD = 0.021$) and that on the limited-time cue ($M = 0.071$, $SD = 0.034$) in the short booking lead-time condition ($p = .981$). Thus, visual attention was found to be the highest when individuals came across limited-quantity scarcity messages under a long booking lead-time, lending support to H3.

Insert Figure 3 here.

With respect to H4, fixation percentage on the AOI was not significantly correlated with booking probability. Given the non-significant result, we explored whether there exists any curvilinear relationship between fixation percentage on the AOI and booking probability. However, no such evidence was found.

With respect to H5, we ran a moderation analysis with scarcity message type as the independent variable, visual attention as the moderator, and booking probability as the dependent variable, while considering the seven PCA components as covariates. There was no significant interaction between scarcity message type and visual attention.

With respect to H6, we ran another moderation analysis with booking lead-time as the independent variable. All the other variables were treated in the same fashion as in the test of H5. As shown in Figure 4, visual attention significantly moderated the relationship between book lead-time and booking probability ($b = -46.29$, s.e.= 21.84 (expressed in a log-odds metric), $p = 0.034$). Fixating more on the scarcity cue, irrespective of its type, led to higher booking probability under a short booking lead-time and lower booking probability under a long booking lead-time. Conversely, fixating less on the scarcity cue resulted in higher booking probability under a long booking lead-time and lower booking probability under a short booking lead-time.

Insert Figure 4 here.

6. Discussion

Our objective was to examine the captivating power of online scarcity messages and their subsequent impact on purchase behaviours through eye-tracking while also considering the factors of scarcity message type and booking lead-time. Limited-quantity scarcity messages were found to attract greater visual attention compared with limited-time scarcity messages. Visual attention was the highest when individuals came across limited-quantity scarcity messages under a long booking lead-time. Moreover, fixating more on the scarcity cue, irrespective of its type, led to higher booking probability under a short booking lead-time and lower booking probability under a long booking lead-time.

This study contributes to the literature in five ways. First, it is one of the earliest eye-tracking studies in the online scarcity marketing realm. Although the fundamental purpose of online scarcity messages is to grab consumers' visual attention, create FOMO, and in turn shape downstream consequences such as purchases, related studies thus far have predominantly relied on self-reported data. To the best of our knowledge, Mou and Shin (2018) is the only exception. Set in the context of smart healthcare products, their study found that time scarcity had a significant influence on visual attention. We augment Mou and Shin (2018) by not only comparing the visual attention attracted by limited-quantity and limited-time scarcity cues in the context of hotels but also teasing out the influence of booking lead-time, a pertinent factor for online hotel booking (Adler & Sarstedt, 2021; Angeletos et al., 2001; Park & Jang, 2018). Previous research, using self-reported data, has often identified limited-quantity scarcity messages to be more influential than limited-time cues (Aggarwal et al., 2011; Song et al., 2021). We extend this finding by showing that the greater influence of limited-quantity scarcity messages could be attributed to their higher ability to attract visual attention.

Second, building on the literature on cue utilisation theory (Feldman & Lynch, 1988; Pervan & Martin, 2012) and cognitive load theory (Casado-Aranda et al., 2023; Peng et al., 2019; Sweller, 1988), this study conceptualised the scarcity message types of limited-quantity and limited-time cues as an extrinsic cognitive load while booking lead-time was treated as an intrinsic cognitive load. The extrinsic cognitive load of scarcity message type was found to affect visual attention. The intrinsic cognitive load of booking lead-time, on its own, did not affect visual attention. However, there was a significant interaction between the extrinsic cognitive load of scarcity message type and the intrinsic cognitive load of booking lead-time. This extends the scholarly understanding of cognitive load theory by revealing how different types of cognitive load could interact in the context of online scarcity messages. Previous

research has highlighted that a short booking lead-time can attenuate perceived nuances between different scarcity message types (Song et al., 2019). Consistent with the literature, we found that in the short booking lead-time condition, visual attention on limited-quantity and limited-time scarcity messages was comparable. However, when booking lead-time was long, the captivating power of limited-quantity scarcity messages exceeded that of limited-time cues.

Third, the study adds to the ongoing debate on the link between visual attention to online cues and consumer outcomes. One view holds that the higher the visual attention attracted by a cue, the greater is its likelihood to shape consequent actions (Aribarg et al., 2010; Badenes-Rocha et al., 2022; Hwang & Lee, 2018). A competing view holds that visual attention is not a sufficient condition for behaviour (He et al., 2014; Khachatryan et al., 2018; Simmonds et al., 2020). We find that under a long booking lead-time, even low visual attention can translate to purchases. To better understand such findings, future research could consider neuroimaging techniques. By observing neural activity patterns, one could gain deeper insights into how visual cues engage cognitive and emotional hubs and relevant functional networks in the brain.

Fourth, this study analyses visual attention to scarcity messages while accounting for a wide range of personality traits that include frugality, risk aversion, self-indulgence, self-control, and prudence. This adds robustness to the results. Even though such traits are known to dictate the extent to which one is susceptible to online temptations (Christiansen & Snepenger, 2005; Sharma et al., 2011; Song et al., 2019), they are not always taken into consideration in either self-reported studies on online scarcity marketing or general eye-tracking studies.

Fifth, this study expands the contextual scope of research on online scarcity marketing. Although the hospitality sector lends itself readily to the use of scarcity marketing

promotions and has expectedly been studied widely in the literature, several studies have been restricted to services that have received largely positive online reviews (e.g., Banerjee & Pal, 2020; Song et al., 2019; 2021). However, an overall positive online rating cannot be taken for granted. As a departure from such hospitality marketing studies, this study has shed light on how online scarcity messages work when a hotel has an overall mediocre rating of '3 out of 5'.

7. Conclusion

This study has shown how visual attention to online scarcity messages and booking lead-time are related to hotel booking probability. It offers three managerial implications. First, when services are keen to draw attention to their online scarcity cues and price promotions, they are better off using limited-quantity scarcity messages. After all, limited-quantity scarcity messages were found to attract greater visual attention compared with limited-time scarcity messages.

Second, managers should invest greater resources in developing their scarcity messaging tactics when booking lead-time is long. When booking lead-time was short, differences between the various types of scarcity messages were found attenuated, perhaps due to the inherent time constraint.

Third, the study reveals that greater visual attention is not a panacea for marketers. Fixating more on the scarcity cue, irrespective of its type, led to lower booking probability under a long booking lead-time. Conversely, fixating less on the scarcity cue resulted in higher booking probability under a long booking lead-time. Therefore, our findings caution managers against using marketing cues too aggressively to capture visual attention. As the UK–the site of data collection in this study–is one of the top countries in the budget hotels

market (GlobalData, 2022), these implications could be particularly relevant for budget hotel managers in the UK.

These implications notwithstanding, the study has a few limitations. First, its scope was limited only to budget hotels. Future research could compare the impact of various online scarcity messages for different types of products (e.g., hedonic vs. utilitarian) and services (e.g., luxury hotel vs. budget hotel).

Second, the participants had to complete the study on a desktop. Given the rise of smartphone usage, comparing visual attention to scarcity messages as a function of device type (e.g., computers vs. mobile devices vs. tablets) could be a worthwhile research endeavour.

Third, in the experimental stimuli, limited-quantity and limited-time restrictions were operationalised as "1 room left" and "1 day left" respectively. The study did not reveal the impact of varying these restrictions. Scholars interested in this area could expand our research design to include the level of limited-quantity scarcity (high as in "1 room left" vs. low as in "5 rooms left") as well as the level of limited-time scarcity (high as in "1 day left" vs. low as in "5 days left") for more nuanced findings.

Fourth, the study was conducted in the context of a domestic destination. The perceived urgency and FOMO triggered by scarcity messages in such a setting could be lower than in the case of international destinations. Therefore, we call for the replication of the current study by varying the nature of the destinations (domestic vs. international).

Finally, although we found even low visual attention to translate to purchases under a long booking lead-time, it was not possible to tease out the reason. To better understand such findings, future research could consider neuroimaging techniques. This approach could deepen the scholarly understanding of the complex interplay between visual attention and

consumer action, potentially contributing to the resolution of the current debate with more concrete, biologically informed evidence.

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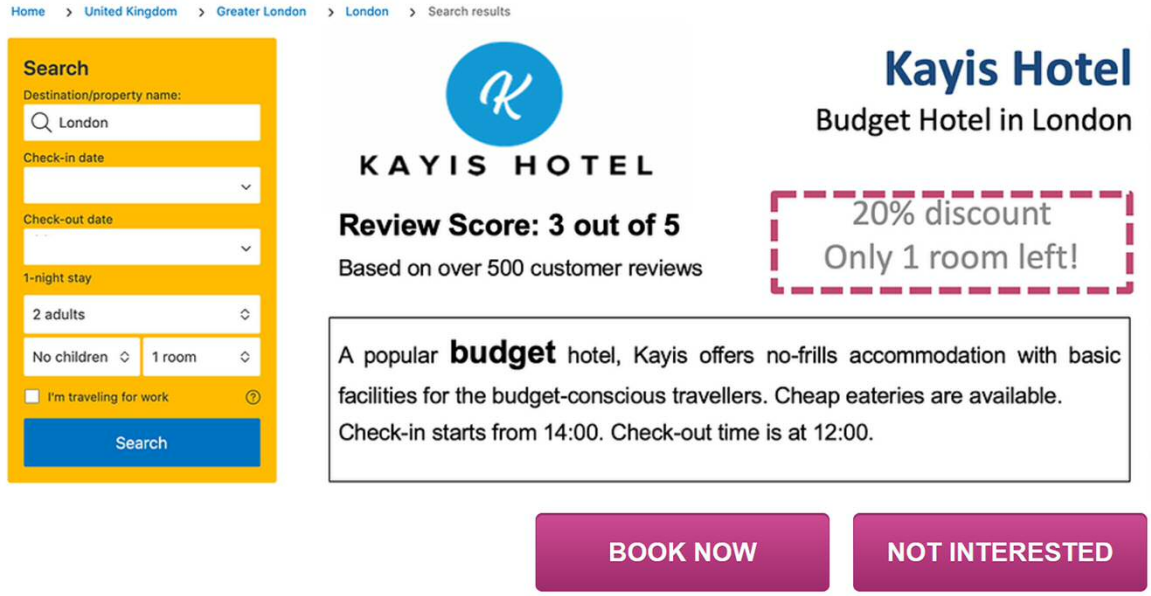


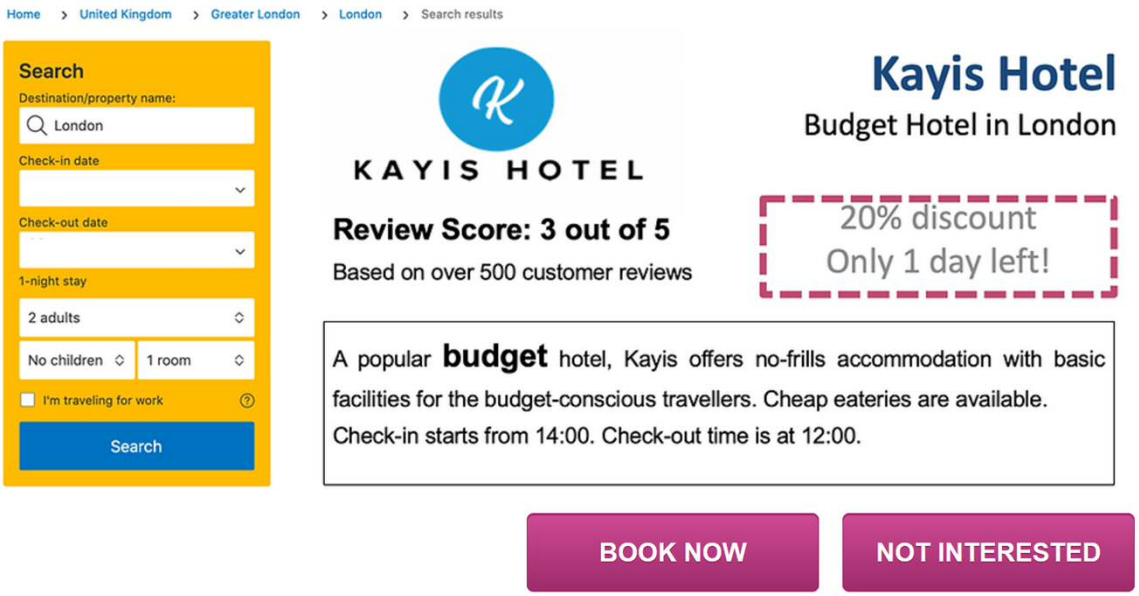
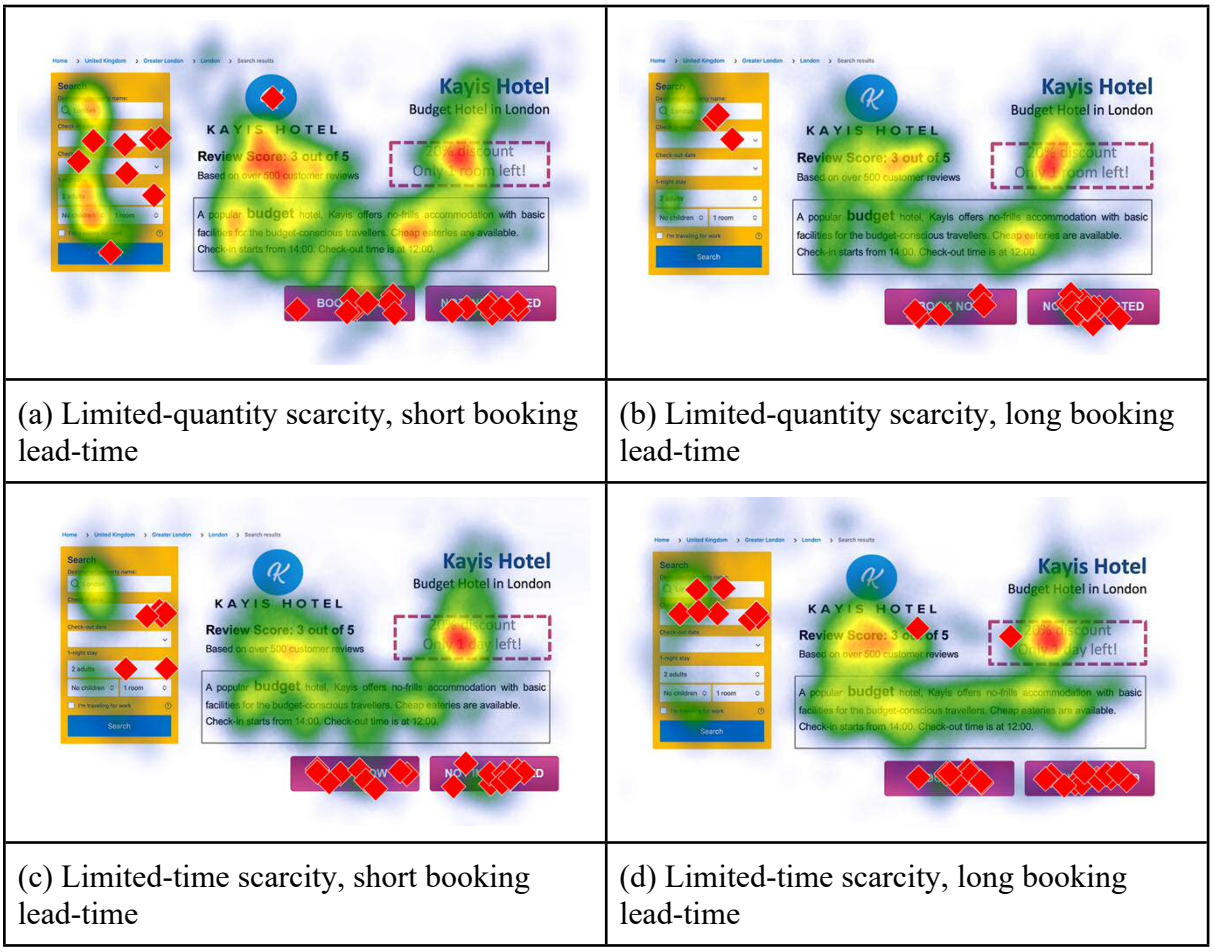


Figure 1: Experimental stimuli (top: limited-quantity scarcity, bottom: limited-time scarcity).



(a) Limited-quantity scarcity, short booking lead-time

(b) Limited-quantity scarcity, long booking lead-time

(c) Limited-time scarcity, short booking lead-time

(d) Limited-time scarcity, long booking lead-time

Figure 2: Heatmaps for the different experimental conditions.

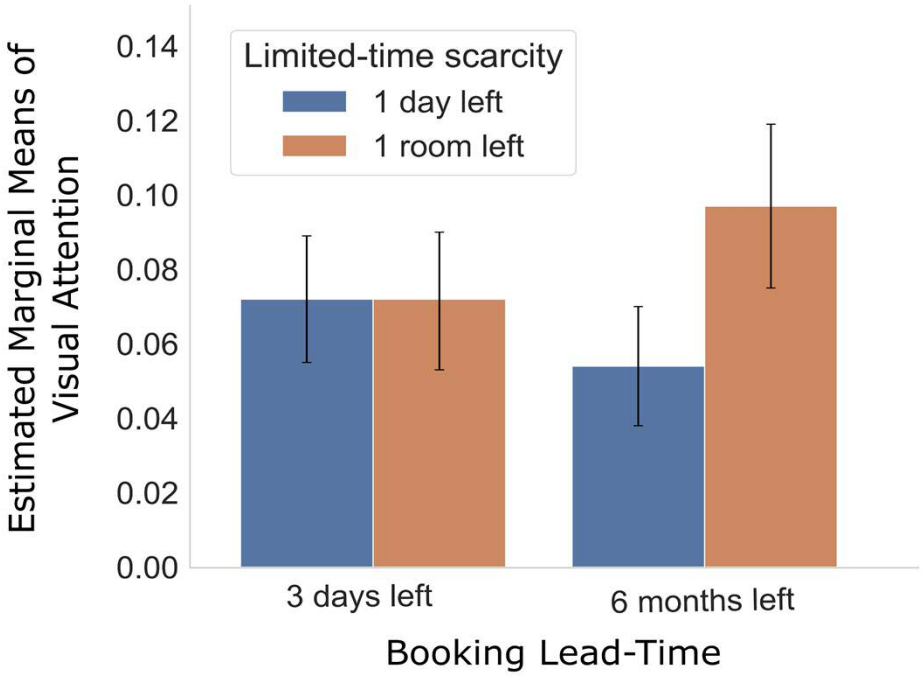


Figure 3: Scarcity message type x booking lead-time interaction.

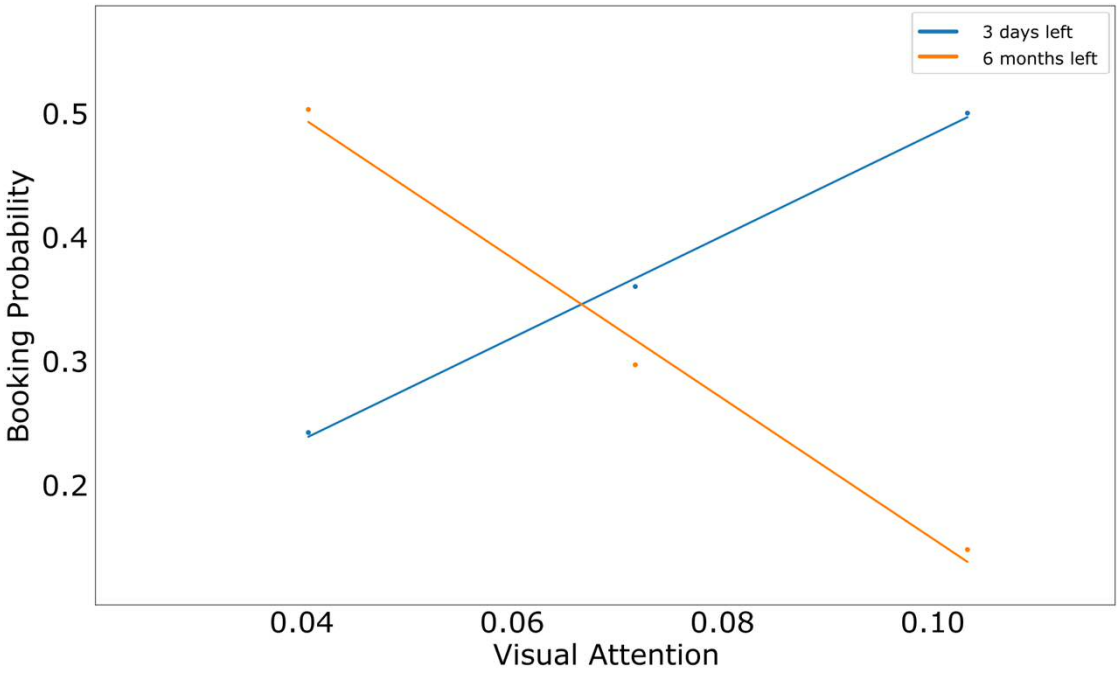


Figure 4: Visual attention moderating the booking lead-time-booking probability relationship.

Appendix

Table A.1 lists all the questionnaire items including their word cloud labels. Figure A.1(a) through (g) present the seven word clouds corresponding to the PCA components. Font size represents the strength of each loading and font colour its sign (red for positive and blue for negative values).

Table A.1: Questionnaire items for the study constructs and their word cloud labels.

Constructs	**Questionnaire items [word cloud label]**
Frugality (Christiansen & Snepenger, 2005)	1) I believe in being careful in how I spend my money. [Discerning]
	2) I discipline myself to get the most from my money. [Value-conscious]
	3) There are things I resist buying today so I can save for tomorrow. [Delayed gratification]
	4) Making better use of my resources makes me feel good. [Resourceful]
	5) If you take care of your possessions, you will definitely save money in the long run. [Cost-effective]
	6) I am willing to wait on a purchase I want so that I can save money. [Patient]
Risk aversion (Song et al., 2019; Mandrik and Bao, 2005)	1) I do not feel comfortable taking chances. [Cautious]
	2) I prefer situations that have foreseeable outcomes. [Predictable]
	3) Before I make a decision, I like to be absolutely sure how things will turn out. [Analytical]
	4) I avoid situations that have uncertain outcomes. [Risk-averse]
	5) I feel comfortable improvising in new situations. [Adaptable]
	6) I feel nervous when I have to make decisions in uncertain situations. [Apprehensive]
Self-indulgence	1) I enjoy spending money. [Indulgent]

(Sharma, Sivakumaran, & Marshall, 2011)	2) I like to indulge myself. [Self-gratifying]
	3) I buy things for pleasure. [Pleasure-seeking]
	4) I like good things in life. [Luxurious]
Self-control (Sharma, Sivakumaran, & Marshall, 2011)	1) I am often restless. [Impatient]
	2) I get bored easily. [Easily-bored]
	3) I find it difficult to concentrate. [Distracted]
	4) I say things without thinking. [Impulsive]
Prudence (Sharma, Sivakumaran, & Marshall, 2011)	1) I am a careful thinker. [Strategic]
	2) I plan everything in advance. [Organized]
	3) I am a methodical person. [Systematic]
	4) I am a cautious shopper. [Selective]

(a)

(b)

(c)

(d)

(e)

(f)

(g)

Fig. A.1: Word clouds for the PCA analysis.