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Consumers' Synesthesia Experience Enhances Consumption Behavior: The Impact of Distributed Lighting Design in Shopping Center

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ABSTRACT

China's shopping centres are facing the challenge of fierce stock competition, and they are using a variety of competitive differentiation strategies and approaches to attract consumers and seek development. Therefore, the study focuses on the impact of distributed lighting in public spaces of shopping centres on consumer behaviour from the perspectives of lighting effects and customer diversion, and explores an important expression to enhance the attractiveness to consumers. This study used the statistical analysis method of quantitative research to obtain data from 607 participants through a non-random sampling method in order to explore the relationship and impact between distributed lighting design, association and consumer behaviour in the public areas of shopping centres. The study found that consumers' associative experience in the public areas of shopping centres exerted a significant mediating effect on the influence of light guide design on consumer behaviour, and the mediating effect contributed 61.11% to the total effect. This study pioneered the introduction of the associative effect into the study of consumer behaviour, thereby constructing a strong link between lighting design and consumer behaviour in shopping centres. Practical implications, limitations and areas for further research are also given.

Keywords: distributed lighting design; shopping centres; synesthesia; consumer behaviour

1 INTRODUCTION

As China's e-commerce booms, the traditional retail industry in China is facing a huge impact,

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however, the rapid rise of shopping centres has become a “safe haven” for the real economy (Zhao, Ping, 2015), and is gradually becoming the dominant mode of retailing in China's cities (Li, Mason and Gan, 2022). At the same time, competition among shopping centres is intensifying, and they are upgrading, for example, by increasing the proportion of food and beverage, entertainment and leisure facilities in the design of commercial spaces to enhance the consumer experience (Wu Xiaoding, 2014). Under this trend of differentiated stock competition, shopping centres must develop competitive strategies to attract consumers and seek growth to withstand revenue declines and competitive pressures. Understanding which factors in shopping centre operations increase and improve the attractiveness to customers, enhance consumer expectations, and increase the likelihood of spending is an important basis for planning, renovating, and investing in shopping centres (Anselmsson, 2016). This is also one of the key factors that drove the development of this study. Therefore, this study explores another important expression of enhancing the attractiveness of shopping centres to shoppers from the perspective of shopping centre lighting design and effects: the impact of lighting design and effects within the commercial space of a shopping centre on consumer consumption behaviour.

Currently, exquisite lighting design is beginning to appear more and more in shopping centres, which includes layout, illumination, music and temperature (Mari and Poggesi, 2013). These help to differentiate, theme and articulate shopping centres, thus providing customers with an exceptional shopping environment and a shopping experience that exceeds expectations. Lighting design can better complement marketing campaigns, enhance shopping centre-store-consumer interactions and deepen the connection with consumers. Research has found that the service landscape, including lighting, has a significant impact on customer loyalty in shopping centres (Shashikala and Suresh, 2013). In addition, lighting design communicates the project positioning and core brand values of a shopping centre and Quartier, Vanrie and Van Cleempoel (2014) argue that lighting not only communicates brand image, but also has a subtle impact on customer mood and ambience perceptions. Park and Farr (2007) used an experimental approach to study consumer emotional and behavioural responses in different lighting situations and they found that bright colours are more likely to evoke emotional experiences in consumers. Lighting effects stimulate the human eye and induce other sensory stimuli, a phenomenon known in psychology as synesthesia. Does associative perception affect consumers' shopping behaviour?

Current research on lighting design and consumer behaviour in shopping centres focuses mainly on the shopping area. It cannot be ignored that the public area of shopping centre is also an important circulation link carrying economic activities, which includes the open area of service space, traffic space and landscape space, which are usually not the sales area of the shop. Public space both decorative, guiding and interactive lighting design, not only can achieve good lighting effects, but also with the public area of the traffic space of the dynamic line planning, so that the different directions of the crowd in the convergence, distribution, and even through the distribution of lighting to drive in the sub-

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direction of the flow of traffic, and at the same time, with the service space of the open area, landscape space together shaped into a very high spatial tension of the whole! It also provides consumers with a unique and beautiful sensory experience, strengthens the viscosity between the shopping centre and the consumers, and significantly increases their stay time in the shopping centre. Therefore, it is urgent and important to discuss the impact of lighting on consumer behaviour in public areas of shopping centres.

Based on these backgrounds, this study attempts to critically assess the impact of distributed lighting in public spaces of Chinese shopping centres on shoppers' behaviours and to test whether empathy mediates the effect on shoppers' behaviours. The main research questions are as follows:

What are the effects of distributed lighting in public spaces of Chinese shopping centres on customer behaviour? What role does synesthesia play in the relationship between lighting and customer behaviour in Chinese shopping centres?

This study has both practical and theoretical value. Practically, the findings of this study reduce to some extent the loss of customers and the lack of consumer motivation caused by the decay and lack of vitality of shopping centres, provide valuable guidance for the sustainable and stable development of shopping centres, and satisfy consumers' needs for social interaction and experiential consumption, thus filling the lack of experience brought about by e-commerce, which is a fast-paced way of shopping. Theoretically, this study effectively fills in the gap of interdisciplinary research around consumer consumption behaviour from the perspective of psychology, and has high research value.

2 LITERATURE REVIEW

2.1 Distributed Lighting Design

Lighting design is a multidisciplinary field that covers the disciplines of art, engineering and science, and is defined as aiming to create lighting effects suitable for specific environments and uses by means of reasonable lighting layouts, luminaire choices, and control technologies (Karlen, Spangler and Benya, 2017) . As early as twelve years ago, Zhan Qingxuan, a professor and doctoral supervisor of Architectural Technology Science at Tsinghua University's School of Architecture, pointed out in his book "Architectural Light Environment" that "Lighting art is used as a carrier to reshape the cityscape and buildings, rather than a reproduction of daytime. Focusing on the function, culture, history and aesthetics of lighting design is a change in the concept of lighting design in recent years. Effective use of energy, protect the environment, improve the quality of lighting, overall grasp of the lighting effect, systematically demonstrate the characteristics and personality of commercial buildings, reasonable distribution of light, in the lighting design implementation process to achieve scientific and rational operation." One of the proposed "reasonable distribution of light", that is, the embodiment of distributed lighting design. Distributed lighting design is centered on the idea that light and light

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sources are spatially distributed patterns. Distributed lighting design is a design method that uses multiple lighting sources and luminaires in a space with the aim of creating an even, soft, multi-dimensional lighting effect. This design method distributes the lighting sources in different positions and angles in order to achieve the desired lighting effect and atmosphere. The purpose of current distributed lighting design has become much more than just providing illumination; it is also about constructing spatial ambience, emphasizing aesthetics, and achieving established scenic objectives. Distributed lighting design is often used in commercial spaces, exhibition halls, hotels, restaurants and other places to create impressive lighting effects.

2.2 synesthesia

Synesthesia is a sensory-perceptual phenomenon that specifically refers to cross-reactivity between human sensory organs, where a single sensory stimulus elicits responses from multiple senses (Spector and Maurer, 2013) . Under normal circumstances, a stimulus from one sensory channel should theoretically only elicit a sensory response from the corresponding channel. When synesthesia occurs, a stimulus to one sensory channel can, however, trigger responses in multiple sensory channels (Hubbard and Ramachandran, 2005) . Synesthesia is the mixing and cross-reacting of different sense organs. All reception may be manifested by sensing taste when seeing a colour, or touch when hearing a sound. For example, people tend to feel warmth when they see red and yellow, and coolness and peace when they see colours such as blue and green (Shahidi et al., 2021) . It is not the aim of this study to investigate the mechanisms and causes of the production of associations, so this aspect will not be discussed in detail. So far, there is no clear, unified explanation for the complex association between colour and mood (Gilbert, Fridlund and Lucchina, 2016) .

2.3 Consumer behaviour

Consumer behaviour refers to the actions, decisions, and reactions, etc. exhibited by individuals or groups of consumers when purchasing, using, evaluating, and disposing of products, services, or ideas, and includes a range of behaviours and processes, from consumer awareness of the product, information acquisition, and evaluation, to the purchase decision, the experience of using the product, and even post-purchase satisfaction and repurchase behaviours. (Solomon, 2015 , Schiffman, Kanuk and Hansen, 2012) . The discipline of consumer behaviour, on the other hand, aims to study and explore how consumers form purchase decisions, how they evaluate brands and products, and how they interact in the marketplace. Consumer behaviour is defined and outlined more in terms of consumer decision making than in other aspects of consumer behaviour, such as the course of action consumers take when choosing a product or shop before developing a clear intention to shop and who to shop with. Therefore, it is necessary to fully consider the special characteristics of the distributed lighting design in the public area of the shopping centre in this study, i.e., the kinetic and sub kinetic lines of consumer actions,

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which are constituted by the distributed lighting design and the walking area in the public area of the shopping centre together. Therefore, when clarifying the concept of consumer behaviour, it is crucial to also sort out customer flow as part of consumer behaviour. The core requirement of customer flow is to attract the attention of consumers as the first step in the shopping process (Ang and Buttle, 2006). Customer flow in shopping centres is a marketing strategy that aims to provide an enjoyable shopping and entertainment experience to attract more customers and prolong their stay in the shopping centre, leading to increased sales and positive word-of-mouth communication. These strategies help shopping centres to remain competitive with their competitors and attract more customers.

2.4 Lighting Design & Synesthesia

The associations triggered by lighting on human vision are usually related to emotions. As shown in the previous section, warm lighting colours such as red and yellow give a feeling of warmth. Kim, Hyun and Park (2020) et al. investigated how each dimension of colour (hue, saturation, and lightness) affects customers' aesthetic perception of luxury hotel rooms, and they found that softening the vibrant colours of the lighting improves the customers' aesthetic perceptions and evaluations. Gong et al. (2017) showed that colour mood does not exist in isolation, but is influenced by background colour and colour preference. Positive colour mood associations tend to originate from commonly preferred colours, whereas negative colour moods tend to be associated with colours that people dislike. Therefore, the hue of light colours, more than saturation and brightness, influences people's emotional experience.

Research by Yildirim, Hidayetoglu and Capanoglu (2011) suggests that when warm colours dominate a particular scene, the scene is more likely to be rated as 'highly arousing', 'exciting' and 'stimulating'. "stimulating". When scenes were dominated by cool colours, they were more likely to be rated as 'less arousing' and less exciting, while scenes were rated more highly on the dimensions of 'spaciousness' and 'tranquility'. and serenity. Therefore, it is generally accepted that colours with cooler and toneless lighting evoke calmer and more serene emotions. Lee and Gong (2022) focuses on the relationship between colour harmony and colour emotions. Lee and Gong (2022) distinguishes between colour-related emotions in five dimensions, as shown in Table 1.

	Correlation coefficient between colour harmony and colour emotions					
	Active-Passive	Heavy-Light	Warm-cool	Soft -Hard	Complex-simple	Harmony -Disharmony.
Active-Passive	1.00					
Heavy-Light	-0.70	1.00				
Warm-cool	0.64	-.050	1.00			

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Soft-Hard	0.60	-0.92	0.60	1.00		
Complex-simple	-0.27	0.62	-0.21	-0.52	1.00	
Harmony-disharmony	0.16	-0.51	0.21	0.49	0.89	1.00

Table. 1 The relationship between colour harmony and colour emotion

Source: Lee and Gong (2022)

According to Lee and Gong (2022) the three dimensions of colour, warm and cold, complex and simple, and active and passive can effectively predict colour harmony. Typically, harmonious colour combinations imply simplicity, passivity and warmth. Referring to the study of Lee and Gong (2022) , this study uses these three dimensions to portray the associative effects of lighting design and uses them to explore their mediating effects on consumer behaviour.

2.5 Lighting Design and Consumer Behaviour

The direct effect of lighting design is to make consumers perceive different visual cues (Visual cues), which affects the shopping behaviour of customers, especially their emotions and moods. Huddleston, Coveyou and Behe (2023) investigated retail shop scenarios in which the visual elements would affect the shopping experience of consumers. Currently, lighting design has become one of the ways to effectively enhance the consumer experience in shopping centres, which can not only satisfy consumers' expectations of a new shopping experience, but also satisfy their aesthetic experience. In the process of lighting design intervention in shopping centres, it influences the consumer behaviour by improving the consumer experience, which is mainly manifested in three aspects, educational experience, aesthetic experience and entertainment experience.

Lighting design in attracting consumer interaction, participation in the performance of more diverse and flexible means, in this process, lighting design can greatly stimulate the sensory experience of customers, caused by the customer's perceptual experience, the special nature of the person makes the art of lighting design in the output process is not uniform to bring the same feeling to everyone, it enables people to produce a different way of thinking, causing a more personalized understanding of the things. It can make people think differently and cause a more personalized understanding of things. According to the Oxford English Dictionary's explanation of entertainment: "An activity that attracts people's attention in a pleasurable way." That is, when people's senses are attracted to the art of light installation, they have been brought into the entertaining experience created for them by the light installation. Liu et al. (2022) found that highly saturated colours significantly improved consumers' desire to consume, and this effect was influenced by the consumption scenario. Highly saturated light colours are more likely to evoke consumers' desire to consume when consumed socially and when the

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consumer is in a central viewing position.

The public areas of shopping centres are often set up with different styles of lighting design, and existing research, which usually focuses on how the lighting design in the shop affects consumers' shopping decisions, ignores the impact of the lighting design in the public areas of shopping centres on consumer behaviour. In view of this, this study focuses on focusing and investigating the effect of common areas in shopping centres' public areas on consumer behaviour. The associative effect, on the other hand, has been much less studied. This study innovatively links the lighting design of shopping centre public areas, consumer associative experience and consumer behaviour to investigate the mediating effect of consumer association. The core objective of this study is to critically examine and assess how the lighting design of shopping centre public areas influences consumer behaviour and how the associative effect mediates this influence. In conjunction with the literature, this study develops the hypotheses, which are described below:

H1: Distributed lighting design significantly influences consumer behaviour in public areas of shopping centres;

H1a: Lighting quality has an impact on consumer behaviour in public areas of shopping centres;

H1b: Lighting effects have an impact on consumer behaviour in public areas of shopping centres;

H1c: The customer infusion design of lighting in public areas of shopping centres has an impact on consumer behaviour;

H2: In the public areas of shopping centres, distributed lighting design can bring consumers a pleasant, warm and associative emotional experience.

H2a: Lighting quality has an impact on the consumer's associative experience in the public areas of shopping centres;

H2b: Lighting design effects in public areas of shopping centres have an impact on consumers' associative experience;

The design effect of lighting for customer infusion in the public areas of H2c shopping centres has an impact on the consumer's associative experience;

H3: Consumer's associative experience under distributed lighting design in public areas of shopping centres has an impact on consumer behaviour;

H4: Consumers' associative experiences within the public areas of shopping centres play a mediating role in the impact of distributed lighting design on consumer behaviour.

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3 METHODS

3.1 Data collection

As China's e-commerce booms, the traditional retail industry in China is facing a huge impact, however, the rapid rise of shopping centres has become a “safe haven” for the real economy (Zhao, Ping, 2015), and is gradually becoming the dominant mode of retailing in China's cities (Li, Mason and Gan, 2022). At the same time, competition among shopping centres is intensifying, and they are upgrading, for example, by increasing the proportion of food and beverage, entertainment and leisure facilities in the design of commercial spaces to enhance the consumer experience (Wu Xiaoding, 2014). Under this trend of differentiated stock competition, shopping centres must develop competitive strategies to attract consumers and seek growth to withstand revenue declines and competitive pressures. Understanding which factors in shopping centre operations increase and improve the attractiveness to customers, enhance consumer expectations, and increase the likelihood of spending is an important basis for planning, renovating, and investing in shopping centres (Anselmsson, 2016). This is also one of the key factors that drove the development of this study. Therefore, this study explores another important expression of enhancing the attractiveness of shopping centres to shoppers from the perspective of shopping centre lighting design and effects: the impact of lighting design and effects within the commercial space of a shopping centre on consumer consumption behaviour.

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This study has both practical and theoretical value. Practically, the findings of this study reduce to some extent the loss of customers and the lack of consumer motivation caused by the decay and lack of vitality of shopping centres, provide valuable guidance for the sustainable and stable development of shopping centres, and satisfy consumers' needs for social interaction and experiential consumption, thus filling the lack of experience brought about by e-commerce, which is a fast-paced way of shopping. Theoretically, this study effectively fills the gap in the interdisciplinary research on consumer behaviour from the perspective of psychology, and has high research value. The research participants selected for the study were from five shopping centres located in Zhengzhou City, China. The research participants were firstly excluded from poor operating conditions due to the influence of their own management, marketing, merchandise, and services, and were therefore randomly selected from shopping centres with an average sales volume of more than RMB 1 billion during the period of 2020-2024. Secondly, the survey participants were selected to be aged 18 years and above who were present at the shopping centre site on the day of the study. Data were collected through an electronic questionnaire using purposive sampling and volunteer sampling, and a total of 607 valid responses were collected. According to Saunders, Lewis and Thornhill (2019), when the population is large, the sample size for non-random sampling should be 400 or more, which is representative of the sample size for this collection. Measurement scales were adapted from published research scales and determined by consulting with experts, and the Delphi method was used to consult and solicit opinions from relevant experts twice in the form of a questionnaire, and the final questionnaire was developed. The scale is shown in Appendix 1.

In particular, the research data will be obtained solely from the consumers' willingness to participate, in which the measurement part about the associative variables are all from the dimensional indicators describing the effect of the consumers' subjective feeling, without considering the bias

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generated by sampling. Moreover, the focus of this study is on consumer behaviour, so the sample is not selected on the basis of whether or not consumption actually occurs. In addition, the sample data will be analyzed and discussed in a unified way after recovery, and will not be talked about separately according to the different sales of the research shopping centre.

The data will be quantitatively analyzed using the software Excel and SPSS after recovery. The main descriptive results of the demographics of the sample are shown in Table 1. 54.9% of the consumers within the sample were female, indicating that women may be slightly more active when it comes to their shopping behaviour, pointing to the need for the lighting design to take more account of how it appeals to the needs and preferences of female shoppers. In terms of age, consumers aged 31-40 accounted for 39.4%, indicating that the lighting design of shopping centres should take more account of the preferences and needs of those aged 30-40. In terms of income, the majority of respondents' monthly income lies between RMB 5,000 and RMB 8,000, reaching 37.1%, followed by those with a monthly income of more than RMB 8,000, accounting for 27%. This means that the majority of people participating in the survey have a certain level of spending power, and the lighting design needs to create a shopping environment that attracts both high-income groups and middle-income level customers. The number of frequent shoppers reached 38.1% and afternoon and evening were the most popular time periods, accounting for 40.9% and 38.1% respectively. This shows that in the afternoon or evening, shopping centres need to take into account the changes in daylight to ensure that the lighting can adapt to the needs of natural light during the day as well as meet the lighting needs of night-time shopping.

variate	Options	Number of persons	Proportion
Gender	male	274	45.1
	female	333	54.9
Age	18-24 years old	100	16.5
	25-30 years old	196	32.3
	31-40 years old	239	39.4
	Over 41years old	72	11.9
Monthly income	Less than 3,000 yuan	68	11.2
	Within 3000yuan-5000yuan	150	24.7
	5000yuan-8000yuan	225	37.1
	Over 8000yuan	164	27
How often you go to the shopping mall	Rarely	43	7.1
	Occasionally	333	54.9
	Frequently	231	38.1

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Time choosing to go to the shopping mall	Forenoon	53	8.7
	Noon	75	12.4
	Afternoon	248	40.9
	Evening	231	38.1

Table 2: Basic information on the population

3.2 Data analysis methods

This study mainly uses quantitative analyses such as regression analysis and mediation analysis. The regression model is.

1) Consumer behaviour = c*lighting design + d1

2)Associative = a*lighting design + d2

3) Consumer behaviour = c'*Lighting Design + b*Association + d3

All data analysis will be done using the software Excel and SPSS.

4 Results and Discussion

4.1 Descriptive statistical analyses

SPSS software was used to carry out a preliminary test of raw data on the 607 valid questionnaires recovered in order to check whether there are extreme values or wrong values in the entered data, and then determine whether the data conforms to normal distribution. The results of the index data processing are shown in Table 3. The maximum and minimum values in the table describe the overall situation of the data can be seen in the current data there are no outliers, from the table of the mean and standard deviation data can be seen in the table of the data fluctuation is small, the data has a stability, the measurement of each variable of the question items can be carried out to further analyze the data.

	n	minimum value	maximum values	average value	(statistics) standard deviation
Distributed Lighting Design	607	1.00	5.00	3.71	0.92
Quality of Lighting	607	1.00	5.00	3.98	0.72
lighting effect	607	1.00	5.00	4.05	0.75
customer infusion	607	1.00	5.00	3.84	0.77
synesthesia	607	1.00	5.00	3.77	0.84
consumer behaviour	607	1.00	5.00	3.77	0.80

Table 3: Descriptive statistical analysis of secondary indicators

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Table 3 provides descriptive statistics on the six dimensions of Distributed Lighting Design, Lighting Quality, Lighting Effectiveness, Customer Orientation, Synesthesia and Consumer Behaviour, including their respective minima, maxima, means and standard deviations, based on which the following analyses were carried out:

1. Distributed lighting design received a mean rating of 3.71 with a standard deviation of 0.92, reflecting a relatively high level of satisfaction with distributed lighting design on a scale of 1 to 5, but with a relatively high degree of divergence of opinion among respondents.

2. Lighting quality received the highest mean rating of 3.98 with a standard deviation of 0.72, indicating that lighting quality was generally rated highly and with relatively good inter-respondent agreement.

3. The mean rating of 4.05 for lighting effects was the highest of all the dimensions, with a standard deviation of 0.75, indicating that respondents generally considered the lighting effects to be good and that the evaluation was relatively consistent.

4. The mean rating for customer infusion was 3.84 with a standard deviation of 0.77, indicating that respondents rated the shopping centre's customer infusion measures favorably, but the consistency of the ratings was slightly lower than the quality of the lighting.

5. The mean ratings for both associative and consumer behaviour were 3.77, with standard deviations of 0.84 and 0.80, respectively, indicating that satisfaction with associative and consumer behaviour is relatively similar and that there is a degree of divergence in the ratings.

Taken together, respondents rated lighting quality and lighting effects most positively, suggesting that these dimensions play a key role in enhancing the customer experience. Comparatively, distributed lighting design, customer infusion, associative sensing and consumer behaviour, while also receiving relatively high ratings, showed large differences in respondents' opinions on these dimensions. This information provides valuable insights for further optimizing and enhancing shopping centre services and design.

4.2 Correlation analysis

	Distributed lighting design	Quality of illumination	Effect of lighting	Customer diversion	synesthesia	Consumer behaviour
Distributed lighting design	--					
Quality of illumination	.485**	--				
Effect of lighting	.602**	.673**	--			
Customer diversion	.728**	.648**	.742**	--		

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synesthesia	.769**	.521**	.676**	.748**	--	
Consumer behaviour	.801**	.575**	.681**	.774**	.791**	--

Table 4: Correlation analysis

** The correlation is significant at the 0.01 level (two-tailed).

The results of the correlation analysis provided in Table 4 reveal the interrelationships between the six dimensions of distributed lighting design, lighting quality, lighting effects, customer infusion, associative sense and consumer behaviour. All correlation coefficients are significant at the 0.01 level of significance, indicating a significant positive correlation between these variables.

1. The correlation between distributed lighting design and the other variables ranged from 0.485 (lighting quality) to 0.801 (consumer behaviour), indicating that it is most strongly associated with consumer behaviour and relatively weakly associated with lighting quality.

2. The correlation coefficient between lighting quality and lighting effects is 0.673, showing that lighting quality is closely related to lighting effects, which is in line with expectations, as both dimensions are directly related to the texture and effect of lighting.

3. The correlation coefficient between lighting effects and customer channeling is 0.742, a high correlation that may reflect the positive impact of good lighting effects on attracting customer flows and increasing the length of time customers stay.

4. The correlation coefficients between customer infusion and association are 0.748 and with consumer behaviour are 0.774, indicating that customer infusion measures are not only closely related to the sensory experience of consumers, but also have a significant impact on their behavioural patterns.

5. The correlation coefficient between association and consumer behaviour is 0.791, the highest pair of correlation coefficients of all variables, indicating a very strong positive correlation between consumers' sensory experiences and their behavioural patterns.

Overall, these correlation results highlight the strong links between the dimensions, and in particular the high correlation between consumer behaviour and all other variables highlights the key role of consumer experience in influencing behaviour. In addition, the interactions between lighting design, lighting quality and lighting effects and how they are linked to influence shopper infusion and sensory experience are clearly demonstrated, providing important insights into enhancing shopper experience and behavioural patterns in shopping centres.

4.2 Factor Analysis

Model	χ^2 /Df	AGFI	GFI	RMSEA	IFI	CFI	NFI	TLI
Critical value of index	<3	>0.9	>0.8	<0.08	>0.9	>0.9	>0.9	>0.9
Results	3.287	0.874	0.902	0.061	0.934	0.933	0.907	0.921

Table 5: Validation of the factor model fitting results

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The validation factor model fit results in Table 5 show that most of the metrics met or exceeded the desired criteria, and only the AGFI was slightly lower, indicating that the model fitted well overall, but there was room for minor improvement. In short, the model reflects the structure of the data well.

4.4 Analysis of research path

path relationship			Estimate	S.E.	C.R.	P	Whether it is significant
synesthesia	<---	Distributed lighting design	0.725	0.044	11.426	***	Yes
synesthesia	<---	Quality of illumination	0.026	0.045	0.631	0.528	No
synesthesia	<---	Effect of lighting	0.361	0.044	7.445	***	Yes
synesthesia	<---	Customer diversion	0.462	0.039	9.396	***	Yes
Consumer behaviour	<---	Distributed lighting design	0.689	0.12	3.852	***	Yes
Consumer behaviour	<---	Quality of illumination	0.167	0.046	3.856	***	Yes
Consumer behaviour	<---	Effect of lighting	0.202	0.081	2.175	0.030	Yes
Consumer behaviour	<---	Customer diversion	0.394	0.087	3.43	***	Yes
Consumer behaviour	<---	synesthesia	0.177	0.213	0.802	0.423	No

Table 6: Analysis of research paths

The results of the research path analyses in Table 6 provide the estimates, standard errors, critical ratios (C.R.), and significance levels of the path relationships between the different variables so that it is possible to understand whether these path relationships are significant and the strength of their effects.

1. The path estimate between associative perception and distributed lighting design is 0.725 and

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the significance level is extremely high (p<0.001), indicating that distributed lighting design has a strong positive effect on associative perception.

2. The path estimate for associative perception versus lighting quality was only 0.026 and insignificant (p=0.528), implying that the effect of lighting quality on associative perception is minimal and almost negligible.

3. The path estimates for the association with lighting effects and the association with customer infusion were 0.361 and 0.462, respectively, which were both highly significant at the significance level (p<0.001), indicating that lighting effects and customer infusion have a positive effect on association.

4. In predicting consumer behaviour, distributed lighting design (estimate 0.689), lighting quality (0.167), lighting effects (0.202) and customer infusion (0.394) all significantly influenced consumer behaviour (p<0.05), with distributed lighting design having the most significant effect.

5. However, the direct effect of associative awareness on consumer behaviour was estimated at 0.177 but was not significant (p=0.423), indicating that the direct effect of associative awareness on consumer behaviour was not significant after taking into account the effects of other variables.

In summary, distributed lighting design, lighting effects and customer infusion are the most important factors influencing the sense of connection, with distributed lighting design having a particularly significant effect on consumer behaviour. Lighting quality, while having a significant effect on consumer behaviour, did not have a significant effect on joint perception. These findings highlight the importance of lighting design and customer infusion strategies in enhancing customer experience and behaviour.

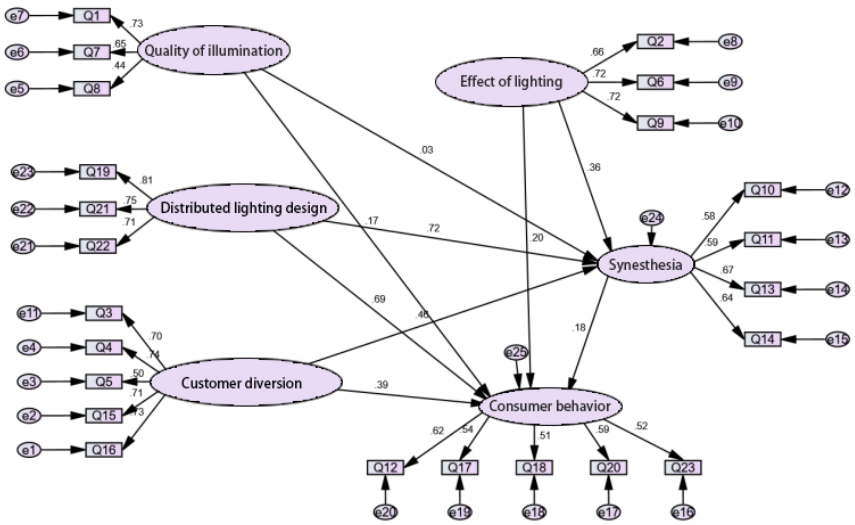

Figure 1: Model of the study structure

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4.5 Mediating effect test

item	Meaning	Effect size	95% CI		Z-value /T-value	p	Conclusion
			Lower limit	Upper limit			
Distributed lighting design => synesthesia => consumer behaviour	Indirect effect	0.288	0.261	0.401	8.296	0	Partial intermediary
Distributed lighting design => synesthesia	X=>M	0.703	0.656	0.749	29.629	0	
Synesthesia => Consumer behaviour	M=>Y	0.409	0.346	0.473	12.616	0	
Distributed lighting design => Consumer behaviour	Direct effect	0.411	0.353	0.469	13.87	0	
Distributed lighting design => Consumer behaviour	Total effect	0.698	0.657	0.74	32.864	0	

Table 7: Mediation test

The mediation test results in Table 7 show in detail the indirect effects of distributed lighting design on consumer behaviour through association, as well as the direct and total effects of distributed lighting design on consumer behaviour. By analyzing these data, we can draw the following conclusions:

1. The effect value of the indirect effect (the influence of distributed lighting design on consumer behaviour through association) was 0.288, with a confidence interval (CI) from 0.261 to 0.401, a z-value of 8.296, and a p-value of 0, which is clearly significant. This indicates that associative perception plays a partial mediating role between distributed lighting design and consumer behaviour, suggesting that distributed lighting design not only directly affects consumer behaviour, but also indirectly affects consumer behaviour by improving the associative experience.

2. The effect of distributed lighting design on associative perception (X=>M) was 0.703, with confidence intervals ranging from 0.656 to 0.749, a z-value of 29.629, and a p-value of 0, which is strongly significant. This emphasizes that distributed lighting design has a significant positive effect on enhancing the associative experience.

3. The effect of associative thinking on consumer behaviour (M=>Y) is 0.409 with a confidence interval from 0.346 to 0.473, a z-value of 12.616, and a p-value of 0, which is highly significant. This

indicates that associative awareness is an important factor influencing consumer behaviour.

4. The effect value for the direct effect (the impact of distributed lighting design directly on consumer behaviour) was 0.411, with a confidence interval ranging from 0.353 to 0.469, a z-value of 13.87 and a p-value of 0, indicating that distributed lighting design has a strong, direct and positive impact on consumer behaviour.

5. The total effect (the combined effect of distributed lighting design on consumer behaviour, including both direct and indirect effects) had an effect value of 0.698, with a confidence interval ranging from 0.657 to 0.74, a z-value of 32.864 and a p-value of 0, which is highly significant. This proves that distributed lighting design has a significant positive effect on consumer behaviour at both direct and indirect levels.

In summary, distributed lighting design has a significant total effect on consumer behaviour, in which associative perception plays a partly mediating role. These results highlight the importance of optimising distributed lighting design to enhance consumer experience and behaviour, and also reveal the mediating role of enhancing the associative experience in shaping consumer behaviour.

4.6 Discussion

This study uses Spss statistical analysis software to apply the questionnaire data, and establishes a model for empirical testing through quantitative research methods. Firstly, the basic influence relationship between distributed lighting design and consumer behaviour is verified; secondly, on the basis of the basic test, the intrinsic mechanism of distributed lighting design influencing consumer behaviour is analysed in depth, and the mediating effect of association in the process of distributed lighting design influencing consumer behaviour is analyzed empirically. In addition, it also explores whether distributed lighting design, including its three subdimensions of lighting quality, lighting effect, and customer infusion design of lighting, has an impact on the association consciousness and consumer behaviour. Through relevant empirical tests, the following main conclusions are drawn:

Assumption number	Hypothetical content	Test results
H1	Distributed lighting design within the public areas of shopping centres can significantly influence consumer behaviour;	set up
H1a	Lighting quality has an impact on consumer behaviour in public areas of shopping centres;	set up
H1b	Lighting effects in public areas of shopping centres have an impact on consumer behaviour;	set up
H1c	The design of lighting for customer orientation within the public areas of shopping centres has an impact on consumer behaviour;	set up

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H2	Distributed lighting design in the public areas of a shopping centre can provide consumers with a pleasant, warm and associative emotional experience.	set up
H2a	The quality of lighting in the public areas of shopping centres has an impact on the associative experience of consumers;	untenable
H2b	Within the public areas of shopping centres, the effect of lighting design has an impact on the consumer's associative experience;	set up
H2c	The design effect of lighting for customer orientation in public areas of shopping centres has an impact on the consumer's associative experience;	set up
H3	Consumers' associative experience under distributed lighting design in public areas of shopping centres has an impact on consumer behaviour.	untenable
H4	The associative experience of consumers in the public areas of shopping centres plays a mediating effect on the influence of lighting design on consumer behaviour.	set up

Table 8: Results of hypothesis testing

In the path analysis in Table 6 above the path estimate for associative perception and lighting quality was only 0.026 and insignificant (p=0.528), indicating that the effect of lighting quality on associative perception is minimal and almost negligible. The result of this analysis shows that hypothesis H2a is not valid. In addition, the direct effect of associative perception on consumer behaviour was estimated to be 0.177, but it was not significant (p=0.423), indicating that the direct effect of associative perception on consumer behaviour is insignificant after taking into account the effect of other variables. The result of this analysis shows that hypothesis H3 is not valid.

As can be seen from the results of hypothesis testing in Table 8, this paper validates 10 research hypotheses centred on distributed lighting design and consumer behaviour, of which 8 hypotheses are supported and 2 hypotheses are not supported. In general, most of the theoretical assumptions proposed in this paper have been supported by empirical data, the research problem can be a better fit for the actual.

4.7 Results

basically, completed the main research content and more successful to achieve the research objectives, the conclusions of the study are as follows:

1) There is a strong and significant positive effect of distributed lighting design on consumer behaviours such as shop and shopping centre selection, consumer spending, and willingness to recommend in the public areas of shopping centres.

2) In the public area of the shopping centre, the distributed lighting design can bring consumers a strong pleasant, warm associative emotional experience.

3) The associative experience of consumers in the public areas of shopping centres under distributed lighting design has a significant and strong positive impact on positive consumer behaviour, e.g. distributed lighting design has a significant and strong positive impact on consumer behaviours such as shop and shopping centre selection, consumer spending, and willingness to recommend.

4) In the public area of the shopping centre, consumers' associative experience plays an obvious mediating effect on the influence of lighting design on consumer behaviour, and the contribution of the mediating effect to the total effect is 45.84%.

5) The customer infusion design of distributed lighting design in the public area of the shopping centre can significantly and strongly influence various positive consumer behaviours, such as such as distributed lighting design on consumer behaviours such as shop and shopping centre selection, consumer spending, willingness to recommend and so on.

6) In the public area of the shopping centre, consumers' associative experience plays a significant mediating effect on the influence of the light guide design on consumer behaviour, and the contribution of the mediating effect to the total effect is 61.11%.

By cleverly combining directional signage with lighting design, shopping centres can provide a more intuitive and compelling navigation system that makes it easier for consumers to find their way around and enhances the overall navigation experience in the shopping centre. This not only helps to increase consumer satisfaction, but also helps to motivate them to explore and shop more actively.

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The Authors declares that there is no conflict of interest

Ethics approval

Not applicable

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