Contents lists available at ScienceDirect

International Journal of Hospitality Management

journal homepage: www.elsevier.com/locate/ijhm

Full length article

Links between cue combinations of physical environments and consumer satisfaction in themed restaurants from a systematic approach–avoidance perspective

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ARTICLE INFO

Keywords:
Themed restaurants
Consumer satisfaction
Physical environment cues
Aggregated case analysis
Rough set approach

ABSTRACT

Customer satisfaction with themed restaurants is predominantly influenced by all the perceivable cues of the physical environment, purposefully designed by service providers through the strategic deployment of signs, symbols, and embedded ideologies to establish brand identity, attract consumers, and stimulate the growth of added value. Due to epidemic prevention and control practices during the COVID-19 pandemic, the awareness of personal protection in public spaces prone to crowding has increased. In addition to the previous hedonic cues, hygiene or safety cues should be emphasised to minimise customers' perceptive insecurity and simultaneously convey a desirable service spirit, to achieve the goal of improving consumers' overall environmental satisfaction. However, there is little understanding of the causal rules between comprehensive physical environmental cues and consumer satisfaction from a systematic 'approach–avoidance' perspective in the post-pandemic period. This study aimed to identify the relationship between the physical environment cues of themed restaurants and consumer satisfaction using aggregated case analysis (ACA) and the rough set approach (RSA). A total of 14 key conditional attributes of themed restaurants and the key characteristics of each attribute were extracted using ACA. Subsequently, 13 decision-making rules were established using RSA. The findings contribute to the research on cause-and-effect relationships between physical environments and consumer satisfaction with themed restaurants and would help decision-makers select efficient interventions to improve the quality of such restaurants based on user satisfaction.

1. Introduction

The COVID-19 pandemic has had a broad and profound negative effect on the restaurant industry (Li et al., 2021). Epidemic prevention and control practices during the pandemic have helped to strengthen the public health needs and awareness of personal protection in public spaces prone to crowding. Although restaurants now operate without any containment measures, the pandemic has changed consumers' lifestyles in many ways. For instance, maintaining social distancing has become a polite gesture, and wearing a face mask a societal norm (Jo et al., 2020). The food service sector as a whole should embrace these changes, incorporate new customer needs into improvement strategies, and invest in measures to ensure both short- and long-term restaurant viability (Filimonau et al., 2021).

A theme restaurant, a specific type of catering establishment with a competitive advantage, in the backdrop of the experience economy (Tsai and Lu, 2012; Yan and Felicen, 2021), is 'primarily run based on spatial planning, décor, and entertainment arrangements, with a distinctive theme or specific style to attract consumers' (Lee et al., 2015). Unlike ordinary restaurants, themed restaurants produce an environment with identifiable public culture signs as a selling point (Yan and Felicen, 2021) and provide more opportunities for activities such as social interaction and entertainment than just food (Beardsworth and Bryman, 1999). In contrast to utilitarian consumption, which is primarily driven by functional purposes (e.g. consumption of ready-to-eat food), consumption at themed restaurants is primarily driven by hedonic motives, which implies that the achievement of their profit targets is highly dependent on consumers' dine-in experiences in a physical environment

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https://doi.org/10.1016/j.ijhm.2024.104055
Received 11 May 2023; Received in revised form 4 December 2024; Accepted 9 December 2024

that provides them a memorable experience (Ryu and Han, 2011; Ishak et al., 2020). A well-arranged dining space, including layout, interior decorations, atmosphere, art and logos, plays a significant role in attracting customer attention and enhancing their pleasure and satisfaction (Raajpoot, 2002).

According to signalling theory, customers driven by goals or motivations may rely on a signal of intentional communication from the service provider to convey desirable, unobservable attributes to estimate intangible qualities without prior information (Connelly et al., 2011). In the post-pandemic era, consumers mainly have two motivations for visiting themed restaurants. The first is for hedonic purposes, similar to pre-pandemic times. Consumers visit themed restaurants in pursuit of a culturally engaged dining experience (Ishak et al., 2020), emotional value (Kim and Moon, 2009), opportunities for display – themselves and their lifestyle– and social interactions (Rezende and Silva, 2014). The second motivation involves avoiding negative outcomes regarding epidemic safety. For the first motivation, consumers judge whether a theme restaurant has certain qualities for social pleasure, a relaxing experience, etc. through relevant environmental cues (e.g. fancy décor, comfortable layout, and unique styles) (Kim and Moon, 2009; Lee et al., 2015). For the second, owing to the airborne characteristics of any virus and high information asymmetry regarding safety, consumers rely heavily on all available cues, such as visible sterilisation and ventilation, separate spaces, or contactless features (Jeong et al., 2021), in the physical environment for health and safety (Bove and Benoit, 2020). According to approach–avoidance theory, these two motives are in conflict. Service providers are usually face a challenge in understanding the specific cues that trigger both positive and negative aspects of consumer behavioural intention and in providing a solution to increasing approach signals while reducing avoidance signals.

Extant literature has explored the physical environmental cues of theme restaurants in both aspects. Based on hedonic motivation, many empirical studies on hospitality have separately tested the correlation between the physical environment cues of themed restaurants and customers' hedonic responses such as revisit behavioural intention (Chang and Cheng, 2023), consumption value (Gu et al., 2021), and repurchase intention (Xu et al., 2023). Based on epidemic safety motivation, some scholars have attempted to create conceptual frameworks for environmental cues regarding how they potentially affect consumers' perceptions of epidemic safety in restaurants (e.g. Tse et al., 2006; Bove and Benoit, 2020; Li et al., 2021). However, knowledge about the effects of cue combinations in physical environments on the judgement of approach–avoidance behaviour intentions from a systematic approach–avoidance perspective is insufficient. Gestalt theory states that a perceiver blends diverse perceived features into a coherent and unitary impression by combining the meanings of individual components and their interrelationships, regardless of the nature of the experience (Kohler, 1929; Koffka, 1935). Based on the Gestalt approach, a perceiver in a themed restaurant derives a holistic image of satisfaction by cognitively organising various stimuli into groups. Thus, understanding the dependent relationships among environmental cues from a systematic perspective is crucial for determining the characteristics of the consumer experience in a complicated real-world situation, as well as for decision-makers to allocate rational resources to physical environment management and improvement (Zheng et al., 2024).

This study seeks to fill this gap by establishing a hybrid multiple-criteria decision-making (MCDM) model combining aggregated case analysis (ACA) and the rough set approach (RSA) to understand the causal effect rules between the physical environment cues of themed restaurants and consumer satisfaction in the post-COVID-19 era from a systematic approach–avoidance perspective. MCDM is a branch of operational research that seeks optimal alternatives in complex scenarios, including various indicators, conflicting objectives, and criteria (Kumar et al., 2017). This field involves multiple variables and conflicting objectives that decision-makers should not ignore in the optimisation and analysis process (Smedberg and Bandaru, 2023). Thus, this study used an MCDM model to construct a comprehensive framework of environmental characteristics with the goal of user satisfaction, integrating both hedonic and epidemic safety demands in post-pandemic times. ACA was employed to extract the key conditional attributes and key characteristics of each attribute from the cases of themed restaurants in China. RSA was used to generate decision-making rules between the physical environment cues of themed restaurants and consumer satisfaction. This study is expected to not only extend research on causal effect relationships between physical environments and consumer satisfaction in themed restaurants but also help decision-makers select efficient interventions to improve the quality performance of such restaurants based on user preference.

2. Literature review

2.1. Signalling theory and physical environmental cues

In classical economic theory, individuals are assumed to be completely rational, and their decisions influenced only by external objective factors they are fully aware of. However, in the real world, people are constrained by limited information acquisition and processing capabilities, and are unable to make perfect decisions. Owing to the pressure of making decisions as quickly as possible and the lack of information integrity and continuity, the decisions or behaviours that people make are actually more 'irrational' or emotional (Simon, 1957). Under this principle of limited rationality, subjective information such as goals and attitudes also affects people's perceptions of information. Therefore, individuals may make optimal decisions or behaviours based on their perception of limited information, which may not fully reflect the objective world (Downs and Stea, 1973).

In this backdrop, signalling theory helps by providing an explanatory basis as the use of signals can allow customers to navigate information about imperceptible attributes and likely outcomes to make their choice behaviours meet their objectives when faced with incomplete, fragmentary, and asymmetrically distributed information (Spence, 1974). According to this theory, customers of themed restaurants find it difficult to estimate the intangible attributes (e.g. high-quality or mediocre, safe or not) without prior information, and to judge the service qualities of the restaurants and make decisions (Byun and Jang, 2019), they may rely on a signal, which is the intentional communication from the service provider aiming to convey desirable unobservable attributes (Connelly et al., 2011).

Customers depend, to some extent, on both appearance and external impressions when making judgements about intangible or imperceptible products and their quality (Levitt, 1981). Among various customer touchpoints, physical environmental cues are considered the most perceptible and external (Zeithaml, 1988). Therefore, this study explores the physical environmental cues that the signaller intentionally creates to alter consumer beliefs in ways that benefit service providers.

2.2. Approach–avoidance motivation

Behavioural decisions are influenced by two distinct motivational systems: the behavioural activation system (BAS) and behavioural inhibition system (BIS) (Carver and White, 1994). BAS responds to reward incentives, leading individuals to pursue positive outcomes (approach), whereas BIS responds to punishment signals, prompting them to avoid negative outcomes (avoidance) (van Zeeland and Henseler, 2018). The behavioural inhibition or activation system works by regulating sensitivity to reward and punishment signals, balancing approach and avoidance motivations and enabling individuals to adapt to various new stimuli (Carver and White, 1994).

In the retail and hospitality industries, this theoretical perspective has been employed to investigate the role of various consumption motivations in consumer decision-making processes, such as shopping motivations (Guo and Main, 2017), booking intentions, and willingness

to pay (Guo and Main, 2017). It can help managers understand the specific factors that trigger both positive and negative aspects of consumer decision-making (e.g. Chang and Cheng, 2023) or potential avoidance factors (e.g. Penz and Hogg, 2011).

Service providers usually face the challenge of providing a solution that meets customers' needs based on three types of conflicts (Solomon et al., 2006): approach–approach conflict (consumers need to choose between two or more desirable options for benefits), avoidance–avoidance conflict (consumers need to choose one of the undesirable options they would otherwise avoid), and approach–avoidance conflict (consumer behaviour is influenced by the opposing forces of positive and negative outcomes) (Williams, 2012, pp. 71–72). In this study, consumers face an approach–avoidance conflict, and this conflicting perspective is applied to explore the physical environmental cues related to consumers' perceived place attraction (PA), driven by hedonic motivation, and perceived epidemic safety (PE), driven by safety motivation. In addition, to measure approach–avoidance behaviour intention, this study used perceived satisfaction (PS) as a decision attribute. In the catering industry, consumer satisfaction is a key indicator of restaurant service quality, brand image building, and market competitiveness (Han and Hyun, 2017). PS with dining experience is a fundamental factor in predicting consumers' behavioural intentions (Anderson and Fornell, 1994). While some studies believe that a high level of PS can lead to repeat patronage (Barber et al., 2011); some others find that, although a positive performance in satisfaction does not necessarily lead to return visits, a negative performance leads to none (Stevens et al., 1995). Accordingly, based on these two perspectives, PS can be used as a predictor of consumers' approach–avoidance behaviour. Thus, this study used it as a decision attribute.

2.3. Gestalt perception and combinations of physical environmental cues

Bove and Benoit (2020) argue that environmental signals represent a cost, and when faced with multiple signals, investment in the choice of signals is important to service providers because it influences their selection of service providers. Moreover, the authors claim, the overall effectiveness of different types of signals operating alongside may not simply be seen as the sum of the effectiveness of each signal operating in isolation. For example, the effectiveness of a signal operating alongside other signal types may be smaller than that of it working in isolation.

According to the Gestalt perspective, the perceiver blends diverse perceived features into a coherent and unitary impression by combining the meanings of individual components and their interrelationships regardless of the nature of the experience (Kohler, 1929; Koffka, 1935). Based on assumptions about how living organisms relate to their environment (Carmer and Rouzer, 1974), the Gestalt (or holistic) approach suggests that a perceiver in a themed restaurant derives holistic images of satisfaction by cognitively organising various stimuli into groups.

Existing studies on this topic are mainly based on the assumption that each environmental condition is completely independent (e.g. Meng and Choi, 2017; Yan and Felicen, 2021), which is not always suitable for complicated real-world situations. A systematic perspective on the dependent relationships among environmental cues is important for decision-makers' rational resource allocation in physical environment management and improvement (Zheng et al., 2024).

2.4. Servicescape and potential physical environmental cues

Servicescape, proposed by Bitner (1992), refers to the physical environment where services are conducted, delivered, and consumed (Figueiredo et al., 2021). It can provide a classification framework for the physical environmental factors of service organisations to help decision-makers strategically manipulate such factors to specifically influence approach and/or avoidance behaviours (Rosenbaum and Massiah, 2011). Servicescape has three dimensions: ambient conditions, space/function, and signs, symbols, and artefacts, all of which have been found to have a direct impact on customers' restaurant consumption experience and perception. In follow-up studies, the framework of Servicescape has been applied and extended to the restaurant industry, and some frameworks such as 'TANGSERV' (Raajpoot, 2002) and 'Dinescape' (Ryu and Jang, 2008) have been developed. Based on these theoretical frameworks, some empirical studies have focused on exploring the perceived physical environment factors linked to the outcomes of consumer perceptions and behaviours in themed restaurants (e.g. Kim and Moon, 2009; Lee et al., 2015; Meng and Choi, 2017; Ishak et al., 2020; Yan and Felicen, 2021) (Table 1).

Servicescape provides a theoretical lens for exploring the tangible cues available to consumers experiencing hospitality services (Nanu et al., 2024). Some studies have provided insightful explorations of the physical environmental cues of themed restaurants, which may have a potential impact on customers' perceived satisfaction (Table 1). Ryu and Han's (2010) empirical study found that facility aesthetics, lighting, layout, and social factors would directly affect customers' overall satisfaction with restaurants. Heung and Gu (2012) demonstrated a direct link between consumer perceptions of restaurant atmospherics (e.g. ambience, facility aesthetics, and spatial layout) and customers' dining satisfaction and return intention. Additionally, the physical environment attributes of themed restaurants, such as background music, atmosphere, cleanliness, style of decoration, and facilities, can affect consumer satisfaction by influencing customer emotions (Meng and Choi, 2017). Yan and Felicen (2021) identified that music and decoration, facility aesthetics, electronic equipment, seat comfort, cleanliness, and other restaurant conditions affect the perceived quality of the Dinescape, and in turn consumer satisfaction. Consequently, these cues were inductively classified into the first three dimensions, listed in Table 2.

After the COVID-19 outbreak, changes in safety precautions were considered key factors affecting consumer satisfaction (Benaglia et al., 2023). Zibarzani et al. (2022) found that COVID-19 safety precautions strengthened the positive relationship between restaurant atmosphere, service, and consumer satisfaction. Based on the DAST framework, Wang et al. (2021) proposed two important factors related to the perceived experience of restaurant consumers during the epidemic: number of people present in the environment (i.e. levels of crowdedness), and restaurant layout (i.e. social distancing). Bove and Benoit (2020) integrated typology with servicescape elements to develop a framework of various safety signals available to service providers, which included four physical environmental factors: food and beverage safety cues, social distancing control, employee appearance and behaviour quality, and visible sterilisation and ventilation. From the perspective of consumer expectations, Doğan (2020) used qualitative inductive analysis to summarise the measures that affect consumers' safety perceptions in catering service spaces, emphasising employee appearance and behaviour quality (e.g. wearing masks, gloves, personal protective equipment and clean uniforms), food and beverage safety cues (e.g. having an open kitchen) and ventilation (e.g. having a disinfection door) have a positive impact on consumers' safety perception. Li et al. (2021) proposed multidimensional and innovative strategies employed by Chinese restaurant enterprises to remain resilient, involving factors that ensure consumer safety and enhance their confidence in dining out, including environmental disinfection, control of social distancing, mobile payments, and separate dining.

In summary, by reviewing empirical research on the relationships between the environmental cues of themed restaurants and customer satisfaction, we summarise the key potential of the physical environment cues of themed restaurants pre-pandemic into three dimensions: ambient conditions (AC), facility aesthetics (FA), and spatial comfort (SC) (Table 2). Next, by reviewing the conceptual frameworks (e.g. Bove and Benoit, 2020; Li et al., 2021; Tse et al., 2006) for environmental cues that may potentially affect consumers' perceptions of epidemic safety in restaurants, the fourth dimension was categorised. Table 2 presents the potential environmental cues for the four dimensions.

Table 1
Servicescape framework and physical environmental cues.

Authors	Frameworks	Dimensions and physical environmental cues	Environments	Outcomes
Bitner (1992)	Servicescape	1. Ambient conditions: Temperature, air quality, noise, music, and odour. 2. Spatial layout and functionality: Layout, equipment, and furnishings. 3. Signs, symbols, and artefacts: Signage, personal artefacts, and style of décor.	Service organisation (conceptual model)	Ultimate customer satisfaction
Raajpoot (2002)	TANGSERV	1. Layout/ design: Decorations, building design, dining hall size, seating arrangement, restaurant location. 2. Product/ service: Food presentation, food serving size, menu design, food variety. 3. Ambience/ social: Light, crowding, music, dining hall temperature.	Restaurants	Overall quality perceptions and subsequent purchase behaviour
Ryu and Jang (2008)	Dinescape	1. Facility aesthetics, 2. Ambience, 3. Lighting, 4. Table settings, 5. Layout, 6. Service staff.	Upscale restaurants	Satisfaction and behaviour (approach/ avoidance)
Kim and Moon (2009)	Following Servicescape	1. Ambient condition, 2. Facility aesthetics, 3. Layout, 4. Electric equipment, 5. Seating comfort, 6. Pleasure-feeling, 7. Perceived service quality.	Themed restaurant	Feeling of pleasure; Overall quality Revisit intention
Ryu and Han (2010)	Following Dinescape	1. Facility aesthetic, 2. Lighting, 3. Layout.	Upscale restaurants	satisfaction and loyalty
Heung and Gu (2012)	Following Servicescape and Dinescape	1. Spatial layout, 2. Ambience, 3. Facility aesthetics.	Restaurants	Satisfaction and behavioural intentions
Lee et al. (2015)	Following Servicescape	1. Aesthetics, 2. Ambient condition, 3. Space/function, 4. Seating comfort, 5. Cleanliness.	Themed restaurant	Satisfaction
Meng and Choi (2017)	Following Servicescape	1. Substantive staging: Background music, atmosphere, cleanliness, style of the decoration, facilities. 2. Communicative staging: Employee behaviour, restaurant culture.	Themed restaurant	Customer emotion, perceived authenticity, and satisfaction
Ishak et al. (2020)	Following Servicescape and Dinescape	1. Aesthetic facility, 2. Comforting ambience, 3. Attentive service staff.	Themed restaurant	Authenticity of the dining experience
Yan and Felicen (2021)	Following Servicescape and Dinescape	1. Quality of Dinescape dimensions: Aesthetics, ambience, lighting, service quality, layout, social factor, overall mean, 2. Quality of Servicescape dimensions: Ambient condition, spatial layout, functionality, signs, symbols and artefacts, overall mean.	Themed restaurant	Satisfaction

3. Study design

This study establishes a hybrid multiple-criteria decision-making (MCDM) model combining ACA and RSA to understand the links between cue combinations of physical environments and consumer perceived satisfaction in themed restaurants in the post-pandemic era from a comprehensive and systematic perspective.

3.1. The aggregated case analysis approach

As shown in Fig. 1, first, the ACA was employed to extract the key conditional attributes and the key characteristics of each attribute. The interview data on consumers' dining experiences in themed restaurants, post-pandemic, which were obtained from a vast number of themed restaurants in China, were inductively analysed. ACA was used to identify and classify the environmental variables found in these cases, and to remove the less important environmental elements taken from previous findings in different contexts.

ACA is a multiple-case analysis approach under which researchers can 'create a coding instrument to classify variables found in the cases and then identify and analyse the patterns, correlations, and outcomes that emerge from the aggregated data' (Gould and Leo, 2010). Interpreting which environmental cues are important to consumers is subjective and is often dependent on specific contexts (Bove and Benoit,

Table 2
Potential environmental cues of themed restaurants influencing customer satisfaction.

Dimensions	Cues	Descriptions	References
Ambient conditions (AC)	Temperature (F_1)	Comfortable temperature.	Ryu and Jang, (2008); Heung and Gu, (2012); Lee et al., (2015); Yan and Felicen, (2021).
	Lighting (F_2)	Making adequate lighting with comfortable brightness; colour temperature and proper position; overall lighting level; warm lighting.	Ryu and Jang, (2008); Ryu and Han, (2010); Heung and Gu, (2012); Lee et al., (2015); Ishak et al., (2020); Yan and Felicen, (2021).
	Aroma (F_3)	Appropriate air quality and odour, pleasant aroma.	Ryu and Jang, (2008); Heung and Gu, (2012); Lee et al., (2015); Chiguvi, (2017).
	Sound (F_4)	Well-controlled noise and background music.	Ryu and Jang, (2008); Heung and Gu, (2012); Lee et al., (2015); Meng and Choi, (2017); Ishak et al., (2020); Yan and Felicen, (2021).
Facility aesthetics (FA)	Thematic symbol (F_5)	For reinforcing a themed image, signs, and symbols provided through ornamental signs, banners, pictures or other fixtures.	Ryu and Jang, (2008); Ishak et al., (2020).
	Style of decor (F_6)	Interior décor in an attractive style, especially in composition and wall and floor decorations, attractive colour schemes, paintings/ pictures, plants/ flowers, artefact and furniture, tableware (e.g. high-quality flatware, glassware, and linen).	Ryu and Jang, (2008); Ryu and Han, (2010); Heung and Gu, (2012); Lee et al., (2015); Meng and Choi, (2017); Ishak et al., (2020); Yan and Felicen, (2021).
	Tidiness and cleanliness (F_7)	Tidiness and cleanliness of the facility, entrances, and corridors.	Lee et al., (2015); Meng and Choi, (2017); Yan and Felicen, (2021).
Spatial comfort (SC)	Layout for accessibility(F_8)	Satisfactory arrangement of spatial relationships among service areas, dining areas, passageways, exit and entry, furnishings, electric equipment (e.g. displays, audio/video machines) without navigation difficulties for users.	Ryu and Jang, (2008); Ryu and Han, (2010); Heung and Gu, (2012); Lee et al., (2015); Ishak et al., (2020); Yan and Felicen, (2021).
	Seating comfort (F_9)	Space between the seats; a comfortable distance from the table; comfortable seats (e.g. padding, backrests heat-dissipating material); seating between neighbours are well spaced out.	Ryu and Jang, (2008); Heung and Gu, (2012); Lee et al., (2015); Yan and Felicen, (2021).
	Circulation (F_{10})	The width of aisles is sufficient for passing through easily, the signs in the corridors provide adequate direction and help you find your way.	Kim and Moon, (2009); Heung and Gu, (2012); Lee et al., (2015); Yan and Felicen, (2021).
Epidemic safety (ES)	Safety cues of food and beverage (F_{11})	Presentation of organic and fresh products and certification of these products. An open kitchen (via TV screen/smart applications). Providing live cooking videos or other disinfection store photos. Presentation of kitchen facilities; robot-aided food delivery systems; providing closed/ packaged food and beverage.	Bove and Benoit, (2020); Brizek et al., (2021); Doğan, (2020); Li et al., (2021); Huang et al., (2022).
	Social distancing control (F_{12})	Controlling the number of people at a table (e.g. a minimum of 6-ft distance between persons). Controlling the number of available tables (e.g. 50 % maximum capacity). Increasing the distance between restaurant tables. Providing separate spaces (e.g. private rooms, private dining tables, or separate dining). Using electronic tables/ electronic bell, mobile payments.	Bove and Benoit, (2020); Kim and Lee, (2020); Doğan, (2020); Shokhsanam and Ahn, (2021); Wang et al.,(2021); Wei et al., (2021); Li et al., (2021); Lu et al., (2020); Brizek et al., (2021); Huang et al., (2022).
	Employee appearance and behaviour quality (F_{13})	Wearing mask, gloves, personal protective equipment and clean uniforms. Displaying the staff's health status code (or a hygiene certificate) at the entrance. Checking customer body temperature or health-status code. Providing a sign forbidding the entry of anyone with a fever or persistent cough.	Bove and Benoit, (2020); Tse et al., (2006); Doğan, (2020); Li et al., (2021); Shokhsanam and Ahn, (2021); Wei et al., (2021); Huang et al., (2022).
	Visible sterilization and ventilation (F_{14})	Visible sanitization procedures. Clean and sanitized surfaces. Installed sterilisation equipment (e.g. full-body disinfectant machines, ultraviolet rays, sensor doors and taps). Providing disinfectant spray. Appropriate	Bove and Benoit, (2020); Tse et al., (2006); Doğan, (2020); Li et al., (2021); Lu et al., (2020); Wei et al., (2021); Huang et al., (2022).

(*continued on next page*)

Table 2 (*continued*)

Dimensions	Cues	Descriptions	References
		ventilation system. Providing a sterile package with fork, knife, and spoon.	

2020). Accordingly, this study suggests that the 'environment-perceived satisfaction' relationships in themed restaurants should be explored in the context of a relatively consistent consumption culture to reduce potential misinterpretation of the results which mix the interpretation of environmental cues by users from markedly different cultural backgrounds. Accordingly, this study considers themed restaurants in China to extract the key conditional environmental attributes (including the key characteristics of each attribute) that potentially influence consumer-perceived satisfaction. As Chinese nationals develop cultural cultivation, aesthetic taste, and higher living standards, many themed restaurants have emerged in towns, counties, and cities. Over the past five years, most themed restaurants have experienced a process that started with a complete shutdown, transitioned to COVID-19 testing restrictions among consumers, and ended with a full opening. This process has helped to raise citizens' awareness of the necessity to maintain hygiene standards in public places and strengthen self-protection efforts.

Regarding the data collected for ACA, 14 potential environmental attributes (i.e. F_1–F_{14}) extracted from the literature (Table 2) were transformed into 14 structured interview questions to collect consumers' opinions about the physical environment characteristics and dining experience in themed restaurants. In individual interviews, each user was asked to recall at least one themed restaurant that they had visited and been impressed with, and to characterise their consumption experiences with respect to these 14 attributes. If they had nothing to say about a certain attribute, they could skip it. Each restaurant was treated as an empirical case.

An inductive analysis of all the collected cases for environmental characteristics was conducted following the logic of a general qualitative inductive analysis (Steps A1–5). The potential factors listed in Table 2 were supplemented or deleted based on frequency of mention. Finally, the key conditional attributes and characteristics of each conditional attribute were obtained. A summary of the data was prepared to ensure that the semantic scale of each factor was universally applicable in all cases. The inductive analysis steps follow those of Zhong and Dai (2019).

Step A1: Sorting memos of the initial data collected.

Step A2: Labelling: Highlighting key terms in the text regarding the subjective understanding and evaluation of the themed restaurant experience and coding the text.

Step A3: Identifying concepts: Asking questions, making comparisons and linkages with theoretical sampling, and expanding terms to concepts.

Step A4: Categorising: Similar concepts were grouped together, and categories, such as temperature, background sound, were developed based on similar concepts in the respondents' responses.

Step A5: Identifying subcategory data and the properties and characteristics of the subcategories along a dimensional range.

3.2. The rough set approach

RSA was employed to generate decision-making rules between the physical environment factors of themed restaurants and consumers' perceived satisfaction. A mathematical tool proposed by Pawlak (1982), RSA uses data mining techniques to identify core attributes and clarify the knowledge of behavioural rules (i.e. if–then rules). It can construct upper and lower approximations of precise sets with equivalence relations, determine the boundaries of classification functions, and extend basic information to obtain reduced attribute sets, core attribute sets, and knowledge rules. By calculating the importance of conditional attributes based on the degree of dependency, the tool simplifies the conditional attribute set, retrieves the core attribute set from multiple simplified conditional attribute sets, and effectively establishes decision rules between the conditional and decision attributes, thereby addressing inaccurate, inconsistent, and incomplete relationships in the information (Mei et al., 2022). RSA has been applied to similar topics to clarify causal relationships between physical environments and user attitudes (Mei et al., 2022; Fan et al., 2023). Thus, it is suitable for generating decision-making rules between the physical environmental factors of themed restaurants and consumers' perceived satisfaction. Using the RSA technique, the survey determined both the core attribute set and decision rules between conditional attributes and decision attributes (i.e. if–then rules). The RSA questionnaire contained questions on both conditional (Part I) and decision attributes (Part II). Part I included 14 questions on consumers' judgement of the key conditional attributes of restaurants, which were formulated based on the ACA induction results of key conditional attributes (for questions) and key characteristics (for answer options). Part II included three questions about overall consumers' judgement of PS, PE, and PA. The detailed steps of a data mining analysis by RSA are as follows (Step R1–5), which follow the RSA method steps in Fan et al. (2023) and Li et al. (2025).

Step R1: Building an information system

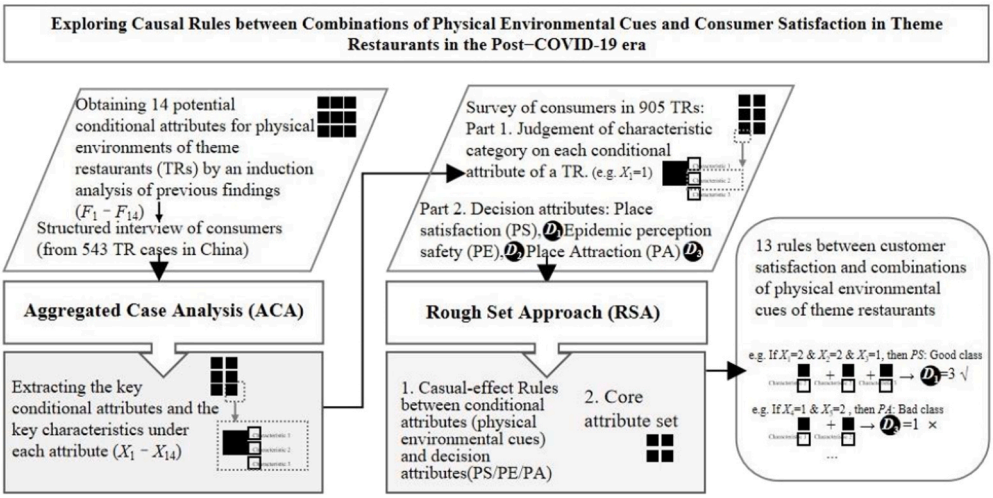

Fig. 1. Research methodology and flowchart.

An information system can be represented as $S = (U, A{=}C{\cup}D, V, f)$, where U is a finite non-empty set of objects (called universe set), A is a finite non-empty set of attributes (which can divide two finite non-empty sets of condition attributes C and decisions D, respectively). $V = \cup_{a\in A} V_a$, where V_a is the set of values for each attribute a (called the domain of attribute a), and $f : U \times A \to V$ is an information description function defined from $U \times A$ towards V (e.g. $\forall x \in U$ if $a \in A$ then $f(x, a) \in V_a$).

Step R2: Confirming indiscernibility relation

For any condition attribute subset $B{\subset}C$, which the associated equivalence relation is defined as Eq. (1).

$$IND(B) = \{(x, y) \in U | \forall a \in B, f_a(x) = f_a(y)\} \tag{1}$$

Where $IND(B)$ is the subset *B-indiscernibility relation*. The $IND(B)$ generates a partition $U/IND(B) = \{I_B | x \in U\}$ over U, where I_B is the equivalence class of an object that consists of all objects $y \in U$ such that x is indiscernible with y by attribute set B.

Step R3: Setting of lower and upper approximations

Set B ($B{\subset}C$) is a subset of the condition attributes, and $I_B[x]$ is the equivalence class function of each object by attribute subset B. The set approximation of the object $X{\subset}C$ obtained using the equivalence class function $I_B[x]$ gives a set of approximations of the lower $\underline{B}X$ and the upper $\overline{B}X$, defined in Eqs. (2–3).

$$\underline{B}X = \{x \in U | I_B[x] \subseteq X\} \tag{2}$$

$$\overline{B}X = \{x \in U | I_B[x] \cap X \neq \varnothing\}, \tag{3}$$

where the lower approximation of X called the positive region of X is denoted by $POS_B(X)$.

Step R4: Confirming dependency of condition attributes

The partitioning of universe U by the indiscernibility relation of decision attribute D is defined in Eq. (4).

$$U/IND(D) = \{D_1, D_2, \ldots, D_k\}, \tag{4}$$

where $U = \cup_{i\in\{1,\ldots,k\}} D_i$ and $\underline{B}D_i$ comprise the lower approximation of each partition D_i by the subset of condition attributes B. The positive region of decision attribute D, which represents the subset of condition attributes B, denoted by $POS_B(D)$ is given by Eqs. (5–6).

$$POS_B(D) = \cup_i^k POS_B(D_i) \tag{5}$$

$$POS_B(D_i) = \underline{B}D_i = \{x \in U | I_B[x] \in D_i\} \tag{6}$$

The dependency degree between condition attribute B and decision attribute D is given by Eq. (7), where $|POS_B(D)|$ denotes the cardinality of $POS_B(D)$, and $|U|$ denotes the cardinality of U.

$$\gamma_B(D) = \frac{|POS_B(D)|}{|U|}, \tag{7}$$

where $\gamma_B(D)$ indicates the degree of dependency between the subsets of decision attribute D and condition attribute B, which can be divided into three relations. The subset of decision attribute D is independent of the subset of condition B ($\gamma_B(D) = 0$). The set of decision attributes D depends completely on a subset of condition attributes B ($\gamma_B(D) = 1$). The subset of decision attribute D partially depends on the set of condition attribute B ($0 < \gamma_B(D) < 1$).

Step R5: Deriving knowledge rules

A reduction in the condition attribute set will preserve the relevant relationship between the condition attributes and decision classes. Therefore, a set of decision rules can be derived from a decision table for decision analysis. The decision rule is given by Eq. (8):

A decision rule in S is expressed as $\Phi \to \Psi$ and read as if Φ then , Φ (8)

where Φ and Ψ represent the conditions and decisions of the rule, respectively. The rules are '*if…then…*' statements, relating to the condition and decision classes. The decision rule reflects a relationship between a set of conditions and a decision. Furthermore, the *strength* of the decision rule $\Phi \to \Psi$ in S can be expressed as $\xi_s(\Phi, \psi) = \sup_S(\Phi, \psi)/card(U)$, where $\sup_S(\Phi, \psi) = card(\|\Phi \wedge \psi\|_S)$ is called the *support* of the rule $\Phi \to \Psi$ in S; and $card$ (U) is the cardinality of U. With every decision rule $\Phi \to \Psi$, we associate a *coverage factor/covering ratio* (CR) defined as $\mathrm{cov}_s(\Phi, \psi) = \sup_S(\Phi, \psi)/card(\|\psi\|_S)$. CR is interpreted as the frequency of the objects having property Φ in the set of objects having property Ψ. The strength of the decision rule can be simply expressed as a ratio: the number of facts that can be classified by the decision rule divided by the number of facts in the data table. Both the CR and the *strength* of the decision rule are used to estimate the quality of the decision rules. Their roles are essential for a decision-maker considering which decision rule to use.

4. Data collection and analysis results

4.1. Aggregated case analysis

ACA data collection was conducted from February to March 2022, and the collectors were 65 undergraduate students from two interior design classes that were household-registered across various provinces of China. After training in data collection skills and matters of importance, the students were asked to seek no fewer than five experienced themed restaurant-goers to conduct personal interviews. They were then asked to specify the reasons why they liked or disliked the restaurants they mentioned with respect to the 14 aspects (Table 2) and to characterise the restaurants; if they had nothing particular to report in a certain aspect, they could opt to skip over. This survey was conducted in China. Three researchers conducted linguistic validation, translated the items into Chinese before data collection, and translated them back before scientific writing. Eventually, 521 respondents accepted the interview, and 543 themed restaurants were obtained. NVivo 12 was used to code and classify the attributes at different stages of data collection.

As a result, 18 attributes were obtained based on the response threshold, where a single response rate should not be lower than 40 % of the total response rate, and factors with fewer than 221 responses were deleted. Ultimately, 14 attributes were retained to be used as conditional attribute questions in the subsequent RSA survey; the scales under the 14 conditional attributes were also the results of induction over the many cases mentioned above, ensuring that the main attribute descriptions were able to incorporate the attributes that appeared in all the restaurants. This process is described in Appendix A.

The semantic scale used in previous surveys investigating the environmental preferences of themed restaurant users mostly adopted the Likert scales; for example, Lee et al. (2015) had included questions such as 'the aroma in this restaurant is pleasant' and adopted a five-point Likert scale which ranged from 5 points for 'very satisfied' to 1 point for 'very dissatisfied'. However, by employing ACA, this research could induce and extract the key characteristics of each attribute – for example, 'the restaurant's background sound is mainly…' with the following choices generated from an induction of the answers to sound-related questions based on a verbatim transcription of the interview: (1) predominantly human sound (like consumer chat sound), overall relatively quiet; (2) predominantly light music (like soothing, small-volume, lyric-less music sound); (3) predominantly heavy music (like fast-rhythm, large-volume, with human sound); and (4) mixed noises. These choices feature more objective attribute categories, which, when subsequently required to generate improvement strategies, could enable decision-makers to formulate more concrete suggestions based on the data analysis results.

4.2. RSA

At this stage, the questionnaire comprised three sections. The first section collected the respondents' background information, including where they would need to fill out their gender, age, regular residence area, region where the restaurant is located, and visit frequency.

The next section was a case-based unit, where the respondents focus on themed restaurants that has left a deep impression on them either because of a pleasant experience or an unpleasant one, and judges the restaurant on every conditional attribute and decision attribute. The decision attribute (D) included three questions: place satisfaction (PS), 'Do you agree with the following statement? Overall, I feel satisfied with the restaurant'; Perceived epidemic safety (PE) 'Do you agree with the following statement? Considering the risk of epidemic infection that I may get from this themed restaurant, the whole environment is safe to me'; Place Attraction (PA) 'Do you agree with the following statement? Considering the benefits that I may get from this themed restaurant, such as a visual experience, social interaction, and affect regulation, the whole environment is attractive to me'. Responses were assessed using a semantic scale ranging from 'strongly disagree (1)' to 'strongly agree (3)'. The condition attribute (X) includes four dimensions and 14 attributes obtained from the ACA results (Table 3). To reduce the vague representation of questionnaire items, respondents were asked to answer questions such as 'Can you give us an example of how you understand this attribute (X_i)?' The respondents were invited to point out the objects in the themed restaurants.

The questionnaire was collected from 32 design program master's students and 65 interior design undergraduates from two classes. During the four-month period from March to June 2022 when the data were collected, 980 questionnaire sets were returned. After excluding invalid sets, 905 valid questionnaires were obtained, mainly because of failure to complete the questionnaires. As seen in Table 4, most respondents were female, aged 18–27, and residing mainly in the central and eastern areas of China. The restaurant cases mentioned by the respondents were mostly from the eastern region. On average, as many as 51.04 % of the respondents visited themed restaurants three or more times every month; the respondents generally had rich experiences visiting themed restaurants.

Rose 2 was used to conduct the RSA analysis. In the RSA, the accuracy and quality of approximations are crucial parameters for the extraction of decision rules. If the upper and lower approximations of a set are equal, the set becomes an exact set. Otherwise, it is called a rough set, where the lower approximation is called the positive area (denoted by $\underline{BX}$ in Eq. 2) of the concept, and the difference between the upper and lower approximations is called the boundary. The approximation accuracy of the decision class is calculated using the ratio of the lower approximation (Eq. 2) to the upper approximation (Eq. 3). For example, in 'Bad class ($D_1 = 1$)' of PS, there are 200 lower approximation objects and 212 upper ones, and the classification accuracy is 0.9434 (Table 5). This implies that the upper ones are not equal to the lower ones, and the approximation boundary of these datasets is rough. For the approximation of PS, PE, and PA, the results of the classification quality for all condition attributes were 0.9381, 0.9768, and 0.9348, respectively (Table 6), all of which fell within an acceptable range. The approximation boundary of all categories under the three datasets remains consistently fuzzy, that is, fuzziness exists (i.e. roughness).

In the reliability analysis results, the average accuracies of PS, PE, and PA were 0.7768, 0.6156, and 0.6066, respectively, all exceeding the threshold value of 0.6, which means their reliability fell within acceptable ranges. Table 6 presents the results for the core conditional attributes for each decision attribute (PS/PE/PA).

This study selected rules with a non-lower-than-10 % coverage degree within the RSA result set. The degree of coverage of a certain rule was obtained by calculating the ratio of the number of objectives supporting the rule to the total number of objectives (n = 905). Considered exclusively on 'Good' class ($D = 3$) and 'Bad' class ($D = 1$), the results

Table 3
Conditional attributes and semantic scale in Part I of the RSA questionnaire.

Dimensions	Key condition attributes	Key characteristics of each attribute
Ambient conditions	The restaurant impressed me in temperature as (X_1)	1 = cold 2 = hot 3 = comfort
	The restaurant impressed me in lighting as (X_2)	1 = bright 2 = lightless 3 = moderate
	The restaurant impressed me in aroma as (X_3)	1 = food 2 = artificial fragrance (e.g. plant scents) 3 = barely scented
	The restaurant impressed me in sound as (X_4)	1 = human sound (e.g. chatting), quiet, overall 2 = light music (e.g. soothing, small-volume, lyric-less) 3 = heavy music (e.g. fast-rhythm, large-volume, human sounded) 4 = mixed noises
Aesthetics	The restaurant impressed me in thematic symbol with respect to (X_5)	1 = artefacts, decorations, and ornaments 2 = colour combo 3 = decoration material combo
	I can sense that the style of decor mainly belongs to (X_6)	1 = ethnic themed (e.g. American countryside, Japanese style, Italian style …). 2 = time themed (e.g. nostalgia-themed) 3 = idiosyncratic themed (e.g. horror-room themed, nightclub themed …)
	The restaurant strikes me as clean in tidiness and cleanliness mainly through (X_7)	1 = none-skin-contact environment (e.g. overall pleasant atmosphere, clean ceiling and walls, and spotless entrance, aisles, and floor) 2 = skin-contact locations (e.g. clean tables, chairs, and washing room) 3 = food contact (e.g. clean tableware and cooking utensils)
Space/ function	The restaurant strikes me as sensible in layout for accessibility mainly through (X_8)	1 = sensible setup at entrance and exit 2 = sensible instalment and layout for facilities (e.g. drinking water machine) 3 = clear partitions (e.g. able to recognize different dining sections) 4 = clear signposting (e.g. easy to locate the restrooms)
	The restaurant chairs strike me as comfortable in seating comfort mainly with respect to (X_9)	1 = seat height 2 = softness/hardness 3 = chair back
	The restaurant aisles strike me in width of aisles as (X_{10})	1 = proper 2 = moderately compact 3 = spacious
Epidemic safety	The restaurant strikes me in safety cues of food and beverage mainly through (X_{11})	1 = display of information on ingredient suppliers and places of origin 2 = display of cooking process (e.g. transparent windows with view of the kitchen) 3 = food delivery process (e.g. robot delivery, or delivery with covers to the dishes)
	The restaurant implements social distancing control for customers mainly through (X_{12})	1 = number of guests per table 2 = number of tables 3 = physical partitions 4 = electronic payment and order placement
	The restaurant strikes me as appropriate in employee	1 = temperature and health code check for customer

(*continued on next page*)

Table 3 (*continued*)

Dimensions	Key condition attributes	Key characteristics of each attribute
	appearance and behaviour quality mainly through (X_{13})	2 = employee uniform and protective gears 3 = public information of temperature check results for employees
	The restaurant strikes me in visible sterilization and ventilation mainly through (X_{14})	1 = public information on disinfection records (location, time, and frequency) 2 = provision of disinfectant products or facilities (e.g. alcohol, hand sanitizer, and sense-based taps) 3 = proper ventilation (e.g. fresh air from air conditioners; ventilation through open windows)

Table 4
Demographic characteristics of participants and case distribution.

Characteristics	Category	N	%
Gender	Female	548	60.6
	Male	357	39.4
Age	18–22	583	64.4
	23–27	227	25.1
	28–32	57	6.3
	33 and above	38	4.2
Regular residence area	Eastern region	696	76.9
	Central region	99	10.9
	Western region	82	9.1
	Northeast	22	2.4
	Abroad	6	0.7
Use frequency of themed restaurants (per month)	Less than 1	18	2.0
	1	179	19.8
	2	246	27.2
	3	189	20.9
	4	101	11.1
	5	88	9.7
	More than 5	84	9.3
Regions where the cases are located	Eastern region	703	77.7
	Central region	96	10.6
	Western region	82	9.1
	Northeast	18	1.9
	Abroad	6	0.7

Table 5
Results of approximations (PS/PE/PA).

Class	No. of objects (n = 905)	Lower approximation	Upper approximation	Accuracy
PS, $D_1 = 1$	209	200	212	0.9434
PS, $D_1 = 2$	440	420	476	0.8824
PS, $D_1 = 3$	256	229	273	0.8388
PE, $D_2 = 1$	271	262	276	0.9493
PE, $D_2 = 2$	257	250	263	0.9506
PE, $D_2 = 3$	377	372	387	0.9612
PA, $D_3 = 1$	297	293	340	0.8618
PA, $D_3 = 2$	268	256	278	0.9209
PA, $D_3 = 3$	340	297	354	0.8390

yielded 13 rules with a non-lower-than-10 % coverage degree (Table 7),

Table 6
Results of core attributes (PS/PE/PA).

Decision attributes	Core attributes	Quality of classification for all condition attributes	Quality of classification for core condition attributes
PS	$X_2\ X_3\ X_6\ X_7\ X_{10}\ X_{12}\ X_{13}$	0.9381	0.6586
PE	$X_1\ X_2\ X_3\ X_7\ X_8\ X_{10}\ X_{11}\ X_{12}\ X_{13}\ X_{14}$	0.9768	0.9768
PA	$X_1\ X_2\ X_3\ X_4\ X_5\ X_6\ X_{10}\ X_{11}\ X_{12}$	0.9348	0.8773

Table 7
Minimal covering rules with strength exceeding 10 % in decision on bad class and good class.

No.	Conditions	Decision (PS/PE/PA)	Number of objects	Coverage degree (%)
1	$(X_1 = 2)$ & $(X_4 = 4)$ & $(X_7 = 3)$ & $(X_8 = 1)$	Bad class (PS, $D_1 = 1$)	143	15.79
2	$(X_4 = 4)$ & $(X_6 = 2)$ & $(X_8 = 1)$ & $(X_{10} = 2)$	Bad class (PS, $D_1 = 1$)	121	13.40
3	$(X_1 = 2)$ & $(X_4 = 4)$ & $(X_7 = 3)$ & $(X_9 = 2)$ & $(X_{10} = 2)$	Bad class (PS, $D_1 = 1$)	108	11.96
4	$(X_4 = 4)$ & $(X_8 = 1)$ & $(X_{10} = 2)$ & $(X_{12} = 2)$	Bad class (PS, $D_1 = 1$)	95	10.53
5	$(X_1 = 3)$ & $(X_2 = 3)$ & $(X_3 = 1)$ & $(X_5 = 3)$ & $(X_{10} = 1)$ & $(X_{11} = 3)$	Good class (PS, $D_1 = 3$)	99	10.94
6	$(X_5 = 3)$ & $(X_8 = 3)$ & $(X_{10} = 1)$ & $(X_{12} = 2)$ & $(X_{13} = 2)$	Good class (PS, $D_1 = 3$)	92	10.16
7	$(X_1 = 2)$ & $(X_8 = 1)$ & $(X_{12} = 4)$	Bad class (PE, $D_2 = 1$)	114	12.55
8	$(X_3 = 1)$ & $(X_7 = 1)$ & $(X_{12} = 2)$ & $(X_{13} = 2)$ & $(X_{14} = 2)$	Good class (PE, $D_2 = 3$)	161	17.77
9	$(X_2 = 3)$ & $(X_{11} = 3)$ & $(X_{12} = 2)$ & $(X_{13} = 2)$ & $(X_{14} = 2)$	Good class (PE, $D_2 = 3$)	146	16.18
10	$(X_4 = 4)$ & $(X_6 = 1)$ & $(X_{10} = 2)$ & $(X_{12} = 4)$	Bad class (PA, $D_3 = 1$)	104	11.45
11	$(X_2 = 1)$ & $(X_5 = 3)$ & $(X_6 = 1)$	Bad class (PA, $D_3 = 1$)	210	23.23
12	$(X_5 = 3)$ & $(X_6 = 3)$	Good class (PA, $D_3 = 3$)	160	17.65
13	$(X_6 = 3)$ & $(X_9 = 2)$	Good class (PA, $D_3 = 3$)	125	13.82

representing the condition combinations leading to different judgement results (Rules 1–6 for PS, Rules 7–9 for PE, Rules 10–13 for PA). Figs. 2–4 are visualisation expression of 'if–then' rules between conditional attributes of physical environments and consumers' judgement results. For example, Rule 1 shows that if the following environmental conditions, $X_1 = 2$, $X_4 = 4$, $X_7 = 3$, $X_8 = 1$, are present in a restaurant at the same time, consumers will feel very dissatisfied (PS, $D_1 = 1$).

5. Discussion and conclusions

The COVID-19 pandemic resulted in extensive economic, social, and cultural transformations (Li et al., 2021). In the 'new normal', consumer attitudes and consumption habits were reshaped. Considering that the longevity and survival of restaurant businesses depend on their ability to develop, position, and market products that meet customers' needs and demands, they must be open to changes and innovations (Doğan, 2020). With the increasing demand for hedonic experiences and emerging epidemic safety, effectively allocating resources and formulating effective strategies to improve the physical environments of themed restaurants have attracted growing attention among scholars and managers in the field within the realm of hedonic services.

This study employed an MCDM model to identify the relationship between the physical environment cues of theme restaurants and

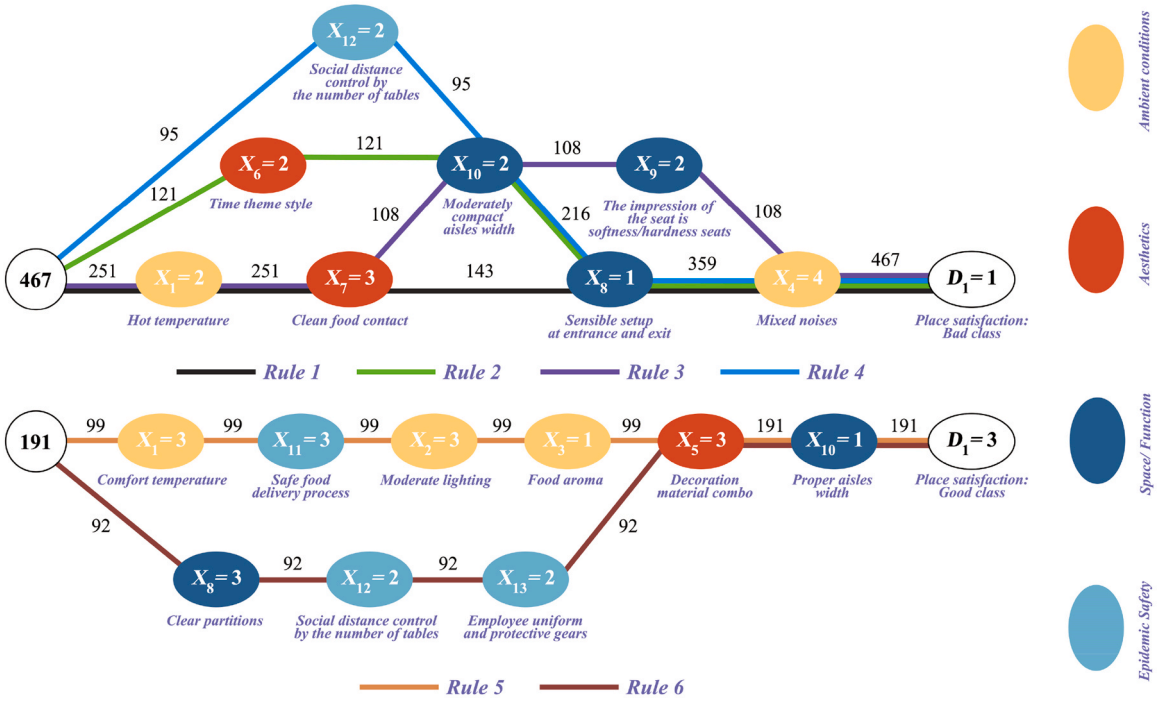

Fig. 2. Causal-rules flow graph of place satisfaction (PS).

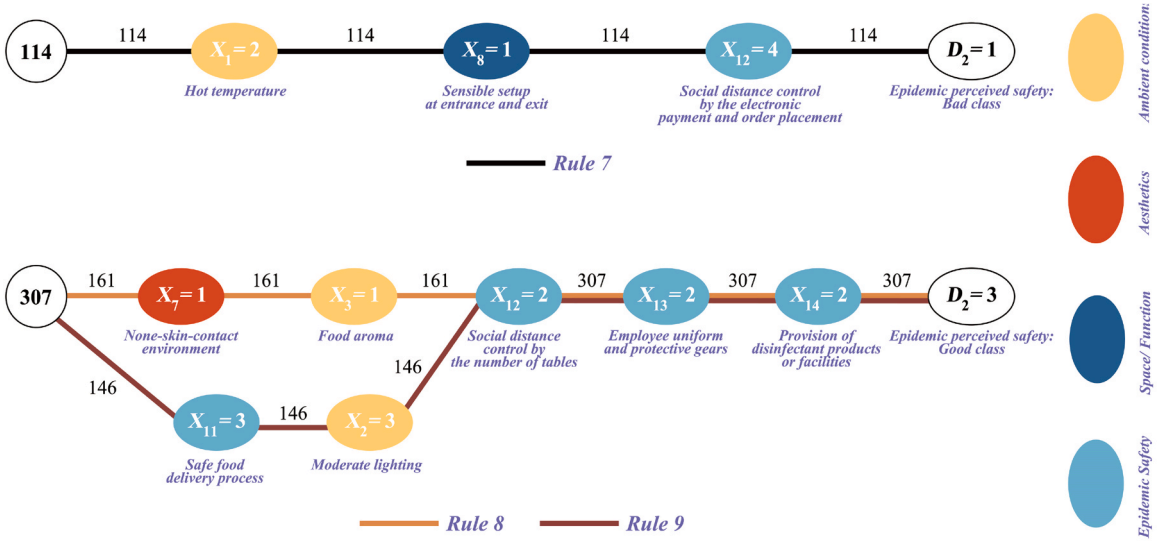

Fig. 3. Causal-rules flow graph of perceived epidemic safety (PE).

consumers' perceived judgement by combining ACA and RSA methods. A total of 14 key conditional attributes of the themed restaurants and the key characteristics of each attribute were extracted using ACA, and 13 decision-making rules established using RSA. Addressing the question on 'environment-perceived satisfaction' rules from a comprehensive, systematic perspective, post-pandemic, has significant theoretical and managerial relevance on several levels.

5.1. Theoretical implications

Using the approach–avoidance theory, this study investigated the causal rules between the combination and matching status of physical environmental cues and customers' perceptions of environmental epidemic safety, environmental attraction, and overall satisfaction with themed restaurants after the pandemic. It makes several theoretical contributions. First, it identifies environmental cues related to epidemic-perceived safety from a consumer perspective. A review of previous studies found that, after the pandemic, consumers had begun to consciously look for signals related to epidemic safety from physical environmental cues in the catering industry, owing to changes in hygiene practices (Foroudi et al., 2021; Li et al., 2021). Some scholars have attempted to create conceptual frameworks for environmental interventions in terms of how they potentially affect consumer perceptions of epidemic safety in restaurants (e.g. Bove and Benoit, 2020; Li et al., 2021; Tse et al., 2006); however, existing research does not provide sufficient empirical evidence to understand the interventions in epidemic safety that can influence customer perceived satisfaction. A few empirical studies on hospitality attempted to separately test the correlation between epidemic prevention measures in the physical environment and customer safety perceptions (e.g. Wang et al., 2021).

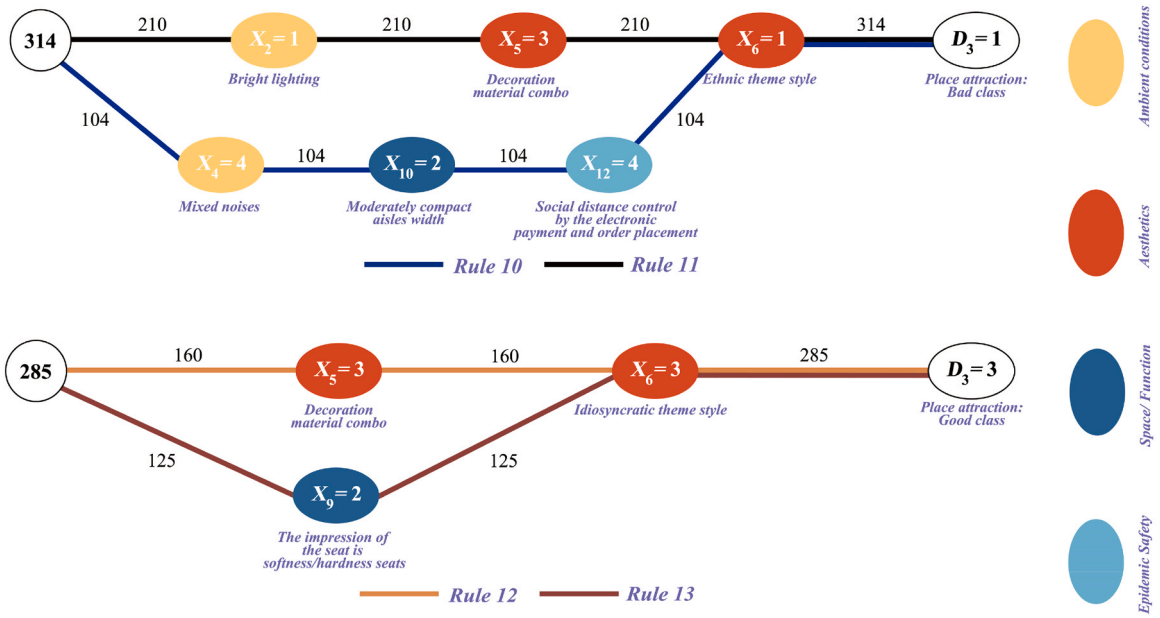

Fig. 4. Causal-rules flow graph of place attraction (PA).

However, consumer perception-based empirical investigations that explore measures the most effective in communicating safety messages to audiences and considering multiple environmental interventions are still lacking. Our empirical investigation considered almost all potential environmental conditions for epidemic safety, and identified the key safeguard measures that can contribute to consumers' satisfaction judgement, such as social distance control by the number of tables ($X_{12} = 2$) in Rules 4 and 6, measures on safe food delivery process ($X_{11} = 3$) in Rule 5, and employee uniforms and protective gear ($X_{13} = 2$) in Rule 6. According to the six rules of PS, constructed after data exploration in this study (Fig. 2), all of four cues ($X_{11} - X_{14}$) in the dimension of ES were mentioned. This study provides the empirical evidence in the Chinese context that consumers are still conscious of receiving epidemic safety related environmental signals from the dining environment.

Second, from the approach–avoidance theory perspective, we separately discuss the causal relationship between environmental cues and PE under safety motivation and the causal relationship between environmental cues and PA under hedonic motivation. The causal relationship between environmental cues and satisfaction evaluation predicted approach–avoidance behaviour. Integrating Figs. 2–4 shows that the rules that reveal the formation of high or low satisfaction (Rules 1–6) contain most of the core cues that lead to high and low PE and PA. Hedonically related benefit-seeking and ES hazard avoidance are the core mechanisms for consumers in themed dining spaces. The overall customer evaluation of their experience in a themed restaurant environment is balanced around the perceived signals of PE and PA, which reflect a mixture of hedonic desire and fear (Chang and Cheng, 2023).

However, the overall satisfaction rating PS, whether for avoidance $D_1 = 1$ rule or approach $D_1 = 3$ rule, is not composed of a simple linear superposition of the various cues in the corresponding rules of PE and PA. For example, in rules (if… then…) explaining low customer satisfaction, a rule consisting of four physical environment cues (Rule 4) exists: one of them ($X_8 = 1$) is one of the cues in Rule 7 that leads to the judgement of low environmental PE under safety motivation; two items ($X_{10} = 2$ and $X_4 = 4$) are two combinations of cues that lead to a low rating of PA under hedonic motivation (Rule 10). The other was a clue to the rule leading to low satisfaction (Rule 6): social distance was controlled by the number of tables ($X_{12} = 2$). Moreover, the combination of five cues that explains high customer satisfaction (Rule 6) is the cause; ($X_5 = 3$) is a clue in the high PA Rule (Rule 12), and ($X_{12} = 2$ and $X_{13} = 2$) is a cue combination in the high PE rules (Rules 8–9). The remaining two items ($X_8 = 3$) can be regarded as another state of element $X_8 = 1$ in the low-PE rule (Rule 7), and $X_{10} = 1$ can be regarded as another state of element $X_{10} = 2$ in the low-PA rule (Rule 10). Therefore, the discussion on the improvement of customer satisfaction in themed restaurants can be based on the approach–avoidance perspective and the basic logic of reducing negative avoidance signals and improving positive approach signals maximally. However, the focus is on the need to systematically consider the combination and collocation relationship between various material environmental cues. The findings provide further evidence to supplement gestalt and approach–avoidance theories in explaining the impact of physical environmental factors in catering spaces on customer evaluation in the post-pandemic era.

Third, this study provides a systematic perspective on the combined effects of physical environment cues on consumer satisfaction. Previous research has provided insights that clarify the correlations and influencing mechanisms between physical environmental cues and customer behavioural intentions in themed restaurants/consumption venues (e.g. Heung and Gu, 2012; Lee et al., 2015; Yan and Felicen, 2021; Chang and Cheng, 2023). However, these studies assumed that each environmental attribute was completely independent, which does not always fit real-world situations. Additionally, the overall effectiveness of different types of environmental cues may not simply be considered the sum of the effectiveness of each signal operating in isolation (Bove and Benoit, 2020). This study suggests that the complexity of the combined effects of physical and environmental cues on consumer satisfaction should not be overlooked. It provides a combination of scenarios that induce different levels of perceived satisfaction to demonstrate efficacy. For example, previous studies found noise to be an important, but an independent, factor affecting the physical environment of a themed restaurant (Edwards and Gustafsson, 2008; Lee et al., 2015; Yan and Felicen, 2021) and did not consider the joint effect of sound in conjunction with other environmental factors.

This study reveals that sound cues can affect consumer satisfaction in conjunction with other concurrent cues. Consider Rule 1 as an example, in which even when a restaurant has sensible entrance and exit setups ($X_8 = 1$) and clean food contact ($X_7 = 3$), if the temperature is extremely high ($X_1 = 2$) and mixed noise can be heard inside ($X_4 = 4$), the consumer feels highly unsatisfied with the restaurant. This demonstrates the combined effects of temperature and sound on consumer satisfaction. Our findings regarding combined effects are interesting as well. For example, social distance control in restaurants (X_{12}) is considered an

important measure under ES, and the provision of such measures in restaurants can ensure hygiene and safety for consumers and minimise their perceived uncertainty and insecurity (Wang et al., 2021). Our results show that using the same element (controlling social distance) in different ways (e.g. $X_{12} = 2$ or 4) paired with various cues resulted in consumers receiving different signals, which may lead them to give different emotional direction evaluations. The intervention of controlling the number of available tables (e.g. 50 % maximum capacity) for social distance control ($X_{12} = 2$) and electronic payment and order placement ($X_{12} = 4$) are considered effective measures of social distance control (Bove and Benoit, 2020; Doğan, 2020; Lu et al., 2020; Wei et al., 2021). Meanwhile, in Rules 7 and 10, $X_{12} = 4$ is considered one of combined cues that cause low PE and PA. In Rule 10, mixed noise ($X_4 = 4$), a moderately compact ($X_{10} = 2$) ethnic theme-style dining environment ($X_6 = 1$), and electronic payment and order placement ($X_{12} = 4$) together with other cues led to the perception of low PA. $X_{12} = 4$ goes beyond the security framework, indicating a signal that breaks the cultural experience.

However, in Rule 7, consumers are likely to feel unsafe in a hot ($X_1 = 2$) environment, with only entrances and exits as a means of controlling social distance, although there is $X_{12} = 4$. In Rules 6 and 9, $X_{12} = 2$ is regarded as one of the combined cues that results in high PE and PS, whereas in Rule 4 it is one of the combined cues results in low PS. An environmental cue may have different effects on user satisfaction when combined with different groups of cues in various scenarios. When $X_{12} = 2$ is paired with conditions related to poor spatial layout (i.e. $X_{10} = 2$ and $X_8 = 1$) and noisy background sounds (i.e. $X_4 = 4$), it could yield a bad class of satisfaction (see Rule 4); however, when it is paired with good spatial layout conditions (i.e. $X_8 = 3$, $X_{13} = 2$, and $X_{10} = 1$) and theme-symbolised decoration materials (i.e. $X_5 = 3$), it can yield a good class of satisfaction (see Rule 6).

5.2. Managerial implications

This study offers several recommendations for managers of themed restaurants, particularly those in China. Bove and Benoit (2020) argued that environmental signals represent a cost, and when faced with multiple signals, wise investment in signal choice is important to service providers because it influences service provider selection for consumers. The study's insights into causal effect relationships can help restaurant decision-makers improve their physical environments through accurate and rational resource allocation, which is important for theme restaurants in terms of both short-term survival and long-term viability in the post-COVID-19 era. By providing casual-effective rules, this study suggests that today, to ensure sustainable development, improvement of the physical environment of a theme restaurant should be exercised through a systematic improvement strategy that motivates multi-factor synergy, meeting maximal conditions under Rules 5 and 6, while maximally avoiding the conditions stated under Rules 1–4.

As shown in Rules 5 and 6, a customer may feel highly satisfied with a theme restaurant when the restaurant meets their conditions, such as a comfortable temperature ($X_1 = 3$), moderate lighting ($X_2 = 3$), food aroma ($X_3 = 1$), eye-pleasing themed decoration materials ($X_5 = 3$), appropriate wide aisles ($X_{10} = 1$), and a safe food delivery process ($X_{11} = 3$); or when the restaurant simultaneously meets conditions including having eye-pleasing decoration material combo ($X_5 = 3$), clearly partitioned spaces ($X_8 = 3$), appropriate wide aisles ($X_{10} = 1$), adequate number of tables ($X_{12} = 2$), and proper employee uniform and protective gears ($X_{13} = 2$). Managers should consider the combined effect of the new epidemic safety-related environmental features (in terms of food and beverages, social distancing controls, employee appearance, and visible sterilisation and ventilation) and other categories of environmental features on overall satisfaction when investing in new environmental interventions.

This study adopted ACA to induce and extract every characteristic under each environmental condition attribute from several cases. The key characteristics were also obtained as semantic scales for each condition attribute. Compared with Likert scales, the categories of semantic scales formulated in this way are more objective, enabling decision-makers to formulate more concrete improvement strategies.

5.3. Limitations and suggestions for future studies

This study has several limitations. The cases mentioned by the respondents originated in mainland China, and most were located in the eastern region. Purposive sampling was used instead of random sampling for the RSA survey. The data collectors selected senior consumers who had a certain degree of understanding of the research topic and abundant experience in conducting the questionnaires. The respondents were mainly 18–27 years old. Although young people are also important customers of themed restaurants, the results are restricted in their applicability on a larger scale. Future research should extend this work to more regions and age groups to increase generalisability, taking consumer heterogeneity in different types of risk and hedonic perceptions into consideration (e.g. Sawang et al., 2023).

CRediT authorship contribution statement

Guan-Qiang Wang: Writing – review & editing, Writing – original draft, Validation, Investigation, Formal analysis, Data curation, Conceptualization. **Bo-Wei Zhu:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Project administration, Methodology, Investigation, Conceptualization, Funding acquisition. **Kaiyang Wang:** Writing – review & editing, Writing – original draft, Visualization, Conceptualization. **Xin-Yang Li:** Writing – review & editing, Writing – original draft, Visualization. **Lei Xiong:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Funding acquisition.

Fundings

This research was funded by the Youth Project of Guangdong Philosophy and Social Science Foundation (GD22YYS11), and the Faculty Research Grant (FRG) of Macau University of Science and Technology (FRG-24–066-FA).

Ethics statement

This study does not involve "human subject research". Data in this study were not obtained through intervention or interaction with individuals or groups, or using personally identifiable information. The research ethics review is not applicable.

Declaration of Competing Interest

The Authors declare that there is no conflict of interest.

Acknowledgements

We are grateful to all the students of Macau University of Science and Technology who took part in data collection in this study for all the hard work and effort put in to make the questionnaire survey a success.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ijhm.2024.104055.

Data availability

Data will be made available on request.

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