

Destination image across Chinese- and English-language reviews of Macao's Historic Centre: A cognitive-affective-behavioral analysis

JI-RUI PANG

Nanjing University of the Arts, School of Cultural Industries, Nanjing, China; e-mail: N244419@iftm.edu.mo

ABSTRACT This study investigates cross-cultural differences in the perceived destination image of the Historic Centre of Macao across Chinese- and English-language reviews of the Historic Centre of Macao. Grounded in the cognitive-affective-behavioral framework, it analyzes user-generated content from Ctrip, MaFengWo, and Tripadvisor. Latent Dirichlet Allocation was used to identify cognitive themes, a Support Vector Machine classifier to estimate sentiment polarity, and semantic co-occurrence networks to examine action-related language. The two language-platform corpora exhibited distinct but overlapping patterns across the three analytical dimensions. Cognitively, Chinese-language reviews emphasize iconic landmarks and symbolic heritage attractions, whereas English-language reviews focus more on the atmosphere of East-West cultural integration and immersive experiences. Affectively, both groups show predominantly positive attitudes, but Chinese-language reviews more frequently foreground crowding, whereas English-language reviews more frequently emphasize cultural interpretation and experiential value. In action-related language, the Chinese-language reviews are more landmark- and photography-oriented, whereas the English-language reviews are more strongly associated with walking, exploration, and learning.

KEY WORDS heritage tourism – destination image – cross-cultural research – cognitive-affective-behavioral theory – user-generated content – historic centre of Macao

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1. Introduction

In the context of rapid urbanization and the continued expansion of tourism economies, the protection and revitalization of built heritage have become central concerns in both urban governance and tourism development. Historical districts and traditional residential environments are not only material repositories of urban memory but also important spaces through which local culture is interpreted, experienced, and circulated (Wang, Li, Liu 2025). This is especially true of the Historic Centre of Macao, which was inscribed on the UNESCO World Heritage List in 2005 and comprises 22 historic buildings and 8 public squares. Since the mid-sixteenth century, Macao has served as a key point of contact between Chinese and Portuguese civilizations. Its architecture, street texture, food culture, and religious landscape collectively reflect a long process of East-West interaction, giving the city a distinctive cultural character that continues to attract global visitors (Suntikul, Jachna 2015).

At the same time, reviews written in different languages may represent heritage destinations in systematically different ways. Variations in language use, values, prior knowledge, and cognitive habits shape how visitors perceive, evaluate, and experience the same place (Vinyals-Mirabent 2019). Although destination image has long been a core topic in tourism studies, cross-cultural comparisons remain comparatively underdeveloped, particularly in the context of cultural heritage destinations (Chen et al. 2024). Language is especially important in this regard because it functions as a stable cultural marker that influences information processing, emotional expression, and behavior in decision-making contexts (Turner, Reisinger, McQuilken 2002; Schuckert, Liu, Law 2015). For this reason, the present study compares Chinese- and English-language review corpora rather than relying solely on nationality or place of residence as a proxy for cultural difference.

In recent years, the proliferation of Web 2.0 applications and social media platforms has made user-generated content an increasingly valuable source of tourism information. Reviews, photographs, and travel narratives posted on online travel platforms allow tourists to move from being passive recipients of destination images to active producers and disseminators of them, thereby exerting a strong influence on the decisions of other potential visitors (Stepchenkova, Kim, Kirilenko 2014; Chen et al. 2024). Because such content is generated spontaneously and at scale, it provides researchers with an opportunity to observe destination image formation in a more naturalistic way than is typically possible through surveys alone (Chen et al. 2021). When combined with computational methods, user-generated content can be used to detect underlying thematic structures, emotional evaluations, and behavior-oriented expressions within large text corpora (Jia et al. 2024).

To organize this analysis, the study adopts the cognitive-affective-behavioral framework. Within this framework, the cognitive dimension refers to what

tourists know, notice, and describe about a destination; the affective dimension concerns emotional evaluations and feelings; and the behavioral dimension concerns action tendencies and experience-related expressions. The framework therefore provides a clear theoretical basis for aligning three analytical methods with three dimensions of destination image: Latent Dirichlet Allocation topic modeling for cognition, Support Vector Machine based sentiment analysis for affect, and semantic network co-occurrence analysis for behavior.

The objective is to explain how the two language corpora differ in the objects, evaluations, and practices through which Macao's heritage destination image is constructed. Three research questions guide the analysis:

1. Which cognitive themes organize Chinese- and English-language representations of the Historic Centre of Macao?
2. How do the salient positive and negative affective attributes differ between the two language corpora?
3. How do behavior-related lexical associations concerning heritage engagement, consumption, and sightseeing differ between the two corpora?

2. Literature review

2.1. *Description of Macao destination*

Macao is internationally promoted through a combination of gaming, food, festivals, and a compact multicultural urban heritage. Within this broader destination, the Historic Centre is presented as an interconnected group of monuments and urban squares woven into the functioning city rather than as an isolated heritage precinct (Macao Government Tourism Office 2021; UNESCO World Heritage Centre 2005). Following the broader discussion of destination image and heritage experience, this section situates the Historic Centre of Macao within its destination context.

Macao's heritage landscape reflects long-term interaction among Chinese, Portuguese, and other trading communities. Churches, temples, civic buildings, plazas, and narrow streets are close enough to be experienced on foot, while their architectural languages and continuing uses produce a visible narrative of exchange (Dewar, du Cros, Li 2012; Suntikul, Jachna 2015). This spatial juxtaposition supports both landmark-focused visits and more relational readings of the ensemble. It also creates a branding challenge: awareness may be concentrated on the Ruins of St. Paul's even though World Heritage value resides in the wider network of sites (Dewar, du Cros, Li 2012).

Research on Macao has examined the changing image of the city through text mining (Liu et al. 2020), User-generated content based visitor perceptions

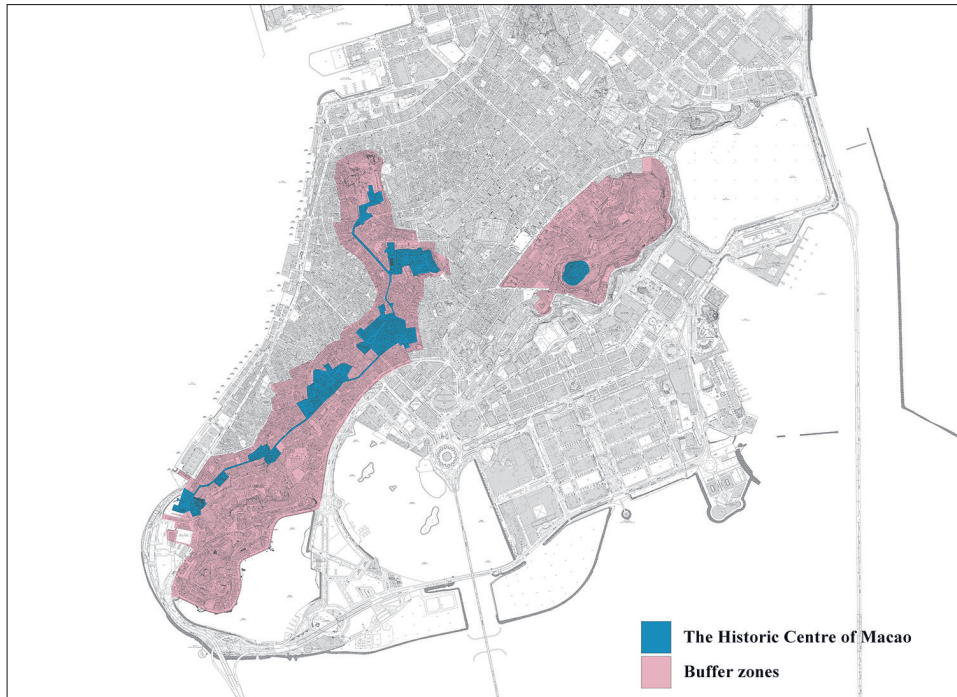


Fig. 1 – The Historic Centre of Macao and its buffer zones. Blue indicates the World Heritage property and pink indicates the buffer zones.

(Yin et al. 2023, Jia et al. 2024), historic squares and urban revitalization (Wang, Yamaguchi, Kawasaki 2016), streetscape structure (Teng, Yang, Huang 2021), heritage planning (Li et al. 2024), and visual conservation (Zhang et al. 2024). This literature establishes the importance of the historic environment but leaves two connected gaps. First, language-group comparisons remain limited for this compact heritage ensemble. Second, cognition, affect, and action-related language are often analyzed separately, making it difficult to see whether landmark recognition, evaluation, and narrated practice reinforce one another.

The Historic Centre of Macao is located in the southern-central part of the Macao Peninsula and is recognized as China's thirty-first UNESCO World Heritage inscription. Its 22 principal monuments and public spaces include A-Ma Temple, Mandarin's House, Senado Square and the Leal Senado Building, the Ruins of St. Paul's, Na Tcha Temple, the surviving Old City Walls, and Mount Fortress. Their distribution makes the property a serial urban ensemble rather than a single bounded attraction. Figure 1 shows the overall spatial relationship between the inscribed property, marked in blue, and its surrounding buffer zones, marked in pink, across the Macao Peninsula.

Its urban landscape combines traditional Chinese architectural elements with Portuguese urban design principles, reflecting the prosperity of the Maritime Silk Road and several centuries of cultural exchange between East and West (Wang, Yamaguchi, Kawasaki 2016; Jia et al. 2024). By the nineteenth century, Macao had evolved into a multicultural port city inhabited by Portuguese, Chinese, Japanese, Malay, Indian, and African communities, contributing to the formation of a distinctive Macanese culture (Dewar, du Cros, Li 2012). This cultural coexistence remains visible in the city's churches, temples, plazas, and winding streets, which together form an urban heritage landscape unlike that of most Chinese cities.

Existing research on the Historic Centre of Macao has primarily focused on architectural form and spatial configuration (Zhou, Wang 2023), heritage conservation and reuse (Li et al. 2024), urban color systems and visual landscape management (Teng, Yang, Huang 2021; Zhang et al. 2024), and tourist experience and satisfaction (Jia et al. 2024; Wang, Li, Liu 2025). For example, Zhang et al. (2024) showed that inconsistencies in façade maintenance and color control may undermine the authenticity of the heritage environment, while Jia et al. (2024) used online reviews to identify broad patterns in visitor experience. Nevertheless, there remains limited research that explicitly compares how visitors from different cultural or linguistic backgrounds perceive the destination image of the Historic Centre of Macao. A cross-cultural, language-based comparison is therefore necessary to extend current knowledge beyond general experience evaluation.

2.2. Place perception, destination image, and heritage experience

Since Hunt (1975) introduced the concept of image into tourism research, destination image has become central to market positioning and destination competitiveness (Zheng et al. 2024). In general, tourism destination image refers to the overall set of impressions, beliefs, evaluations, and feelings that tourists hold toward a place. Following Gartner (1993), destination image can be understood as comprising cognitive, affective, and conative components. Together, these perspectives show why an image cannot be reduced to a list of monuments: it also includes atmosphere, perceived value, comfort, identity, and anticipated or narrated conduct.

In heritage tourism contexts, this multidimensional structure is especially relevant because tourists do not merely consume attractions; they interpret symbolic meanings, negotiate authenticity, and evaluate the relationship between history, culture, and experience. The attractiveness of a World Heritage city partly rests on claims of historical continuity and cultural distinctiveness, yet tourism presentation can stage, simplify, or commercialize those qualities. MacCannell (1973) described the tension between staged display and the tourist

search for an authentic “back region”, while Wang (1999) distinguished object-related authenticity from existential experiences of feeling true to oneself. For Macao, authenticity can therefore refer to the material conservation of a church or temple, the credibility of interpretation, the coexistence of living religious practice with tourism, or an embodied sense of discovery in streets beyond the most photographed façade.

The heritage encounter is also shaped by crowding. Crowding is not simply a visitor count; it is an evaluation of density relative to expectations, activity, control, and place type. In Florence, for example, tourists could interpret urban density positively as liveliness or negatively as obstruction and loss of enjoyment (Popp 2012). Research on heritage cities further shows how concentration at a small number of iconic sites can produce a “vicious circle”: rising visitation and tourism-oriented commerce weaken residential functions and the qualities that initially supported attraction (Russo 2002). Overtourism should thus be analyzed as a context-specific relationship among visitors, residents, governance, and urban systems rather than as a universal numerical threshold (Koens, Postma, Papp 2018). These concepts are directly relevant to Macao, where famous monuments, food streets, retail activity, and everyday urban circulation overlap within a compact area.

2.3. Cross-cultural and language-mediated destination images

Cross-cultural research has demonstrated that tourists from different societies do not respond to the same destination in uniform ways. Culture shapes values, behavioral norms, emotional display rules, and preferred communication styles, all of which influence what visitors notice and how they evaluate it (Kang, Moscardo 2006; Özdemir, Yolal 2016). Heritage destinations are particularly sensitive to such variation because they contain symbolic and historical content that may be interpreted differently depending on visitors’ cultural background. As a result, not all heritage destinations possess universal appeal, nor do all source markets respond equally to the same destination attributes (Dewar, du Cros, Li 2012).

Language plays a critical role in this process because it is both a carrier of culture and a medium through which cognition, affect, and behavior are expressed. Compared with indicators such as nationality or religion, review language provides an observable basis for corpus construction, although it should not be treated as a direct or exclusive measure of culture in cross-cultural studies (Schuckert, Liu, Law 2015). Recent research supports this approach. Chen et al. (2024), for instance, showed that Chinese- and English-language reviews exhibited significant differences in theme perception and emotional orientation toward Xiamen. Lee

and Park (2023) found that tourists from different source markets varied considerably in their evaluations of Hong Kong's culture, infrastructure, atmosphere, and social environment. Wang et al. (2024), in a study of panda tourism, reported that English-language reviews emphasized animal welfare, whereas Chinese-language reviews paid more attention to parent-child experiences. These findings suggest that a language-based comparison of the Historic Centre of Macao is both theoretically meaningful and practically useful.

2.4. Cognitive-affective-behavioral theory

The tripartite view of attitude distinguishes cognitive, affective, and behavioral components (Rosenberg et al. 1960). Cognition refers to beliefs, perceptions, knowledge, and judgments concerning an object; affect refers to the feelings or emotional responses elicited by that object; and behavior refers to intentions or actions associated with it. In tourism, this framework has been widely used to explain how tourists perceive destinations, form emotional evaluations, and develop subsequent behavioral tendencies (He, Zhan, Fang 2025).

Within destination studies, the cognitive dimension concerns what tourists know about a destination and the attributes they associate with it; the affective dimension concerns how they feel about that destination; and the behavioral dimension concerns experience-related actions, intentions, or action-related expressions associated with cognitive themes and evaluative language. Numerous studies have applied the cognitive-affective-behavioral model using questionnaires, interviews, or structured scales. Yang et al. (2022), for example, linked aesthetics and involvement to cultural identity formation in heritage tourism, while Chen and Xu (2021) used the model to explain the formation of tourist loyalty in rural homestays. These studies confirm the usefulness of the model, but most are based on conventional survey data.

The present study extends this line of research by applying the cognitive-affective-behavioral framework to large-scale user-generated content. More specifically, the framework directly guides methodological selection. Topic modeling is used to capture the cognitive dimension because topics represent what tourists repeatedly notice and describe. Sentiment analysis is used to capture the affective dimension because emotional polarity and sentiment-laden words reflect tourists' positive and negative evaluations. Semantic network co-occurrence analysis is used to capture the behavioral dimension because action-related expressions in reviews reveal how tourists connect attractions, consumption, and cultural participation in practice. In this way, the cognitive-affective-behavioral model is not treated merely as a conceptual backdrop; it functions as the organizing logic of the entire research design.

3. Methodology

3.1. Research design and analytical framework

The study follows the cognitive-affective-behavioral framework in a three-step analytical sequence, as shown in Figure 2. First, the cognitive dimension is examined through Latent Dirichlet Allocation topic modeling in order to identify the major themes that Chinese- and English-language reviews use to describe the Historic Centre of Macao. Second, the affective dimension is analyzed through an Support Vector Machine-based sentiment classifier to determine the polarity of reviews and the most salient positive and negative sentiment words. Third, the behavioral dimension is explored through semantic network co-occurrence analysis centered on culture/history, buying/eating, and visiting/photo-taking expressions. This design allows the three dimensions of destination image to be examined in a coordinated and theoretically coherent manner.

3.2. Data collection and preprocessing

A Python-based web crawler was developed to collect visitor reviews from three travel platforms: the Chinese online travel agencies Ctrip and MaFengWo, and the international platform Tripadvisor. According to QuestMobile (2024), Ctrip recorded 83.94 million active users in March 2023, making it the most widely

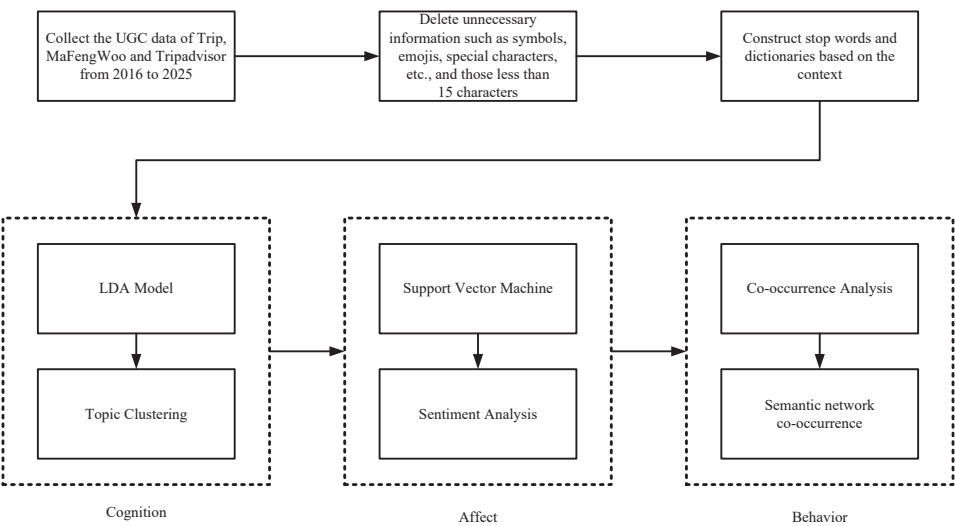


Fig. 2 – Research process

used online travel platform in China. Founded in 1999, Ctrip offers over 1.7 million travel-related services globally. Mafengwo, a comparatively younger yet highly influential platform, hosts extensive user-generated travelogues, reviews, and destination guides. TripAdvisor is a global travel information platform where users from diverse countries share their travel experiences through reviews (Wong, Qi 2017). Employing both domestic and international platforms enhances source diversity and mitigates platform-specific biases, thereby enabling the study to capture a broader spectrum of review styles, linguistic features, and travel motivations. The collection period covered January 2016 to September 2025 and focused on the 22 buildings and 8 squares that constitute the Historic Centre of Macao. Data collection started on September 1, 2025. After cleaning, the final corpus contained 11,520 reviews, including 5,806 Chinese-language reviews and 5,714 English-language reviews.

The raw texts were preprocessed to remove symbols, emojis, special characters, and other irrelevant content. Reviews containing fewer than 15 words or lacking substantive meaning were excluded. To preserve linguistic specificity, the Chinese and English corpora were processed separately. For Chinese reviews, Jieba segmentation was used together with a custom stopword list developed for the context of the Historic Centre of Macao, following Zhang et al. (2023). Onomatopoeic expressions and extremely high-frequency but analytically uninformative words such as “Historic Centre of Macao” and “Macao” were removed. At the same time, attraction names such as “Ruins of St. Paul’s”, “A-Ma Temple”, and “Senado Square” were added to the segmentation dictionary to preserve semantic integrity.

For English reviews, all texts were converted to lowercase and attraction names were standardized before tokenization. Expressions such as “mazhu temple”, “ma temple”, and “ama temple” were unified as “A-Ma Temple”. Common but contextually weak function words were removed, and tokenization and lemmatization were performed with NLTK-based tools. This normalization procedure ensured that key place names were retained as stable analytical units across subsequent modeling steps. In addition, the corpus was divided into two periods, 2016–2020 and 2021–2025, in order to preserve the possibility of examining temporal change in future analyses.

3.3. Latent Dirichlet Allocation topic modeling

Latent Dirichlet Allocation is an unsupervised probabilistic topic model that represents each document as a mixture of latent topics and each topic as a probability distribution over words (Blei, Lafferty 2006). In tourism research, Latent Dirichlet Allocation has been widely used to identify recurring semantic structures in large bodies of reviews, posts, or travel narratives. In the present study, separate Latent

Dirichlet Allocation models were estimated for the Chinese-language and English-language corpora in order to compare the cognitive structures reflected in the two groups' descriptions of the Historic Centre of Macao.

To determine the optimal number of topics, the study jointly considered perplexity and topic coherence. Perplexity evaluates model fit by measuring how well a model predicts unseen textual data; lower values generally indicate a better statistical fit (Cao et al. 2009). Topic coherence, by contrast, evaluates the semantic consistency of the top words within a topic; higher values indicate better interpretability (Mimno et al. 2011). Because statistical fit and substantive interpretability do not always point to the same solution, the final number of topics was selected by considering both indicators together rather than relying on a single criterion.

3.4. Support Vector Machine-based sentiment analysis

Support Vector Machine is a supervised classifier that identifies a separating boundary between labeled classes while maximizing the margin between them. Support Vector Machine was selected because linear Support Vector Machines perform reliably with sparse, high-dimensional text features and have been widely tested in tourism sentiment research (Kirilenko et al. 2017), the preprocessed user-generated content texts were converted into term frequency-inverse document frequency vectors and used to train a linear-kernel Support Vector Machine model. Term frequency-inverse document frequency increases the weight of terms that are frequent in a review but comparatively uncommon across the corpus, reducing the dominance of ubiquitous words. For each language corpus, the data were split into training and testing sets at a ratio of 7:3. After model training, the complete datasets were classified to obtain positive and negative sentiment probabilities for each review.

Define the positive-class probability explicitly. If 0.60 is retained, introduce an uncertainty/neutral band or justify why every value below 0.60 is negative; report sensitivity to 0.50 versus 0.60. Based on the classified texts, the study further summarized the ten most salient positive and negative sentiment words in each language group, thereby identifying the lexical triggers associated with favorable and unfavorable visitor evaluations.

3.5. Semantic network co-occurrence analysis

The behavioral dimension was examined through semantic network co-occurrence analysis. Co-occurrence networks depict how frequently words appear together,

with thicker links indicating stronger associations between terms. In this study, three behavior-related analytical foci were constructed: cultural identity behavior, consumption behavior, and tourism behavior. These dimensions were operationalized through core terms related respectively to “culture/history”, “buying/eating”, and “visit/take photos”.

By calculating co-occurrence frequencies between the core terms and surrounding words, the study generated node attributes and edge weights that reveal how tourists connect specific attractions, evaluations, and actions in their review narratives (Xiang et al. 2025). Compared with topic modeling and sentiment classification, this approach is especially useful for uncovering relational patterns embedded in action-oriented language, thus complementing the other two components of the cognitive-affective-behavioral framework.

4. Results

4.1. Cognitive topic clustering

4.1.1. Topic number selection

Figures 3 and 4 present the perplexity and coherence results for the Chinese-language and English-language corpora. In the Chinese corpus, topic coherence reaches its highest value at $K=4$, while perplexity remains within an acceptable range before rising sharply as the number of topics continues to increase. This pattern suggests that a four-topic solution provides the best balance between model fit and semantic interpretability.

For the English corpus, the coherence curve displays several local peaks, and the highest coherence value appears at a relatively small number of topics. However, a two-topic solution is too coarse to capture the thematic diversity evident in the English-language reviews. After jointly considering coherence, perplexity, and substantive interpretability, the study retained five topics for the English corpus. This decision yields a more analytically meaningful representation of the cognitive structure reflected in English-language user-generated content.

4.1.2. Topics in Chinese-language user-generated content

The first Chinese-language topic centers on traditional Chinese architecture in the historic district, especially the Zheng Family Mansion, Nezha Temple, and Lu Family Mansion. Associated words such as “visit” and “worth seeing” indicate that this topic combines architectural recognition with evaluative appreciation. A representative review notes that the restored Lingnan-style mansion reveals

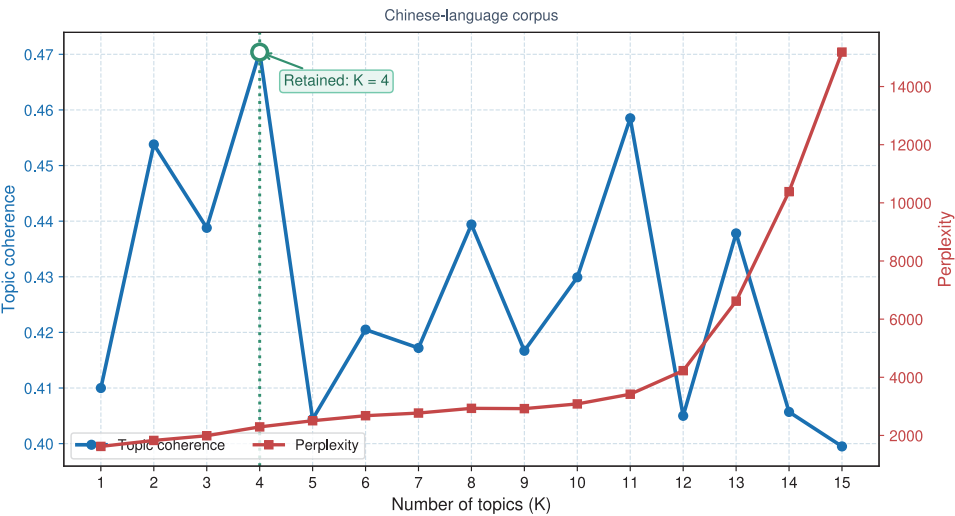


Fig. 3 – Perplexity and coherence of Chinese user-generated content. The annotation identifies the maximum-coherence solution; K = 4 was retained. Source: authors’ analysis.

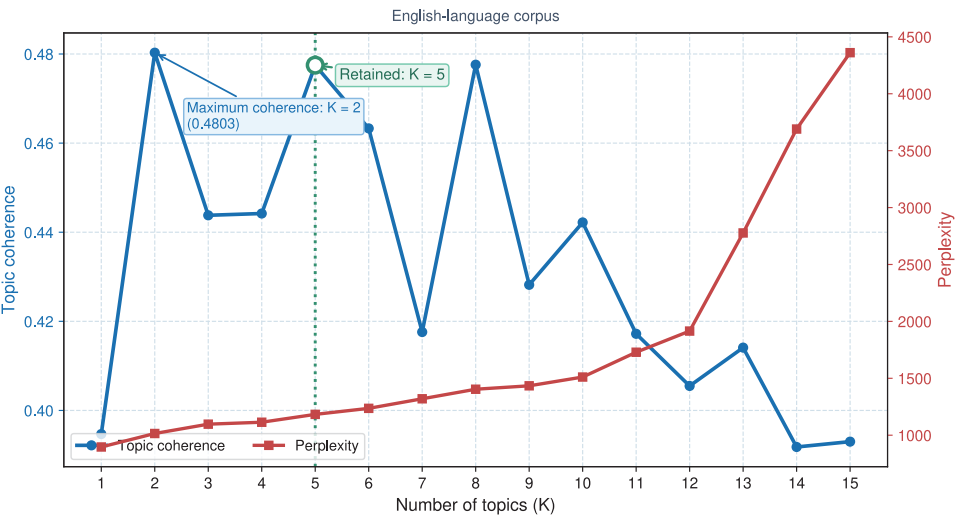


Fig. 4 – Perplexity and coherence of English user-generated content. The maximum-coherence solution is K = 2; K = 5 was retained after considering thematic interpretability and diagnostic performance together. Source: authors’ analysis.

a carefully organized courtyard layout and a blend of Chinese and Western architectural forms. Overall, this topic reflects a cognitively concrete understanding of specific heritage buildings and their historical value.

The second topic is organized around Senado Square and its surrounding Portuguese-style civic buildings, including the Holy House of Mercy and the Municipal Affairs facilities. High-frequency words such as “square”, “fountain”, and “pavilion” indicate that this topic highlights the square as a visually attractive urban landmark and a popular setting for photography. Reviews repeatedly emphasize the vibrant colors of the surrounding façades and the square’s strong Southern European atmosphere.

The third topic focuses on the Ruins of St. Paul’s and is strongly associated with landmark recognition, photography, and check-in behavior. Keywords such as “Ruins”, “attraction”, “photograph”, and “check-in” show that this site functions as the most iconic image node in the Chinese-language corpus. The Ruins of St. Paul’s are not only described as historically significant but also as a compulsory photo location for first-time visitors to Macao.

The fourth topic centers on Mount Fortress and the adjacent museum area. Terms such as “museum”, “fortress”, “history”, and “ancient” indicate that this topic combines historical understanding with on-site exploration. Compared with the more crowded Ruins of St. Paul’s area, comments in this topic often highlight Mount Fortress as a quieter and more contemplative heritage space.

4.1.3. Topics in English-language user-generated content

The first English-language topic concerns temple visits and worship practices, especially those associated with A-Ma Temple. Core words such as “temple”, “incense”, “pray”, “worship”, and “goddess” indicate a strong interest in traditional Chinese religion and ritual observation. Reviews in this topic often describe the temple not only as a historic site but also as a living sacred space in which local religious practices remain visible.

The second topic centers on the Ruins of St. Paul’s and nearby fortifications. Keywords such as “St. Paul”, “facade”, “view”, “fortress”, and “fort” show that English-language reviews also recognize this site as an iconic landmark. However, the emphasis is somewhat less on obligatory check-in behavior and more on visual appreciation, panoramic views, and the spatial relationship between the ruins and nearby defensive heritage.

The third topic highlights architectural features across the World Heritage landscape as a whole. Terms such as “building”, “architecture”, “cathedral”, “UNESCO”, and “world heritage” suggest that English-language reviews are comparatively more attentive to the broader heritage assemblage and to the formal qualities of East-West architectural integration.

The fourth topic captures general visitor behavior and subjective on-site experience. Words such as “visit”, “walk”, “climb”, “photo”, and “enjoy” indicate an experiential orientation toward movement, observation, and exploration. Reviews in this cluster often frame the Historic Centre of Macao as a place worth wandering through in order to learn about local culture.

The fifth topic concerns shopping and culinary experience. Core terms including “buy”, “shop”, “souvenir”, “food”, and “egg tart” show that consumption is closely integrated into the English-language reviews’ experience of the destination. Nevertheless, consumption in this context is not described purely as commercial activity; it is linked to local flavor, place-specific products, and the experiential appeal of everyday street life.

4.2. *Affective analysis*

The sentiment classification results are summarized in Table 1. Across both language groups, the overall emotional tendency is predominantly positive, but the lexical composition of positive and negative evaluation differs in meaningful ways. In the Chinese-language corpus, the most salient positive words include “good-looking”, “worthwhile”, “good”, “comfortable”, and “beautiful” indicating that visual appeal, immediate satisfaction, and the pleasant atmosphere of the heritage environment are major sources of positive evaluation. Reviews frequently praise the preservation of historic buildings, the city’s Portuguese charm, and the lively urban ambiance surrounding central attractions.

The negative side of the Chinese-language corpus is dominated by words such as “crowded”, “people”, “expensive”, “disappointed”, and “overcrowded”. These expressions suggest that physical congestion, heavy visitor flow, and related inconvenience are the main triggers of negative affect for Chinese-language reviews. In other words, dissatisfaction is driven less by the symbolic meaning of the site than by the embodied experience of crowding, queuing, and reduced comfort in highly concentrated tourist zones.

In the English-language corpus, the most salient positive words include “good”, “worth”, “like”, “unique”, “beautiful”, “great”, and “excellent”. These words indicate not only general approval but also recognition of distinctiveness and experiential value. Representative reviews emphasize that the Historic Centre of Macao feels culturally unique, architecturally striking, and worthy of time and attention. This suggests that positive affect among English-language reviews is closely tied to cultural exploration and to the perception of the site as an unusual and meaningful heritage setting.

Negative English-language sentiment is reflected in words such as “poor”, “bad”, “worse”, “expensive”, “waste”, “dirty”, “inconvenient”, and “awful”.

Table 1 – Top ten positive and negative sentiment words in Chinese and English user-generated content

Language	Sentiment	Top ten words
Chinese	Positive	Good-looking; Worthwhile; Good; Comfortable; Beautiful; Stunning; Recommend; Delicious; Convenient; Likeable
Chinese	Negative	Crowded; People; Expensive; Disappointed; Regretful; Disappointing; Dirty; Boring; Crowd; Overcrowded
English	Positive	Good; Worth; Like; Unique; Beautiful; Great; Nice; Recommend; Comfortable; Excellent
English	Negative	Poor; Bad; Worse; Expensive; Waste; Dirty; Inconvenient; Uncomfortable; Annoying; Awful

Note: Terms are ordered by model-derived salience within each language and polarity. Bold type identifies exact terms shared by the two language corpora within the same polarity; regular type identifies corpus-specific terms.

Although these expressions occur less frequently than positive ones, they point to dissatisfaction with tourism facilities, service quality, accessibility, and the commercialization of parts of the visitor experience. Compared with the Chinese-language corpus, English-language negative evaluations appear somewhat more closely connected to interpretive and service-related expectations rather than solely to crowd density.

4.3. Semantic network co-occurrence

4.3.1. Cultural identity behavior

Figure 5 presents the semantic network centered on culture and history. In the Chinese-language network, the strongest associations cluster around “History”, which is linked to terms such as “Ruins of St. Paul’s”, “A-Ma Temple”, “Church”, “Architecture”, “Landmark”, “Symbol”, and “Significance”. This pattern indicates that Chinese-language reviews frame cultural identity primarily through concrete heritage symbols and historically meaningful sites. The co-occurrence of words such as “feel”, “witness”, and “location” further suggests an experiential form of cultural recognition in which visitors perceive themselves as encountering and confirming the historical significance of specific landmarks.

By contrast, the English-language network is organized around “History” and “Culture” in relation to terms such as “Visit”, “View”, “Learn”, “Portuguese”, “Museum”, “Temple”, “Walk”, and “Worth”. This configuration indicates a more exploratory and interpretive engagement with the destination. Rather than concentrating exclusively on single iconic attractions, English-language reviews more often relate cultural identity to movement through the historic environment, cross-cultural comparison, and the educational value of the visit. Taken together,

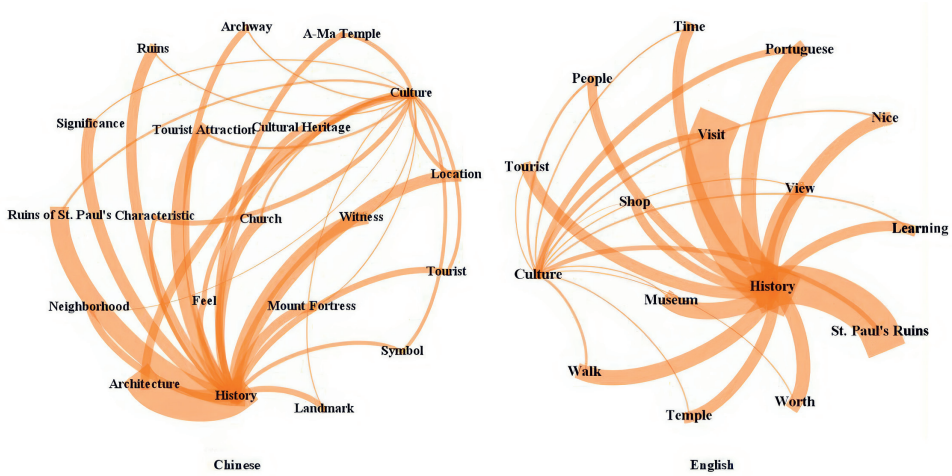


Fig. 5 – Co-occurrence networks for culture- and history-related expressions in (left) Chinese-language and (right) English-language reviews. Labels are co-occurring terms; wider lines indicate stronger relative co-occurrence.

the two networks suggest that Chinese-language reviews emphasize symbolic recognition of landmark heritage, whereas English-language reviews emphasize learning, viewing, and experiencing cultural hybridity.

4.3.2. Consumption behavior

Figure 6 displays the semantic network centered on buying and eating. In the Chinese-language network, “Buying” and “Eating” are associated with words such as “souvenir”, “shopping”, “snacks”, “egg tarts”, “take photos”, and “Ruins of St. Paul’s”. This structure indicates that consumption is strongly embedded in landmark-based tourism and photo-taking practices. Food and shopping are not treated as separate activities; rather, they form part of a check-in style consumption experience connected to famous attractions and walkable tourism circuits.

In the English-language network, the strongest links around “Buying” and “Eating” connect to terms such as “snack”, “food”, “local”, “sample”, “famous”, “St. Paul’s Ruins”, “visit”, and “walk”. Compared with the Chinese-language network, the English-language network places greater emphasis on tasting local products and integrating consumption into exploratory walking. This suggests that, for English-language reviews, shopping and food consumption function as extensions of cultural experience and place discovery rather than as purely transactional behavior.

Despite these differences, the two language groups also share important commonalities. In both networks, Portuguese-style snacks, egg tarts, souvenirs, and

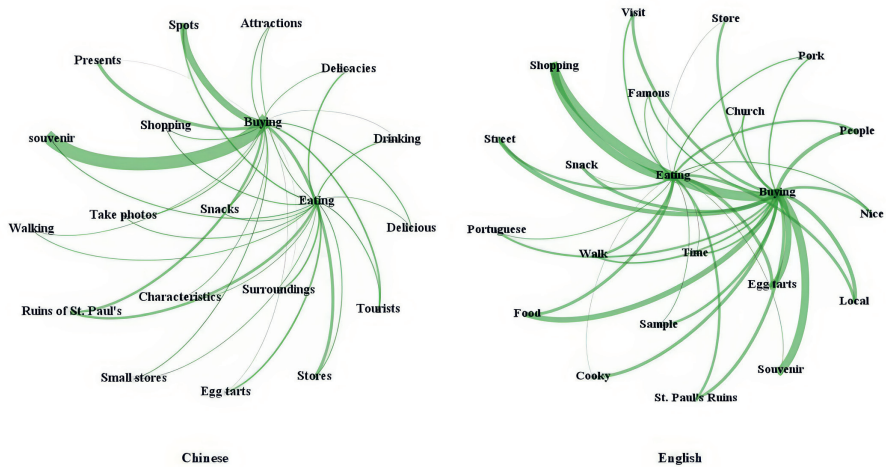


Fig. 6 – Co-occurrence networks for buying- and eating-related expressions in (left) Chinese-language and (right) English-language reviews. Labels are co-occurring terms; wider lines indicate stronger relative co-occurrence.

streets near major attractions occupy a central place. This suggests that Macao's heritage consumption landscape is formed through the close integration of landmark sightseeing, everyday street experience, and food-related memory.

4.3.3. Tourism behavior

Figure 7 presents the semantic network related to visiting and photo-taking. In the Chinese-language network, the core nodes “Visit” and “Take Photos” are strongly associated with “Ruins of St. Paul’s”, “Mount Fortress”, “Photo Spot”, “Suitable”, “Good-looking”, “Souvenir”, and “Open”. This pattern indicates that tourism behavior among Chinese-language reviews is closely tied to visually recognizable landmarks, route convenience, and the practical conditions that support photography and sightseeing. The prominence of “Take Photos” confirms the importance of image capture and shareable landmark presence within this group’s destination experience.

In the English-language network, “Visit” is the dominant node and is linked to “Worth”, “View”, “Walk”, “Tourist”, “Time”, “Temple”, “St. Paul’s Ruins”, and “Recommend”. Although “Take photos” also appears, it is less central than in the Chinese-language network. This suggests that English-language reviews frame tourism behavior more as a process of moving through space, allocating time, and evaluating the site’s experiential and interpretive value. Recommendation and perceived worth are integrated into this behavioral structure, indicating a stronger emphasis on discovery and reflective appraisal.

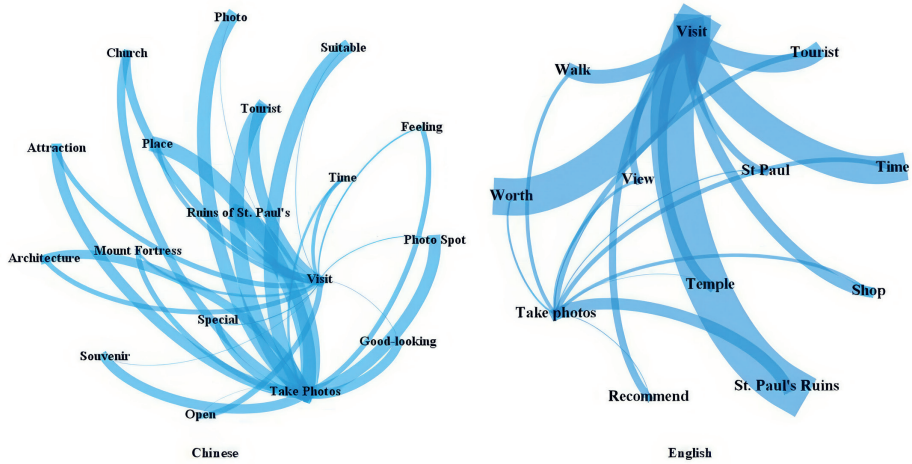


Fig. 7 – Co-occurrence networks for visiting- and photography-related expressions in (left) Chinese-language and (right) English-language reviews. Labels are co-occurring terms; wider lines indicate stronger relative co-occurrence.

Overall, the tourism-behavior networks confirm the distinction already visible in the cognitive and affective analyses. Chinese-language reviews display a more landmark-oriented, photo-centered, and check-in style pattern, whereas English-language reviews display a more exploratory, walking-based, and experience-oriented pattern.

5. Discussion

5.1. From landmark recognition to relational place experience

The three analyses converge on two contrasting, but overlapping, ways of assembling Macao's destination image. Chinese-language reviews more often organize cognition around iconic nodes, evaluate the immediate visual and bodily experience, and connect sightseeing to photography. English-language reviews more often distribute attention across the heritage ensemble, living religion, walking, cultural interpretation, and experiential value. The distinction is not that one group sees monuments and the other does not; the Ruins of St. Paul's is central to both. Rather, it concerns how the landmark is placed in a narrative. In the Chinese corpus it frequently serves as the destination's visual shorthand, while in the English corpus it more often becomes one stop within a walk connecting ruins, fortifications, temples, and streets.

This pattern extends destination image beyond attribute recognition. Tuan's (1977) distinction between space and experienced place helps explain why the

same arrangement can support different images. A landmark-centered itinerary converts the district into a sequence of recognizable nodes and photo opportunities. A walking-and-learning narrative emphasizes relations among sites and makes the route itself part of the heritage experience. Neither is intrinsically superficial or deep. Chinese-language reviews of Mount Fortress also contain reflective experience, while English-language reviews include photographs, shopping, and iconic attractions. The results identify modal emphases within platform corpora, not fixed cultural types.

The findings align with comparative work in Xiamen and Hong Kong, where language or source-market groups differed in thematic attention, atmosphere, and evaluation (Chen et al. 2024; Lee, Park 2023). Macao's specificity lies in the extreme proximity of Chinese and Portuguese heritage forms and in the dominance of one façade within the city's visual brand. Dewar, du Cros and Li (2012) identified the difficulty of extending awareness beyond iconic heritage; the present results show that this challenge is uneven across communicative communities. Multilingual interpretation can therefore do more than translate identical facts. It can connect a familiar landmark to the spatial and historical relationships that constitute the World Heritage ensemble.

5.2. Authenticity, crowding, and the platform-mediated heritage gaze

Reviewer narratives of authenticity take several forms. English-language attention to living worship, architectural interweaving, learning, and local food suggests a search for credible cultural context rather than only intact fabric. This resembles Wang's (1999) distinction between object authenticity and existential experience: value may arise from feeling engaged in a meaningful walk or observing an active temple, even when tourism services are present. It also qualifies a simple MacCannellian contrast between staged and authentic space (MacCannell 1973). In Macao, photographed landmarks, religious practices, retail streets, and residents' routines occupy the same compact urban field; authenticity is negotiated through their coexistence.

Chinese-language negative affect is especially sensitive to crowding. Because landmark-centered practices concentrate visitors at the same photogenic nodes, cognitive salience and behavioral narration may reinforce congestion. This echoes the relational nature of tourist crowding observed in Florence: density becomes negative when it obstructs expected activities and perceived control (Popp 2012). The result also recalls the heritage-city cycle described by Russo (2002), in which iconic cores accumulate visitors and tourism commerce while less famous areas receive limited attention. Macao differs from many European cases because its tourism economy, border regime, casino brand, and high share of short visits

produce a distinctive mobility system. Even so, dispersing attention across the serial property may simultaneously improve visitor experience and reduce pressure on the most visible sites.

Platform architecture also matters. Ctrip and Mafengwo integrate attractions with itineraries, photography, booking, and recommendation practices, while Tripadvisor organizes a globally recognizable review-and-rating environment. These affordances may amplify the observed differences. The analytical outcome should therefore be described as a language–platform pattern rather than evidence that language alone produces behavior. Future work using the same languages across multiple platforms, together with surveys or GPS-supported route data, could separate language, origin, platform, and itinerary effects.

5.3. *Shared consumption and transferability*

Consumption networks are more similar than the heritage-engagement networks. Egg tarts, souvenirs, famous foods, and shopping streets connect to major attractions in both corpora. This shared repertoire suggests that destination images are neither wholly culturally specific nor fully homogenized. Global travel platforms circulate recognizable products and evaluative conventions, while language communities still assemble them into different stories of place. Macao's food landscape is particularly suited to this hybrid image because Portuguese-associated products are marketed within a Chinese urban context and are readily integrated into pedestrian heritage routes.

Transferability is therefore conditional. In other Chinese or Asian gateway cities, researchers may also find contrasts between iconic-node tourism and relational exploration, but the relevant symbols and platform ecologies will differ. In European or American heritage cities, crowding and authenticity may be equally important, yet resident displacement, transport systems, museumization, and the geography of day trips may produce different networks. The analytical framework can travel more readily than the substantive result: cognitive-affective-behavioral dimensions and coordinated text methods offer a comparative template, whereas Macao's topic labels and language patterns remain case specific.

6. Conclusion

This study compared 11,520 Chinese- and English-language reviews of the Historic Centre of Macao through a cognitive-affective-behavioral framework. Its contribution is a theoretically coordinated reading of established computational methods rather than a claim of algorithmic novelty. Topic modeling identified

what reviewers noticed, sentiment analysis compared evaluative vocabularies, and semantic networks showed how action-related terms connected places, objects, and judgments.

The answers to the research questions are explicit. For research question 1, Chinese-language cognition is structured more strongly by iconic landmarks – especially the Ruins of St. Paul’s, Senado Square, and Mount Fortress – whereas English-language cognition gives greater weight to the connected World Heritage ensemble, living religion, architecture, walking, and East–West cultural interweaving.

For research question 2, both corpora are predominantly positive, but Chinese-language dissatisfaction is more concentrated on crowding and congestion; English-language negative terms are more dispersed across service, value, convenience, and environmental quality. Shared positive and negative attributes demonstrate overlap rather than two separate images.

For research question 3, Chinese-language behavior-related expressions more strongly connect sightseeing with landmark photography, while English-language expressions more strongly connect visits with walking, learning, time, and perceived worth. Consumption is comparatively similar across corpora.

Theoretically, the study links destination image to place-making practices and clarifies what can – and cannot – be inferred from user-generated content. Cognitive-affective-behavioral dimensions are not directly observed mental states; they are analytical lenses on recurring themes, evaluations, and narrated actions. The language comparison likewise captures communicative and platform environments, not national essences. These boundaries make the interpretation more geographically precise and reduce the risk of cultural stereotyping.

For management, a single undifferentiated heritage message is unlikely to be optimal. Chinese-language communication can retain the appeal of core landmarks while using real-time crowd information, timed interventions, and route prompts to direct visitors toward secondary sites and quieter periods. English-language interpretation can strengthen connections among temples, churches, fortifications, civic spaces, and food streets through coherent walking routes, multilingual signs, and explanations of living heritage. Across markets, the goal should be to convert the Ruins of St. Paul’s from an isolated visual icon into a gateway to the serial property.

The study has limitations. Its contributors are self-selected platform users; language is confounded with platform and cannot establish cultural causality; attraction listings create spatial bias; English may be a second language; user demographics are unavailable; the 2016–2025 period includes COVID-related discontinuity; and NLP preprocessing is not perfectly equivalent across languages. Support Vector Machine outputs are comparative classifier results rather than direct emotion measures, and co-occurrence networks do not record actual

trajectories or causal sequences. Future research should compare the same language across platforms, use manually validated multilingual sentiment samples, analyze periods separately, include underrepresented streets and public spaces, and combine reviews with interviews, surveys, or consent-based mobility traces. Comparative applications to other Asian and Euro-American heritage cities would test which patterns reflect Macao's cultural setting and which generalize to dense urban heritage destinations.

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ORCID

JI-RUI PANG

<https://orcid.org/0009-0005-2967-971X>