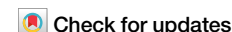# Exploring the cultural landscape of Hong Kong through spatial analysis of street names

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This study examines the cultural landscape of Hong Kong through a systematic analysis of its street names. Geographic data for 4095 street names were collected, and 1454 annotations were added, utilizing a modified version of the Australian National Placenames Survey (ANPS) categorization system. The study classifies Hong Kong's street names into seven distinct groups: descriptive, associative, evaluative, occurrent, copied, eponymous, and innovative. By employing ArcGIS StoryMap, Kernel Density Estimation (KDE), and Standard Deviational Ellipse (SDE) analysis, the research reveals distinct patterns in the distribution of street names, reflecting historical and cultural influences. Further discussion highlights how these street names reveal Hong Kong's colonial past, multicultural background, reclamation changes, and commercial legacy. Based on these findings, the study proposes preservation strategies focusing on regional protection zones, cultural landscape tourism, and historical education initiatives to safeguard this valuable aspect of Hong Kong's cultural heritage.

Street names are more than mere tools for spatial orientation and administrative control[1]; they are powerful political instruments that inscribe the ideologies of ruling regimes onto the urban landscape and into the fabric of everyday life[2]. This perspective resonates with Henri Lefebvre's seminal argument that "social space is a social product."[3] Street names, as social products, are not merely passive labels on a pre-existing map, but function as "a means of production... a means of control, and hence of domination, of power."[3] Building on this, the creation of a clear and systematic street naming network can thus be understood as a crucial technology of modern governance. This technology is central to what Michel Foucault termed biopolitics[4]. Biopolitics is a power over life that operates through regulatory mechanisms, one of which Foucault identifies as the series of "population-biological processes-regulatory mechanisms-State"[4]. Systems such as the police, postal services, taxation, and public health all rely on a stable address system to locate, monitor, and act upon every individual, thereby managing the population's collective health, welfare, and security. Street names, therefore, become a fundamental instrument of biopolitics, transforming the urban landscape into a grid of governance that shapes the everyday lives of all residents. The study of street names is thus an entry point into the fundamental processes through which power, memory, identity, and language are spatially inscribed, making them essential to understanding the social and cultural dynamics of urban environments[5].

Toponymy, the study of place names–including street names–has evolved significantly over time. Early 20th-century toponymic research was predominantly linguistic, emphasizing the etymological origins of place names and prioritizing the collection and explanation of names based on their linguistic components[6]. Since the 1990s, toponymy has undergone a paradigm shift, moving beyond linguistic analysis to examine connections between place names and power, ideological values, and political identities[7–9]. This critical turn aligns with the growing recognition of Intangible Cultural Heritage (ICH). UNESCO defines ICH as the practices, representations, and knowledge that communities recognize as part of their heritage, providing them with a sense of identity and continuity[10]. Within this framework, street names are understood not as static labels but as a form of living heritage. They function as intangible cultural assets that encode collective memories, social values, and power dynamics. These assets are continuously reproduced through everyday use[6]. This perspective is further underscored by the formal recognition of geographical names as ICH by international bodies like UNESCO, which highlights their value beyond simple cartography[11].

When focusing on Hong Kong, the history of its street names is deeply intertwined with its colonial past. Britain acquired Hong Kong Island following the First Opium War (1839–1842), gained the Kowloon Peninsula after the Second Opium War under the 1860 Convention of Beijing, and leased the New Territories in 1898 under the Convention for the Extension of Hong Kong Territory. During this colonial period, urban development imbued public spaces with distinctly British characteristics, resulting in numerous street names of British origin that persist to this day.

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Following Hong Kong's return to Chinese sovereignty in 1997, most colonial street names were preserved, despite discussions by the Preparatory Committee for the Hong Kong Special Administrative Region (SAR) in 1996 about renaming colonial geographical features[12]. This preservation offers a unique opportunity to study street-naming practices spanning both colonial and post-colonial eras.

As historical markers, Hong Kong's street names commemorate individuals who contributed to the city's development[13] and honor significant figures and events from Chinese history. As cultural symbols, auspicious names reflect local communities' hopes and aspirations[14]. As emblems of multiculturalism, the dual naming system and diverse origins of street names showcase the city's complex history as both a trading port and former British colony. This multilayered significance makes street names a compelling lens through which to interpret Hong Kong's cultural landscape.

Existing research on Hong Kong's street names has developed along two major streams. The first stream, primarily historical and political, has documented how streets were named after British officials, royalty, and other notable figures during the colonial period[15]. Scholars in this area have explored the spatial politics of naming. The concept of spatial politics refers to the contestation over how space is produced, represented, and controlled, recognizing that it is not a neutral backdrop but a medium through which power is asserted[3,16]. In the context of toponymy, street naming is not a passive act of labeling but an active political tool. This tool is used to claim territory, legitimize authority, and inscribe a particular ideology or historical narrative onto the landscape[2,17]. Applying this lens, scholars have analyzed Hong Kong's commemorative street names as cultural landscapes that reflect these power dynamics and colonial legacies[18]. These studies have provided invaluable, though often descriptive, accounts of how colonial power was inscribed onto the city's topography[15,19], traditionally focusing on Hong Kong Island and Kowloon[20,21].

Complementing this, a second stream of research has analyzed Hong Kong's street names through the critical lenses of linguistic landscape, translation studies, and semiotics. These scholars treat the bilingual street sign itself as a rich text. For instance, diachronic studies have traced the gradual shift from a monolingual Chinese to a bilingual landscape, examining how the visual prominence and format of English and Chinese evolved to reflect changing power relations and collective identities over decades[22]. Quantitative analyses have further documented the dominance and function of English and Chinese across different urban districts, confirming that visual arrangement is a key indicator of sociolinguistic status, though the visual landscape may not always align with the spoken reality[23]. Other studies have deconstructed the political and cultural implications of translation choices. They analyze phenomena such as 'domestication with positive connotation' and 'bilingual incompatibilities,' where phonetic and semantic renderings are strategically employed to negotiate colonial history and local identity[24]. This body of work offers deep qualitative insights, with recent research applying frame analysis to reveal how power, commodification, and local creativity interact to shape the disparate linguistic landscapes of different urban spaces, from the globalized center to the local periphery[25].

Despite the richness of these two research streams, a significant gap remains at their intersection. The historical stream has mapped the 'who' and 'where' of naming[15,18], while the linguistic stream has offered deep qualitative analyses of specific signs, translation strategies, or districts[24,25]. However, to our knowledge, a systematic, large-scale classification and spatial analysis of the entire toponymic landscape has not yet been undertaken. Such an approach is needed to bridge the gap between broad historical narratives and granular, case-specific analyses. It allows us to move beyond individual stories or specific areas to identify the overarching patterns, thematic concentrations, and absences across the whole city, providing a comprehensive empirical foundation that complements existing work.

This study aims to fill this gap by conducting a systematic classification and spatial analysis of Hong Kong's street names. Through this analysis, the study provides a nuanced understanding of how these toponyms function as a form of ICH, revealing the complex interplay of geography, history, and power that has shaped the city's urban fabric. Our findings offer a crucial analytical foundation for future discussions on cultural memory and heritage preservation in Hong Kong.

Methods
Study area
Hong Kong, a SAR of the People's Republic of China, includes Hong Kong Island, the Kowloon Peninsula, the New Territories, and over 200 smaller islands, encompassing a total land area of approximately 1104 square kilometers. Its diverse topography, marked by steep terrain and a jagged coastline, has played a significant role in shaping its urban development and cultural geography.

Before becoming a British colony, Hong Kong was part of Xin'an County under Chinese jurisdiction. Historical records, such as the Ming Dynasty's "Yue Da Ji: Map of Guangdong Coast" (1595), documented coastal place names in Guangdong, including Stanley, Shau Kei Wan, Tseung Kwan O, Kwai Chung, and Tsim Sha Tsui, indicating the presence of indigenous settlements in Kowloon and Hong Kong Island[26]. The Qing Dynasty's "Xin'an County Gazetteer" further documented over a hundred villages within the Hong Kong area. By 1841, when British forces arrived, the local population was estimated at approximately 7450 people, primarily engaged in agriculture, fishing, and quarrying. These communities were concentrated along the eastern and southern coasts of Hong Kong Island and on boats.

After the British occupation of Hong Kong in 1841, urban development accelerated, and street naming became a powerful tool for asserting colonial authority. Streets such as Queen's Road and King's Road, named after British royalty, embedded colonial memory into the urban landscape. In addition to royalty and officials, the land auctions that began in 1841 also paved the way for commercial entities and influential figures, such as Jardine, Matheson, and Dhunjibhoy Ruttonjee Bisney, to have their names engraved onto the city's streets[27].

The governance of street naming evolved over time. An initially top-down process, where names were proposed by the Public Works Department and submitted by the Colonial Secretary for the Governor's approval (1897-WWII), transitioned towards a more consultative model. A key turning point was in 1953, when the Colonial Secretary directed the Chairman of the Urban Council and the District Commissioner for the New Territories to take charge of street naming and consult local citizens and organizations, which led to the creation of the Urban Council's "Street Name Select Committee." This committee formalized the process through guidelines that, among other rules, prohibited using the names of living people and protected historical names from alteration. Further responding to criticism over opaque practices between 1968 and 1970, the government began to welcome suggestions from the public and civic groups actively[13]. This evolution in procedure marked a definitive shift from a commemorative, top-down approach to one that increasingly valued bottom-up input and the practical, functional needs of the community.

Following the transfer of sovereignty to China in 1997, most colonial-era street names were preserved, reflecting a sense of continuity that acknowledges and respects the region's historical and cultural heritage. These evolving street naming practices highlight the city's dynamic identity while leaving a tangible record of its complex, layered history.

Research framework
The research framework, as illustrated in Fig. 1, consists of four key components: data collection, data preprocessing, spatial pattern analysis, and street name cultural protection. The initial phase of data collection involved gathering spatial and street naming data from diverse sources, such as Hong Kong street name data, spatial datasets, street naming information from multiple origins, historical street naming years, and ancient maps, which were compiled into a comprehensive database. Following this, data preprocessing was conducted, where the collected data was organized and categorized using the modified version of ANPS toponymic categorization
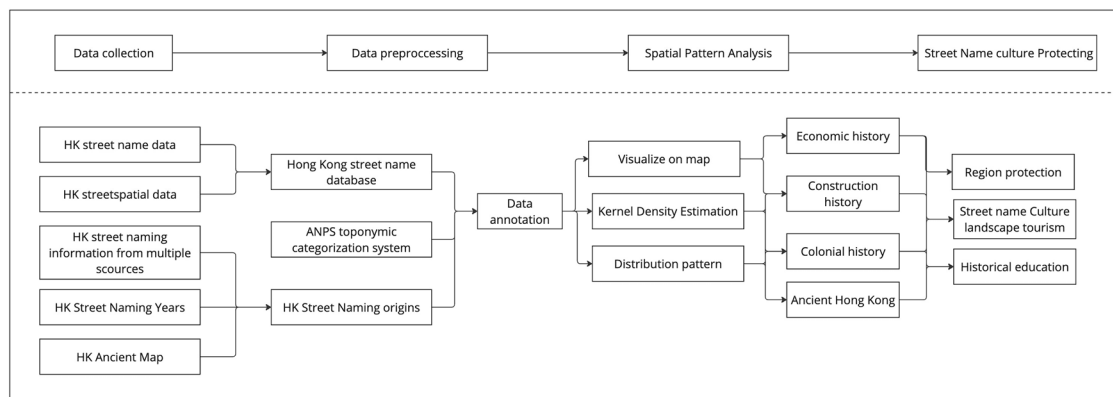
Fig. 1 | Research framework. The framework consists of four main stages: data collection, data preprocessing, spatial pattern analysis, and street name culture protecting.

Table 1 | Data sources for Hong Kong Street names research

Data type	Source description
Hong Kong Street Name database includes both gazetted and ungazetted street names and spatial data	Common Spatial Data Infrastructure (CSDI) Portal[1]
The maps of Hong Kong Territory Map	Hong Kong Territory Map[2]
Hong Kong government report (1842–1941)	Hong Kong Government Reports Online[3]
Government Notices and Plans for Street Naming	Lands Department Website[4]
Books about Hong Kong street name stories	Signs of a Colonial Era, History of Hong Kong Engineering II, Tai Po Stories, The Secret History of Hong Kong's Eastern District Streets, Once Upon a Street
News report about Hong Kong street name stories	Hong Kong Free Press, Place Names Series[5]
Wikipedia Hong Kong street names	Wikipedia: Characteristic street names in Hong Kong
Encyclopedia of road in Hong Kong	Hong Kong Road Encyclopedia (Fandom Wiki)[6]
Historical records and chronicles	Hong Kong Chronicles[7]

This table presents various data sources that can be used for researching Hong Kong street names, including government databases, maps, historical reports, books, news articles, Wikipedia, and online encyclopedias.

[1] https://portal.csdi.gov.hk/geoportal/.
[2] https://www.landsd.gov.hk/en/resources/mapping-information/ehkg.html.
[3] https://sunzi.lib.hku.hk/hkgro/index.jsp.
[4] https://www.landsd.gov.hk/en/survey-mapping/mapping/street-geographical-place-naming/street-naming.html.
[5] https://hongkongfp.com/tag/place-names-series/.
[6] https://hkroad.fandom.com/wiki/.
[7] https://www.hkchronicles.org.hk/.

system to create a structured database of Hong Kong street names and their origins. The next stage, spatial pattern analysis, focused on visualizing the data on maps, performing kernel density estimation, and identifying street name distribution patterns across Hong Kong. This analysis connected the patterns to Hong Kong's historical context–including its economic, construction, and political changes since 1841–to reveal how street names preserve valuable social, economic, and geographic history, which is an important cultural heritage. Finally, the research concludes with street name culture protection, providing suggestions for protecting the cultural landscape of Hong Kong street names through regional protection, cultural landscape tourism, and historical education initiatives.

Data collection
The foundational dataset for this research comprises 4095 gazetted and ungazetted street names and their corresponding spatial data, obtained from the Hong Kong Lands Department's database (as of January 2024). A core requirement of our analytical approach is the availability of detailed etymological information for each street name, which is necessary for a meaningful classification of its origins. To fulfill this requirement, an extensive data collection process was undertaken, cross-referencing a wide array of sources including books, news articles, historical maps, and government records (see Table 1). This intensive effort enabled the successful

annotation of the origins for 1053 streets, which form the basis of our analysis.

It is important to acknowledge that the availability of historical records led to a geographic concentration of these annotated streets in the historically dense areas of Kowloon and Hong Kong Island, with comparatively less coverage in the New Territories. While this implies potential omissions, we contend that this sample of 1053 streets is substantial and provides a rich cross-section of Hong Kong's toponymic landscape, serving as a valuable foundational reference for future research.

Data categorization
This study establishes a toponymic framework to systematically categorize the street names of Hong Kong. The foundation of this framework is adapted from the Australian National Placenames Survey (ANPS) classification system[28].

The ANPS system is suitable as it is built upon a universal logic of place-naming, progressing from a fundamental motivation (to distinguish) to a set of core intentions (e.g., to characterize, to commemorate) and their resulting expressions (the categories themselves). This principled, intention-based approach provides a robust and theoretically sound foundation that transcends specific cultural contexts[28].

Table 2 | Street Naming Classification System

Main Type	Subtype	Explication	Example(s)
1. Descriptive	1.1 Topographic	Names denoting physical appearance, shape, or geography	TRIANGLE STREET - named after its triangular shape
	1.2 Relational	Names denoting location, orientation, or relationship to other features	UPPER STATION STREET - a sloping road connected to Police Station Street
	1.3 Functional	Names denoting primary purpose or function of the area	SPORTS ROAD - named for proximity to Happy Valley and Hong Kong Football Club
2. Associative	2.1 Natural Environment	Names from natural world features (flora, fauna, landforms)	SAI YEUNG CHOI LANE - originally a field for growing watercress
	2.2 Culture & Activities	Names from historical events, commerce, cultural practices, occupations	UPPER LASCAR ROW - named for East Indian sailors who lived and traded in the area
	2.3 Structures & Landmarks	Names from specific buildings, infrastructure, or landmarks	OBSERVATORY ROAD - named after the Hong Kong Observatory located nearby
3. Evaluative	3.1 Commendary	Names reflecting positive emotion, aspiration, or commendation	VICTORY AVENUE, HOPE ROAD, BRIGHT STREET
	3.2 Condemnatory	Names reflecting negative emotion, tragic history, or pejorative meaning	WANG TAU HOM - site of Japanese executions during WWII
4. Occurrent	4.1 Incident	Names recording specific events or incidents	BOUNDARY STREET - marks the 1860 Treaty of Peking demarcation line
	4.2 Occasion	Names recording specific times or dates	JUBILEE STREET - commemorates Queen Victoria's Golden Jubilee
5. Copied	5.1 Locational	Names borrowed from other places	CANTON ROAD - named after Guangdong Province
	5.2 Linguistic	Names derived from other languages or cultures	EARL STREET - named after the European noble title
6. Eponymous	6.1 British Royalty	Named after members of British royalty	PRINCESS MARGARET ROAD - named after Princess Margaret
	6.2 Public Service Personnel	Named after governors and government officials[1]	BONHAM ROAD - named after Sir George Bonham, 3rd Governor of Hong Kong
	6.3 Mythological/Historical	Named after mythological or historical figures[2]	SUNG WONG TOI ROAD - commemorates the last two emperors of the Southern Song Dynasty
	6.4 Occupational	Named after notable figures from various occupations[3]	HO TUNG ROAD - named after prominent entrepreneur Sir Robert Ho Tung
7. Innovative	7.1 Systematic Planning	Names created as coherent sets following specific themes	CHERRY PATH - part of Palm Springs' floral-themed street system
	7.2 Individual Innovation	Names from singular creative acts, linguistic play, or mistakes	REDNAXELA TERRACE - result of backwards transcription of "Alexander"

[1]Public Service Personnel includes ministers, governors, civil servants, government engineers, and military personnel.
[2]Mythological/Historical includes historical figures from ancient China and Hong Kong, as well as mythical characters and missionaries.
[3]Occupational includes businessmen, medical professionals, and non-government engineers.

This theoretical foundation is complemented by the framework's practical relevance. While the colonial histories of Australia and Hong Kong are indeed distinct, they have produced analogous naming practices that align closely with the ANPS categories. For instance, the prevalence of eponymous names honoring colonial figures (e.g., Bonham Road in Hong Kong, Port Macquarie in Australia) and copied names transferred from the United Kingdom (e.g., Kent Road in Hong Kong, Epping in Australia) demonstrates the framework's direct applicability.

However, despite its applicability, a direct application of the ANPS model is insufficient. Hong Kong's unique socio-linguistic landscape necessitates significant adaptations. This research adopts the seven-category framework of the 2020 ANPS model but refines its subcategories to be specifically tailored to the Hong Kong context. Detailed definitions and examples of these categories are provided in Table 2 and Fig. 2.

In developing this framework, the study acknowledges the inherent complexities of toponymic classification. Indeed, it is an "impossibility to fit all the variety of geographical names into the Procrustean bed of one classification"[29]. Yet, this inherent complexity does not absolve the need for methodological rigor. Even when "different features are present simultaneously in a complex way," it remains a "basic requirement for any toponymic study that the criteria of the inquiry shall be distinguished clearly"[30].

In direct response to this challenge, this framework rejects a rigid hierarchical structure in favor of a Multi-label Classification Protocol. This protocol is founded on the principle that a single street name can embody multiple, co-existing naming intents. The objective is not to force a name into a single category, but to capture its multifaceted nature. Therefore, the task is to assign up to two co-equal classification labels to each street name. These labels are selected from the entire classification system (see Table 2 and Fig. 2) to best explain the name's semantic identity and origin. If a name possesses a genuinely singular intent, only one label is assigned; a second label is not imposed.

To ensure consistency and resolve potential ambiguities in applying this protocol, the following guiding principles are established in order of precedence.

The Bilingual Divergence Principle is the primary guiding principle. If a street's official English and Chinese names have different semantic origins, the two assigned labels must correspond to the core meaning of each respective name. For example, for Power Street (大強街), the English name is classified as Associative/Structures & Landmarks (referencing the nearby power station), while the Chinese name, meaning "Great Strength," is classified as Evaluative/Commendatory.

Following this is the Core Intent Selection Principle. For names where both languages share a common origin, or for single-language analysis, the goal is to select the one or two labels that most comprehensively define the name's origins, meaning, and characteristics. For Sze Mei Street (四美街), the name's meaning of "Four Beauties" is Evaluative/Commendatory, while
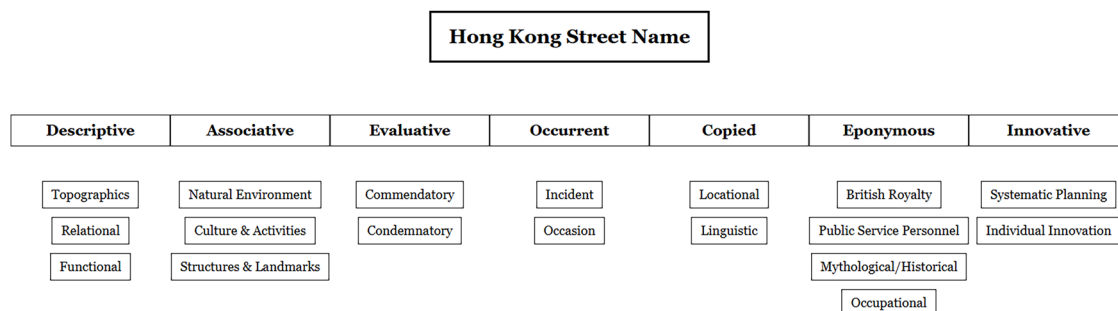
Hong Kong Street Name

Descriptive	Associative	Evaluative	Occurrent	Copied	Eponymous	Innovative

Topographics	Natural Environment	Commendatory	Incident	Locational	British Royalty	Systematic Planning
Relational	Culture & Activities	Condemnatory	Occasion	Linguistic	Public Service Personnel	Individual Innovation
Functional	Structures & Landmarks				Mythological/Historical	
					Occupational	

Fig. 2 | Categorization framework. The framework is a modified version of the Australian National Placenames Survey (ANPS) categorization system, adapted for the context of Hong Kong street names.

its creation as part of a systematically named series for the San Po Kong industrial area is Innovative/Systematic Planning. A name like Station Lane (差館里) has a singular purpose to describe its proximity to a station and would receive a single label: Associative/Structures & Landmarks.

Further guiding the process is the Base Name Precedence Principle. For composite street names, the classification is determined by the primary intent of the base name, not the generic modifier (e.g., Road, Street, Lane). The modifier can, however, inform the selection of a second label if it provides significant functional or relational information.

Finally, the Semantic Transparency Principle for Transliterations clarifies how to handle transliterated names under the Bilingual Divergence Principle. The classification depends on whether the Chinese characters introduce a new meaning. This distinction leads to two types of transliterations. For transparent transliterations, where the Chinese characters are primarily phonetic placeholders and do not form a new, overriding meaning (e.g., Sutherland Street), the Chinese name's classification simply mirrors that of its English source. Conversely, for opaque or re-semanticized transliterations, where the transliteration creates a new, strong, and independent meaning, it is treated as a semantic divergence and classified independently. A classic case is Fife Street, where the Chinese transliteration was re-semanticized to mean "Fast Fortune".

Validation of the classification framework

To quantitatively assess the reliability and objectivity of the classification protocol, an inter-coder reliability (ICR) analysis was performed. In a novel approach suited to the study's computational nature, a Large Language Model (LLM) was employed as an independent second coder. GPT-5 classified all 1053 street names based on the identical, explicitly defined classification system and guiding principles, and the results were compared with the author's classifications. The level of agreement was evaluated using two distinct metrics. Under a stringent "exact match" criterion, where all assigned labels for a given street name must be identical, the analysis yielded a Cohen's Kappa coefficient of 0.468. Interpreted using widely accepted benchmarks, this value represents a "Moderate" level of agreement[31]. Furthermore, to account for the multifaceted nature of toponyms, agreement was also evaluated based on a "partial match" criterion, where at least one label must match. This approach yielded a high agreement rate of 0.83, with an average Jaccard similarity of 0.647.

Comparing the differences revealed GPT-5's limitations in interpreting culturally-specific nuances in Chinese toponyms. For instance, for the systematically named streets in the Tai Po Industrial Estate that begin with "大" (Great), the researcher assigned dual labels of "Systematic Planning" and "Commendatory", recognizing the auspicious connotations embedded in these names–a common practice in Chinese culture. The LLM, while consistently identifying the systematic planning aspect, frequently missed the implicit, culturally-embedded commendatory meaning. This discrepancy demonstrates that while AI provides systematic consistency, culturally-nuanced toponymic analysis requires the contextual understanding that human expertise offers. Therefore, subsequent analyses in this paper are based on the primary researcher's coding, which is better equipped to capture these essential cultural subtleties.

Spatial analysis and visualization

This study combines interactive, exploratory visualization with formal quantitative techniques to provide a multi-faceted understanding of Hong Kong's toponymic patterns. Based on a preprocessed database of street names, an ArcGIS Storymap https://arcg.is/f4qWD was developed to visualize each street on a map. This interactive storymap also provides access to background information for 1053 street names by simply clicking on the streets displayed. This feature enables a detailed understanding of each street's history and significance. Additionally, Storymap facilitates the identification of spatial clustering within specific categories of street names, offering insights into their geographic distribution and thematic relationships. Kernel Density Estimation (KDE) and Standard Deviational Ellipse (SDE) are employed as its primary quantitative techniques for spatial analysis. KDE is a non-parametric method used to estimate the probability density function of a random variable. By using KDE, this study identifies the distribution patterns of street names within various categories and subcategories, providing valuable insights into how these street names, as elements of cultural heritage, are connected to Hong Kong's history. These findings are essential for formulating recommendations on the protection of these cultural markers based on spatial analysis. SDE method was employed to further explore the spatial distribution and directional trends of street names across Hong Kong. SDE provides a statistical summary of the central tendency, spatial dispersion, and directional orientation of point data, offering a deeper understanding of geographic patterns. For this study, SDE was applied to each category of street names (e.g., Descriptive, Evaluative, Eponymous, etc.) to identify the primary areas of influence and the extent of spread for each naming convention.

Our approach is fundamentally exploratory, aiming to investigate Hong Kong's cultural landscape through the observation of visual and spatial distribution patterns. In this, it differs from regression-based methodologies that seek to explain why certain naming outcomes occur, such as predicting the probability of a specific street name or constructing toponymic indicators for correlation with socioeconomic phenomena[32–34]. While powerful for predictive modeling, these methods are not primarily designed to visualize or analyze the detailed spatial geometry of name distributions.

Furthermore, while using GIS to map the spatio-temporal dynamics of street renaming is a valuable approach[35], our focus is different. Given Hong Kong's unique history, characterized by relative toponymic stability and continuity rather than the radical, regime-driven turnovers seen in postsocialist Europe, an analysis of the accumulated spatial patterns is particularly revealing. Therefore, this study concentrates on exploring spatial distribution and clustering. By employing interactive GIS visualization for different street name categories, alongside KDE and SDE, we can identify the geographical clustering (hotspots) and directional trends of these categories, revealing a latent spatial logic that might be obscured in aspatial

Table 3 | Classification and distribution of Hong Kong street names

Main Category	Subcategory	Count
Associative		**453**
	Culture & Activities	94
	Structures & Landmarks	267
	Natural Environment	92
Eponymous		**289**
	Public Service Personnel	175
	Occupational	71
	British Royalty	24
	Mythological/Historical	19
Innovative		**229**
	Systematic Planning	223
	Individual Innovation	6
Descriptive		**193**
	Relational	90
	Functional	56
	Topographics	47
Copied		**162**
	Locational	157
	Linguistic	5
Evaluative		**119**
	Commendatory	115
	Condemnatory	4
Occurrent		**9**
	Incident	7
	Occasion	2
Total Annotations		**1454**

Bold values denote the total counts of each main category.

models. This approach, which uses the description of spatial patterns as a gateway to understanding cultural and historical processes, aligns with recent scholarship. For instance, the study of traditional villages in Western Hunan also utilized KDE to first identify the spatial distribution patterns of natural and cultural toponyms before delving into their formation mechanisms[36]. While their study proceeds to a quantitative causal analysis using a geodetector, both studies share the foundational premise that a robust description of spatial patterns is a crucial first step. By applying a similar descriptive spatial lens, our study provides a foundational understanding of how historical layers–colonial, commercial, and cultural–have been inscribed onto Hong Kong's geography, making our approach highly appropriate for the specific context and research questions of this study.

Results

Classification statistics for street names
This study reviewed 1,053 street names in Hong Kong, primarily located in Kowloon and Hong Kong Island. These names were categorized into seven main categories, each with several subcategories. The detailed distribution of these classifications is presented in Table 3. As the table illustrates, the categories are led by Associative (453) and Eponymous (289) names. These are followed by Innovative (229), Descriptive (193), Copied (162), Evaluative (119), and finally Occurrent (9) names. It is important to note that the categorization is non-exclusive, meaning a single street name can be assigned up to two categories. This approach resulted in a total of 1454 annotations from the 1053 unique street names analyzed.

Spatial distribution of street name
As illustrated in Figs. 3, 4, street names with descriptive purposes are widespread throughout Hong Kong. Those with evaluative purposes are primarily concentrated in San Po Kong, Tai Po, and Yuen Long. Occurrent category street names, which often denote long roads, are typically found along the seashore or near boundary lines. Street names with copied purposes are mainly located in the southern part of Kowloon. Eponymous streets are predominantly found in the southern regions of Kowloon and the northern parts of Hong Kong Island. Innovative names, which are often related to real estate developments by developers and the government, are distributed sporadically across the Hong Kong map.

As shown by the Standard Deviational Ellipse (SDE) analysis in Fig. 5, the seven street name categories exhibit distinct spatial patterns in their distribution, orientation, and dispersion, revealing different toponymic footprints across Hong Kong. The Descriptive, Innovative, and Associative categories are characterized by the largest ellipses, indicating that these names are the most widely dispersed throughout the territory. They share a dominant northwest-southeast orientation, encompassing vast areas of the New Territories, Kowloon, and Hong Kong Island. Notably, the Eponymous category presents a unique pattern with an elongated, distinct north-south orientation. Its ellipse stretches from the urban core of Hong Kong Island and Kowloon deep into the New Territories, suggesting a strong connection to historical development corridors. The remaining categories demonstrate progressively higher levels of spatial concentration. The Evaluative category forms a more compact ellipse centered over Kowloon, also with a primary north-south orientation. Finally, the Copied and Occurrent categories are the most geographically focused, displaying very tight, compact ellipses centered over the dense urban heart of Kowloon. This high concentration indicates that these naming practices are highly localized to specific, core urban areas.

Street name in descriptive category
The Descriptive category comprises Topographic (47), Relational (90), and Functional (56) subcategories. As the Relational subcategory primarily indicates directional or spatial relationships between streets and has a weaker connection to Hong Kong's cultural and geographical landscape, this analysis focuses on the more revealing Functional and Topographic names. Figure 6 illustrates their distinct spatial patterns.

Mong Kok (Point A) showcases a dense cluster of Functional names that chronicle the area's complex geographical and commercial evolution. For instance, Sai Yee Street (洗衣街), literally "Washing Clothes Street," traces its origins to a stream where laundry services congregated before it was culverted in the 1930s. The area's history as a hub for light industry is embedded in names like Pak Po Street (白布街, "White Cloth Street") and the nearby Hak Po Street (黑布街, "Black Cloth Street"), which point to a once-thriving dyeing industry[37]. The process of urban expansion through land reclamation is also evident. Reclamation Street (新填地街), built by prison laborers on land reclaimed from the sea in the 1880s, was officially named to reflect this origin[38]. Similarly, Anchor Street preserves the memory of the former Yaumatei Typhoon Shelter, where ships once anchored before further reclamation transformed the waterfront into land.

In contrast, the Sai Ying Pun area (Point B) reveals the commercial roots that run deep in Hong Kong's history, with its street names serving as a living record of early trade activities. Soon after the city was formally declared a British colony at nearby Possession Street in the mid-19th century, Chinese businessmen established a number of nam pak hong, or south-north trading houses, to conduct trade with the mainland and Southeastern Asian countries[39]. This explosion of local enterprise is documented in Sai Ying Pun's functional names, which reveal a fascinating dichotomy between colonial English and local Chinese toponymy. For instance, Ham Yu Street (鹹魚街, "Salted Fish Street") is a direct reference to the area's historical role as the center of Hong Kong's salted fish industry, a vital part of the local diet since the 19th century, having been relocated to its present site on Des Voeux Road West after the original market was demolished following the 1894 plague[40].
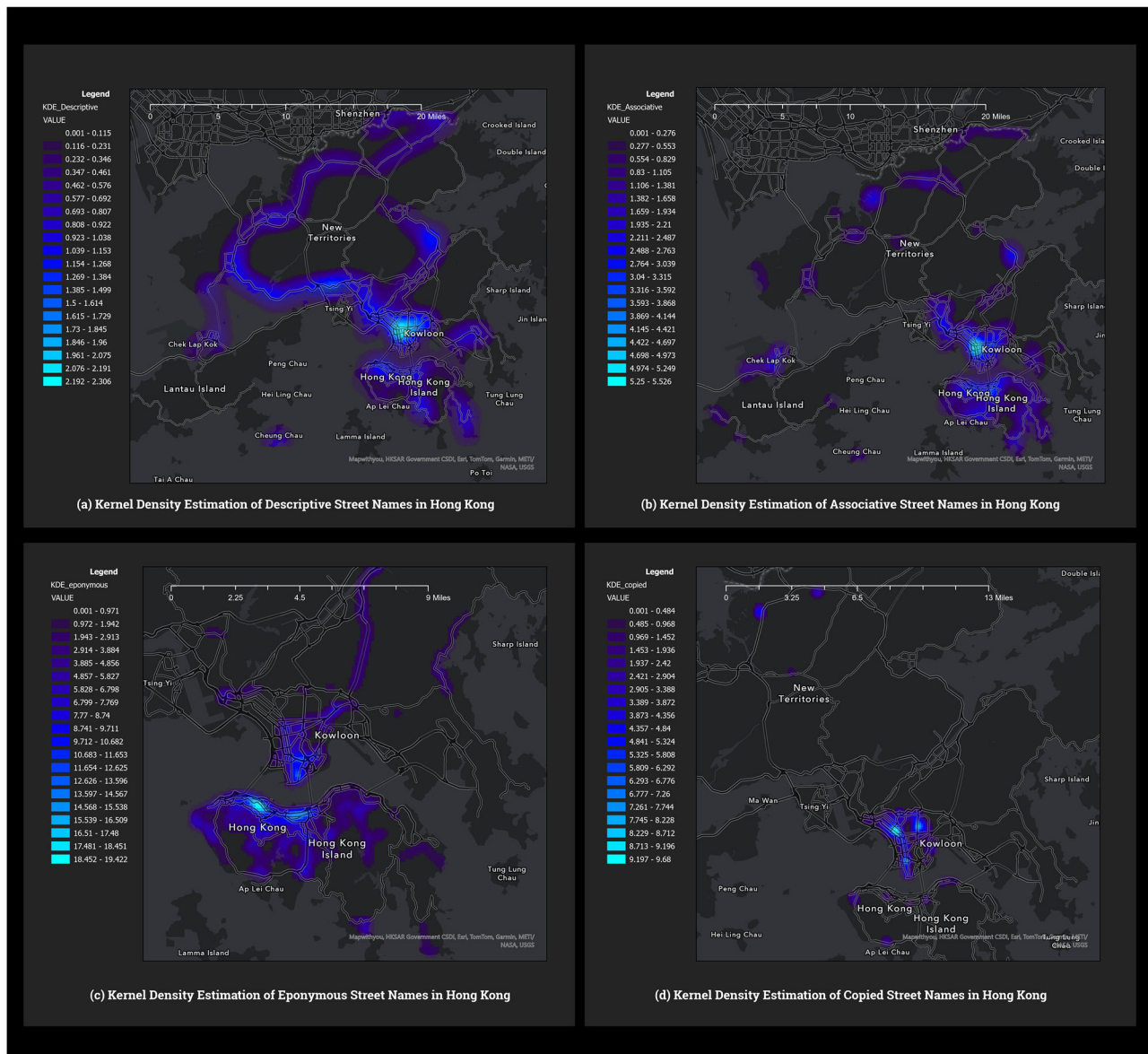
Fig. 3 | Kernel density estimation results of Hong Kong street name categories. Kernel density distribution of street name categories in Hong Kong: (**a**) Descriptive, (**b**) Associative, (**c**) Eponymous, and (**d**) Copied street names.

Meanwhile, other streets exhibit a split identity. Jervois Street (蘇杭街) was officially named after Sir William Jervois, a British military commander, but its enduring Chinese name, "Soo Hong Street," signifies its prominence as a marketplace for silk and textile merchants from Suzhou and Hangzhou[15,41]. Likewise, Lyndhurst Terrace (擺花街) is named in English for an assistant magistrate, but its Chinese name, "Pai Fa Kai" ("Flower Arrangement Street"), vividly recalls the 19th-century flower stalls that catered to the patrons of brothels once concentrated in the area[15,41]. These names serve as records of the district's unique landscape, shaped by both local enterprise and colonial administration.

The Eastern District (Point C), however, Eastern District features Topographic names that function as cartographic memories, preserving the geography of Hong Kong Island's former coastline. Causeway Road (高士威道) and Tung Lo Wan Road (銅鑼灣道) trace the original shoreline of the eponymous "Copper Gong Bay" (Tung Lo Wan), so named for its gong-like shape before extensive land reclamation[42,43]. Tsat Tsz Mui Road (七姊妹道, "Seven Sisters Road") immortalizes the name of a former bay, which was named after seven submerged reefs visible only at low tide[41,42,43]. After the bay was reclaimed post-war, the name was transferred to the road,

preserving a piece of local folklore. Finally, the name Quarry Bay itself reflects this dual heritage; its English name refers to the granite quarries that dominated the area in the 19th century, while its original Chinese name, Tsak Yue Chung (9C02;9B5A;6D8C;), meaning "Crucian Carp Stream," recalls a natural feature that has long since vanished[44]. Together, these names provide an invaluable geographical record of Hong Kong before its dramatic transformation.

Street names in evaluative category
The spatial distribution of Evaluative street names, as revealed by the Kernel Density Estimation (KDE) in Fig. 7, shows highly concentrated clusters. These clusters are not randomly distributed; instead, they correspond to specific historical and developmental contexts, falling into two distinct subcategories: Commendatory and Condemnatory.

The most intense concentrations, marked as Point A and Point B, consist overwhelmingly of Commendatory names. These names were systematically applied during periods of development to bestow auspicious wishes and foster economic prosperity.
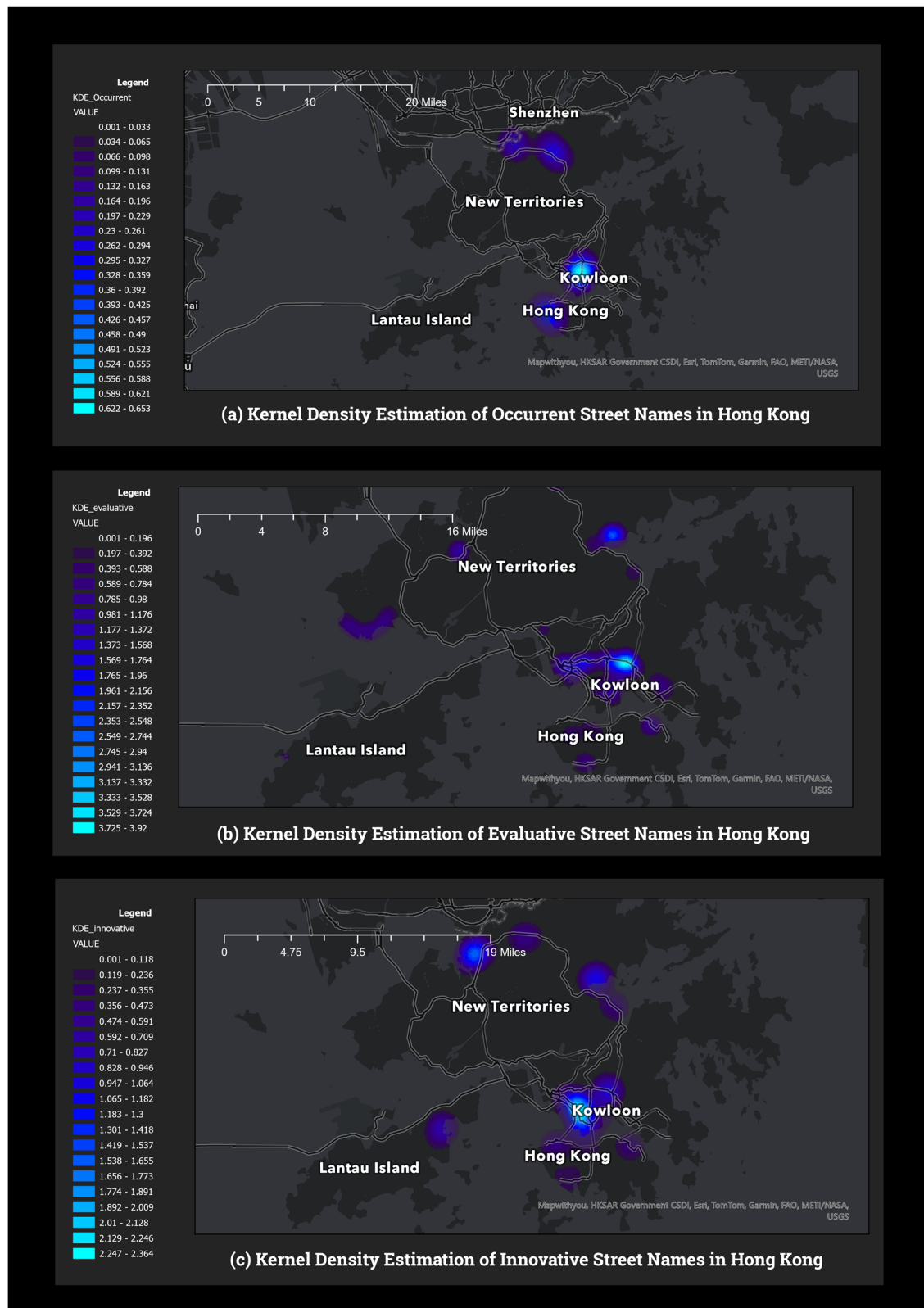
Fig. 4 | Kernel density estimation results of Hong Kong street name categories. Kernel density distribution of street name categories in Hong Kong: (**a**) Occurrent, (**b**) Evaluative, and (**c**) Innovative street names.

In Kowloon (Point A), encompassing both the San Po Kong industrial area and the adjacent Fung Wong New Village. This area showcases two distinct but complementary auspicious naming strategies from the 1960s. In San Po Kong, a planned naming system was implemented in 1961 for its industrial core, known as the "Eight Streets." To avoid confusion with existing numbered streets and to attract investment, names were created by combining modified Chinese numerals with auspicious characters (e.g., Dai You Street (大有街) for "Great Existence," Sheung Hei Street (雙喜街) for "Double Happiness")[19]. Nearby, the streets of Fung Wong (Phoenix) New
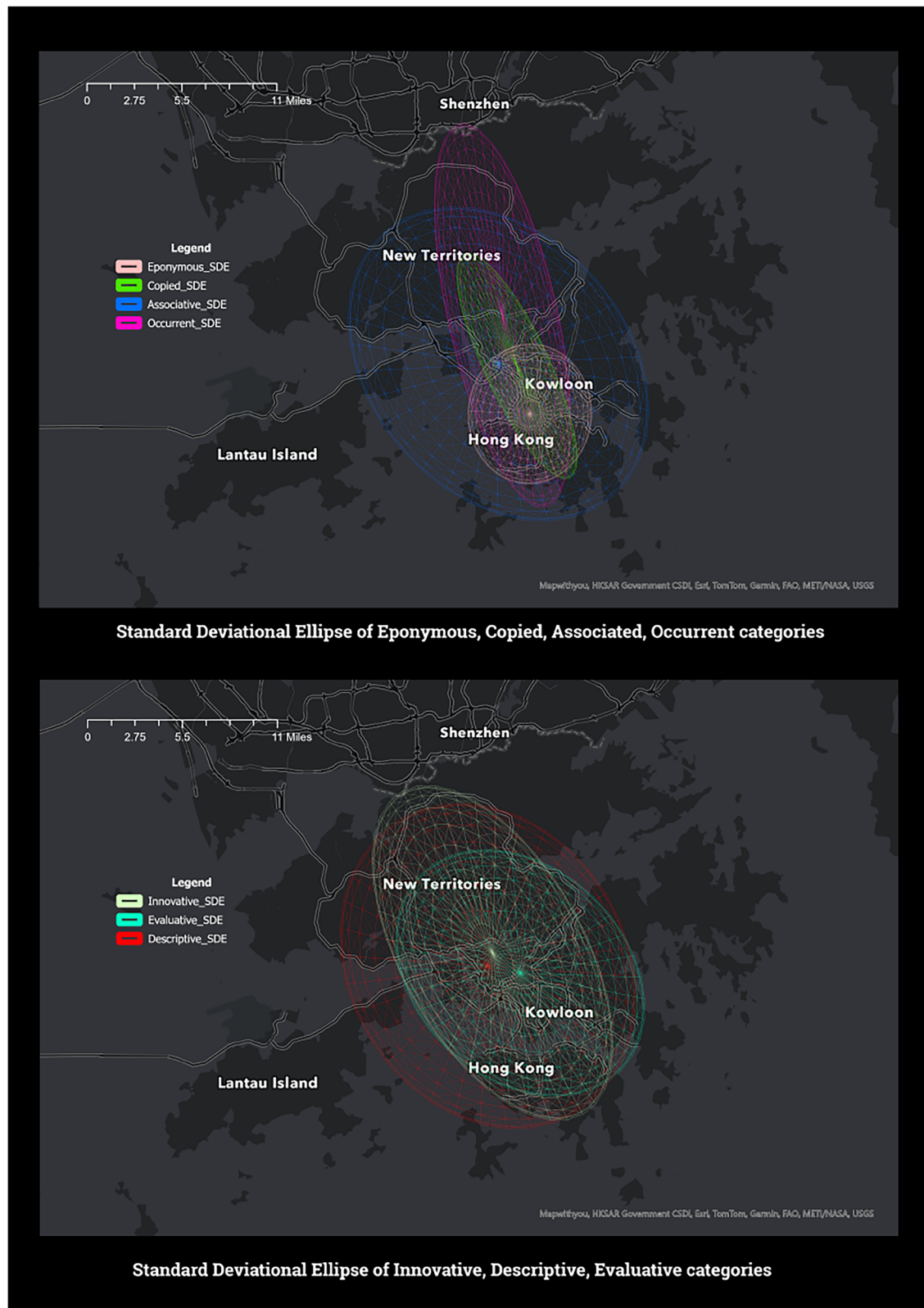
Fig. 5 | Standard deviational ellipse of each category. The upper section of the figure presents the standard deviational ellipses of Eponymous, Copied, Associated, and Occurrent categories, while the lower section presents those of Innovative, Descriptive, and Evaluative categories.

Village are systematically named using the character "Fung" (鳳), a powerful symbol of rebirth and good fortune in Chinese culture.

Similarly, in the Tai Po Industrial Estate (Point B), Hong Kong's first industrial estate, developed in the 1974[45], its street grid was systematically named to promote growth. Nearly all roads begin with the character "Dai"

(大), meaning "great" or "big," followed by words conveying prosperity and success (e.g., Dai Fu Street for "Great Fortune," Dai Cheong Street for "Great Prosperity").

In contrast to these auspicious naming patterns, Point C identifies a smaller but significant cluster of Condemnatory names, concentrated in the
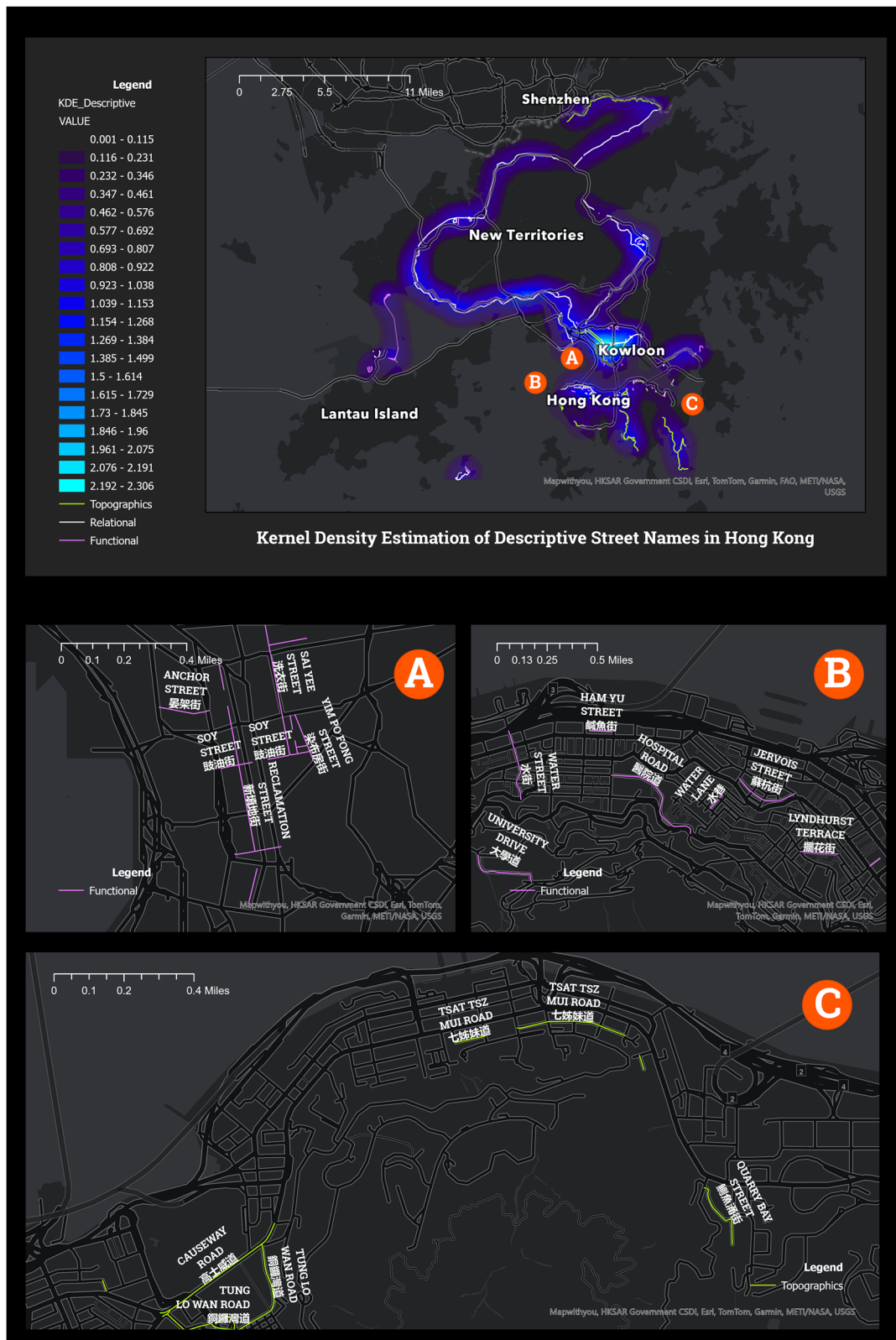
Fig. 6 | Kernel Density estimation of descriptive street names in Hong Kong. The insets highlight different types of descriptive names: **A** Functional names in Mong Kok; **B** Functional names tied to local trade in Sai Ying Pun; and **C** Topographic names referencing local geography in the Eastern District.

Wang Tau Hom area. The name "Wang Tau Hom" (橫頭磡) has complex origins, and its classification as Condemnatory stems from a layered and inauspicious history[19].

While one interpretation suggests the name is purely geographical, meaning "the place below the rocky cliff of a horizontally-lying Lion Rock,"

its negative connotations are deeply rooted in its past. First, the area served as a large Chinese cemetery established in 1903, which inherently imbued the location with associations of death and the supernatural in local folklore. This reputation was further darkened during the Japanese occupation, when, according to local lore, the area was reputedly used as an execution
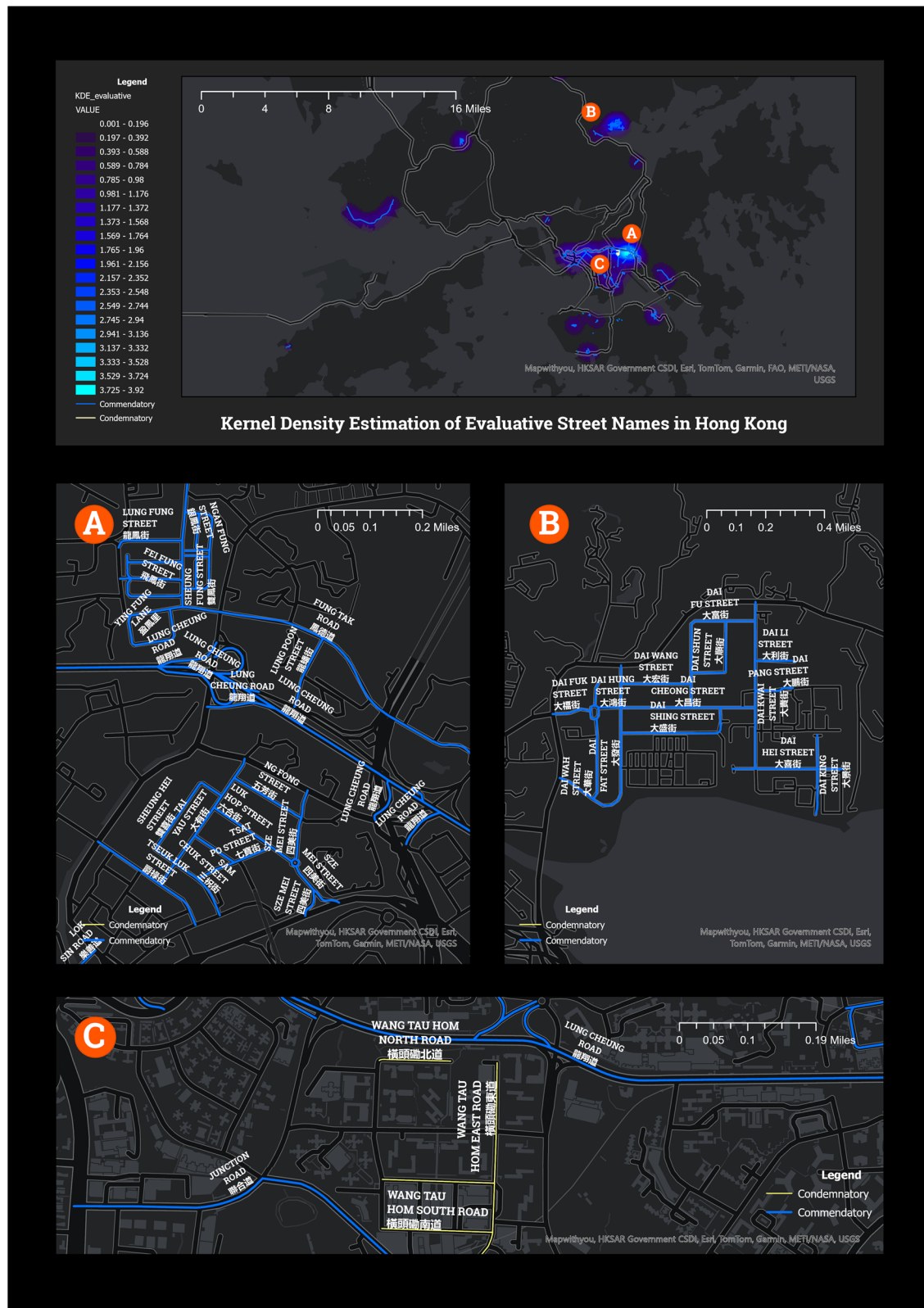
Fig. 7 | Kernel density distribution of evaluative category street names.
A, **B** represent high-density clusters primarily consisting of Commendatory subcategory streets, with Point A located in San Po Kong industrial area and Fung Wong New Village, and Point B in Tai Po Industrial Estate. Point **C** represents Condemnatory subcategory streets, mainly concentrated in Wang Tau Hom area.
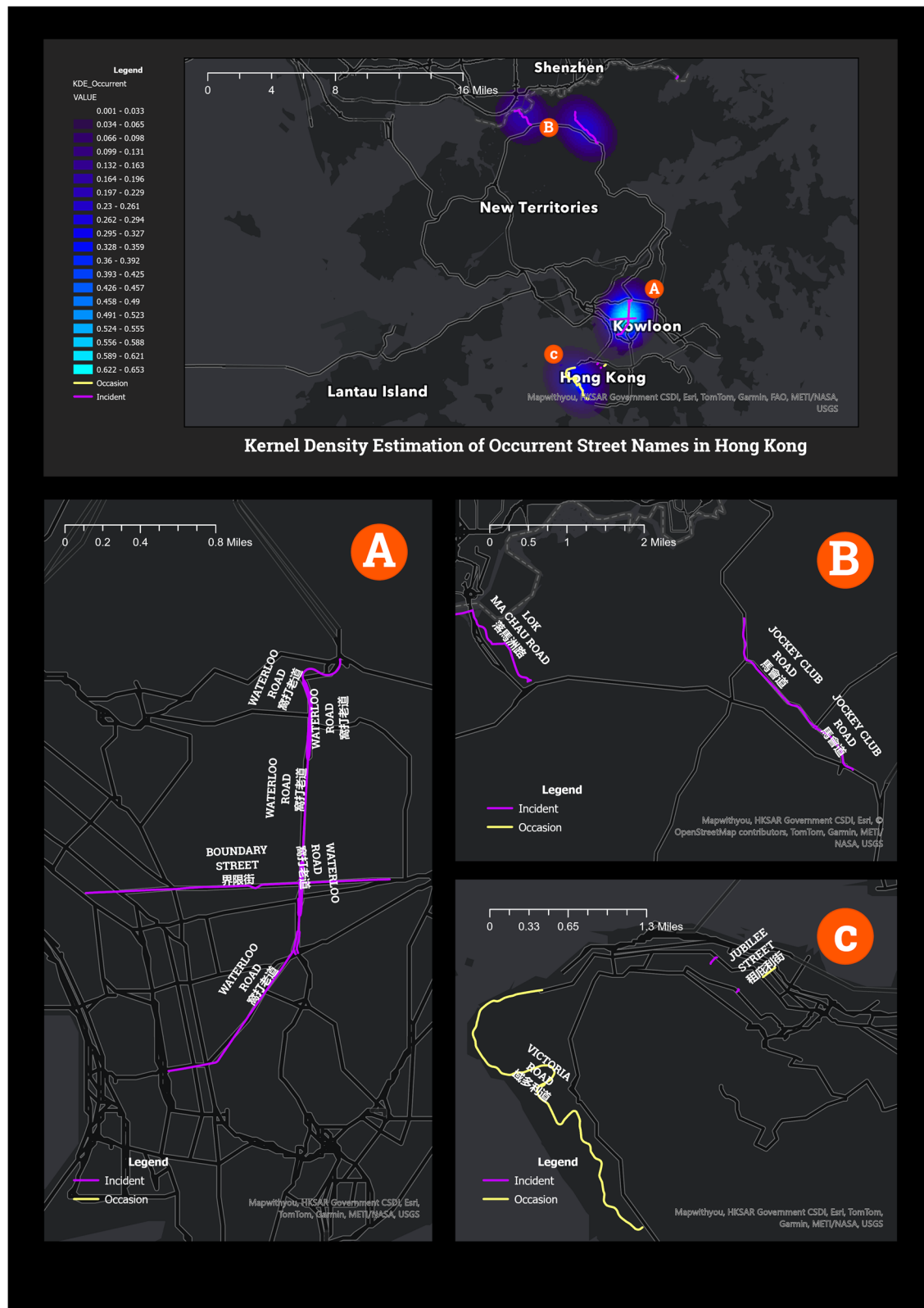
Fig. 8 | Kernel Density estimation of occurrent street names in Hong Kong. A Sham Shui Po area featuring Boundary Street and Waterloo Road; **B** North District in New Territories with Jockey Club Road and Lok Ma Chau Road; **C** Hong Kong Island centered on Victoria Road and Jubilee Street.

ground. This grim association is powerfully amplified by a linguistic feature of the name itself: in Chinese, "Wang Tau Hom" (橫頭磡) is a near-homophone for "Wang Tau Kan" (橫頭砍), which graphically translates to "horizontal head chop" or "beheading."

Therefore, the name's condemnatory power is not derived from a single source but from the cumulative weight of its history as a place of burial and trauma, reinforced by this powerful linguistic association. The area's eventual transformation from a cemetery into a large-scale resettlement

estate creates a stark juxtaposition, embedding these complex historical layers and cultural perceptions directly into its nomenclature.

Street names in occurrent category

Street names in the Occurrent category transform thoroughfares into linear historical archives, commemorating specific incidents or celebrating significant occasions. Although this category contains only nine streets, they are often major, lengthy roads whose names are deeply intertwined with pivotal moments in Hong Kong's history. The Kernel Density Estimation (Fig. 8) reveals distinct clusters that correspond to these two subcategories: Incident and Occasion. The Incident subcategory, marking geopolitical events, boundaries, and foundational moments, forms the most prominent clusters.

The Kowloon area (Point A) highlights two different types of historical incidents. Boundary Street is a prime example of a name marking a local geopolitical event. It physically represents the original 1860 frontier established by the Convention of Peking, dividing British-held Kowloon from Qing territory[38,46]. In contrast, Waterloo Road commemorates an event entirely external to Hong Kong–the 1815 Battle of Waterloo–inscribing British imperial military history onto the city's grid[38]. Other critical "Incident" names include Possession Street (水坑口街), with its English name marking the very spot where the British first landed and claimed Hong Kong in 1841, and Chung Ying Street (中英街), which literally means "China England Street" in Sha Tau Kok, uniquely functioning as the physical border itself, laid upon a dried riverbed along the 1898 boundary line[43,47].

New Territories (Point B), this region showcases incidents from both deep and modern history. Lok Ma Chau Road (落馬洲路) has origins tracing back to the Southern Song Dynasty, named for the act of officials dismounting their horses ("Lok Ma") to greet the fleeing emperor[48]. Juxtaposed with this is Jockey Club Road (馬會道), a modern name commemorating a local philanthropic event: the Hong Kong Jockey Club's funding of a community clinic in the 1950s.

The Occasion subcategory, though less numerous, marks moments of celebration, primarily those tied to the British monarchy. Hong Kong Island (Point C) features streets that fix imperial milestones in time and space. Jubilee Street was named to celebrate the Golden Jubilee (50th anniversary) of Queen Victoria's reign, while Victoria Road commemorates her Diamond Jubilee (60th anniversary)[15]. These names served to reinforce the colonial relationship by embedding celebrations of the British Crown into the landscape of Hong Kong.

Street names in copied category

Street names within the Copied category borrow from a diverse international palette, reflecting Hong Kong's multicultural identity, colonial history, and economic aspirations. These names are overwhelmingly Locational, drawing from geographic places, while a small subset of six are Linguistic, copying aristocratic titles. An updated count reveals that the most prominent sources are Britain (56) and China (56), followed by America (22), Switzerland (10), Vietnam (6), France (6), Germany (3), and one street each for Indonesia and Malaysia. As Fig. 9 illustrates, these names cluster in distinct areas, each revealing a different motivation for borrowing from abroad, directly linking spatial patterns to specific social, political, and economic forces.

Kowloon Tong (Point A) highlights a dense cluster that exemplifies how colonial planning shaped residential landscapes. Planned in the 1920s by British entrepreneur Montague Ede, the Kowloon Tong Garden City was a direct implementation of a specific residential zoning policy: a low-density, garden suburb model designed for the emerging middle class, including British expatriates[49,50]. Consequently, its street grid was systematically named after places in Britain (e.g., Kent Road, Oxford Road, Cumberland Road). This toponymic strategy was integral to the planning ideology, designed to invoke an "imagined English countryside" and create a familiar and prestigious environment[51]. This act of copying was therefore a powerful tool of socio-spatial engineering, creating an exclusive, class-based enclave that used the cultural capital of "Englishness" to attract a specific elite

demographic and physically manifest colonial social hierarchies. This observation is consistent with diachronic analyses tracing how language choices in the landscape evolved to serve different class and identity functions over time[22].

Cheung Sha Wan area (Point B) shows a major concentration in Cheung Sha Wan, where streets are named after Chinese provinces and cities (e.g., Nanking Street 南京街, Canton Road 广东道). This cluster is the result of a direct government policy intervention, not private development. The practice was formally established in 1909 when the government renamed many Kowloon streets to avoid duplication with Hong Kong Island[51,52]. The choice of names was deeply tied to migration patterns and economic geography, reflecting cities and provinces with which Hong Kong had strong trade connections and from which significant portions of its population originated[53]. The naming scheme thus served as a cartographic record of the city's deep and enduring economic and cultural ties with mainland China[51].

A more contemporary manifestation of this copying phenomenon is evident in Yuen Long (Point C), which illustrates a modern, developer-driven planning ideology that commodifies place for marketing purposes. This cluster is centered on the housing development California Garden (and its phase, Royal Palm), where streets are named after places in California, USA (e.g., Santa Clara Avenue, San Francisco Avenue) to evoke an image of American luxury[54]. This is a common branding strategy in newer developments, also reflected by another Sun Hung Kai Properties project, the Swiss-themed luxury villa complex Valais in Sheung Shui, whose streets are named after Swiss localities like Geneva Drive and Bern Avenue. These copied names are a key part of a wider marketing strategy used to build a premium brand image and sell an aspirational lifestyle, reflecting a cultural and economic desire for foreign prestige and exclusivity.

Street name in eponymous category

Kernel Density Estimation (KDE) analysis reveals that eponymous street names are predominantly located in the southern regions of Kowloon and the northern parts of Hong Kong Island. The eponymous category is subdivided into four subcategories: British Royalty, Public Service Personnel, Professional and Vocational, and Mythological and Historical. Figure 10 shows the kernel density distribution of street names in each subcategory. Each subcategory reveals distinct patterns of concentration, reflecting historical, cultural, and administrative influences on street naming practices in Hong Kong.

British Royalty names demonstrate a clear pattern of colonial place-making, with names concentrated in historically significant areas. As Fig. 11 shows that these streets are primarily major thoroughfares located along the northern shore of Hong Kong Island and in southern Kowloon. These locations were the epicenters of colonial administration, commerce, and high-status residence, reflecting a deliberate strategy to honor the monarchy in the most visible and important parts of the city. The most intense concentration is found on Hong Kong Island (Point A), forming the backbone of the early colonial capital, Victoria City. This cluster includes foundational thoroughfares such as Queen's Road, Connaught Road, Queensway, and Gloucester Road. Naming this critical infrastructure after monarchs like Queen Victoria and royal dukes firmly stamped British sovereignty onto the urban landscape[15]. This pattern extends to Victoria Road (Point B), a street named to commemorate the Queen and associated with the exclusive residential areas on the island's western side. Additionally, the presence of long, important roads in Kowloon (Point C) named after a Prince (Edward), King (George V, in King's Park), and a Princess (Margaret) reveals the extension of colonial power across the harbor[15]. This practice reinforced the colonial power structure by embedding the prestige of the British monarchy into the very fabric of Hong Kong's most important urban centers.

Streets named after Public Service Personnel are concentrated in a pattern that directly reflects the administrative and developmental history of colonial Hong Kong, as shown in Fig. 12. The distribution is densest in the core urban areas where these officials wielded influence. The most significant cluster is located on the northern shore of Hong Kong Island (Point
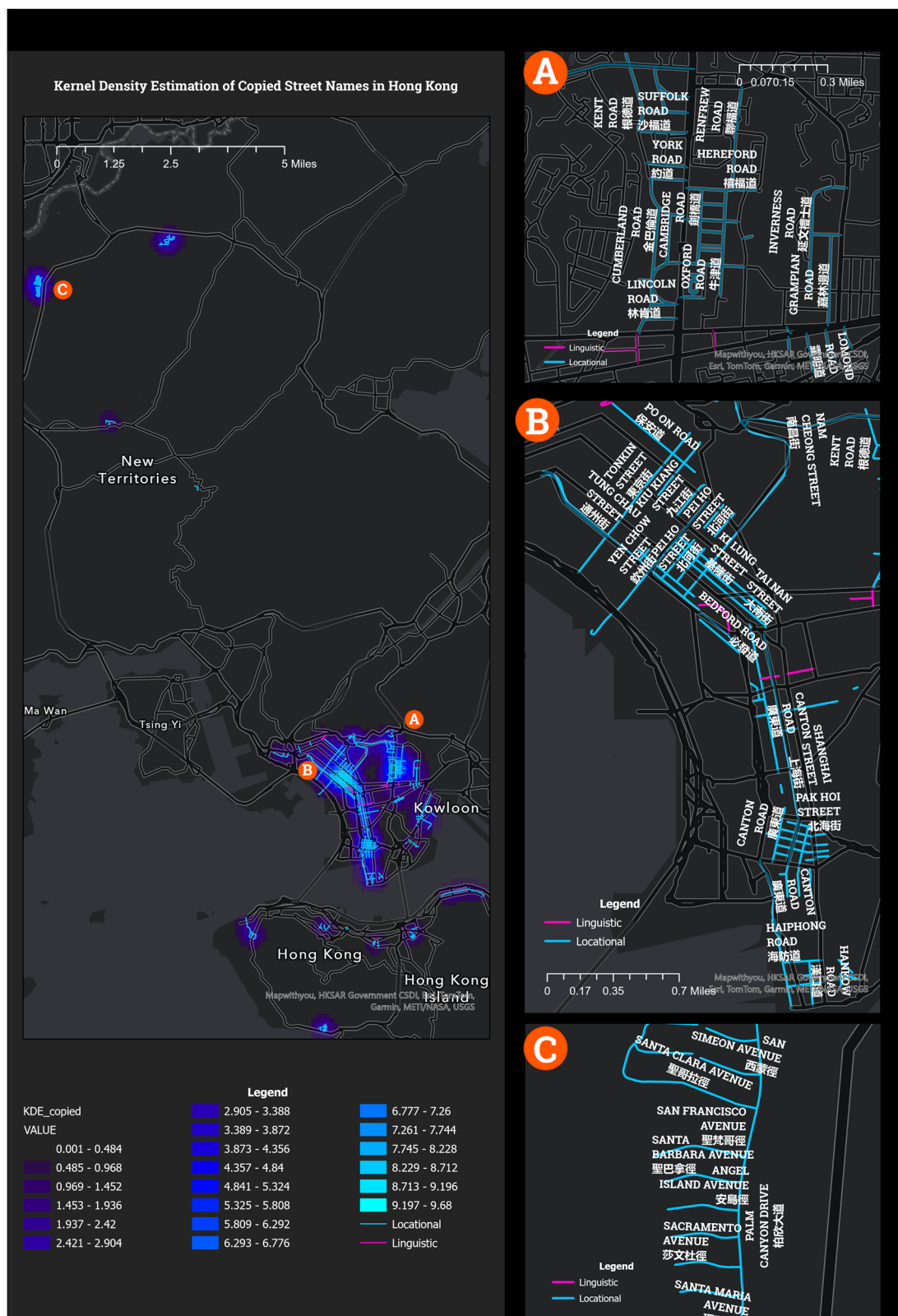
Fig. 9 | Kernel Density estimation of copied street names in Hong Kong. A Kowloon Tong area featuring streets named after British locations; **B** Cheung Sha Wan area with streets named after Chinese provinces; **C** Yuen Long area centered on Royal Palm, featuring streets named after places in California, United States.

A), the historical heart of the colonial administration. This area, encompassing Central, the Mid-Levels, and Wan Chai, is where the names of numerous former governors and high-ranking officials are immortalized in the urban fabric[15]. Streets such as Hennessy Road, Bowen Road, Kennedy Road, and MacDonnell Road serve as a permanent tribute to the highest

echelons of colonial power. This commemorative practice also extended to Kowloon (Point B). While the density is lower than on Hong Kong Island, important arteries like Nathan Road (named after a governor) and streets named after other key officials, such as Jordan Road and Gascoigne Road, demonstrate that the recognition of colonial administrators was a crucial
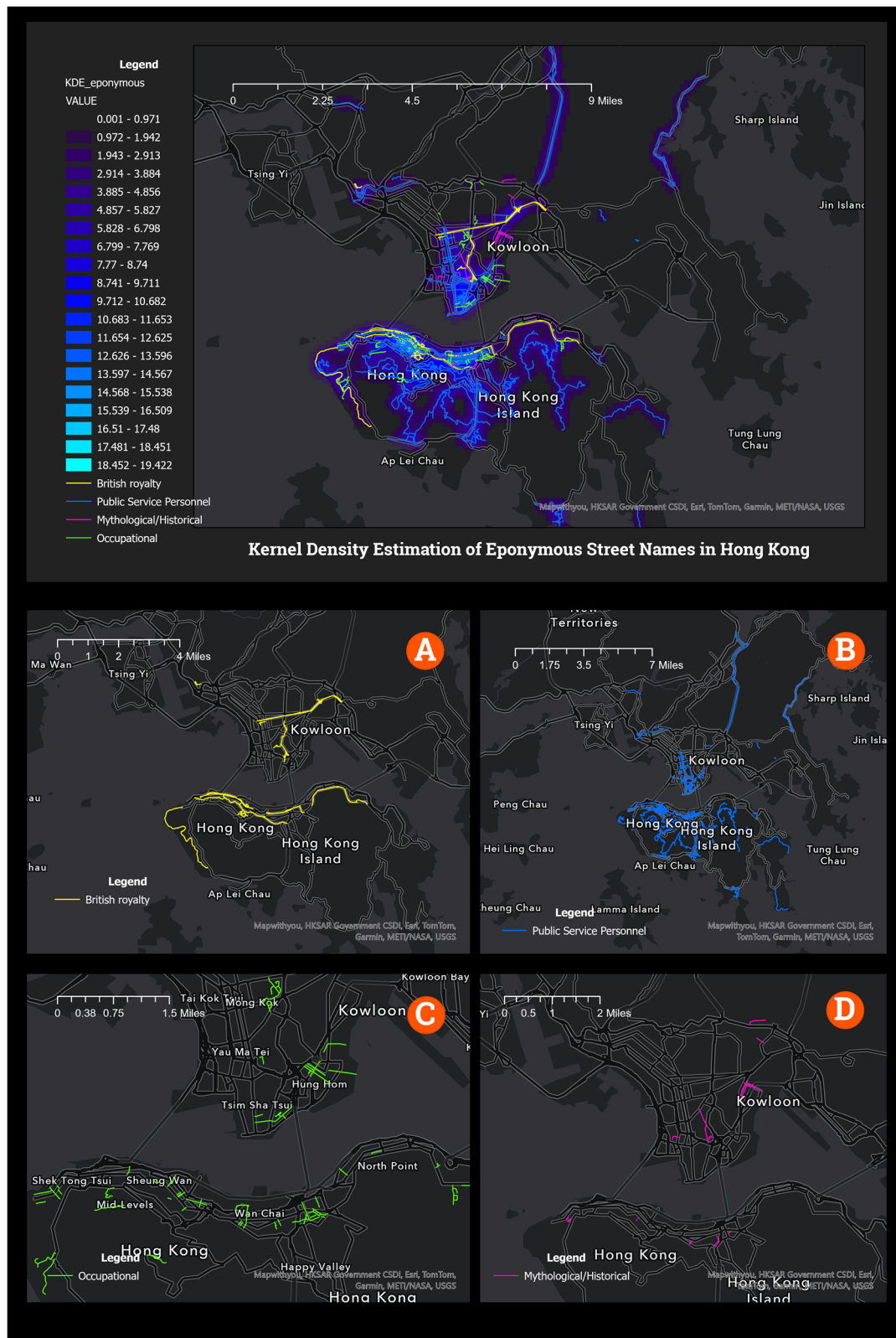
Fig. 10 | Kernel Density estimation of eponymous street names in Hong Kong. The top map shows the overall distribution of eponymous street names with highest concentrations in Central Hong Kong and Kowloon areas. The four detailed maps below display the spatial distribution of subcategories: **A** British Royalty street names; **B** Public Service Personnel street names; **C** Mythological/Historical street names; **D** Occupational street names.
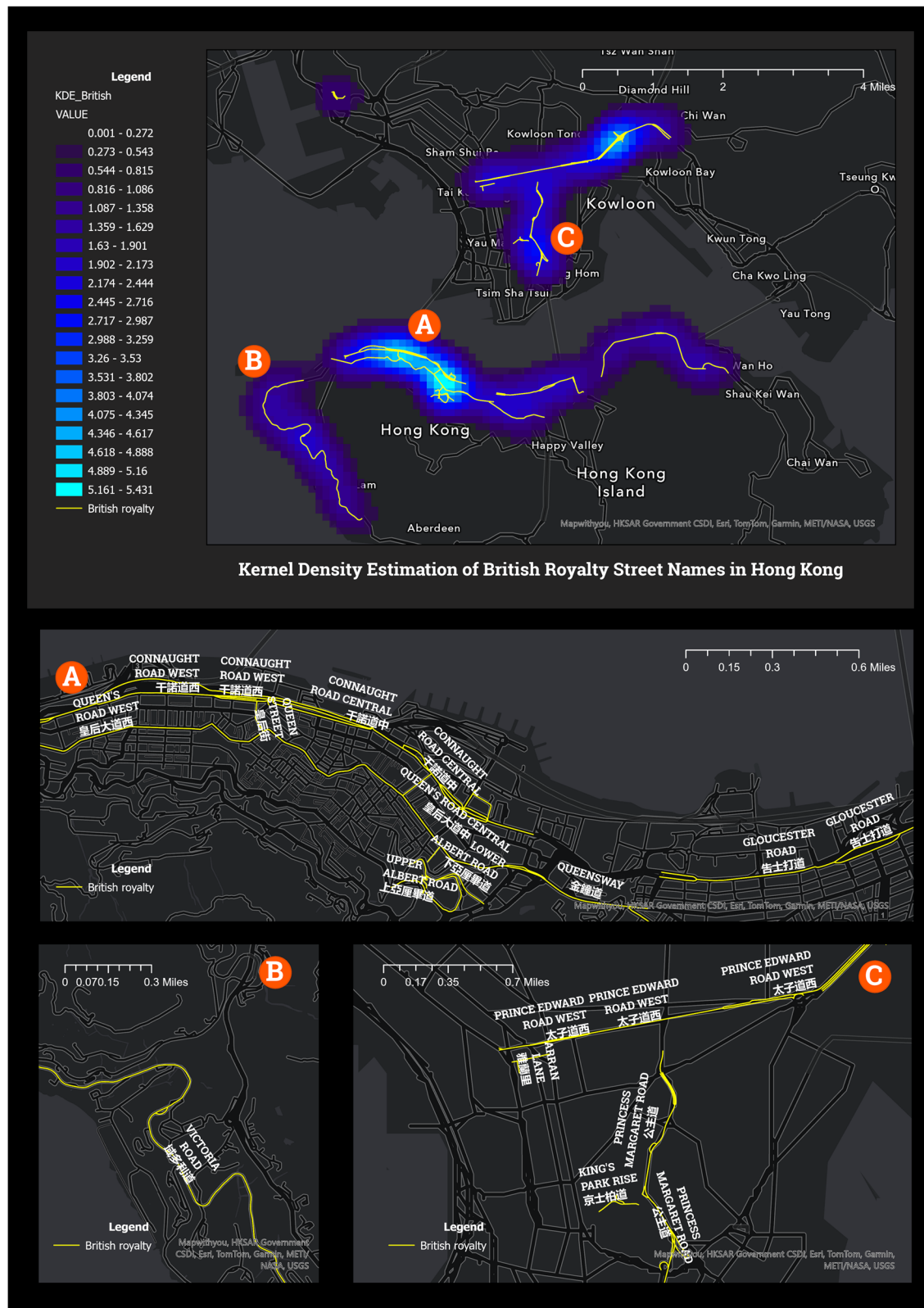
Fig. 11 | Kernel density estimation of British Royalty street names in Hong Kong. The figure shows the overall distribution of British Royalty street names across Hong Kong. The three detailed maps below display the key concentration areas: **A** Central and Mid-Levels featuring Queen's Road Central, Connaught Road, and Gloucester Road; **B** Victoria Road; **C** Kowloon area showing Prince Edward Road, Princess Margaret Road and King's Park Rise.
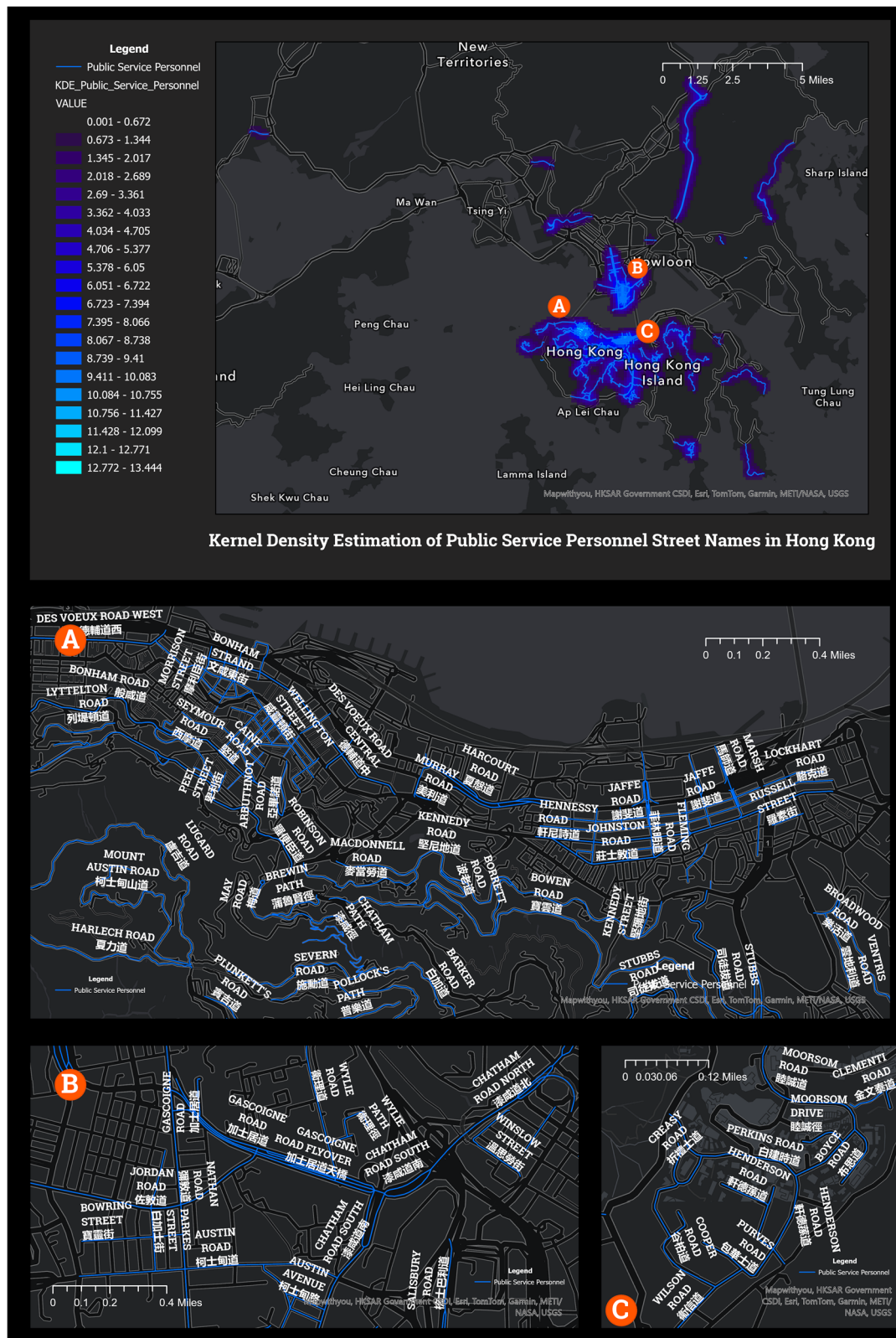
Fig. 12 | Kernel density estimation of Public Service Personnel street names in Hong Kong. The top map shows the distribution of Public Service Personnel street names across Hong Kong. The three detailed maps below display the streets in key concentration areas: **A** Hong Kong Island (Central and Mid-Levels); **B** Kowloon (Yau Ma Tei and Jordan); **C** Jardine's Lookout.
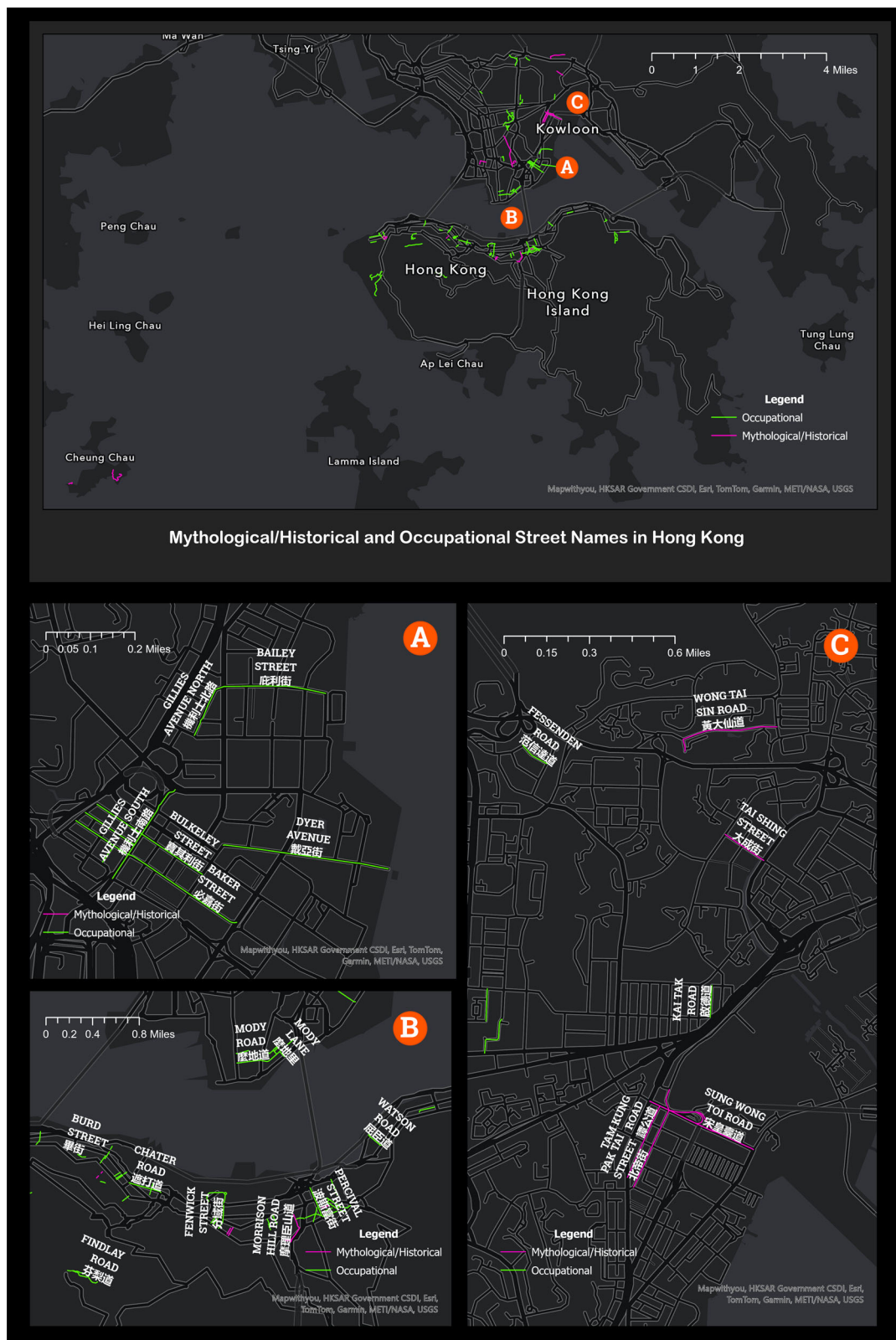
Fig. 13 | Mythological, Historical, and Occupational street names across Hong Kong. The top map displays the overall distribution of these street names across the city. The three detailed maps below show: **A** Whampoa area; **B** Victoria Harbour waterfront; **C** Kowloon City.

part of the urban expansion across Victoria Harbour[38]. A notable and unique cluster is found at Jardine's Lookout (Point C). This area is distinguished by streets named in honor of government engineers and surveyors, such as Perkins Road, Wilson Road, and Henderson Road. These individuals were instrumental in shaping Hong Kong's challenging topography and infrastructure[13]. Naming this specific area after them highlights the colonial government's practice of recognizing not only its executive leaders but also the technical experts who made the city's development possible.

Streets named after professional and vocational figures form dispersed clusters primarily along the coastlines of Victoria Harbour, as shown in Fig. 13. This category is predominantly composed of merchants (58), alongside non-government engineers (13) and medical personnel (1). The coastal concentration of these streets reflects Hong Kong's foundational identity as a center for trade and shipping, an urban development pattern driven by maritime commerce from the city's earliest colonial days[55]. A significant cluster exists in Hung Hom (Point A), an area historically dominated by the Whampoa Dockyard. Streets like Baker Street and Dyer Avenue are named after key figures and occupations associated with the dockyard's operations, preserving its industrial legacy in the local toponymy[55]. On Hong Kong Island and in Tsim Sha Tsui (Point B), streets such as Chater Road, Mody Road, and Percival Street are named after influential merchants and taipans, many associated with powerful trading houses like Jardine Matheson[55]. Their concentration in historical commercial hubs highlights the immense influence of trade on the city's development[56]. Collectively, these names commemorate individuals from diverse professional backgrounds, underscoring Hong Kong's multicultural and commercial heritage.

Streets named after mythological and historical figures are generally scattered across the territory. This includes names linked to religious figures, such as Don Bosco Road on Cheung Chau and Pui To Road in Tuen Mun, which reflect the influence of missionaries. However, a notable exception is a meaningful cluster found in Kowloon City (Point C), as illustrated in Fig. 13. This area is historically significant, centered around Sung Wong Toi (Terrace of the Song Kings), a location commemorating the refuge of the last two emperors of the Song Dynasty[38,48]. Its historical importance is further underscored by the discovery of numerous Song-Yuan era artifacts and its proximity to the former Kowloon Walled City. The concentration of names such as Sung Wong Toi Road, Tam Kung Road (a sea deity), Wong Tai Sin Road (a Taoist deity), and Tai Shing Street (honoring Confucius) in this specific area is not coincidental. It reflects a conscious effort to embed traditional Chinese culture, history, and mythology into the urban memory of Kowloon, creating a distinct cultural landscape.

Street name in innovative category
The Innovative category of street names is divided into two subcategories: Systematic Planning (223) and Individual Innovation (6). Individual Innovation typically arises from accidental errors in translation or understanding, resulting in unique names; these are not the focus of this analysis. Systematic Planning, however, involves the deliberate, large-scale naming of streets by government bodies or private developers. This approach often uses thematic conventions that can overlap with locational or commendatory names, and includes themes such as plants, numbers, or specific vocabulary. As illustrated in Fig. 14, these systematically named clusters reveal distinct historical, cultural, and commercial narratives across multiple locations throughout Hong Kong.

In Tai Kok Tsui (Point A), following land reclamation in the 1920s, the government implemented a thematic naming scheme using plants. This was a planned choice rather than a reflection of local flora, creating a "garden" of street names like Maple Street, Willow Street, Cedar Street, and Cherry Street[38]. The Shau Kei Wan and Taikoo area (Point B) showcases both corporate influence and local themes. The street names around the former Taikoo Dockyard reflect the unified planning and influence of the Taikoo conglomerate, a direct example of naming rights shifting to developers[55]. Nearby in Shau Kei Wan, a cluster of five streets–Hoi Ning Street, Hoi Lee

Street, Hoi Ching Street, Hoi An Street, and Hoi Foo Street–are collectively known as the "Five Hoi Streets," all beginning with the character for "sea" (海).

Sai Ying Pun (Point C), the horizontal streets here were named with a simple and direct numerical system, ascending from the waterfront: First Street, Second Street, and Third Street. The fourth street was named High Street to avoid the number four, whose pronunciation in Cantonese is a homophone for "death" and is considered unlucky. The name "High Street" was chosen instead to reflect its higher geographical position, demonstrating a clear cultural adaptation in urban planning. Similarly, Aberdeen (Point D) honors the area's heritage as a historic fishing village. Streets such as Yue Fai Road, Yue Kwong Road, and Yue Lei Street all begin with the character "Yue" (漁), meaning "fishing".

This systematic, top-down approach to naming–whether based on local culture, thematic coherence, or commercial identity–reflects a well-documented evolution in toponymic practices. Scholars in the field of critical toponymy argue that place naming is an exercise of power, shifting from organic, community-based origins to deliberate strategies by authorities like planners and developers[17]. In Hong Kong, this is evident in the large-scale, thematic naming schemes implemented by both the colonial government and private corporations like Swire, which shaped entire districts to project a specific commercial or orderly identity[55]. This process, often described as the 'commodification of place,' turns street names into tools for marketing and urban governance, marking a clear shift in naming authority toward institutional actors[57].

Street name in associative category
The Associative category is subdivided into Culture & Activities (94), Structures & Landmarks (267), and Natural Environment (92). The Natural Environment subcategory is excluded from this analysis, as many streets named after plants reflect systematic, non-native planning—overlapping with the Innovative-Systematic category—rather than the local ecology. Instead, this section focuses on how Structures & Landmarks and Culture & Activities names preserve Hong Kong's corporate and social history. Figure 15 illustrates the distinct clusters of these names.

Point A and B demonstrate how entire districts became toponymic archives for Hong Kong's dominant colonial-era trading houses, or hongs. When overlaid with Eponymous-Occupational names, these clusters reveal the profound influence of corporate development. Causeway Bay (Point A) highlights the historical footprint of Jardine Matheson. Streets such as Jardine's Bazaar and Jardine's Crescent are named for the company's foundational landmarks. This corporate branding is reinforced by a cluster of streets named for its executives (taipans), including Percival Street, Irving Street, and Keswick Street, cementing the company's legacy in the urban fabric[19,42]. Similarly, Quarry Bay (Point B) maps the historical domain of the Taikoo Group (John Swire & Sons) Names like Taikoo Wan Road and Taikoo Shing Road mark the location of the former Taikoo Dockyard and Sugar Refinery. The surrounding area, including Kornhill Road and Greig Road, is named for the company's managers, creating a cohesive landscape that memorializes the corporation's activities.

A different kind of historical layering is revealed in Mong Kok and Sham Shui Po (Point C). Here, combining Functional names (discussed previously) with names from the Culture & Activities subcategory allows for a reconstruction of the area's timeline, tracing its evolution from an agrarian landscape to an urban center. Names like Sai Yeung Choi Street (西洋菜街, "Watercress Street"), Tung Choi Street (通菜街, "Water Spinach Street"), and Apliu Street (鴨寮街, "Duck Pen Street") evoke a pre-industrial scene of vegetable fields and poultry farms on reclaimed land[38,50]. Other names trace former geographical features. Un Chau Street (元州街) is named after a former round island ("Yuen Chau"), while Tai Po Road (大埔道) refers to a historical wharf ("Tai Po" meaning "big port" or "wharf"). Together, these names outline a Kowloon coastline and island geography that existed long before extensive land reclamation, preserving a cartographic memory of a vanished landscape.
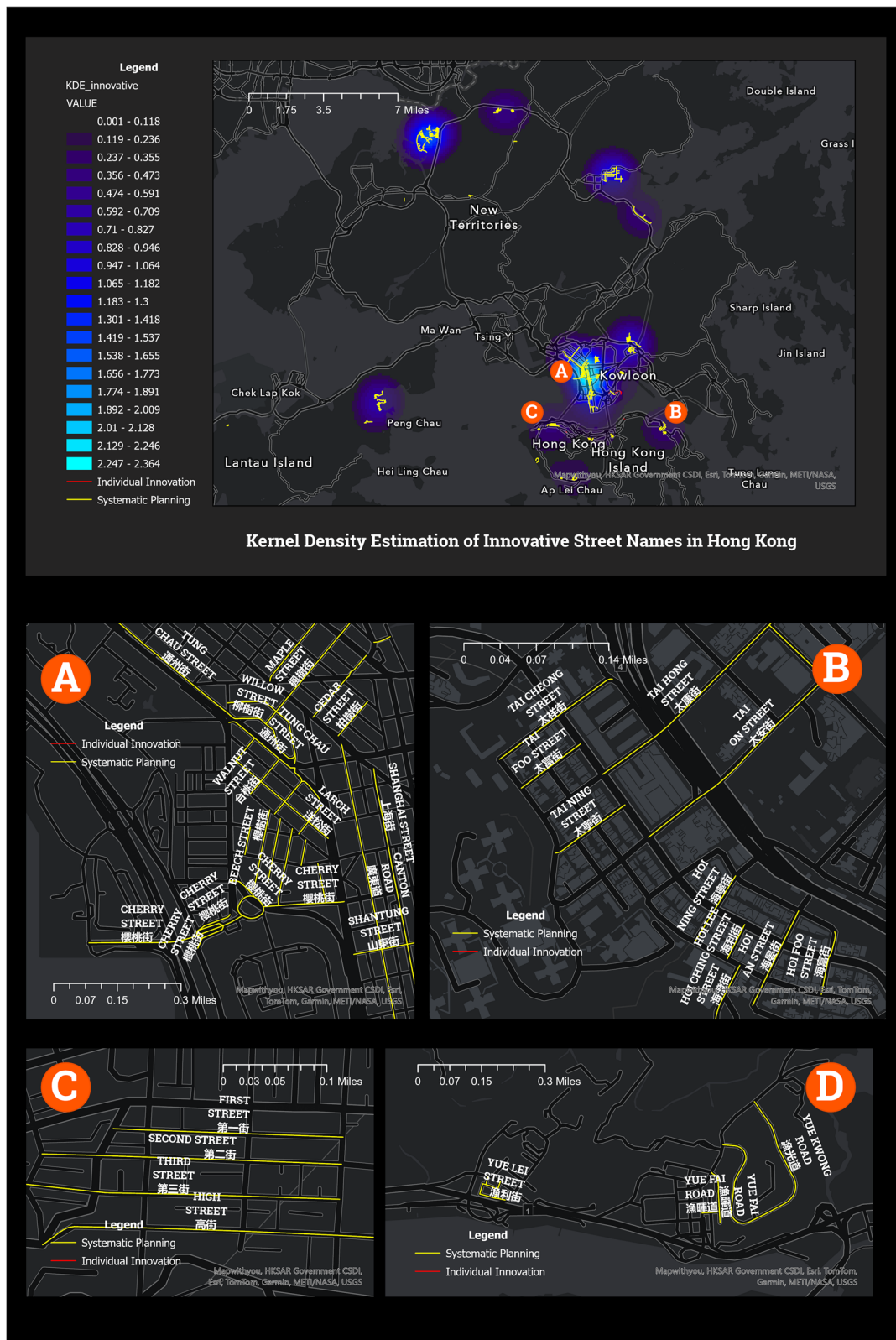
Fig. 14 | Kernel density estimation of innovative street names in Hong Kong. The top map shows the overall distribution of innovative street names across Hong Kong. The four detailed maps below display: **A** Plant-named streets in Tai Kok Tsui; **B** Sea-themed street names in Shau Kei Wan and Taikoo Dockyard area; **C** Numerically-named streets; **D** Fishing-themed street names in Aberdeen.
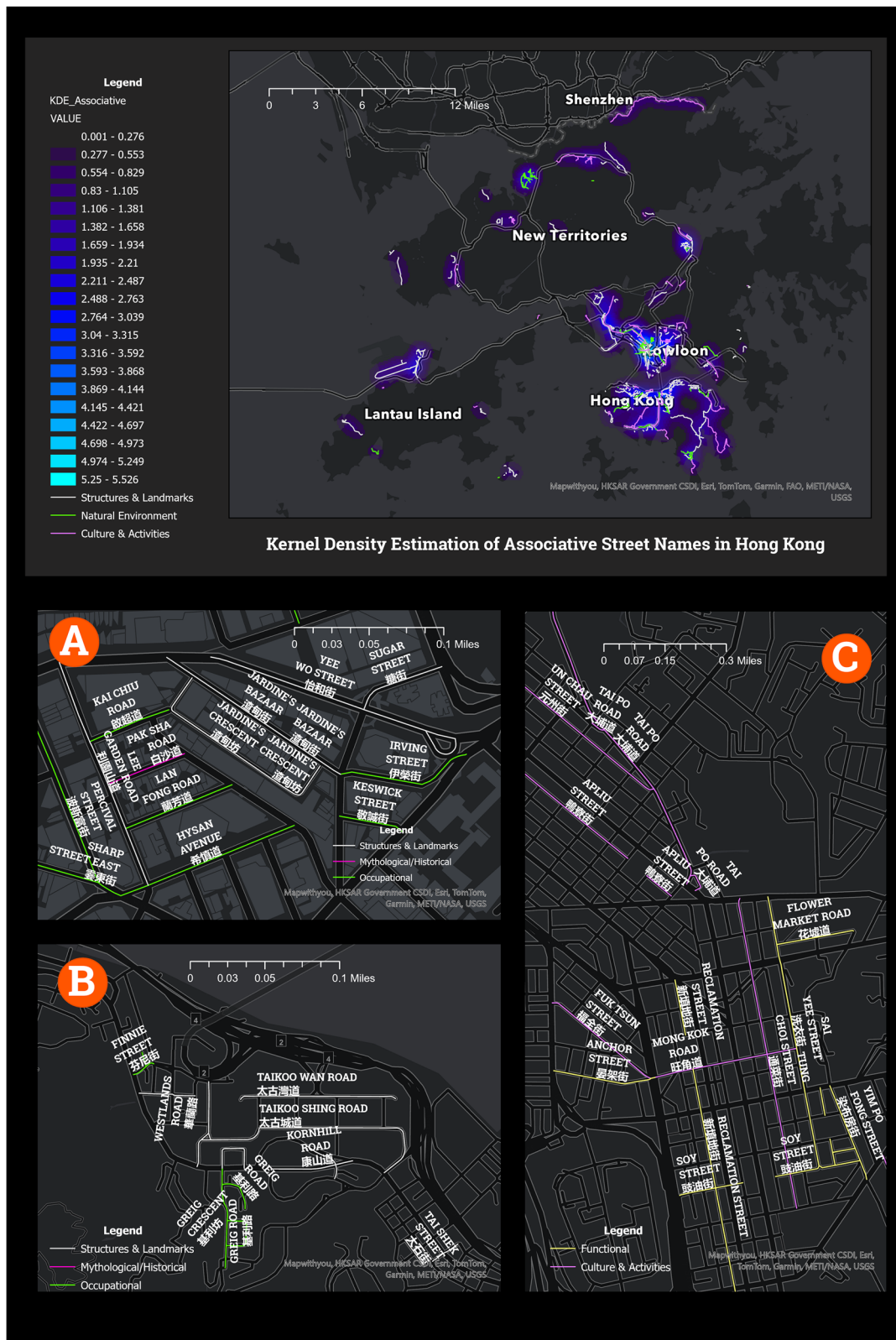
Fig. 15 | Kernel Density Estimation of Associative Street Names in Hong Kong. The insets show distinct clusters: **A**, **B** 'Structures & Landmarks' and 'Occupational' names reflecting corporate history; and **C** 'Culture & Activities' names preserving Mong Kok's agrarian past.

Discussion

Street names in Hong Kong offer powerful insights into the city's historical, cultural, and economic evolution. Before British colonial rule, Hong Kong was part of Xin'an County under Chinese administration. The arrival of British forces in 1841 marked a pivotal shift in Hong Kong's administrative and spatial organization, transforming the very production of its space. This colonial project imposed what Henri Lefebvre calls "conceived space"–the abstract, top-down space of planners and rulers, designed for control and domination[3].
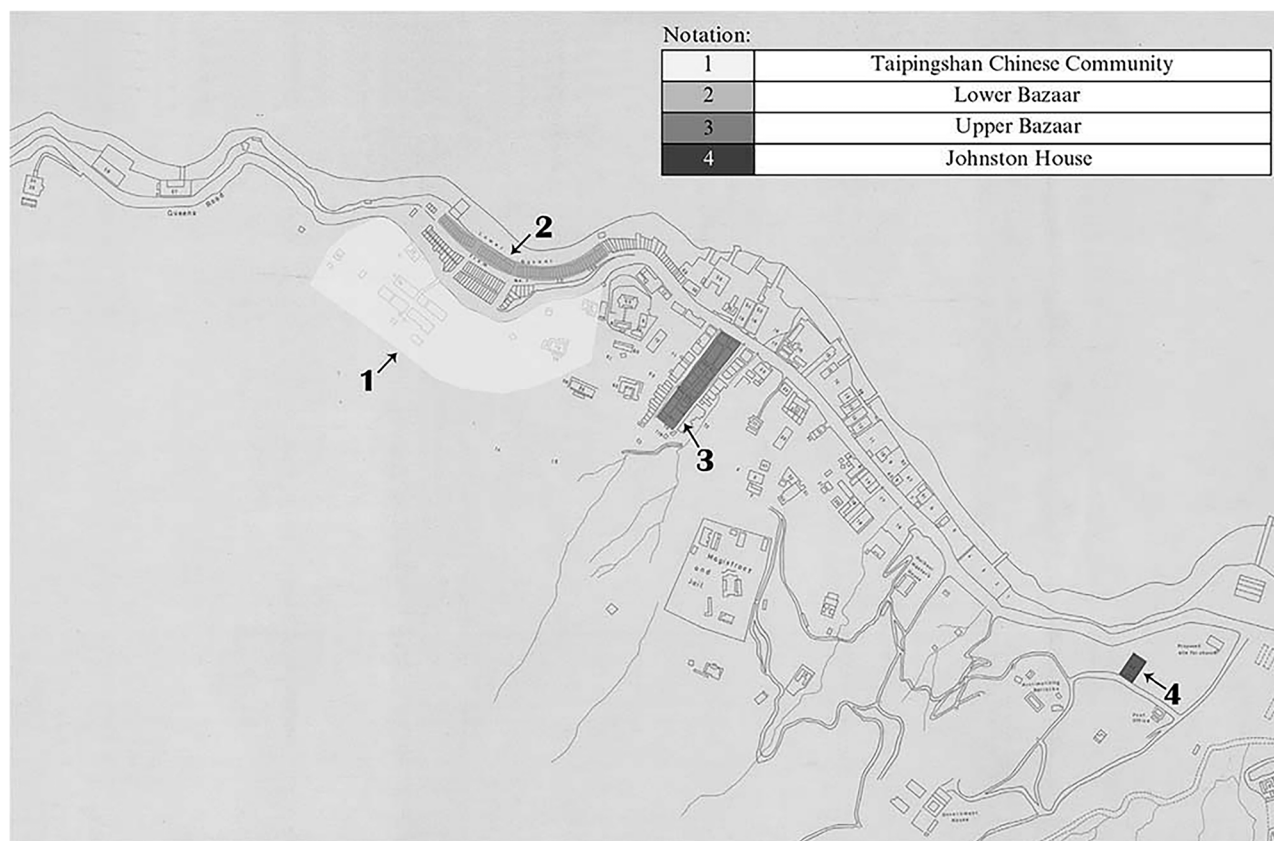
Fig. 16 | The first city development blueprint drafted by Gordon (6 July 1843). Source: The National Archives (UK), CO129/2, p. 457; from *Making Hong Kong*, Edward Elgar Publishing, 2018 (Chapter 1: "Duality in Planning, 1841–1898"). https://doi.org/10.4337/9781788117951. The original archival image is in the public domain.

The British colonial administration adopted a systematic approach to urban development, using street naming as a primary tool to create and assert these new representations of space. Gordon's 1843 urban blueprint (Fig. 16) is a quintessential example. It proposed a rationalized, belt-shaped urban area along the coastline, with Queen's Road serving as the city's primary artery[58]. Spatial analysis provides visual confirmation of this top-down, power-laden process. Kernel Density Estimation (Figs. 11 and 12) reveals that names of British royalty and public service personnel form an overwhelmingly dense cluster. This cluster is concentrated on the northern shore of Hong Kong Island, the historical heart of colonial administration. This spatial concentration is reinforced by major thoroughfares from the Occurrent category (Fig. 8), such as Jubilee Street and Victoria Road, which inscribed imperial milestones directly onto the city's prime thoroughfares. This is not merely a collection of names but the tangible cartographic footprint of Lefebvre's "conceived space".

Furthermore, our analysis reveals not just the density but also the directionality of this power. The distinct north-south orientation of the Eponymous category's Standard Deviational Ellipse (Fig. 5) empirically traces the primary axis of colonial expansion from the island into Kowloon. This strategic spatial logic, now rendered quantitatively visible, exemplifies a Foucauldian technology of power-knowledge[59]. The act of mapping and naming renders a foreign territory legible, classifiable, and therefore controllable. This practice inscribed imperial representation onto the landscape, unfolding systematically along a clear axis of expansion. It produced a specific 'knowledge' or 'truth' about the city: that its significance and history began with the British. This, in turn, exemplifies the broader phenomenon that "the power of naming is often the first step in taking possession"[2].

This dominant representation of space, conceived on maps and in official documents, was designed to directly structure the spatial practice–the everyday movements and routines of the city's inhabitants. Originally a military patrol route, Queen's Road became Hong Kong's first

modern thoroughfare, dictating the flow of commerce and daily life according to a new colonial logic. Furthermore, these colonial representations often clashed with or sought to erase pre-existing representational spaces–the lived, symbolic spaces of the indigenous population. The renaming of Chek-Chu to Stanley is a stark example of this conflict. This act of overwriting local toponyms is a classic manifestation of what Edward Said, in Orientalism, identified as a core colonial strategy: the power to represent, and thereby silence, the 'Other'[60]. By replacing indigenous names rich with local memory and meaning, the colonizer creates a landscape that is familiar and affirming to themselves while rendering the original history selectively irrelevant[60]. While "Stanley" was imposed as the official, colonial representation, the continued local use of Chinese toponyms signifies a persistent, alternative lived space. Following the 1997 transfer of sovereignty, Hong Kong retained its colonial-era street names. Their persistence reflects a complex landscape where dominant historical representations still shape contemporary life. These representations exist in a state of perpetual negotiation with the lived experiences of citizens.

Beyond colonial influences, Hong Kong's street names vividly reflect its multicultural heritage shaped by its role as an international trade hub. A review of the Copied and Eponymous categories reveals the predominance of names linked to Britain, Mainland China, and local origins, alongside influences from other nationalities. This multicultural naming pattern aligns with Hong Kong's diverse population, which included 8.4 percent ethnic minorities as of the 2021 government census[61].

In the Kowloon Peninsula, numerous streets bear names of Chinese cities, reflecting historical trade ties and migration patterns. The designation of Kowloon Tong as a residential area in the 1920s brought a wave of British influence, with streets named after English counties. Adjacent areas[50], such as Ho Man Tin, were developed as a Portuguese garden city by Francisco Paulo de Vasconcellos Soares, catering to the Portuguese community. Following the Portuguese colonization of Macau in the 16th century, many

Portuguese relocated to Hong Kong after its establishment, often employed by British companies due to their linguistic skills in Cantonese and English, as well as their relatively lower wage expectations[53]. While the Portuguese population in Ho Man Tin has largely dispersed, streets in the area continue to commemorate the Soares family.

The Jewish community, particularly the Kadoorie and Sassoon families, also left their mark on Hong Kong's streetscape. Streets such as Sassoon Road and Kadoorie Hill honor their contributions to Hong Kong's development, including investments in real estate, public utilities, and banking. Kadoorie Hill was transformed into an upscale residential garden villa area and remains a symbol of upper-class living[62]. The Parsi community's contributions are preserved in street names such as Mody Road and Breezy Path, reflecting their pivotal role in Hong Kong's early trade. By 1860, out of 73 firms listed in Hong Kong, 17 were operated by the Parsi community[63].

Beyond these communities, a different kind of influence is visible. As critical toponymy suggests, place names can also function as tools of marketing and social distinction. Street names inspired by American, Swiss, French, and other European locations reflect efforts to evoke modernity and prestige, particularly in residential developments targeting affluent demographics. This 'toponymic commodification' uses prestigious foreign names to construct a symbolic landscape of elite living[57]. These diverse influences, from historical communities to modern branding, echo Hong Kong's multicultural fabric, shaped by its history as a free trade port and its role as a crossroads of cultures in Asia.

Building upon the analysis of how Topographic and Functional names preserve local history, Hong Kong's legacy of land reclamation offers a particularly compelling narrative. The city's urban landscape has been influenced through extensive land reclamation, which currently constitutes 6 percent of Hong Kong's total area, supports 27 percent of its population, and hosts 70 percent of its commercial activities[64]. Despite these physical changes, many street names continue to reflect the geography and cultural heritage of areas prior to reclamation, serving as a record of the historical coastline. Queen's Road, originally adjacent to the seafront, traces the early colonial coastline. Bonham Strand, whose name directly translates to "beach," highlights its historical connection to the sea. Following a major fire in 1851, Governor Bonham advocated for using debris to reclaim land, creating new territory while retaining the original street name.

The shoreline reclamation project that began in 1868 in what is now Des Voeux Road further illustrates this phenomenon. Originally referred to as Praya West and Praya Central, the reclamation shifted the Central district's coastline northward. Victoria Park and Causeway Bay exemplify the retention of historical names post-reclamation. Historically, the coastline on both sides of what is now Victoria Park was shaped like a copper gong (tung lo in Cantonese), giving rise to the name Causeway Bay (Tung Lo Wan). The former coastline aligns with where Tung Lo Wan Road is today. By preserving these historical names, Hong Kong maintains a tangible link to its past, embedding the narrative of its coastal evolution directly into the urban grid. These names are not just geographical markers; they are 'cartographic memories.' The spatial visualization offers its key contribution here. It provides a method to empirically identify and validate these 'cartographic memories,' revealing the vanished landscape beneath the modern city. This demonstrates how toponymy can serve as a resilient archive against physical transformation.

Hong Kong's rise as an international trading hub is also intricately mapped in its street names. Spatial analysis makes the commercial and industrial power of colonial-era trading giants tangible. Specifically, the geographical clustering of Associative names and Eponymous names honoring vocational figures reveals the enduring toponymic footprints of the city's great trading hongs. This evidence provides a direct cartographic link to Sir Henry Pottinger's foundational vision of Hong Kong as a "bonded warehouse" for international merchants, which laid the foundation for a cityscape that reflects its mercantile past[65]. In Kowloon, the street names in Whampoa Garden signify the historical importance of the Whampoa Dockyard. Established in 1863, the dockyard became a pivotal maritime

institution by the 1880s, monopolizing shipbuilding in the region[66]. The transformation of this area into Whampoa Garden following the land exchange agreement in 1984 with the Hong Kong government reflects a narrative of industrial evolution and urban redevelopment. The streets here, named after the engineers and figures associated with the dockyard, serve as commemorative spaces, linking the present-day commercial landscape to its robust industrial past.

Similarly, Quarry Bay's street names chronicle the Swire Group's historical commercial ventures. Initially focusing on the tea and silk trade, Swire expanded into shipping and sugar refining, establishing significant operations like Taikoo Sugar and Taikoo Dockyard[67]. The eventual merger of Taikoo with Whampoa Dockyard and the subsequent redevelopment of the area into a mixed-use district reflect a broader trend of industrial transformation. The names of the streets in this area retain the memory of Quarry Bay's industrial roots, embedding the legacy of trade and manufacturing into the urban fabric.

Causeway Bay further exemplifies this pattern, with its streets echoing the history of Jardine Matheson Co. From its controversial beginnings in the opium trade to its diversification into a multitude of industries, Jardine's influence is indelibly marked in the area[68]. Streets named after Jardine's establishments and activities narrate the transition of Hong Kong from a strategic position to a diversified commercial and industrial hub.

The post-war period in Hong Kong marked a significant shift in commercial street naming. In industrial areas such as San Po Kong and Tai Po, unlike the earlier practice of naming streets after companies and their founders, these areas–home to a large number of smaller companies rather than dominant giants–adopted names embedding local cultural elements and conveying positive connotations. This systematic approach to naming reflected a broader effort in land development, prioritizing industrial diversification and urban renewal over colonial commercial influences.

These street names underscore the transition from the dominance of trading giants to a focus on property development and industrial diversification. This geographical nomenclature not only mirrors the city's shifting economic priorities but also serves as a bridge between the past and the present, offering a layered understanding of Hong Kong's evolution within the global economic system.

Hong Kong's street names are a vital component of the city's cultural heritage, serving as repositories of historical, geographical, economic, and multicultural narratives. These names form a rich and complex cultural landscape that embodies both tangible and intangible heritage values. In contrast to other island cities in Asia, such as Taiwan and Singapore, where street names have often undergone renaming following changes in government authority[69–71], Hong Kong has largely retained its original street names, preserving the full storytelling of its history. This divergence offers a powerful lens through which to understand Hong Kong's unique toponymic trajectory. In post-independence Singapore, for instance, the state actively intervened in the toponymic landscape as a core nation-building project. This was pursued through sometimes contradictory phases of "Malayanising" and later "multiracialising" the cityscape in a conscious break from the colonial past. Although these top-down policies often met with public resistance and ultimately led to what Yeoh describes as a "littered" landscape [71], the very act of state-led intervention stands in stark contrast to Hong Kong, where the colonial toponymic layer remains largely intact. Similarly, Taiwan's toponymic landscape has been a battleground for what Hui terms "toponymic politicking"[69]. Successive regimes have used renaming as a political weapon to assert legitimacy and erase the legacy of their predecessors. For example, the Kuomintang systematically imposed a "map of China" to establish its hegemonic narrative, while the Democratic Progressive Party later launched "de-Chiang-ization" campaigns. Hong Kong, by comparison, has not witnessed this scale of state-led ideological renaming. The preservation of its street names is less a deliberate policy and more a consequence of its unique political arrangement under "One Country, Two Systems."

This unique, layered, and spatially distinct toponymic landscape, as demonstrated through our analysis of its underlying power relations,

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identity politics, and ideological imprints, provides a clear rationale for targeted preservation. Our findings directly inform the strategies needed to safeguard it. First, our spatial analysis revealed that historically and ideologically related street names form distinct geographical clusters, a phenomenon reflecting the uneven sociolinguistic ecologies within the city[25]. This spatial clustering makes a zone-based approach not only logical but necessary. Second, our classification has shown that these names are more than labels; they are rich narrative repositories and sites of contested memory, revealing conflicts and complexities in translation and cultural representation[24]. This inherent storytelling potential makes them ideal assets for cultural tourism and public engagement. Finally, our comparative analysis with Singapore and Taiwan underscores that Hong Kong's largely intact toponymic heritage is a rare and valuable case. Its preservation is not guaranteed, making proactive educational initiatives crucial to foster public appreciation and guard against future erasure.

Based on these direct analytical insights, we propose the following three key strategies to safeguard this unique cultural landscape:

(1) Regional Protection Zones: Establish thematic protection zones based on clusters of street names that share historical or cultural significance (e.g., colonial history districts, historical commercial areas, and traditional neighborhoods). Implement special preservation measures to protect areas with a high concentration of historically significant street names, ensuring that redevelopment does not erase this heritage. Develop zone-specific guidelines with tailored preservation strategies that align with each zone's unique historical and cultural characteristics.

(2) Cultural Landscape Tourism: Develop heritage tourism infrastructure centered on street names through multiple approaches including: themed walking trails that highlight various aspects of street name heritage (Colonial Heritage Trail focused on administrative figures, Maritime Heritage Route following historical coastal streets, and Multicultural Heritage Path showcasing diverse ethnic contributions); integration of street name histories into existing heritage tourism programs; interactive digital platforms for self-guided tours with multimedia content; and interpretive signage installed in situ to explain the historical significance of street names.

(3) Historical Education Initiatives: Connect street names with broader historical narratives through educational programming including: creating teaching materials that promote awareness of Hong Kong's unique heritage in schools and universities; organizing community engagement programs to collect and preserve oral histories related to street names from local residents; and fostering institutional partnerships between educational institutions and heritage organizations to support research, documentation, and public outreach efforts.

Hong Kong's street names form a unique cultural landscape, bridging the past and present while offering valuable insights into the complex processes that have shaped one of Asia's most dynamic urban environments. Thus, the preservation of Hong Kong's street names transcends mere historical documentation; it represents a critical effort to safeguard the city's cultural identity and collective memory. By implementing thoughtful strategies, it can be ensured that these street names remain living links to the past while staying relevant to the contemporary city. Future research could explore the potential of applying this combined historical and spatial distribution analysis framework to other cities in East Asia with colonial or multicultural histories, such as Taiwan, Singapore, or Macau. By leveraging this approach, these cities could identify specific areas for implementing preservation strategies while uncovering how their street names reflect unique historical narratives and cultural identities. Through such comparative initiatives, Hong Kong's street names can continue to serve as a model for preserving urban heritage, ensuring that its rich history and identity persist into the future.

Data availability
All data supporting the findings of this study are included in the manuscript and its supplementary information file.

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Author contributions

Y.C. (Yao Chen) conceptualized the study, conducted the analysis, and drafted the main manuscript text. H.D. (Henry Duh) supervised the research. Both authors reviewed and approved the final manuscript.

Competing interests

The authors declare no competing interests.

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