Pedestrian access to transit in evolution: unfolding the spatialization of rapid-transit planning

This article retraces the impact of evolving hegemonic rapid transit planning and design strategies on pedestrian integration between stations and neighbourhoods, using Hong Kong as a longitudinal case. Mixed-methods research, triangulating documentary analysis, spatial analysis, and in-depth interviews, identified six typologies across three historical phases. The findings demonstrate that pedestrian access to transit is spatially heterogeneous, shaping the evolution of the station area from a connecting structure into an interconnecting infrastructure. Unfolding the historical interplay of hegemonic forces in the production of pedestrian spaces, this study innovatively bridges the research gap between planning policies and fine-grained urban design features.

Keywords: station area; pedestrian environment; transit urban design (TUD); transit oriented development (TOD); walkability; Hong Kong Mass Transit Railway (MTR).

Introduction

The growing world urban population and rampant climate change demand the broader application of rapid transit systems. Against the backdrop of a global demand to reshape cities for sustainable transport, the Hong Kong Mass Transit Railway (MTR) station built-up environment emerged as a benchmarking best practice commonly referred to when highlighting 'the importance of providing well-integrated, seamless pedestrian connections between surrounding neighbourhoods and transit stops' (Suzuki, Cervero, and Iuchi 2013, 179; see also Cervero, Guerra, and Al 2017; Suzuki et al. 2015). Hong Kong is a paradigmatic case of a transit railway structured along highly populated and densely built-up areas. The structure serves as a model in developing contexts in which policymakers aim to achieve sustainable transport amidst compact urbanization (Suzuki et al. 2015).

This study aims to challenge the well-established interpretation of the Hong Kong station area pedestrian environment (SAPE) as a monolithic concept, demonstrating that the network of pedestrian linkages to the transit stop is multifaced and in continuous (re)development. This paper, employing documentary and spatial analysis complemented by interviews with planning experts, disentangles the historical interplay of the forces shaping SAPE. Subsequently, it analyzes planning strategies, financial instruments, and spatial forms, retracing the historical and geographical evolution of the Hong Kong SAPE over four decades (1979–2020), and identifies three phases of development. In Phase One (1970s–80s), stations were integrated with well-connected outdoor SAPEs. Conversely, in Phase Two (1990s–the 2000s), SA developments comprising sizable commercial complexes often incorporated part of the PEs, serving as final destinations while limiting the SA route directness for pedestrians. The more recent Phase Three (2010s–) marked a shift in the production and integration of SAPE, facilitating pedestrian navigation to destinations further apart in the neighbourhoods.

The remainder of this paper is organized as follows. The first part reviews the literature on the determinants of pedestrian-oriented SA design and defines the analytical framework guiding data collection and analysis. The findings are presented in a discursive form, describing the evolution of pedestrian access to transit by focusing on the planning approach and produced spatial forms. The dual-level analysis reports the findings of the qualitative (planning) and quantitative (spatial form) analyses. The final sections discuss the findings within the context of the literature and conclude the article by drawing attention to their significance in the current development of SA planning in Asian cities and beyond.

Pedestrian-oriented urban design in station areas

Numerous studies have highlighted the importance of micro-space pedestrian design for SAPE and examined how the design impacts micro-level urban forms and programmatic functions. Transport studies have identified urban design variables related to pedestrian connectivity, such as block size (Ewing and Cervero 2010), street network connectivity (e.g. number of intersections per km^2), and route directness (Agrawal, Schlossberg, and Irvin 2008; Jiao, Chen, and He 2017). Results of prior studies also suggest that smaller blocks, higher intersection density, and the most direct route might create favourable conditions for pedestrian-oriented design (Handy 1996; Cervero et al. 2009). Focusing on investigating the PE connected to stations, recent studies have considered the structure or level of a station and its exit system (Loukaitou-Sideris et al. 2013; Loo and du Verle 2017). Loukaitou-Sideris et al. (2013) showed how the level at which a station is constructed is related to pedestrian accessibility and connectivity challenges in the SA.

The station exit/entrance system impacts pedestrian accessibility to and from the neighbourhood surrounding the station. The total number of exits per station indicates the degree of accessibility within the neighbourhood (Loukaitou-Sideris et al. 2013; Loo and du Verle 2017). For example, a higher number of exits might be associated with higher pedestrian accessibility to remote areas of the neighbourhood or with the possibility of alternative walking routes, thus making the station a pedestrian connector that enhances pedestrian movement to and from different parts of the neighbourhood (Loo and du Verle 2017; Murakami, Villani, and Talamini 2021). In high-density cities, where stations develop in three-dimensional urban contexts, studies suggest that the type of exit (e.g. covered/uncovered) and the programmatic function of spaces connected to the station exit might be critical elements for pedestrian use (Cui, Allan, and Lin 2015; Villani and Talamini 2020). Hong Kong, one of the most exemplary and extreme volumetric urban

environments worldwide, exemplifies this notion. Zacharias and He (2018) suggested that transit-connected underground paths almost invariably lead pedestrians directly to the streets.

Hong Kong also has a large variety of transit-connected spaces (Xue, Ma, and Hui 2012). Loo and Du Verle (2017) deemed covered access to metro stations an essential factor for walkability and encouraging the use of public transport. Zacharias and He (2018) correlated different exit spaces (on streets or commercial spaces) with street-level pedestrian flows. Although these recent studies have focused on only a few stations in limited high-density environments, the findings suggest that spatial analysis can provide crucial information on pedestrian connectivity and accessibility in SA in vertically developed urban contexts such as Hong Kong.

Hong Kong: from transnational influences to a prototypical development

Since the 1960s, the city has been at the centre of an international urban planning thinking network (Bristow 1989; Forsyth 2019). International influences have stimulated the planning of new towns in peri-urban areas as a strategic response to growing population pressures and congestion (He et al. 2020). Concurrently, the seminal work of the British planner Colin Buchanan introduced the concept of 'traffic architecture'(Buchanan 1963), which became instrumental in the development of Hong Kong's extensive grade-separated pedestrian systems—elevated, underground, or indoor pedestrian networks (Cui, Allan, and Lin 2013, 2016). To address crowded street spaces, these pedestrian systems were designed around transit hubs throughout the central urban core (Wan 2010) and new towns (Tan and Xue 2014) to mitigate conflicts between the ever-increasing motorized traffic and pedestrians.

Since the end of the colonial era, in the 1,104 km^2 area of the Hong Kong Special Administrative Region, urban development has been deeply intertwined with railway station area planning. Within this environment, the MTR Corporation (MTRC) has gained a city-shaping role in the urbanization of transit corridors through its particular financing tools, constituting a model for pursuing transit value capture through the synchronized development of the railway infrastructure and the property above and around stations to finance rapid transit through private development land premiums and rents (Cervero and Murakami 2009; Tang et al. 2004). As a result, approximately 41% of Hong Kong's population resides within 500 m of an MTR station (Tang et al. 2004), approximately 49% of the high share of public transport trips are through the railway (MTRC 2018), and private automobile ownership is low. In 2019, five million of the seven million residents used the MTR daily, making this transport mode an essential part of Hong Kong's everyday life (HKSAR Transport Department 2019).

In recent years, the expansion of MTR with the completion of new stations has resulted in a shift in the approach to SA pedestrian planning (Higgins 2019; He et al. 2021).

Research gap

Some crucial questions remain unanswered. (RQ1) How has SA planning evolved since the construction of the first railway line? (RQ2) What are the spatial characteristics and morphological developments of SAPE?

This paper aims to contribute to academic and practical debates against the backdrop of a growing demand for context-dependent SA planning that acknowledges neighbourhood heterogeneity, local complexity, specificity, and diversity(Loo 2017; Loo and du Verle 2017). In addition, understanding the evolution of the physical features

characterizing the SAPE may prove crucial for evaluating pedestrian access to transit, referring to the ability of pedestrians to access and navigate the environment in proximity to transit stations, which is considered central to station–neighbourhood integration (Schlossberg and Brown 2004; Cervero and Sullivan 2011; Handy 1996).

Research approach and methods

This mixed-methods research focuses on the longitudinal case (Yin 2014) of Hong Kong. It triangulates (Creswell and Creswell 2018) documentary analysis, quantitative spatial analysis, and in-depth interviews for interpretative policy investigation. Our research approach answers the call for multidimensional investigations of the urban environment, requiring epistemological broadening by combining the political, economic, and cultural aspects of urban design and development (Madanipour 2006). Adopting this perspective includes applying dynamic analytical lenses to address the process of spatial change over time rather than being confined to a particular place or time in the process (Lefebvre 1991). Employing a multidimensional and dynamic perspective, this study considers urban design as part of the broader context of the urban development process and examines the significance of PE's urban design from the planning, transport, finance, and user perspectives. Aiming to address the research questions, our investigation employs (1) documentary analysis to investigate the planning and financial strategies supporting SA development, (2) spatial analysis to categorize and examine the SAPE produced by specific planning and financial mechanisms adopted, and (3) content analysis of in-depth interviews with knowledgeable planners and urban designers to increase validity and provide supplementary information on the strategies, spatial characteristics, and challenges of SAPE development.

First, our investigation is based on a thorough review of the planning strategies and financial instruments supporting Hong Kong SA development for the period 1979–

2020, which covers the entire period of MTR network planning in Hong Kong from its inception to recent years. This paper reviewed documentary materials, including MTRC's annual reports, Hong Kong Special Administrative Region (HKSAR) policy documents, academic papers, newspaper articles, and consultancy publications. Documents were selected based on the screening of online resources concerning the planning and financing of representative SA projects. Content analysis (Hsieh and Shannon 2005) was applied to the selected documents, and an in-depth examination of the text served to identify the content related to planning strategies and financial instruments adopted during the period under investigation. The collected information was then evaluated and categorized following Gössling's approach (2013). The following section presents the findings through a descriptive account of the planning and financial mechanisms for each phase of SA development.

Second, the investigation concentrated on the fine-grained urban design features of the PE connected to the stations which emerged from the scientific literature on SA urban design (including the structure of the stations and features characterizing the PE and SA street-intersection density). Thirty representative stations, accounting for 223 exits, were selected for in-depth analysis. In the context of this study, a *station* is identified as one of two types of projects: (1) a project at an infill site when developed in a core or downtown area where human settlements and infrastructure historically existed, or (2) a project at a greenfield site when developed on inactive or unused land with development potential requiring substantial infrastructural investment (Alker, Joy Roberts, and Smith 2000).

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Figure 1. The six functions of spaces outside the MTR exit in Hong Kong

The following PE features were considered for quantitative analysis: (1) the structure or level of the station, (2) the type of exit, (3) the function of the space connected to the exit, (4) the exit location in the surrounding environment, and (5) the street intersection density. Data were collected from the MTRC website through a Google Street View audit of the environment (Rundle et al. 2011) and onsite fieldwork. First-hand data related to the MTR exit locations were collected using online satellite imagery (OSI) (Monkkonen 2008). PE data were geoplotted using a GIS platform. Overall, the observed space connected to the exit consisted of six functional areas (Fig. 1): open space at ground level, underground road or parking, commercial complex space, residential or office complex space, open space on the podium, and footbridge space. Four total exit structure types were observed (Fig. 2): an independent box structure on the sidewalk, exit integrated into a building's façade, exit inside a building, and exit as a pedestrian footbridge. Most MTR stations have remained largely unchanged since construction completion; nevertheless, information on the stations constructed during early phases which underwent major redevelopment in more recent years was made available by the MTRC. The following findings are presented through descriptive statistics and fieldwork observations of the evolution of PE in Hong Kong over the three phases mentioned above for each infill and greenfield project.

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Figure 2. The four MTR Exit structure types in Hong Kong

In addition, this study conducted in-depth face-to-face interviews with senior experts. Purposive sampling selected four senior planners, urban designers, and experts in Hong Kong's SAPE planning for in-depth interviews. The aims of the interviews were (1) to examine with expert informants the evolution of station area integration with the

neighbourhood's pedestrian environment; (2) to elicit expert opinions on the underlying logic and motives that guided the planning of SA over time; and (3) to identify the significant challenges in the development of the SA (including local population concerns upon announcement of MTR station).

Each interview lasted between 45 and 120 minutes. The interviewees were a former director of the HKSAR Planning Department (Interview #1), an associate director of a major transport consultancy firm (Interview #2), a director of a major planning consultancy firm and former president of the Hong Kong Institute of Planners and the Hong Kong Institute of Urban Design (Interview #3), and a vice chairman of a local district council and chief executive officer of a non-profit organization devoted to urban design (Interview #4). While the first interview occurred in September 2019, the other informants were interviewed in August 2021. The interviewees offered diverse vantage points ranging from urban planning to urban design, occupying positions situated within the local government, private sector, and advocacy orientation. The different positionalities have been crucial for disentangling the complex matrix of intervening forces that shaped pedestrian access to transit production in Hong Kong over the last four decades. A standard iterative process, including content analysis (Hsieh and Shannon 2005), was employed to analyze the transcribed interview materials. The main reference for this methodological approach was Parajuli and Pojani's examination of barriers to the pedestrianization of city centres (Parajuli and Pojani 2018). The analysis was manual and performed by two researchers. The first researcher screened all materials and identified the content related to planning strategies, spatial characteristics of the pedestrian environment, and challenges in SAPE development. Interpretations were based on briefings and in-depth discussions with the second researcher.

The triangulation of methods enabled the identification of three main phases of historical development: Phase One (1979–1980s), Phase Two (1990s–2000s), and Phase Three (2010s–2020).

Findings

This nonconforming section presents the findings in the form of narrative history. The three identified phases were divided into 'planning' and 'spatial form' for a total of six sub-sections. The 'planning' chapters focus on the apparatuses of value and conceptual models that drove the planning discourses and set the financial mechanism for infrastructural development. The 'spatial form' sections provide an account of the spatial production of pedestrian space as quantitatively measured through a series of parameters and qualitatively interpreted through direct observations and in-depth interviews. The narrative history describes (RQ1) how SA planning evolved over time and (RQ2) the spatial characteristics and morphological development of the SAPE. Finally, the section 'From planning visions to produced space' offers an expert-based critical summary of the historical spatializations of hegemonic visions.

Phase One—planning: from the connection of an expanding urban area to the introduction of the 'railway + property' development model.

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Figure 3. Evolution of the MTR properties total GFA per year of station construction and percentage of exits leading to connected commercial or residential properties per year of station construction. (compiled by authors from MTRC (2020))

In the 1960s, owing to intense population growth and rapid economic development, the viability of the Hong Kong transportation system was threatened. Thus, the first large-scale railway system plan was commissioned from Freeman Fox and Partners, based on

the model of the Japanese public transport bound-form-built environment in metropolitan areas (Tan 2014; Tan and Xue 2016; Mizuoka 2018). Initiated by the 1970 Colony Outline Plan, the Hong Kong railway system was conceived as a rapid transit system built in existing urban areas consisting of a street grid with rectangular blocks and an overall compact form, mainly developed on Hong Kong Island and some parts of the Kowloon Peninsula (Tan and Xue 2016; Shelton, Karakiewicz, and Kvan 2011; Tong and Wong 1997). By the mid-1980s, three lines (Kwun Tong, Tsuen Wan, and Island Lines) shaped a cross-harbor rapid-transit system, connecting urban areas to greenfield peri-urban stations (commonly referred to as New Town stations). Although these new towns were primarily planned to host the booming population, they served a mix of residential, commercial, and office functions (Interview #2). The first MTR experiences and projects applying the land value capture model, specifically the 'railway + property' development model (R+P), started in this period with the Kowloon Bay Station and the Central Station. The application of R+P involves the construction of a podium with a shopping mall, office buildings, and residential towers above the station (Cervero and Murakami 2008). For both projects, the colonial government offered a land plot to the MTRC for free or made highly favourable arrangements. Since then, raising capital through property development to cover transport infrastructure construction costs has become common for the MTRC; by 1991, there were 19 projects developed along the three MTR lines(Mizuoka 2018).

Phase One—spatial form: flowing into open public space

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Figure 4. a) Distribution of space connected to the exit and b) distribution of exit structure type

During Phase One of the MTR SA planning, 26 of the 39 stations opened between 1979 and 1985 were built as underground structures serving commuters living in the built areas above stations. Stations opened during these years had a utilitarian design, and the MTR owned or managed a few properties in the surrounding area (1,265,300 m^2; Fig. 3). Phase One (see Table 1) stations comprised (1) infill stations and (2) greenfield peri-urban stations. Our results revealed that infill stations connect to the urban environment through numerous exits (eight on average) widely distributed in the neighbourhood to serve all possible pedestrian destinations in the street network. In these older urban areas, the maximum distance observed from the station centroid to the exit was 176.14 m, allowing pedestrians to quickly reach the exit. The station exits (Fig. 4) mainly linked pedestrians to open public spaces at ground level (92.19%). Quantitative findings may only partially explain the nature of PE in older urban neighbourhoods.

On-site observations also revealed that these spaces are often places where social interactions and exchanges occur. In these areas of the city, it is not unusual to observe the elderly sitting in makeshift furniture or to find mobile food vendors selecting exit premises for their businesses and other formal or informal on-street commercial or convivial activities (Villani and Talamini 2021). The exit design consisted mainly of an independent enclosed structure within the sidewalk (box structure) which covered the stairs that led pedestrians to the station concourse. Our findings demonstrate that highly connected PEs with a high intersection density (425.93 per km^2) characterize the infill station areas in Phase One. Moreover, the greenfield peri-urban stations were found to have a similar exit location dispersal as the infill stations and considerable exit availability (6.5) for pedestrians to connect to different routes in the New Towns (Table 1). Nevertheless, 30.77% of these stations were connected to footbridge spaces and 15.38% of the exits were connected to elevated pedestrian podia. The remaining exits, which

account for approximately half of the total exits, are connected to the street-level pedestrian space. Most of the exits were integrated into the façades of the buildings (92.31%). The street-level intersections were found scarce (257.01 km^2) compared to the infill station area, reflecting a planning approach aimed at segregating pedestrian space (footbridges or podia) from street-level traffic.

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Table 1. Exits type, structure and connected space characteristics across the three SA development phases.

Phase Two—planning: 'railways as the backbone of urban development'

In Phase Two of the station-area planning, from the late 1980s to the 2000s, Hong Kong's urban and spatial configuration was shaped by globalization-driven developments and constant re-imaging of the city. During this phase, the city underwent the Airport Core Program, the largest infrastructure program in its history, including the construction of the Airport Railway Line (Airport and Tung Chun Line) on reclaimed land. Since its inception in 1999, the 'railways as the backbone of urban development' policy (HKSAR Transport Bureau 1999) has consistently been implemented and supported by government initiatives. In the development of new lines, railway-connected projects located above and surrounding the station would need to provide a commercial return to the corporation, according to the policy (HKSAR Transport Bureau 2000). The success of this system has been related to the Hong Kong R+P financial model (Cervero and Murakami 2009; Tang et al. 2004), which was aggressively implemented after the MTRC transitioned to an entrepreneur-oriented mode of operation when 23% of the MTRC became private (the MTR Corporation Limited succeeded the government-owned MTRC in June 2000 and was listed on the Hong Kong Stock Exchange in October of the same year). The R+P

approach was successfully adopted in the 1990s for the Tung Chung, Airport Express, and Tseung Kwan O lines. The planning for new railway station areas adopted R+P. Stations such as Kowloon, Olympic, and Tsing Yi were planned on reclaimed land; thus, stations were planned, designed, and constructed together with surrounding buildings, megastructures, and flagship projects.

The R+P approach had a double effect on the PE. On the one hand, in the new developments, grade-separated pedestrian connectivity was sought by developers as a means of drawing pedestrians to commercial complexes (Interview #2). On the other hand, transport infrastructure, mainly high-capacity highways, had a segregation effect on the SA layout (Interview #1). In parallel development, intensity instruments (e.g. density bonuses) catalyze the retrofitting of existing urban areas to integrate station facilities with multilevel commercial complexes at relatively high densities (e.g. Hysan Place and Pacific Place). In the market-driven environment of Hong Kong, direct three-dimensional pedestrian connections to privately owned properties were produced by developers who negotiated with the MTRC and several government departments to build underground or overhead pedestrian connections (Interview #2).

Phase Two—spatial form: enlarged catchment and increased integration into buildings and indoor commercial space

During Phase Two, between 1998 and 2004, 21 of the 27 stations were built as at-grade or elevated stations, implementing new large-scale developments in greenfield areas or low-density New Territories (the more recently urbanizing region in Hong Kong). Simultaneously, some Phase One infill urban stations were retrofitted. Most properties owned or managed by the MTRC were located in stations opened during Phase Two, between 1998 and 2009 (Fig. 3). Specifically, 6,750,760 m^2 of properties were directly owned or managed by MTRC, mostly directly integrated with the stations (Fig. 3).

Stations were planned with tower buildings clustered on and around the station, and exits were directly connected to commercial complexes. Phase Two stations are distinguished between (1) infill stations, including stations that underwent major redevelopment through the construction of connected stations or exits; (2) greenfield urban stations planned on reclaimed land in urban areas; and (3) greenfield peri-urban stations planned, outside the urban core, in the New Territories.

The infill category includes stations in old urban neighbourhoods in prime commercial and business locations, renewed and connected with the built environment to shape multiple-use projects that integrate the stations with multilevel commercial or office complexes at a relatively high density. These redeveloped station areas are characterized by complex connections with the urban neighbourhoods surrounding the station. Stations were built under pre-existing urban areas and connected to adjacent buildings or stations (for example, East Tsim Sha Tsui connected to Tsim Sha Tsui and Hong Kong connected to Central). The redevelopment of infill stations was supported by density bonuses given to developers and results in the insertion of exits with the existing urban fabric. Our findings demonstrate that exits were widely distributed in the urban environment, reaching destinations up to 370 m away from the centre of the station (Table 1). On average, these infill stations had the highest average number of exits (10.50), suggesting a very high patronage. The exit distance standard deviation for the infill stations was also found to be the highest of the entire sample (93.06 m), indicating that the exits were spread over a wide range of locations within the SA. This exit system allowed pedestrians to reach areas of the urban neighbourhood further away from the station centre. In addition, the exits were linked to a highly interconnected street network (618.15 street intersections per km^2). Most of the exits emerged as open spaces within the street network (Fig. 4); nevertheless, some stations were directly connected to indoor

commercial complexes (18.75%) through redevelopment. Among the different types of stations identified in this study, in Phase Two, infill stations had the highest percentage of exits integrated into buildings (26.56%).

In greenfield urban stations, commercial and residential buildings were densely clustered at and around the stations, exits were almost equidistant from the centroids of the stations, and the standard deviation of the exit distance was found to be relatively low (38.90 m). The data also show that exits were not well dispersed in the neighbourhood, thus preventing pedestrians from reaching more distant destinations in the area through station PE.

Among all the stations considered in this study, Phase-Two greenfield urban stations had the highest percentage of exits driving pedestrians directly to indoor spaces in commercial (30%), residential and office buildings (10%), and service roads/parking (30%; Fig. 4). Pedestrian spaces were located within all-weather-protected facilities and interiorized, self-contained spaces subject to circuitous circulation layouts of commercial complexes. In these stations, reaching outdoor pedestrian networks or destinations (outside the station complex) requires detours through spaces that are unfriendly to pedestrians. Some exits were also connected to semi-public spaces on the podia terraces (10%). The pedestrian space was developed three-dimensionally with footbridge exits (13.33%). This pedestrian segregation was accompanied by a street network with a lower intersection density (300.53 intersections) than that in older station areas. Owing to the high concentration of services, the area surrounding the urban greenfield stations was characterized by high-capacity roads bordering the station block, and stations were mainly accessed through railway transport. Thus, the PEs outside the station presented unfavourable conditions for pedestrians. Eventually, R+P resulted in new urban developments isolated from the older urban fabric of Kowloon (Interview #4).

Greenfield peri-urban areas were developed as new large neighbourhood units far from the urban cores. Commercial and residential functions were often concentrated within a 500 m buffer from the station, and underdeveloped or rural areas surrounded those functions. These stations were found to be relatively small and had the lowest average number of exits (4.40) and the lowest average distance of the exit from the station (70.41 m; Table 1) of the whole sample. A high percentage of exits (27.27%) were directly connected to commercial spaces, eventually making the shopping centre the core area of activity in New Towns (Fig. 4). In addition, New Towns showed a high connection between stations and podia terraces (13.64%). These spaces were disconnected from ground-level streets, resulting in accessibility hindrances and heavy surveillance by private management. The street network in New Towns was found to have the lowest connectivity among all the studied SAs, with 277.57 intersections per km^2, and the small number of sidewalks along traffic arteries made walking outside the station complex extremely difficult. As a result, in these areas, commercial development above the station and elevated pedestrian bridges were the connecting infrastructures that linked some high-end residential developments surrounding the stations (Interview #1).

Phase Three—planning: with reduced land available for value capture, network extension is delivered through the build-operate-transfer method.

In 2007, the Hong Kong government launched 10 major infrastructure projects, among which the West Island Line (WIL) and Shatin to Central Link (SCL, joined with the Kai Tak area development) were included in an ambitious HK$97 billion investment project (HKSAR 2007a; HKSAR 2007b) to revive the local economy. Concurrently, the MTRC also initiated the integration of the Hong Kong railway system with the high-speed railway network of China, developing a 26 km high-speed infrastructure within the city territory. To finance these infill developments in mature urban neighbourhoods, the

build–operate–transfer (BOT) financial model was preferred over the R+P mechanism, mainly because R+P would have required an exceptional number of land grants to meet the funding investment for construction under conditions of a lack of developable land. More specifically, the land parcels available for private development were relatively small and scattered; thus, the construction of direct pedestrian connections to stations was not deemed a viable investment for developers (Interview #2). Moreover, there was growing criticism by different developer groups and the public of the R+P instrument. MTRC was criticised for favouring unfair competition for land developing rights and for its inability to contribute to affordable housing provision through the R+P (Musil 2019). Both these new lines required a strong government financial investment of HK$30.1 billion (Musil 2019). In particular, the SCL was funded through a concession approach under which the government bore the infrastructure cost and construction; the local government also granted a service concession to the MTRC for rail operations for 50 years (HKSAR Legislative Council 2008). The WIL extension, deemed a 'financially nonviable' project (HKSAR Legislative Council 2008), received an initial cash subsidy for construction. In addition to the change in the infrastructure financing mechanism, different urban design and planning objectives were introduced to lower the building FAR and increase the supply of open spaces and facilities, which were later supported by a new long-term planning agenda (HKSAR 2016). Clear instances of this planning direction are recently opened stations, such as Kai Tak, built under a park, providing a massive gathering space in front of the station (Interview #4). New station projects are expected to 'inject new vitality' into old and poor urban districts, thus affording development opportunities in the communities to be served by these lines (MTRC 2021). These developments capitalize on neighbourhoods with a rich historical and multicultural heritage (Kowloon City and the western part of Hong Kong Island). Overall, in Phase

Three, the downsizing of property development (see also Fig. 3) contributed to a shift in the MTRC business model, whereby it concentrated mainly on transit operations and turned to asset management (Aveline-Dubach and Blandeau 2019). Part of this shift involved increasing income through retail, advertising, and other services inside the stations' premises as well as through the management of rental properties, shopping malls, and offices outside the stations.

Phase Three—spatial form: extending the reach of exits three-dimensionally and functioning as an integrated pedestrian infrastructure

The latest MTR development phase, ranging from 2014 to the present, involves the implementation of infill projects, where stations have been constructed underground (10 of 12 stations) and connected to mature mixed-use urban areas with old building stocks previously not connected to the MTR network. To date, Phase Three has only included infill stations. Our findings demonstrated that the exits (limited in number, 3.75 on average) spanned highly distant areas of the neighbourhoods; Phase Three stations had exits located at the highest average distance (185.45 m) from their centroids (Table 1). Further, Phase Three SAPE connected extensively distant and multilevel destinations in the neighbourhoods. Almost all exits were found to be connected to the open space at ground level (94.44%), with a structure built using independent boxes or integrated into buildings. The recently completed exits are standalone structures with a wide entrance to the station. Located in old neighbourhoods, these stations connect topologically separated and topographically diverse urban areas. Some pedestrian connections reached elevated podiums approximately 40 m above the station level. Owing to the hilly topography of some station areas, the street network density was lower than that of Phase-One infill stations. Subsequently, the station exit system has been widely used as a supplementary or alternative pedestrian street network in a station area. Although the newest projects on

the SCL were set to redevelop large urban areas, the exit system was also planned to interconnect the surrounding older urban neighbourhoods.

From planning visions to produced space

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Figure 5. Axonometric views of the six spatial forms corresponding to the three phases of MTR station-area

The evolution of SAPE shows how planning goals have influenced the production of SA pedestrian spaces (Fig. 5). In Phase One, the embryonic development of the MTR aimed to overcome surface transportation limitations, serving an expanding population with an efficient rapid transit system. In this phase, stations link pedestrians to a highly connected street-level network through exits that are widely distributed in the neighbourhoods. Subsequently, stations in Phase One 'tend[ed] to be built underneath [a consolidated urban environment]. There might be a corner of a building with a station entrance, but the rest of the building interacts well at street level [and these stations] are in a well-connected grid' (Interview #4). PE connected to infill stations mainly consists of outdoor public spaces in the form of narrow sidewalks with high pedestrian activity in consolidated urban areas. In such PE, commuters directly 'come out from the station, [and] walk across the road' (Interview #2). In contrast, elevated pedestrian corridors seclude pedestrians in New Towns in peri-urban areas.

Phase Two marked a shift in transport planning, shaping the city itself through the R+P financial model. SAPE was significantly more indoor-oriented and volumetrically unfolded in commercial flagship developments. In prime commercial locations, stations were redeveloped; thus, the PE was partially rerouted inside new commercial complexes resulting in 'genuine vertical urbanism' (Interview #3). 'Developers are more than willing

to pay the money to connect to the MTR [aiming to] draw many people into the shopping mall' (Interview #2), thus producing a privately owned public space that is perceived as being 'not that public' (Interview #4). In the infill commercial redevelopments, 'there is no seating in the public area [which] is part of the commercial complex' (Interview #4).

The urban blocks in greenfield station areas are larger with lower street intersection density, and high-capacity car-oriented infrastructure characterizes PE in these SAs. Inevitably, 'all the lives of the conventional city are internalized into the shopping malls; therefore you cannot have a wide diversity of retail and eating facilities because all the tenants in a shopping mall are strategically selected by the shopping mall owners, the anchor tenants' (Interview #1). From Phase One to Phase Two, the destination of SAPE shifted from the outdoor public space to a station-integrated commercial complex. 'So the building is really sitting on an island. And it only becomes nice once you get onto the roof of the podium level. And then you're into somebody else's land. Basically, it's no longer part of the public realm. It's a secluded public realm or privatized public realm, more a private space, wherever you want to call it, it's a private space, really. So quite separate' (Interview #4). Sometimes, semi-private outdoor spaces are gated for exclusive residents' use; therefore, 'the wider benefit' remains unclear (Interview #2). 'Not just for the residents, but also for the public' (Interview #2).

Phase-Two PE was confined to what was defined as an indoor 'station-based real estate ideal' (Li 2013), 'where the station becomes an island' (interview 4). The overall directness of the SA route within Phase Two is limited by the rationale for channelling pedestrians inside the circulation plans of commercial spaces, which are considered 'premium networked spaces'(Graham 2000, 185; Graham and Marvin 2001). Nevertheless, in these SA, the local connectivity is low, whereas the connection to the MTR network, high-capacity vehicular roads, and global flows (e.g. airports and high-

speed rail) is high. The vehicular transport infrastructure has a 'segregative effect' on the layout of these SAs (Interview #1), where pedestrians can only rely on the elevated pedestrian network to reach the waterfront or cross the station from North to South (Interview #4). In these cases, the equitable use of pedestrian infrastructure has become a concern, especially when facilities for disabled people are not adequately provided (Interview #3).

A change in the infrastructure financial mechanism and the need to redevelop and connect mature urban neighbourhoods triggered Phase Three. The station exit system has become a means for pedestrians to navigate and reach destinations further apart in neighbourhoods on different topographical levels. The PE connected to the station mainly consists of a street-level open space integrating some outdoor playgrounds and larger gathering spaces, potentially creating 'opportunities for a community to wait for friends in front of the station […] To have a better environment for pedestrians and the community' (Interview #4). However, the construction of new lines and stations in Phase Three improved local accessibility and lifted housing market prices in neighbourhoods newly connected to the MTR network (Higgins 2019; He et al. 2021). In Phase Three, there was less 'room for a large-scale commercial redevelopment on top of the stations' (Interview #2). Nevertheless, as ageing blocks are undergoing complete redevelopment, future station-connected PEs and street networks might radically change under the pressure of a rampant gentrification process (e.g. block-scale redevelopment might occur).

Discussion

Collectively, the phases of the historical evolution of the Hong Kong SAPE show how strategic planning has changed over four decades, moving from a utilitarian infrastructural construction to a public financing approach through a phase of value-capture-driven development. Noticeably, Phase One entailed a dual-mode approach

which was evident in the analysis of the built PE. On the one hand, the paper illustrated the retrofitting of existing built-up areas connecting underground stations to their public open spaces via free-standing exits (92.19% of the total). By contrast, the study described the materialization of overseas (primarily European) theoretical urban models based on grade separation (46.15% of greenfield peri-urban exits connected to podia and footbridges). The theoretical underpinning of Phase Two may be ascribed to the impact of the increasing global financialization that resulted in the partial privatization of the rapid transit service provider and consumerism-driven production of space. In Phase Two, exits connected to an indoor commercial space ranged from a minimum of 18.75% in the infill stations to 30% in the greenfield urban stations. Eventually, the third ongoing phase witnessed a resurgence of the hegemony of volitional spatial planning (Cupers 2016) over profit-driven public investment (Fig. 3). Concurrently, station exits increased their reach; the average distance from the station centroid ranged from 82.17 m in Phase One to 185.45 m in Phase Three. Moreover, the Phase Three SAPE functions as a network interconnecting topographically diverse neighbourhoods, thus completing its transformation from a station connecting structure to an SA interconnecting infrastructure.

The transnational building of urban design (Orillard 2014) profoundly influenced Hong Kong's urban space production and pedestrian access to transit. In Phase One, utilitarian modernist principles drove the design of PE within sizeable public housing estates in New Towns. The influence of Colin Buchanan's seminal work *Traffic in Towns* (Buchanan 1963) is found in a three-dimensional grade-separated pedestrian network that extends over new urban expansions (Fig. 5). In this phase, owing to the pressure of rapid population growth, MTR construction and urban development had to proceed quickly, leading to a lack of integration between rural areas and self-sufficient peri-urban

developments made of few offices scattered around the SAs, residential buildings, and shopping malls (Interview #2).

In Phase Two, the adaptation of postmodern precepts to high density produced peculiar hybrid urban design ensembles made of large commercial containers surrounded and surmounted by cruciform plan residential skyscrapers or prismatic office towers (Fig. 5). Phase Two was also characterized by purely residential peri-urban SAs (Interview #2). In this phase, the failure to integrate the SAPE with the surrounding areas was partially due to site conditions – new developments on reclaimed land were often physically separated from old urban areas by existing traffic arteries or geographical features – and the need to subject PE to the logic of commercialism-driven profit.

Eventually, Phase Three focused on boosting the process of mixed-use urban renewal by providing rapid transit accessibility and interconnected pedestrian infrastructure. Thus, the infill development of Phase Three, beyond the commonalities with Phase One, constitutes an evident attempt to build a three-dimensional interconnecting network diffusely linked with the existing open public space to cater to the synergetic amelioration of the urban environment. Despite the recent (Phase Three) apparently genuine attempt to operate towards the interests of the whole society, in Hong Kong, the urban development process still lacks community involvement (Interview #3), being profit-driven and favoured by the local government as the primary source of income since the colonial age (Interview #3).

Beyond the evolution of pedestrian access to transit and all its possible coherent narratives lies a complex dynamic and conglomerate of contrasting economic interests, technical questions, and societal demands, represented by various stakeholders, as emerged in Interview #2: ‘[T]his is really complex. They need to consider whether we can acquire the land, whether there are technical challenges, what is the ground

situation…, and many different aspects are to put in, not just technical, but also social, land availability, etc.' Disentangling such a complex net of power relationships and identifying the reasons for 'meaningless' public consultation (Interview #3) will require further research. Such a scholarly effort should align with this study in interpreting the SAPE not as a coherent model or a consistent approach to be emulated but rather as a system in evolution. As emerged from the analysis, each historic phase accounts for different hegemonic visions, technological progress, and balance of power between stakeholders.

A significant contribution of this study is its research design: the employment of an analytical method aimed at systems thinking enables the universal transferability of the approach. The quantitative analysis of the produced space is easily reproducible on rigorous methodological grounds, while primary data collection and interpretation of qualitative findings depend on contextual factors and scholars' positionality. Furthermore, the findings will necessarily be context dependent. Finally, the transnational spatialization of hegemonic ideas into the production of space is necessarily filtered by local societal values, structures, and practices, as revealed by this analysis of the case of Hong Kong.

Conclusion

This study aimed to disentangle the dynamic interweaving of hegemonic forces, planning strategies, and financial instruments that shape SAPE production. A focus on the extreme conditions of Hong Kong – an early operator of underground rail in Asia and a city with a mature and continually evolving rapid transit system in which five out of seven million inhabitants use the metro daily – can provide crucial lessons for many cities worldwide.

Undoubtedly, the Hong Kong transit-supportive and high-density nodes above and around many stations have advanced the city's three-dimensional spatial rationale and urge the examination of PE characteristics that promote user-centered urban design.

Through a review of documentary material, first-hand spatial data, and in-depth interviews, this study retraces the evolution of PEs connected to stations, advancing a nuanced understanding of the spatial features of the 'seamless pedestrian integration' (Suzuki, Cervero, and Iuchi 2013, 179). This study identified three SA development types across three phases, illustrating how PE evolved from a station-connecting structure to an SA interconnecting infrastructure (Figs. 4, 5).

Hegemonic planning visions promoting traffic-free town centres influenced a demographic-concerned Phase One (1970s–80s), resulting in new metro lines retrofitting existing urban areas or expanding into greenfield developments to ease the pressure of population explosion and industrial upgrading. Our findings demonstrate how transit stops in this first phase connect directly to the open space at the ground level of existing urban areas or elevated podia in greenfield developments (Figs. 1–5). The need to boost international investment and global city status ultimately coincided with the partial privatization of the MTR, resulting in the financially shaped Phase-Two consumerism-driven railway-cum-property construction (1990s–2000s). All-encompassing hyper-capitalism then subjected the production of space to the logic of profit, seeking land appreciation through transit-connected real-estate developments and encapsulating access to transit within shopping malls (Fig. 3). In the 21st century (2010s–), an economy-concerned Phase Three resulted from the contraction of demographic pressure and the property sector. The subsequent crucial role of the central government in boosting urban (re)development entails shaping the volitional geography. In this phase, planning strategies follow international practices to propose loose and protean concepts of sustainability and quality of life (HKSAR 2016). Such practices capitalize on rich urban cultural capital and promulgate SAPE as an interconnection between disconnected old neighbourhoods (Figs. 1–5).

Today, Hong Kong's seamless pedestrian integration and three-dimensional space development, as well as the recent intensive use of underground spaces, continue to progress. As the Hong Kong SA has undergone multiple phases of development with different spatial and programmatic characteristics of the PE, policymakers, planners, and urban designers are confronted with a legacy of diverse approaches and the resulting spatial configurations. With this caveat in mind, the PE characteristics and limitations highlighted in each Hong Kong SA development phase can be relevant both locally and internationally. Nevertheless, benchmarking of SA development against Hong Kong by mainland Chinese and Asian cities (Aveline-Dubach and Blandeau 2019; Bon 2015) may reinforce the global hegemonic forces with which Hong Kong is aligned. Context-dependent responses to local geographic specificities are necessary to avoid producing generic spaces. This study argues against the uncritical adoption of international urban design models. From this standing, it demonstrates that there is no one 'Hong Kong model' but a series of visions, concepts, and approaches that contributed to the production and superimposition of various spatial forms across locational and temporal dimensions.

This paper illustrates how the SAPE recently stepped away from a business-led urban regime that not only engulfs pedestrians into a consumerist apparatus bus but also compromises users' freedom of movement and choice. Although strategic planning currently points in a promising direction, much remains to be done to reduce the excessive reliance and dependency on the private sector in urban design. This paper advocates a pedestrian-centered set of prescriptive policies that prioritize making SAPE a place for public life.

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