Frontiers of Architectural Research 15 (2026) 385–408

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.keaipublishing.com/foar

RESEARCH ARTICLE

Spatiotemporal characteristics and influencing factors of pop-up activities in Beijing based on artistic ecosystem framework

Delong Sun [a,b], Xiaoyan Mi [a,*], Jiayu Wang [a], Xuefeng Jiang [a], Shichen Zhao [a,c]

[a] *School of Architecture, Tianjin University, Tianjin 300072, China*
[b] *School of Architecture and Urban Planning, Chongqing University, Chongqing 400044, China*
[c] *Department of Architecture and Urban Design, Faculty of Human-Environment Studies, Kyushu University, Fukuoka 819-0395, Japan*

Received 6 November 2024; received in revised form 23 May 2025; accepted 26 May 2025

KEYWORDS
Pop-up activities;
Artistic ecosystem;
Activity responsiveness;
Activity aggregation;
GTWR models

Abstract Pop-up activities connecting online initiations with offline gatherings are crucial in the vibrancy of Chinese cities. However, the spatial and temporal dynamics influencing their distribution remain underexplored. This study addresses this gap by employing an artistic ecosystem model, integrating Douban activity data with built-environment metrics from Beijing's Fifth Ring Road in 2013, 2016, and 2019. Using geographically and temporally weighted regression and geographically weighted regression, we investigate how factors such as spatial flexibility, organizer's popularity, and urban amenities affect activity responsiveness and aggregation across three levels: core, sub-core, and associated circles. Our findings reveal notable temporal fluctuations in the spatial impacts on activity responsiveness, with high-impact zones increasingly concentrated in central areas, reflecting uneven urban development. Furthermore, spatial imbalances contribute to central-peripheral and north-south disparities, particularly influencing the patterns in the sub-core and associated circles. Despite varying influencing factors, the sub-core circle, which is mainly shaped by artistic and social ambiance, is consistently dominant. Distinct activity types are driven by different factors and display diverse spatial patterns. These findings enhance the understanding of urban pop-up geography in Chinese cities and highlight the need for adaptive urban planning strategies that emphasize the flexible, activity-based use of spaces, fostering sustainable urban development.

* Corresponding author.
E-mail address: xiaoyan_mi@tju.edu.cn (X. Mi).
Peer review under the responsibility of Southeast University.

https://doi.org/10.1016/j.foar.2025.05.009

1. Introduction

The term "pop-up," regarded as both a business and an urbanization strategy, describes all temporary commercial and non-commercial activities (Beekmans and Boer, 2014; Bishop and Williams, 2012). The former includes pop-up shops and experiences, clusters, service facilities, and space brokerage services (Warnaby and Medway, 2022). The latter refers to a heterogeneous variety of temporary urban practices, including the temporary occupation of venues for a specific duration (Ferreri, 2015; Harris, 2015), such as restaurants, bars, and open-air cinemas that utilize vacant commercial buildings or wastelands. It could be considered an important complement to top-down urban renewal, playing a catalytic role in the re-urbanization process of declining areas. This phenomenon has been widely discussed in academic domains including pop-up urbanism (Beekmans and Boer, 2014; Hou, 2010), tactical urbanism (Lydon and Garcia, 2015), temporary urbanism (Franck and Stevens, 2006), and DIY urbanism (Iveson, 2013). Unlike Western cities, the central areas in major Chinese cities have not witnessed a significant decline. However, traditional commercial centers are losing their appeal because of e-commerce and the COVID-19 pandemic. Meanwhile, online communities have propelled the rise in experiential pop-up activities, blending digital and physical spaces. Although these events transform underutilized urban areas and address public space shortages (Zhang and Li, 2020; Zhang and Xiong, 2013), their role in urban planning remains overlooked and their spatial context undefined.

This study defines "pop-up activities" as temporary social events that blend online and offline experiences, fulfilling artistic and leisure needs in urban areas, and "pop-up spaces" as the indoor and outdoor venues hosting them. Douban, a key social networking service, serves as a key platform for these activities, which typically involve informal organizers, participants accessing online channels, and the temporary use of diverse spaces (Fig. 1), such as social salons in restaurants or original markets in commercial atriums.

Pop-up activities, which differ from traditional social events, have emerged owing to network information technology and become proliferated due to fragmented lifestyles (Couclelis, 2000) and multitasking (Kenyon, 2008). These activities, characterized by their utilization patterns, have the following features.

First, temporality refers to the appearance of pop-up spaces at the start and disappearance at the end of an activity, with low transformation costs, as activities typically last a day but may recur periodically (Colomb, 2012).

Second, flexibility refers to the matching of pop-up activities to space types, allowing for diverse uses. For instance, small-scale screenings in bookstores, social salons, stand-up performances in cafés, and temporary markets on streets. Factors such as rent, transportation costs, and information technology infrastructure (Fang, 2019; Wang et al., 2019; Yang et al., 2018) can influence the diversity of activities, potentially extending beyond their original uses. The greater the difference between the actual and original space use, the higher the flexibility.

Third, "diverse domains" refers to Douban-based activities spanning artistic, sports, social, and educational categories, encompassing both traditional forms (e.g., sports and screenings) and newer activities (e.g., gatherings, markets, and board games). These activities can be categorized into four major types—artistic, sports, social, and educational—based on their nature.

Fourth, "varied venues" refers to activities that extend beyond public spaces to include privately owned locations, such as offices and residential buildings, fostering a symbiotic relationship between pop-up activities and these spaces. Social platforms play a crucial role in connecting

Fig. 1 Pop-up activities (e.g., social salons, original markets, and temporary exhibitions).

participants, who are often strangers, thereby expanding social networks.

The concept of pop-up activities is rooted in prior research on flexible, informal, and online-to-offline (O2O) business models, such as "in-building stores" in office spaces (Wang, 2020). While these models share the flexibility of pop-ups, they lack the aspect of temporality. Related concepts such as "informal space" describe spontaneously transformed areas that emerge when existing urban structures are unable to meet rapid development needs (Chen and Li, 2021). These studies focus on informal business activities or mobile vendors in specific communities, even though pop-up activities on platforms such as Douban extend across larger geographic areas.

Current studies on pop-up spaces are mainly from media and sociological perspectives, emphasizing the role of network information technology in artistic media and social relationships (Chen and Yang, 2012; Du et al., 2014; Liu, 2014; Wang, 2012). Research on marketing and design focuses on pop-up stores (Shi et al., 2021), interactive design (Yao, 2019), and low-cost strategies, highlighting the "co-creation" process between organizers and participants (Overdiek and Warnaby, 2020; Pfeufer and Suwala, 2020; Taube and Warnaby, 2017). However, comprehensive research on pop-up activities from geographical and spatial perspectives remains limited.

The urban environment that nurtures pop-up activities demonstrates ecosystem-like dynamics, akin to other bottom-up urbanization phenomena. Ecological theories, traditionally applied in business and industry management (Moore, 1993; Odum and Barrett, 1971; Pratt, 1997), have also been extended to the "artistic ecosystem" concept (Jiang, 2005; Liu and Fang, 2021), which examines the interactions among creative talents, enterprises, and consumer markets (Li and Wang, 2013). While some studies have explored the artistic ecosystem from a macro perspective (Shi and Dong, 2021), others have investigated complex social networks within music venues and performances (Behr et al., 2016), emphasizing the importance of artistic spaces and diversity in live music ecosystems (Van der Hoeven and Hitters, 2019).

The artistic ecosystem framework extends traditional urban models by emphasizing dynamic interactions over static structures. Rather than focusing solely on permanent land uses and economic competition, it recognizes the fluidity of cultural activities, temporary space utilization, and social network importance. While "artistic" in name, this framework encompasses diverse creative and cultural temporary activities including exhibitions, markets, brand promotions, and community gatherings. It conceptualizes these activities as an ecosystem with four interacting components: creators/organizers, spatial venues, participants/audiences, and supporting environments. This approach enables analysis of how these elements co-evolve to create distinctive activity patterns across urban spaces. Pop-up activities, more diverse than traditional artistic events, span arts, education, entertainment, and sports, involving high social participation in various settings. By examining these multi-dimensional interactions, the framework reveals how temporary activities revitalize urban areas through unique ecosystem dynamics that conventional models might overlook.

However, studies on pop-up spaces remain largely qualitative and case specific, lacking spatiotemporal analysis and a comprehensive understanding of the ecosystem factors that influence these activities. Therefore, this study approaches pop-up activities on an urban scale, examining the interactions between factors of the artistic ecosystem influencing pop-up activities and providing planning guidance for urban vitality and effective allocation of service facilities.

2. Methods and theory

2.1. Constructing artistic ecosystem framework applicable to pop-up activities

To analyze Beijing's pop-up activities, we employ an expanded artistic ecosystem framework as mentioned above. The construction model of artistic ecosystems (Shi and Dong, 2021) comprises three concentric circles: core, sub-core, and associated. The core circle represents the microenvironmental system of pop-up activities, including organizers, participants, and pop-up spaces. The sub-core circle includes functional amenities coexisting with pop-ups, reflecting the spatial ambience. Given the inherent social and leisure attributes of pop-up activities, these facilities contribute to the aggregation effects. The associated circle refers to the urban environmental substrate, including urban morphology, transportation infrastructure, land use patterns, and house prices, which accommodates pop-up activities. The core circle represents the fundamental occurrence of pop-up activities, whereas the sub-core and associated circles provide the outer loop of the material, information, and energy flow.

2.2. Data sources and construction of indicator system

This study analyzed Douban activity data, selecting Beijing as the focus owing to its high volume of activities. The research targeted the area within the Fifth Ring Road, which is divided into 2672 grid cells (500 m × 500 m) (Fig. 2). Data on the activity ID, organizer, name, type, location, time, and participant numbers were collected and cleaned. Three periods: 2013, 2016, and 2019 were strategically selected to capture distinct phases in Beijing's pop-up activity development. The year 2013 represents an early stage when pop-up activities were beginning to emerge in China especially through the platform Douban, 2016 marks a period of rapid growth coinciding with Beijing's implementation of creative industry policies and significant subway network expansion; and 2019 represents the pre-COVID maturity phase when pop-up activities had become a well-established urban phenomenon. This three-year interval also provides sufficient temporal spacing to observe meaningful changes. Additionally, these years offer relatively complete and comparable data quality, essential for our temporal analysis.

Quantitative measures were adopted to capture both spatial and non-spatial aspects of activity responsiveness and aggregation for pop-up activities following the evaluation criteria for live music artistic circles proposed by Behr

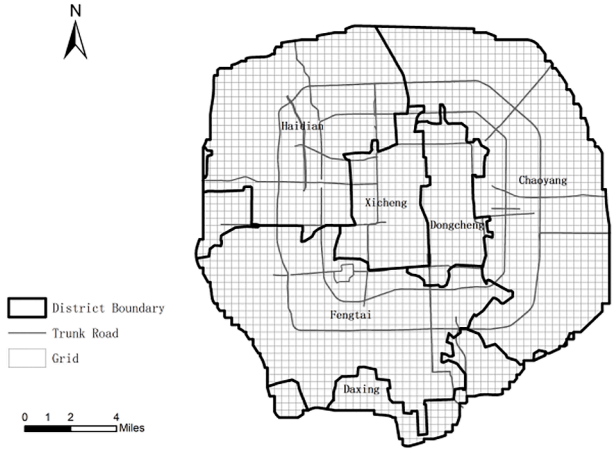


Fig. 2 The research area (The map was processed based on data from OpenStreetMap).

et al. (2016). Activity responsiveness reflects the actual participation level, measured by the ratio of participants to interested individuals. Both metrics are derived from user interactions visible on Douban's event pages, where users can indicate their interest in events by clicking buttons labeled "interested," "want to attend," or "attended." For each activity, we specifically count the number of users who clicked "interested" as interested individuals. Meanwhile, the "participants" metric is calculated by counting users who clicked "attended," representing actual participation in the event. This participation ratio provides insight into how effectively different urban areas convert online interest into physical attendance, serving as a key indicator of location attractiveness for pop-up activities. Activity aggregation indicates the preferred locations for pop-up spaces, represented by their density. The higher the proportion of actual participants and the greater the density, the more suitable the area is for accommodating pop-up activities.

Regarding independent variables, studies on the distribution of commercial spaces have considered market factors (population density, types of commercial facilities, and density of commercial activities), transportation infrastructure (density of public transportation stations, road density, and accessibility), and economic factors (property prices, rent, etc.) (Chen, 2019; Fang, 2019; Wang and Fu, 2019; Yang et al., 2018). The core circle includes factors directly related to activities such as the organizer's popularity and spatial flexibility. The former is reflected by the number of followers, while the latter is assessed by comparing the pop-up activity's content with the functional attributes of the pop-up space. Highly flexible spaces typically require lower conversion costs and fewer administrative approvals for hosting pop-up activities, thus facilitating greater diversity of events. Throughout this study, we quantify spatial flexibility through an index combining venue type and diversity of events. The magnitude of disparity between the two represents the level of flexibility of the pop-up space (Table 1 and Table 2). The sub-core circle encompasses the ambience of the surrounding areas, while considering artistic, social, sports, and educational ambience. The associated circle includes socioeconomic and built-environment factors such as house prices, transportation hubs, road network density, accessibility, and land-use mix. We developed a two-level indicator system with 13 attributes (Table 1). The data were processed using ArcGIS, and the visualization results for the dependent and independent variables are presented in Table 3. Regarding activity responsiveness, zero-value areas are infrequent. Near-zero values for this metric are primarily concentrated in sparsely populated urban fringes and highly centralized commercial districts within the city center. In contrast, concerning activity aggregation, areas with zero values and near-zero values comprise nearly 40% of the study area within Beijing's Fifth Ring Road. These low-aggregation zones are predominantly located in: (i) peripheral residential clusters, particularly in underdeveloped suburban neighborhoods with sparse populations and limited commercial facilities; (ii) newly planned districts where incomplete infrastructure (such as metro stations and shopping centers) contributes to fragmented urban activities; and (iii) industrial zones and logistics hubs characterized by low-density human interaction, despite established transportation networks.

2.3. Research methods

This study employed geographically weighted regression (GWR) and geographical and temporal weighted regression (GTWR) models to investigate the spatiotemporal characteristics of influencing factors on pop-up activities. Unlike traditional parametric econometric models, GWR addresses spatial non-stationarity by allowing parameter estimations to vary across locations (Brunsdon et al., 1996; Fotheringham and Brunsdon, 1999; Fotheringham et al., 2003), providing crucial insights into location-specific dynamics. Building upon this foundation, GTWR incorporates temporal attributes alongside spatial variations, effectively handling spatiotemporal non-stationarity and enabling the analysis of panel data (Brunsdon et al., 1996; Fotheringham et al., 1998; Huang et al., 2010). These models serve complementary purposes in our analytical framework. While GWR focuses exclusively on spatial heterogeneity, identifying how various factors influence pop-up activities differently across Beijing's urban landscape, GTWR captures how these spatial relationships evolve over time. For instance, GWR might reveal that transportation accessibility exerts stronger influence in certain districts, while GTWR can demonstrate how this influence has strengthened or weakened between 2013 and 2019 following infrastructure developments. By employing both approaches, we achieve a more comprehensive understanding of the complex spatiotemporal dynamics shaping Beijing's pop-up activity ecosystem, gaining insights that neither model alone could provide.

Initially, a multiple linear regression analysis was conducted using SPSS software. We tested the OLS model residuals for spatial autocorrelation using Moran's I statistic, which yielded values of 0.717, 0.842, and 0.813 for 2013, 2016, and 2019 respectively of activity responsiveness, 0.937, 0.475, and 0.827 for 2013, 2016, and 2019 respectively of activity aggregation (all significant at $p \leq 0.001$). These results confirmed significant spatial dependence in the residuals, indicating that the OLS model itself does not

Table 1 Research indicator system.

	Level 1 indicators	Level 3 indicators		Calculation	Data source
Dependent variable	**Non-spatial dimension**	Activity responsiveness		Ratio of participants to interested individuals in pop-up activities within each grid.	Douban platform
	Spatial dimension	Activity aggregation		Point density of pop-up activity (pop-up space) within each grid.	
Independent variable	**Core circle**	Organizer's popularity		Number of followers of the organizers within each grid.	
		Spatial flexibility		Mismatch between activity types and spatial function within each grid, assigned values of 0, 0.5, and 1 based on the size of the differences. (Detailed in Table 2)	
	Sub-core circle	Ambience of the surrounding area	Artistic ambience	Point density of cinemas, bookstores, theaters, museums, libraries, and art galleries within each grid.	Gaode open platform
			Sports ambience	Nearest distances from each grid centroid to parks and stadiums within a 1000-m radius.	
			Social ambience	Point density of malls, bars, and cafes within each grid.	
			Educational ambience	Nearest distances from each grid centroid to universities within a 1000-m radius.	
	Associated circle	Built environmental factors on a larger scale	Service of transport infrastructure	Point density of bus stops, metro stations, parking lots, bicycle parking points, and service areas within each grid.	Gaode open platform, Lianjia, and OpenStreetMap
			Road network density	Line density of motor vehicle lanes, non-motorized vehicle lanes, subway lines, and sidewalks at all levels within each grid.	
			Accessibility	Average road network accessibility within each grid based on the origin destination (OD) cost matrix.	
			Land use mix	Poi mixture index within each grid, calculated as: $Entropy = -\sum_{i=1}^{n} p_i \log_n p_i$.	
		Socio-economic factors	House prices	Unit prices of second-hand housing within each grid.	

account for spatial autocorrelation. Multiple linear regression analysis was performed on activity responsiveness, aggregation, and various indicators. After eliminating the indicators with VIF >5 and $p > 0.05$, eight factors remained for both activity responsiveness and activity aggregation. Table 4 presents the spatial distributions and test results of the OLS model. The selected factors were then used in the GTWR and GWR models. The GTWR model calculated the overall spatiotemporal evolution patterns of the factors, whereas the GWR model calculated the impact of the factors on specific types of pop-up activities.

To verify the goodness-of-fit and diagnostic validity of the models, the modified Akaike Information Criterion (AICc) and adjusted coefficient of determination (R^2-adjusted) were compared across the different models considered (Akaike, 1998). Crucially, an analysis of the model residuals was also conducted. As illustrated in Fig. 3, the residuals from both the Geographically Weighted Regression (GWR) and Geographically and Temporally Weighted Regression (GTWR) models demonstrate a closer adherence to a normal distribution, a key assumption for robust model inference. Consequently, both the superior goodness-of-fit, as indicated by AICc and R^2-adjusted values, and the enhanced explanatory power of the independent variables were effectively captured using the GTWR models (Table 5).

Table 2 Criteria for identification of spatial flexibility.

Disparity level		0	0.5	1
Activity type		Space type (L1)	Space type (L2)	Others (L3)
Artistic activities	Film (cinema events, film festivals, thematic screenings)	Cultural, commercial (excluding clubs, exhibitions), educational	Exhibition halls, theaters, commercial (clubs, exhibitions), open spaces	Office, residential and other spaces
	Drama (opera, theater, dance, traditional opera)	Cultural, educational	Commercial, office (exhibition halls, theaters)	Open spaces, residential and other spaces
	Music (live shows, concerts, music festivals)	Cultural, commercial, sports, open spaces	Commercial (bars, clubs, entertainment)	Educational, office, scenic spots, residential and other spaces
	Exhibitions	Educational, cultural, open spaces, office (exhibition halls, lobbies), scenic spots	Office (culture, commerce), commercial	Theaters, sports, residential and other spaces
Sports activities	Sports	Sports, open spaces	Commercial (sports), commercial	Cultural, educational, office, scenic spots, residential and other spaces
	Travel	Open spaces, scenic spots	—	—
Social activities	Gathering (markets, socializing, photography, food, lifestyle, language, nightclubs, board games, parties)	Commercial, open spaces, educational, scenic spots, sports	Residential, cultural	Exhibition halls, theaters, office and other spaces
Educational activities	Public welfare	Office (non-commercial), educational, healthcare, medical	Open spaces, residential, office (commercial)	Cultural, commercial, sports and other spaces
	Lecture (press conferences, meetups, sharing sessions, salons)	Office, educational, cultural	Commercial	Sports, scenic spots, residential and other spaces
	Courses	Educational	Office, commercial, culture	Cultural, open spaces, sports, scenic spots, residential and other spaces
	Parent-child	Educational, lifestyle services	Open spaces	Cultural, commercial, exhibition halls, theaters, office, sports, scenic spots, residential and other spaces

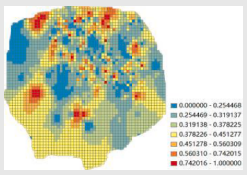
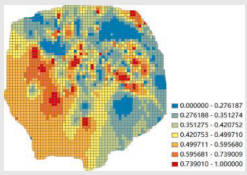
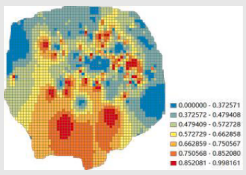
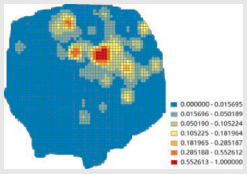
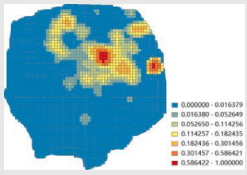
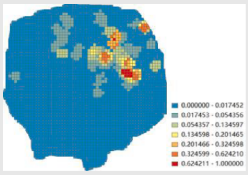
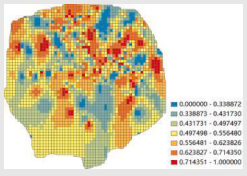
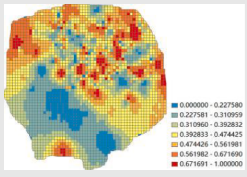
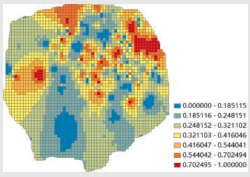
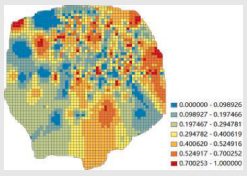
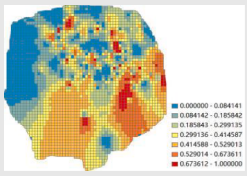
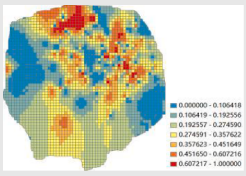
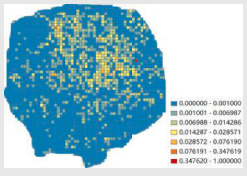
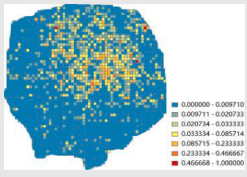
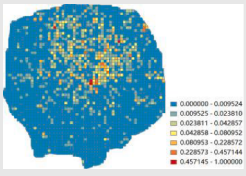
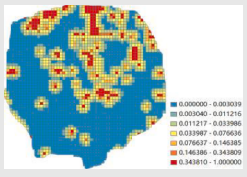
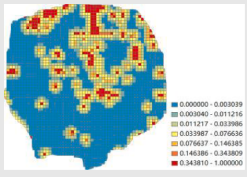
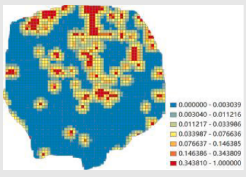
The spatial type information in this table is sourced from Douban Platform. Due to varying data completeness, there are certain overlaps and discrepancies with AMAP POI data. The actual classification involves manual identification of primary and secondary space categories.
All listed space types are basic categories, requiring further functional identification for specific classification. Lifestyle service facilities have rich attributes and fine-grained classifications but occupy a small proportion in pop-up spaces (except for parent-child activities), thus manual assignment was adopted.

3. Results

3.1. Characteristics of spatial and temporal differentiation of influencing factors

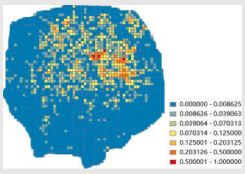
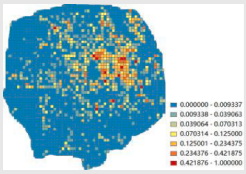
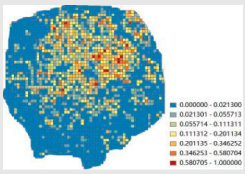
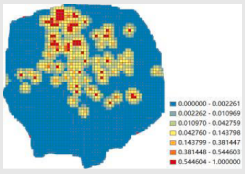
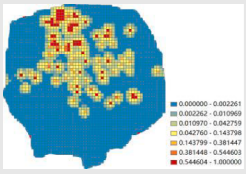
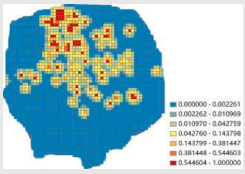
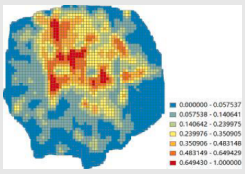
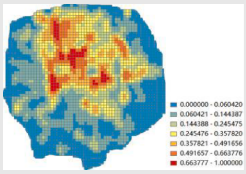
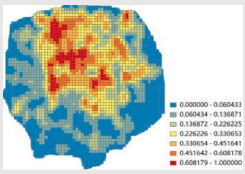
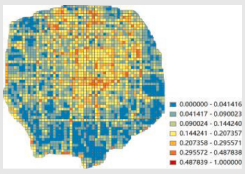
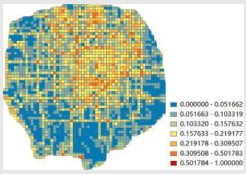
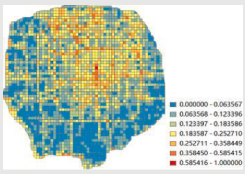
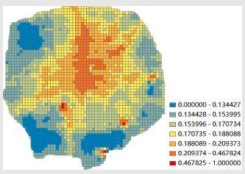
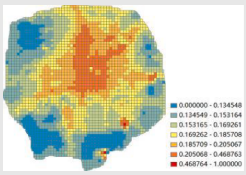
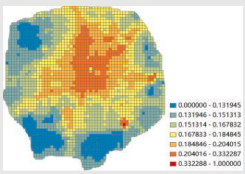
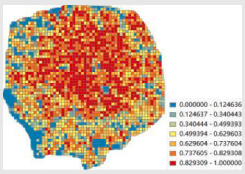
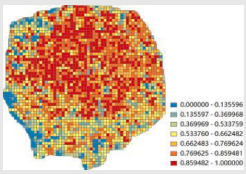
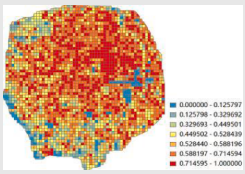
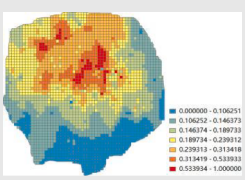
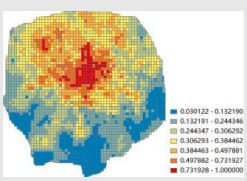
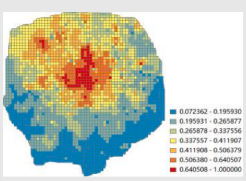
Visualizations of the GTWR coefficient calculations were generated for 2013, 2016, and 2019. As shown in Tables 6 and 7, the factor impacts on activity responsiveness fluctuated significantly over time, whereas those on activity aggregation remained stable. Regarding activity responsiveness, the influence of factors from the sub-core circle revealed more substantial changes than those from other circles. The high-impact areas of the core and associated circle factors shifted from the outskirts to the city center,

Table 3 Visualization of variables.

		2013	2016	2019
	Activity responsiveness			
		1a	1b	1c
	Activity aggregation			
		2a	2b	2c
Core circle	Organizer's popularity			
		3a	3b	3c
	Spatial flexibility			
		4a	4b	4c
Sub-core circle	Artistic ambience			
		5a	5b	5c
	Sports ambience			
		6a	6b	6c

whereas accessibility followed the opposite trend. Regarding activity aggregation, the spatiotemporal pattern of the associated circle factors showed minimal variation. The high-impact areas remained stable in the transitional zone between Dongcheng and Chaoyang districts along the Second Ring Road. Notably, transport infrastructure had an opposite impact direction compared to the other factors.

Tables 8 and 9 present average absolute impact coefficient comparisons across the different periods. This comparison reveals the dominant influences in the artistic ecosystem of the pop-up activities. Overall, sub-core circle factors emerged as the dominant determinants of both activity responsiveness and activity aggregation, with a relatively strong impact observed in both artistic and social ambiences. Road network density and organizer's popularity also demonstrated significant influences on activity responsiveness. Factors within the core circle consistently exerted stronger influence on activity aggregation

	Social ambience			
		7a	7b	7c
	Educational ambience			
		8a	8b	8c
Associated circle	Service of transport infrastructure			
		9a	9b	9c
	Road network density			
		10a	10b	10c
	Accessibility			
		11a	11b	11c
	Land use mix			
		12a	12b	12c
	House prices			
		13a	13b	13c

Note:The map was processed based on data from OpenStreetMap.

Table 4 Univariate statistics for the variables used in the models ($N = 2672 \times 3$).

		Med	Ave	SD	Moran's I[a]	OLS[b] *p*-value Activity responsiveness	OLS[b] *p*-value Activity aggregation	VIF
	Activity responsiveness	0.585036	0.46233	0.167439	0.762228	—	—	—
	Activity aggregation	0.001871	0.008666	0.044607	0.941789	—	—	—
Core circle	Organizer's popularity	0.375690	0.421881	0.155212	0.882447	**0.000**	**0.000**	1.066
	Activity flexibility	0.443295	0.288724	0.175888	0.850967	0.060	**0.000**	1.049
Sub-core circle	Artistic ambience	0.004762	0.003175	0.014979	0.249679	**0.000**	**0.000**	1.104
	Sports ambience	0.001000	0.056077	0.225578	0.475254	**0.021**	0.152	1.024
	Social ambience	0.007813	0.009545	0.034315	0.348052	0.235	**0.000**	1.136
	Educational ambience	0.001000	0.026143	0.154662	0.360975	**0.000**	0.536	1.036
Associated circle	Service level of transport facilities	0.001947	0.186068	0.184531	0.946530	**0.000**	**0.000**	1.737
	Road network density	0.023389	0.127425	0.095158	0.535345	**0.000**	**0.006**	1.242
	Road network accessibility	0.176789	0.169659	0.033659	0.779034	**0.000**	0.688	1.319
	Land use mix	0.354950	0.613728	0.237104	0.481383	0.157	**0.004**	1.165
	House prices	0.207582	0.235358	0.132666	0.928507	**0.000**	**0.000**	1.592

Med: median; Ave: average; SD: standard deviation.
After applying the min-max normalization method to the data, all variables were linearly transformed to obtain dimensionless, pure numerical values mapped within the interval (0, 1).
Bold values indicate statistical significance at $p \leq 0.05$ level.
[a] All values of Moran's I are significant at $p = 0.000$.
[b] F-test of the linear regression indicates that the results are statistically significant at $p = 0.000$.

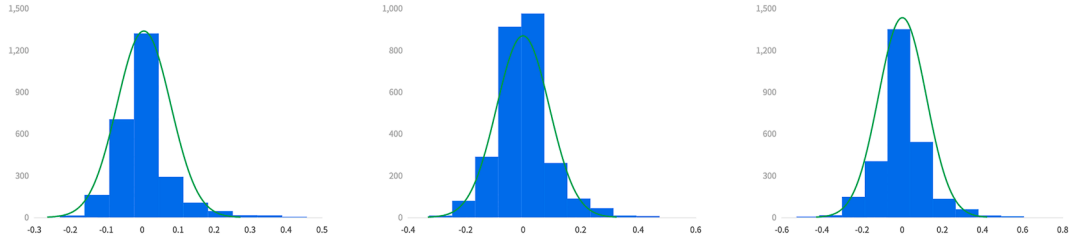


Fig. 3 Histograms of residuals for OLS, GWR, and GTWR Models.

compared to those in associated circle, with the importance of spatial flexibility increasing over the study period.

3.1.1. Core circle

3.1.1.1. Organizer's popularity. As shown in Table 6(1(a)-1(c)) and Table 8, the impact of Organizer's popularity on activity responsiveness initially increased significantly, followed by a slight decrease. The high-value areas of positive impact shifted from the northern and southern ends of the Fifth Ring Road to central business districts such as Xidan,[1] Shichahai,[2] and Wangfujing.[3] The negative impact area shifted from the western city to the Fifth Ring Road outskirts and was later replaced by positive impacts in 2019. This spatial shift reflects changes in the organizer's scale and clustering. Around 2013, the organizers of pop-up activities in Beijing were mainly bars and café owners spread across the city (Table 6(1(a))). However, with the organizer proliferation between 2013 and 2016 (Table 6(1(b))) and a relatively stable scale upgrade between 2016 and 2019 (Table 6(1(c))), high-value areas of influence formed around Shichahai, the 798 Art Center,[4] and Haidian universities.[2]

Tables 9 and 7(1(a)) illustrate the consistent decline in the impact of organizer's popularity on activity aggregation. However, the high-impact areas remained mostly stable over time. Positive high-impact areas, except for Fengtai and Shijingshan, with a weaker entertainment ambience, were concentrated in the Shichahai-Gulou[5] area, a popular spot for Beijing's youth.

3.1.1.2. Spatial flexibility. Tables 9 and 7(2(a)-2(c)) show the annual increase in the impact of spatial flexibility on activity aggregation, with a major leap from 2016 to

[1] A historic commercial district in Beijing's Xicheng District, named after the "Xidan Archway" from old Beijing, known for its vibrant shopping scene.
[2] A historic scenic area featuring lakes, traditional hutongs, and vibrant nightlife in Beijing's old city center.
[3] A prominent shopping street in Dongcheng District, Beijing, named after a well in front of a royal residence, symbolizing Beijing's commercial heart.
[4] A renowned contemporary art center converted from decommissioned military factory buildings in northeast Beijing.
[5] Located in Dongcheng District, Beijing, "Gulou" translates to "Drum Tower," a historic structure once used for timekeeping, now a cultural landmark.

Table 5 Comparison of GTWR, GWR, and OLS models.

		GTWR	GWR	OLS
Activity responsiveness	AIC	−7874.5	−5949.92	−4321.63
	R^2 adjusted	0.857	0.769	0.629
Activity aggregation	AIC	−9148.20	−8441.29	−7148.61
	R^2 adjusted	0.815	0.699	0.586

2019. Negative impact areas shifted regularly, but high-impact areas consistently remained in the Shichahai-Gulou area. These areas, which are mostly small commercial spaces such as bars, are suitable for gatherings but have limited flexibility, leading to negative impacts. From 2013 to 2019, positive high-impact areas shifted from office spaces in Zhongguancun Industry Park[6] and the universities cluster in Haidian District to residential areas near Xisi Hutong[7] and the south side of Chaoyang Park,[8] advancing toward the city center with a significant increase in impact.

3.1.2. Sub-core circle

3.1.2.1. Artistic ambience. Tables 8 and 6(2(a)) illustrate the steady increase in the impact of artistic ambience on activity responsiveness, particularly from 2016 to 2019. Positive high-impact areas shifted from the city outskirts to the center. Art forms such as stand-up comedy and crosstalk have transitioned from online popularity to offline theaters. In addition to cinemas collaborating with pop-up organizers for exclusive concert screenings and documentary viewings, bookstores also hosted artistic salons and book signings to engage and attract a broader audience. As a city's artistic ambience improves (Table 3 (5(a)-5(c))), its influence on activity responsiveness increases.

Table 7(3(a)-3(c)) and Table 9 demonstrate that the influence of artistic ambience on activity aggregation declined annually. However, it remained significant near universities in the Haidian District. Other high-impact areas shifted from the artistically featured Nanluoguxiang[9] to office parks in the Chaoyang District.

3.1.2.2. Sports ambience. Table 6(3(a)-3(c)) and Table 8 indicate that the impact of sports ambience on activity responsiveness initially decreased, then increased with minimal fluctuation. Positive and negative influence areas changed constantly. A positive influence was observed in open spaces such as the Summer Palace, Olympic Park, Temple of Heaven, Workers' Stadium, and Chaoyang Park (Table 3(6(a)-6(c))). Generally, such spaces include outdoor pop-up activities with a large number of participants. However, infrequent events at non-fixed venues make high-impact sports ambience areas unstable. Therefore, sports ambience does not significantly influence activity aggregation.

3.1.2.3. Social ambience. Table 7(4(a)-(c)) and Table 9 illustrate that the influence of social ambience on activity aggregation grew annually, peaking between 2016 and 2019. The positive influence area expanded, covering most urban spaces except for Fengtai and Shijingshan districts. Improvements in social amenities along the Fifth Ring Road (2013—2019) and development in the northern urban area (2016—2019) shifted the high-impact areas from Shichahai-Gulou to areas near universities and Zhongguancun Industry Park (Table 3(8 (a)-8(c))).

3.1.2.4. Educational ambience. Table 6(4(a)-4(c)) and Table 8 indicate a slight increase in the influence of educational ambience on activity responsiveness, albeit with minor fluctuations. In 2019, areas around universities in the Haidian District and Zhongguancun Industry Park became high-impact centers. Despite the weaker educational ambience in southern urban areas, the positive influence was stronger. Fewer universities and limited recreational amenities led to pop-up activities occurring primarily near universities, with students being the main participants.

3.1.3. Associated circle

3.1.3.1. Service of transportation infrastructure. Table 6 (5(a)-5(c)) and Table 8 show that the impact of transport infrastructure on activity responsiveness initially declined and then significantly increased with expanding positive impact areas. Between 2013 and 2016, as shown in Table 6(5(a)-5(c)), with the opening of metro stations, such as Line 14, high-impact areas shifted from the outskirts to the city center. After 2016, the opening of Line 16 (Bei'anhe to Xiyuan) strengthened ties between the China Agricultural University, other universities in the Haidian district and Zhongguancun Industrial Park. Consequently, the high-impact area shifted in this direction.

Table 7(5(a)-5(c)) and Table 9 illustrate that the impact of transport infrastructure on activity aggregation slightly declined before increasing. Low-impact areas were still concentrated in the city center, where the transport infrastructure is well-developed (Table 3(9(a)-9(c))). The

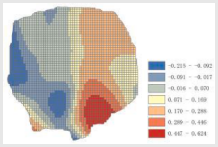
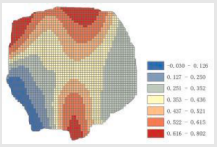
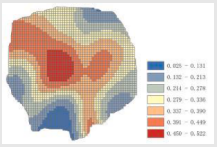
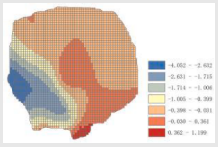
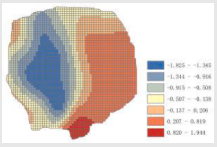
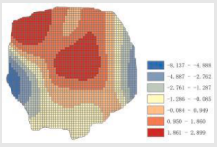
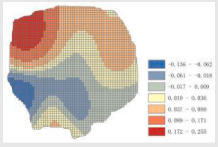
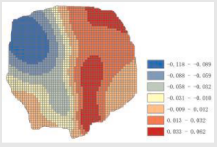
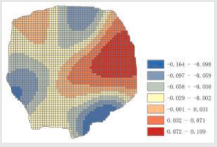
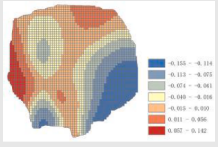
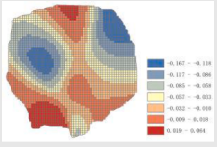
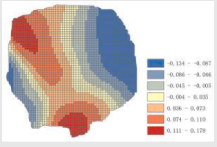
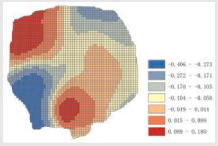
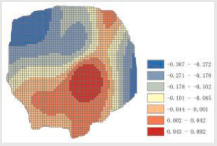
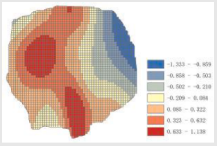
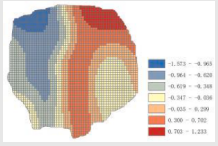
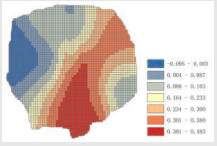
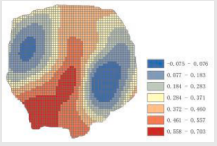
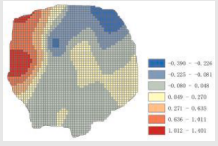
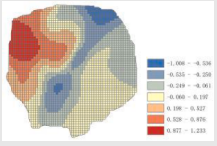
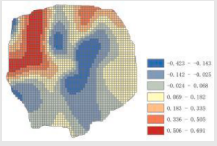
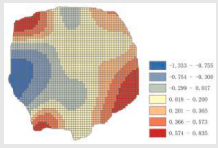
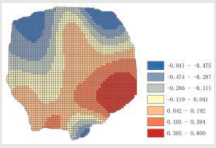
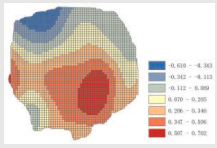
[6] Often referred to as "China's Silicon Valley," this area in Haidian District is a major technology hub, home to numerous tech companies and research institutions.

[7] A traditional alleyway in Beijing, part of the city's extensive network of hutongs, offering a glimpse into the capital's historical urban layout.

[8] An urban park in Chaoyang District, Beijing, known for its recreational facilities and scenic landscapes, often compared to New York's Central Park.

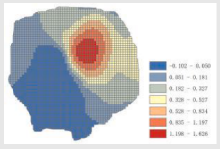
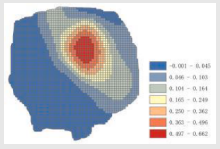
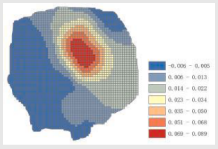
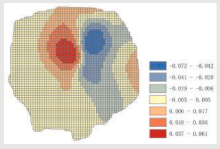
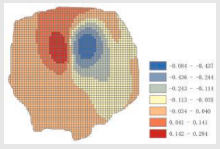
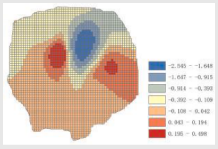
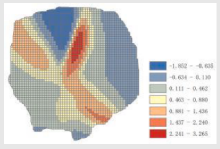
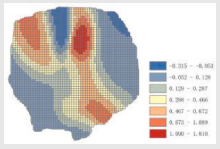
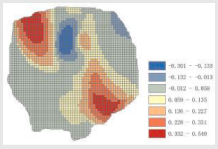
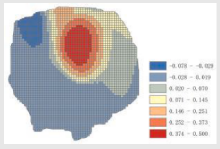
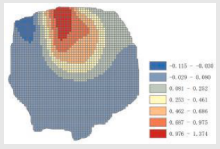
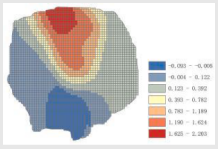
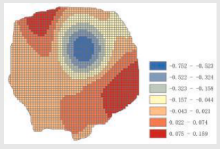
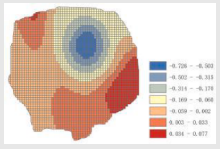
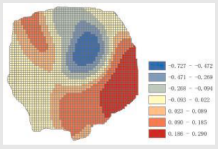
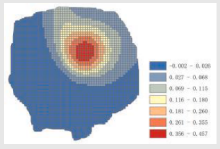
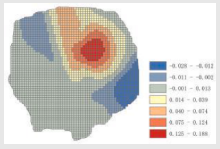
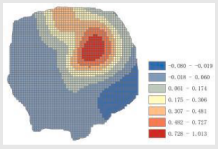
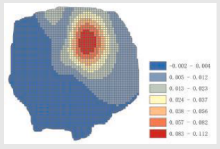
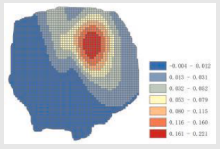
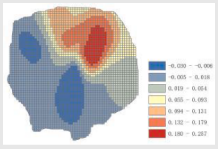
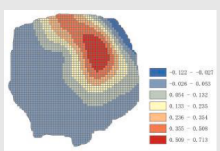
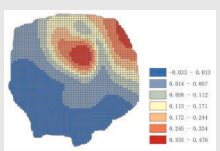
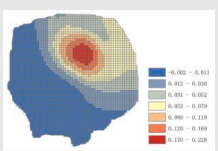
[9] A well-preserved ancient alley in Dongcheng District, Beijing, dating back over 700 years, renowned for its blend of traditional architecture and modern boutiques.

Table 6 Regression coefficients and spatial distribution of GTWR with the dependent variable as activity responsiveness.

		2013	2016	2019
Core circle	Organizer's popularity	 1a	 1b	 1c
Sub-core circle	Artistic ambience	 2a	 2b	 2c
	Sports ambience	 3a	 3b	 3c
	Educational ambience	 4a	 4b	 4c
Associated circle	Service of transport infrastructure	 5a	 5b	 5c
	Road network density	 6a	 6b	 6c
	Accessibility	 7a	 7b	 7c
	House prices	 8a	 8b	 8c

Note:The map was processed based on data from openstreetmap.

Table 7 Regression coefficients and spatial distribution of GTWR with the dependent variable as activity aggregation.

		2013	2016	2019
Core circle	Organizer's popularity	 1a	 1b	 1c
	Activity flexibility	 2a	 2b	 2c
Sub-core circle	Artistic ambience	 3a	 3b	 3c
	Social ambience	 4a	 4b	 4c
Associated circle	Service level of transport facilities	 5a	 5b	 5c
	Road network density	 6a	 6b	 6c
	Land use mix	 7a	 7b	 7c
	House prices	 8a	 8b	 8c

Note:The map was processed based on data from OpenStreetMap.

Table 8 The mean absolute values of the regression coefficients in GTWR with the dependent variable as activity responsiveness.

	Core circle	Sub-core circle			Associated circle			
	Organizer's popularity	Artistic ambience	Sports ambience	Educational ambience	Service of transport infrastructure	Road network density	Accessibility	House prices
2013	0.146	**0.519**	0.053	0.046	0.106	**0.465**	0.210	**0.299**
2016	**0.405**	**0.640**	0.037	0.049	0.073	0.210	**0.301**	0.233
2019	0.315	**1.521**	0.044	0.069	**0.469**	**0.317**	0.165	0.268
Total	**0.289**	**0.893**	0.045	0.055	0.216	**0.334**	0.225	0.267

Note: Bold values indicate 3 highest absolute values of the regression coefficients.

Table 9 The mean absolute values of the regression coefficients in GTWR with the dependent variable as activity aggregation.

	Core circle	Sub-core circle			Associated circle			
	Organizer's popularity	Spatial flexibility	Artistic ambience	Social ambience	Service of transport infrastructure	Road network density	Land use mix	House prices
2013	**0.264**	0.011	**0.592**	0.083	0.087	0.056	0.012	**0.126**
2016	**0.100**	0.076	**0.319**	**0.192**	0.085	0.020	0.029	0.087
2019	0.015	**0.255**	0.108	**0.448**	0.139	**0.143**	0.048	0.034
Total	**0.126**	0.114	**0.340**	**0.241**	0.104	0.073	0.030	0.082

Note: Bold values indicate 3 highest absolute values of the regression coefficients.

positive impact areas continued to expand, particularly in the northwest and southeast, where the transportation infrastructure is less developed (Table 3(9(a)-9(c))).

3.1.3.2. Road network density. Table 6(6(a)-6(c)) and Table 8 indicate that the impact of road network density on activity responsiveness initially declined and then increased, forming a stable belt-shaped positive impact along the northeast-southwest axis, despite a stable road network density. Initially, responsive individuals were scattered in the central area; however, high-value aggregation areas disappeared in the north and were concentrated in the southwest and south, where road density is uneven and subway density is low, favoring areas with better car traffic.

Table 7(6(a)-6(c)) and Table 9 illustrate that the impact of road network density on activity aggregation initially declined and then increased significantly, with high-impact areas remaining stable in the high-density road network areas between the Second and Fourth Rings, which host most pop-up activities. This region, with its traditional *Hutongs* and dense small blocks, contrasts with modern urban areas and remains a key pop-up activity hub.

3.1.3.3. Accessibility. Table 6(7(a)-7(c)) and Table 8 demonstrate that the impact of accessibility on activity responsiveness rose and then fell, with high positive impact areas first appearing in the northwestern region, which had weak accessibility and low responsiveness, whereas in the southern areas indicated a slight negative impact. The positive impact areas were mainly due to the presence of attractive parks, which are scarce resources offering high accessibility within otherwise low-accessibility areas. High negative impact areas shifted from the north, with intermediate accessibility, to the central urban areas that are characterized by dense small-scale social activities and better accessibility.

3.1.3.4. Land-use mix. Table 7(7(a)-7(c)) and Table 9 illustrate a steady increase in the impact of land-use mix on activity aggregation, with little change in spatial patterns. The positive impact areas expanded between the Second and Fourth Ring Roads, overlapping with the high aggregation zones of pop-up activities (Table 3(2(a)-2(c))). These areas offer abundant services and diverse entertainment due to their high land-use mix, thereby enriching pop-up space selection. Negative impact areas were concentrated around industrial parks in Shijingshan, Haidian, and Fengtai, where the land-use mix is low and activities occur in large, uniform open spaces.

3.1.3.5. House prices. Table 6(8(a)-8(c)) and Table 8 show that the impact of house prices on activity responsiveness initially decreased and then increased with minimal fluctuations. To better isolate the unidirectional influence of house prices and mitigate potential confounding effects from reverse causality (i.e., activity responsiveness influencing house prices), this analysis utilizes house price data from the preceding year (t-1). This approach helps to clarify the subsequent observed trends, revealing that positively impacted areas grew, with high-impact areas shifting from the city's outskirts to its southeast. In 2013, high-impact areas had low overall house prices, but higher prices for properties

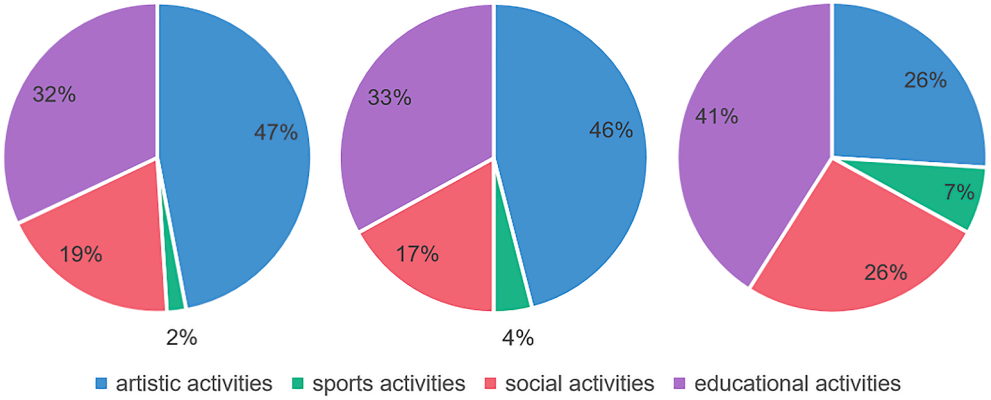


Fig. 4 Proportion of different types of pop-up activities in 2013, 2016, and 2019.

with complete facilities. Since 2016, large-scale activities have moved south, concentrating in parks surrounded by high-priced properties.

Table 7(8(a)-8(c)) and Table 9 illustrate a steady decline in the impact of house prices on activity aggregation, with positively influenced areas concentrated in high-priced, low-density traditional buildings in the city center.

3.2. Identification of factors influencing different types of pop-up activities

Figure 4 and Table 10 illustrate the frequency of different types of pop-up activities across various years. Tables 11 and 12 present the results of GWR analysis for each type of pop-up activity. Excluding educational activities, the sub-core circle exerts the greatest influence on both activity responsiveness and aggregation, followed by the associated and core circles.

3.2.1. Artistic activities

The primary factors for activity responsiveness were artistic ambience, house prices, and spatial flexibility, whereas the organizer's popularity, land-use mix, and road network density were relatively limited. High-value areas, positively influenced by artistic ambience and house prices, were mainly in central Xicheng and peripheral districts such as Chaoyang and Fengtai. Xicheng's traditional *Hutongs*, inside the Second Ring, house many small theaters, bookstores, and artistic spaces, and Chaoyang's high-value areas center around the 798 Art District. In these areas, artistic enterprises in prime locations increased rental costs, boosting their struggle for activity responsiveness. Conversely, a strong positive correlation was found near wetland parks with complex recreational facilities in Fengtai, which had weaker artistic ambience and lower house prices (Table12(1(b), 1(c))). Areas with high spatial flexibility demonstrated weaker or negative impacts, indicating a preference for spaces aligned only with artistic functions (Table12 (1(d)), Table 3(4(a)-4(c))). Organizer's popularity was more influential in areas such as Haidian and Chaoyang (Table 12(1(e))). Road network density high-impact areas, with high-value factors, were dispersed (Table 12(1(f)), Table 3(10(a)-10(c))). In traditional tourism and leisure areas, such as Nanluoguxiang, high land-use mix correlates with higher participation in art activities. Conversely, in peripheral mono-functional areas, such as the 798 and Temple of Heaven, low land-use mix accompanies high participation in art activities.

The primary factor for activity aggregation is social ambience, with house prices, organizer's popularity, spatial flexibility, transport infrastructure, and artistic ambience showing weaker influences. High-value areas positively impacted by social ambience, house prices, and organizer's popularity were concentrated in Dongcheng, including Nanluoguxiang (Table 12(2(b)-2(d))). Central Dongcheng, with its low spatial flexibility, was negatively impacted by this factor. The opposite was observed outside this area, indicating the coexistence of art with daily activities (Table 12(2e)). The positive impact of transport and artistic ambience was limited mostly to Dongcheng's high-value core (Table 12(2(f)-2(g))). Despite the relatively uniform artistic ambiance within Beijing's Third Ring, famous theaters including the Meng Jinghui Studio strengthened their influence (Table 3(5(a)-5(c))).

3.2.2. Sports activities

The primary factors for activity responsiveness were educational ambience, sports ambience, accessibility, and organizer's popularity, with land-use mix and road network density exhibiting weak impacts. High-value areas positively influenced by educational and sports ambiences were primarily in the outskirts of the Haidian and Chaoyang Districts, near the Fifth Ring (Table 12(3(b), 3(c))). Parks and university athletic facilities in these regions emerged as major attractions for participants (Table 3(6(a)-6(c))). (2) Accessibility and land-use mix had stronger impacts in eastern urban areas, where major sports venues such as Olympic Forest and Beihai Park[10] are located (Table 12(3(d), 3(f))), Table 3 (6(a)-6(c))). Sports activities are predominantly outdoor, requiring smoother road networks and diverse amenities as many participants drive (Table 3(11(a)-11(c),12(a)-12(c))). The impact areas of organizer's popularity and road network density were more scattered,

[10] One of China's oldest and best-preserved imperial gardens, located in central Beijing, featuring historical architecture and serene landscapes.

Table 10 Frequency of different types of pop-up activities in 2013, 2016, and 2019.

Activity Type		Frequency (2013)	Frequency (2016)	Frequency (2019)
Artistic activities	Film (cinema events, film festivals, thematic screenings)	879	457	174
	Drama (opera, theater, dance, traditional opera)	223	166	54
	Music (live shows, concerts, music festivals)	1412	655	77
	Exhibitions	94	93	72
Sports activities	Sports	54	70	75
	Travel	50	45	26
Social activities	Gathering (markets, socializing, photography, food, lifestyle, language, nightclubs, board games, parties)	1077	519	377
Educational activities	Public welfare	416	34	11
	Lecture (press conferences, meetups, sharing sessions, salons)	1256	640	529
	Courses	77	313	52
	Parent-child	5	20	14

suggesting a less concentrated influence (Table 12(3(d), 3(g))).

Social ambience and house prices are the primary factors affecting activity aggregation, whereas road network density, sports ambience, and organizer's popularity have weaker impacts. High-value areas impacted by social ambience and house prices encompassed commercial centers including Xidan and Guomao,[11] as well as areas around Chaoyang and Olympic Forest Parks (Table 12(4(b), 4(c))). High-value areas positively influenced by road network density formed a belt along the northwest side of the city, coinciding with the factor's high-value areas (Table 12(4(d)), Table 3(10(a)-10(c))). Sports ambience exhibited a positive correlation, with large open spaces serving as high-value centers (Table 12(4(e))). Sports pop-ups occurred indoors, in gyms within offices and malls, in the city center. Renowned organizers host events more frequently to attract participants (Table 12(4(f))).

3.2.3. Social activities

The key factors influencing activity responsiveness were social ambience, road accessibility, and house prices, whereas organizer's popularity had a weaker impact. Accessibility shifted from negative to positive, spreading outward from the city center (Table 12(5(c))). House prices exhibited a positive correlation in the northern and southern regions, and a negative correlation in northern Fengtai (Table 12(5(e))). Artistic ambience and the organizer's popularity displayed weak or negative correlations in the northern city center but positive correlations in the southern periphery zone (Table 12(5(b))). Overall, these trends suggest that participants were more open to various organizers and preferred northern areas with more comprehensive facilities. Comparatively, vehicular accessibility was more influential in peripheral areas (Table 12(5(c))).

The primary factor for activity aggregation was social ambience, whereas the effects of transport infrastructure, road network density, and organizer's popularity were weaker. High-value areas with positive impacts from the first three factors were found in northern Haidian and the CBD, where well-developed public transport, road networks, and diverse venues, such as cafés and bookstores, offer abundant space for social activities, thereby amplifying their impact (Table 12(6(b)-6(d))). The negative impacts of organizer's popularity were concentrated in residential clusters around universities between the Second and Third Rings, extending to the northwest (Table 12(6(e))). This occurs because diverse activities reduce participants' focus on well-known organizers. In other regions, organizers with greater online exposure positively impacted social activity aggregation.

3.2.4. Educational activities

The primary factors influencing activity responsiveness were educational ambience, social ambience, organizer's popularity, and accessibility, whereas transport infrastructure and spatial flexibility had weaker impacts. The high positive impact zones of educational ambience coincided with areas of high educational concentration, with nearby commercial centers and offices serving as key venues (Table 12(7(b)), Table 3(8(a)-8(c))). Consequently, the influence of the social ambience followed the same trend as that of the educational ambience (Table 12(7(c))). The high positive impact zone of organizer's popularity was concentrated in the central urban area (Table 12(7(d))). This is attributed to the higher density of activities from where popular organizers draw more attention (Table 3(3(a)-3(c))). Accessibility exhibited significant variation in the western part, indicating a stronger impact on participation where road networks are less balanced (Table 12(7(e)), Table 3(11(c))). The positive impact zones of transport infrastructure were scattered around the bus and subway stations (Table 12(7(f)), Table 3(9(c))). The high positive impact zone of spatial flexibility was primarily located on the city's outskirts near residential areas, offices, galleries, and commercial streets (Table 12(7(g))).

The influences of road network density, organizer's popularity, social ambience, spatial flexibility, land-use mix, and transport infrastructure diminished sequentially for activity aggregation. Road network density and land-use mix have similar impacts, with high-value areas

[11] Short for "China World Trade Center", this area in Chaoyang District is Beijing's central business district, characterized by modern skyscrapers and international trade centers.

Table 11 The mean absolute values of the regression coefficients in GWR.

		Artistic activity responsiveness		Artistic activity aggregation		Sports activity responsiveness		Sports activity aggregation	
		OLS *p*-value	Regression coefficient	OLS *p*-value	Regression coefficient	OLS *p*-value	Regression coefficient	OLS *p*-value	Regression coefficient
Core circle	Organizer's popularity	**0.000**	0.087	**0.000**	0.040	**0.000**	0.129	**0.001**	0.044
	Activity flexibility	**0.000**	0.172	**0.000**	0.020	0.196	—	0.506	—
Sub-core circle	Artistic ambience	**0.002**	0.236	**0.001**	0.007	0.690	—	0.533	—
	Sports ambience	0.793	—	0.998	—	**0.000**	0.244	**0.010**	0.061
	Social ambience	0.077	—	**0.000**	0.191	0.522	—	**0.000**	0.489
	Educational ambience	0.459	—	0.152	—	**0.000**	0.247	0.206	—
Associated circle	Service level of transport facilities	0.573	—	**0.000**	0.019	0.221	—	0.153	—
	Road network density	**0.017**	0.002	0.322	—	**0.001**	0.008	**0.000**	0.094
	Road network accessibility	0.099	—	0.170	—	**0.000**	0.157	0.216	—
	Land use mix	**0.011**	0.003	0.855	—	**0.000**	0.010	0.105	—
	House prices	**0.000**	0.215	**0.000**	0.095	0.077	—	**0.000**	0.290
		Social activity responsiveness		**Social activity aggregation**		**Educational activity responsiveness**		**Educational activity aggregation**	
		OLS *p*-value	Regression coefficient	OLS *p*-value	Regression coefficient	OLS *p*-value	Regression coefficient	OLS *p*-value	Regression coefficient
Core circle	Organizer's popularity	**0.000**	0.043	**0.034**	0.021	**0.000**	0.263	**0.000**	0.048
	Activity flexibility	0.740	—	0.070	—	**0.000**	0.061	**0.000**	0.023
Sub-core circle	Artistic ambience	**0.007**	0.301	0.647	—	0.828	—	0.180	—
	Sports ambience	0.264	—	0.084	—	0.054	—	0.061	—
	Social ambience	0.678	—	**0.000**	0.345	**0.021**	0.267	**0.000**	0.024
	Educational ambience	0.152	—	0.090	—	**0.002**	0.268	0.096	—
Associated circle	Service level of transport facilities	0.305	—	**0.000**	0.052	**0.000**	0.075	**0.000**	0.001
	Road network density	0.051	—	**0.009**	0.032	0.059	—	**0.001**	0.067
	Road network accessibility	**0.016**	0.253	0.840	—	**0.000**	0.186	0.573	—
	Land use mix	0.152	—	0.312	—	0.840	—	**0.013**	0.008
	House prices	**0.000**	0.181	0.676	—	0.248	—	0.536	—

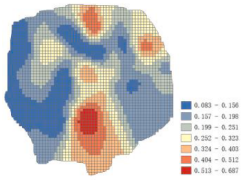
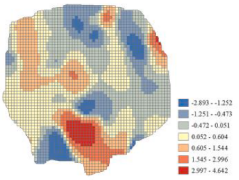
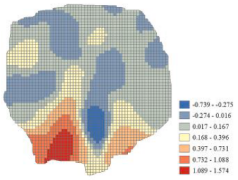
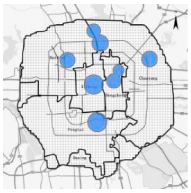
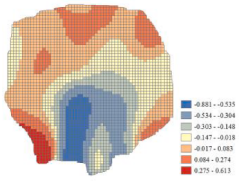
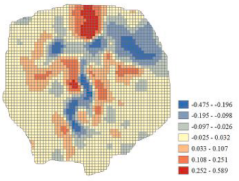
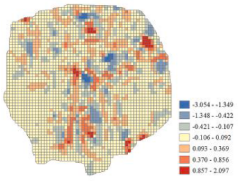
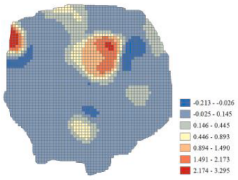
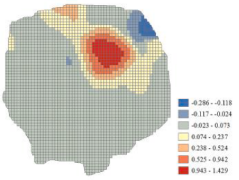
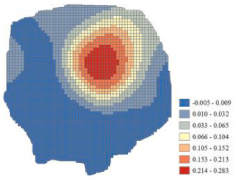
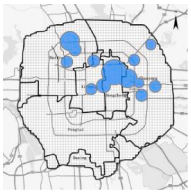
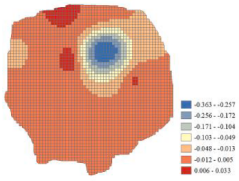
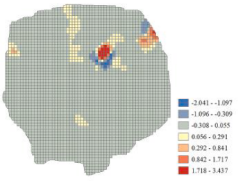
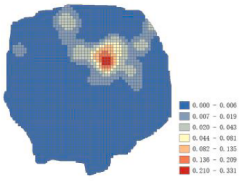
Note:Bold values indicate statistical significance at $p \leq 0.05$ level.

concentrated in regions with a strong educational ambience (Table 12((8(b), 8(f)), Table 3(10(a)-10(c))). The influence of organizer's popularity followed a similar trend as activity responsiveness, with a distinction in SOHO office clusters on the east side, where organizers are highly qualified (Table 12(8(d))). The positive influence of spatial flexibility was concentrated primarily in areas north of the Haidian district and south of Chaoyang Park within older, densely populated residential neighborhoods (Table 12(8(e))). These spaces often house individual studios, flower shops, and bookstores, which differ from the predominant residential functions, enabling convenient participation by residents. The high-value areas of positive influence from the transport infrastructure were predominantly concentrated around metro stations in the central urban area (Table 12(8(g)), Table 3(9(c))).

4. Discussion

This study focuses on the flexibility of urban spaces, where the use of space is no longer limited to a single static function. This phenomenon reflects the spontaneous spatial production and consumption strategies characteristic of post-industrial cities, as well as the management of surplus urban space within the framework of the sharing economy (Harris, 2015). Adaptable pop-up spaces appeal to the young population and have a strong potential for urban vibrancy. This study highlights the importance of understanding broader pop-up activities and their driving factors, beyond those limited to temporary use, by utilizing spatiotemporal geographic data, which complement existing qualitative and narrative studies (Andres, 2013).

Table 12 Regression coefficients and spatial distribution of GWR with the dependent variable as the suitability factor for different types of pop-up activities.

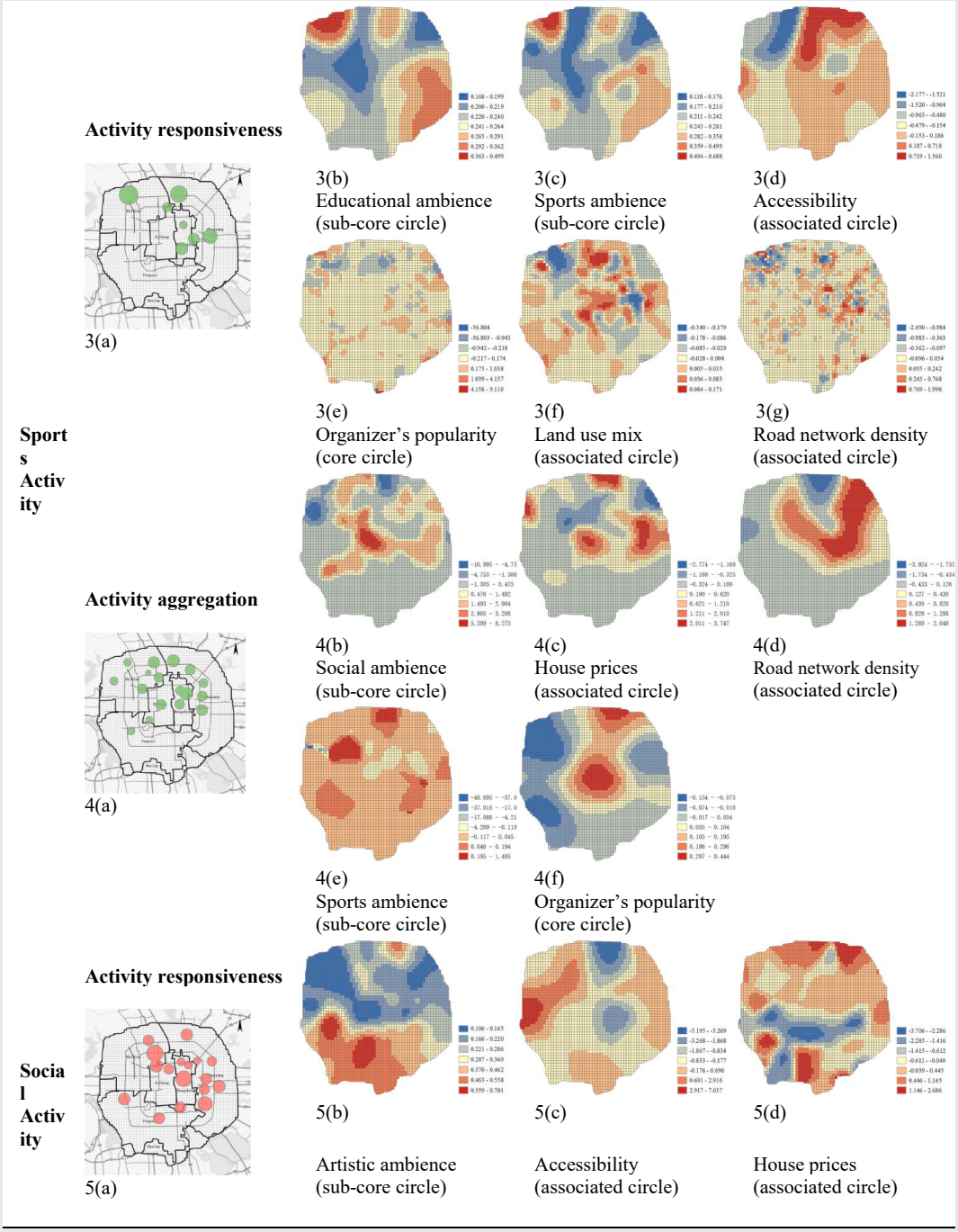
Activity Type	Suitability for Activity	Dominant Impact Factors		
Artistic Activity	Activity responsiveness			
	 1(a)	1(b) Artistic ambience (sub-core circle)	1(c) House prices (associated circle)	1(d) Spatial flexibility (core circle)
				
		1(e) Organizer's popularity (core circle)	1(f) Land use mix (associated circle)	1(g) Road network density (associated circle)
	Activity aggregation			
	 2(a)	2(b) Social ambience (sub-core circle)	2(c) House prices (associated circle)	2(d) Organizer's popularity (core circle)
				
		2(e) Spatial flexibility (core circle)	2(f) Service of transport infrastructure (associated circle)	2(g) Artistic ambience (sub-core circle)

Moreover, an ecological perspective is introduced, and an ecosystem of pop-up activities is constructed to reveal the driving factors and dynamics of this phenomenon. Two weighted regression models are employed to examine the factors influencing the responsiveness and aggregation of pop-up activities within the Fifth Ring Road of Beijing from 2013 to 2019. The results reveal influencing factors that vary over time and across areas, indicating the presence of a spatiotemporal non-stationarity mechanism that may be inadequately captured by linear regression. Based This study develops the concept of spatial flexibility based on the reality of Chinese urban development and provides theoretical references for future research.

4.1. Explanation based on artistic ecosystem framework

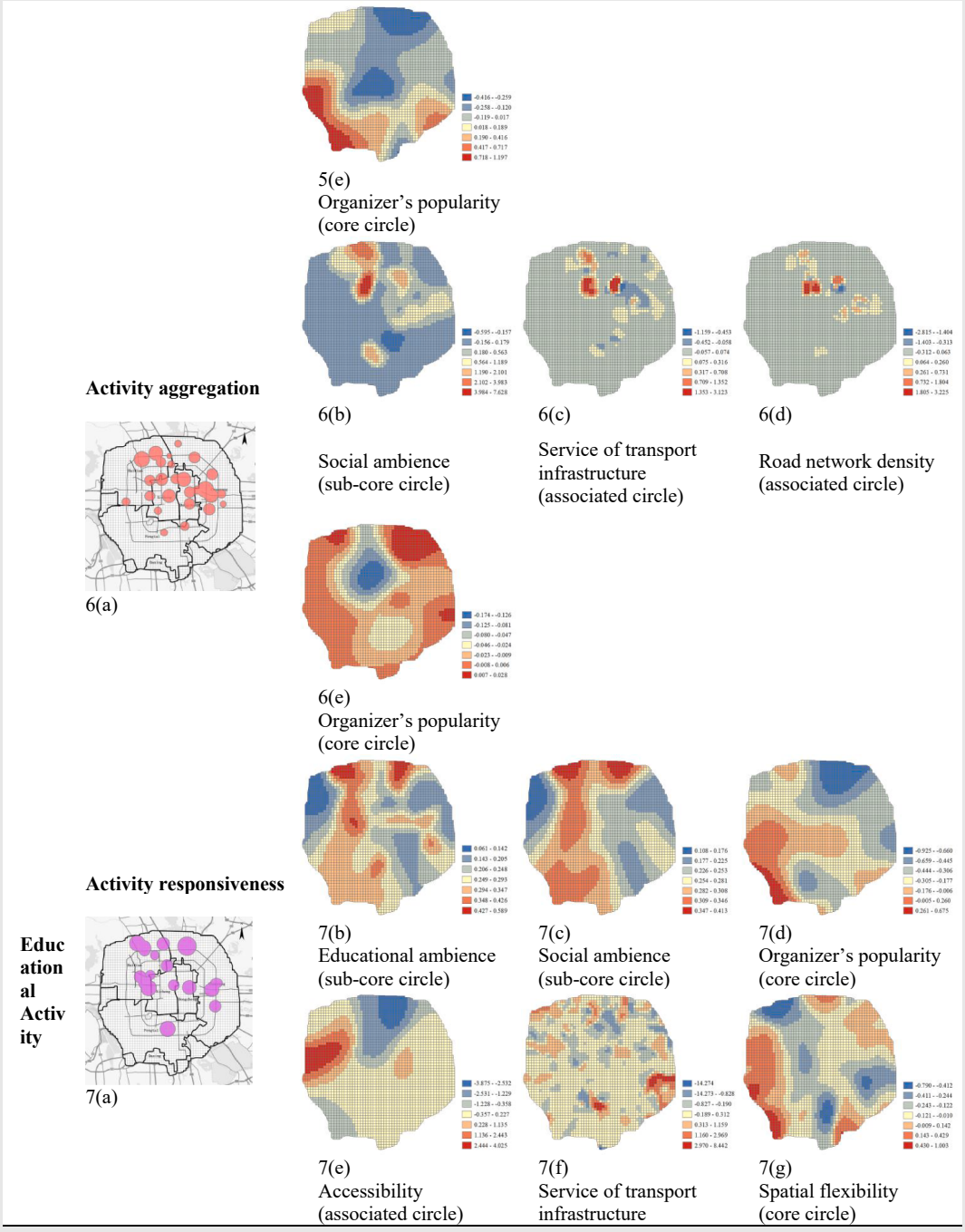
The influencing mechanism of pop-up activities is explained based on the artistic ecosystem circle framework (Fig. 5). Generally, the influence of the sub-core circle factors is more pronounced, followed by the core and associated circles. These factors provide the foundation and motivation for the operation, function, and sustainable development of the artistic ecosystem of pop-up activities.

The sub-core circle functions as the primary foundation for the operation of the pop-up activity ecosystem. They offer stable functional spaces that align with the nature of



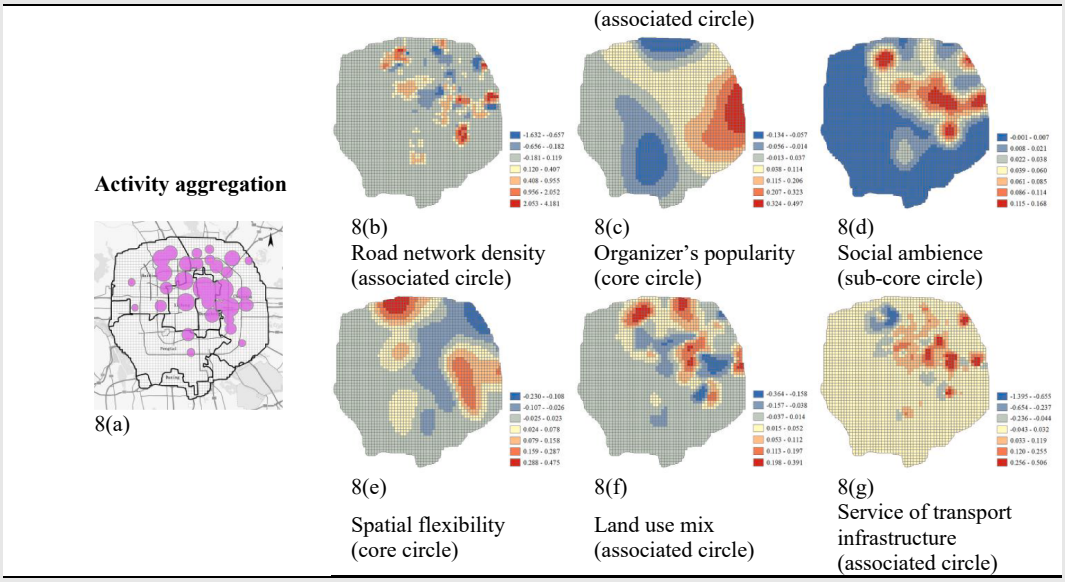
the activities and exert a predominantly positive influence on both activity responsiveness and aggregation. However, certain subtle idiosyncrasies highlight the inherent flexibility of pop-up activities. For instance, social ambience exerts no significant effect on activity responsiveness, whereas sports and educational facilities do not influence activity aggregation. This is largely influenced by the scale and frequency of the activities. While social venues typically accommodate small- and medium-sized activities, sports and educational pop-up activities are not limited to their respective ambiences, but occur across a broader array of informal spaces.

Core circle factors such as organizer's popularity and spatial flexibility provide direct momentum and indirect potential for pop-up activities. They exhibit greater variability over time, and their impact increases. Organizer's popularity become spatially centralized, although their influence steadily diminishes. The rise of small-scale



organizers, such as promoters of life yoga and drama centers, spurs trends in shopping malls and office spaces. Spatial flexibility is increasingly concentrated in northern urban areas, particularly in well-zoned, mixed-use neighborhoods near universities and shopping districts, driven in part by the economics of mixed use. This trend highlights the growing importance of flexible use of urban spatial resources (Harris, 2015), especially for educational activities with fewer spatial constraints.

Associated circle factors remain stable, with gradual improvements in transport infrastructure owing to the expansion of the Beijing Metro. These factors have a greater impact on activity responsiveness than on aggregation. Although transport conditions and house prices affect both activity responsiveness and aggregation, the influences of other factors vary. For instance, accessibility is crucial for large-scale activities and has a significant impact in peripheral areas with limited accessibility. By



Note:The map was processed based on data from OpenStreetMap.

contrast, central areas with higher land-use diversity are more conducive to the aggregation of various activities.

4.2. Trends of evolution

The spatial influence of factors on pop-up activities evolves significantly over time, with factors affecting responsiveness showing greater temporal fluctuation than those influencing aggregation. This temporal instability in responsiveness reflects the uncertainty in participation driven by evolving urban policies and socioeconomic conditions.

The high-impact zones for most influencing factors have gradually shifted from the urban periphery toward the city center between 2013 and 2019. This spatial reconfiguration likely stems from Beijing's uneven development pattern, where rising costs in central areas have pushed certain organizers and artistic activities toward peripheral locations, paradoxically enhancing the prominence and exclusivity of remaining central spaces. The shift became particularly pronounced after 2016, coinciding with intensified creative industry policies. Moreover, shifts in associated circle factors such as rising housing prices and new metro stations are more concentrated in the central and northern areas, further reinforcing the centralization trend (detailed in Section 3.1.3.1) and reflecting the relationship between gentrification processes and pop-up space development (Harris, 2015).

Unlike the fluctuating responsiveness patterns, the influence of most factors on activity aggregation remained relatively stable throughout the study period. However, spatial flexibility and artistic ambience exhibited notable temporal variability due to changes in their spatial distribution. Spatial flexibility influence strengthened in northern districts but weakened in southeastern areas where flexible spaces became increasingly scarce, thereby amplifying the impact of the remaining flexible venues. Similarly, artistic ambience became more concentrated in central areas while diminishing in southeastern and northwestern districts, consequently heightening its influence in these regions as a scarcer resource (detailed in artistic ambience from Tables 3 and 6).

Government policies might play a role in shaping Beijing's pop-up activity landscape by influencing various components of the artistic ecosystem framework—including venue provision, infrastructure development, and the enhancement of atmospheric factors that collectively foster pop-up activities. The 2014 "Beijing Cultural Creative Industry Functional Zone Construction Plan" transformed spaces like the 798 Art District into vibrant cultural hubs, resulting in a significant increase in pop-up activities within these designated zones after 2016 (Table 3). Simultaneously, the National Cultural Industry Innovation Experimental Zone (2014) provided financial incentives and streamlined administrative procedures, particularly benefiting Chaoyang District, while the "Design Capital" initiative developed industrial clusters in areas such as Zhongguancun. These policies enhanced district vitality by encouraging adaptive reuse of spaces and fostering creative industry concentration, providing physical venues for diverse pop-up activities and contributing to increased activity density after 2016, as evidenced in locations like Langyuan Vintage and Chaoyang Park, where the social ambiance in the sub-core circle became notably stronger.

Despite these apparent correlations, we acknowledge that the relationship between policy implementation and pop-up activity patterns was rarely direct. Many activities emerged through bottom-up initiatives navigating existing frameworks rather than as direct policy responses. Policy effects appeared most evident in designated creative zones, while established commercial centers exhibited patterns more closely tied to market dynamics than government interventions.

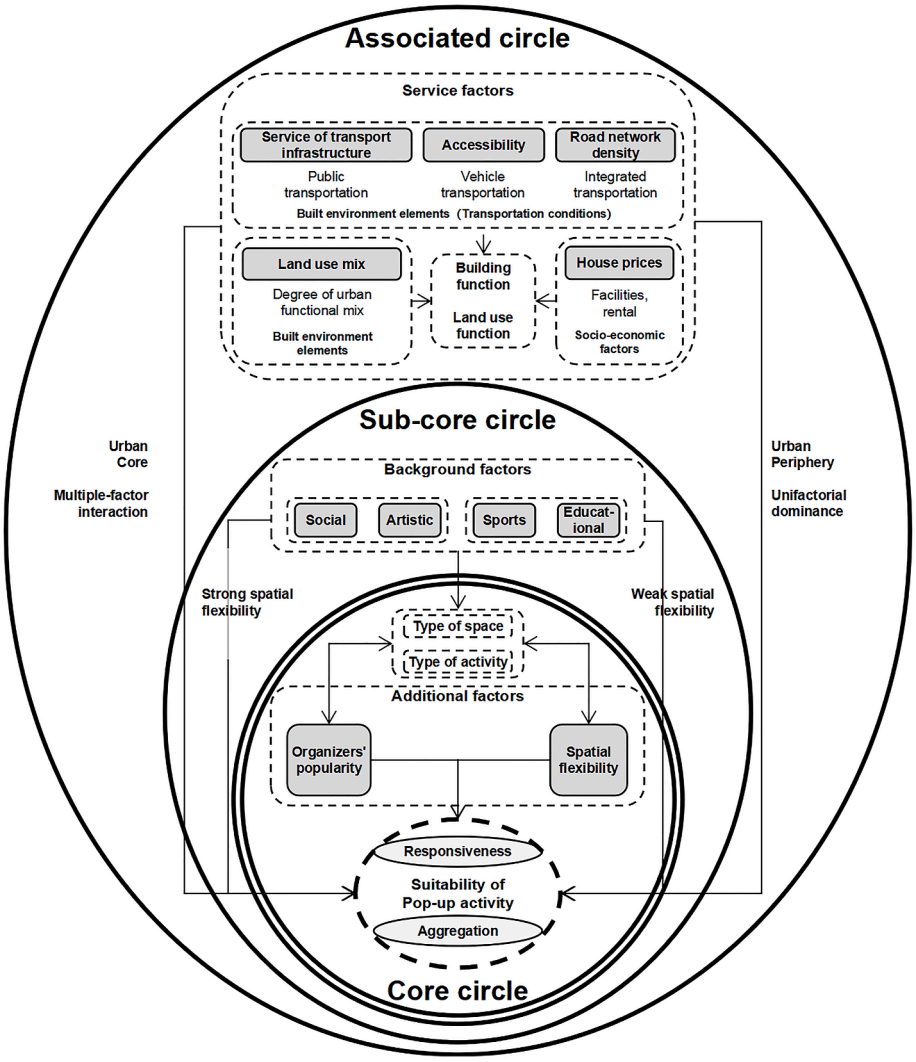


Fig. 5 The influencing mechanism of suitability for pop-up activities in Beijing.

4.3. Central-peripheral differences and north-south disparities

As a monocentric city, Beijing's central and northern regions are more developed than its peripheral and southern regions. Factors within the sub-core and associated circles exhibited a pattern of central-peripheral and north-south disparities, which, to some extent, also reflected uneven urban development. Unlike cities in Western societies, pop-up activities in Beijing showed minimal presence in peripheral areas or declining industrial zones, as evidenced in activity aggregation from Table 3 where grid cells in the southern and eastern part typically hosted fewer pop-up events annually. This contrasts sharply with central western and northern areas such as Nanluoguxiang. This centralization differs from Western examples (Andres and Grésillon, 2013; Martin et al., 2020; Scott and Szili, 2018) where temporary uses often flourish in peripheral areas due to lower rents, relaxed regulations, and deliberate revitalization policies for post-industrial zones. In Beijing, however, pop-up activities remained concentrated in centrally located areas with established commercial infrastructure, primarily in the form of recreation and leisure activities.

In mixed commercial and residential areas, factors such as artistic amenities attract small organizers and incubate small-scale activities (e.g., aesthetic salons and English corners), lacking a single dominant effect. As demonstrated in Section 4.2, with the gathering effect of facilities weakens on the outskirts, single-factor advantages, such as accessibility and transportation infrastructure, become prominent. The focal point is the traditional tourist and recreational areas around Nanluoguxiang in the central northern part of the city, where factors, apart from spatial flexibility and transport facilities, generally exert positive impacts (Table 6).

4.4. Variations in activity types

The influence on pop-up activities varied by type. Artistic and sports activities are widespread, with artistic events lasting longer, whereas sports activities tend to be shorter and less frequent. Conversely, educational and social activities are generally small to medium-sized and held more

frequently. Sub-core circles significantly influence activity responsiveness, except for social activities, owing to their smaller scale and higher frequency. Excluding educational activities, sub-core circles exert a significant influence on activity aggregation, primarily demonstrating the flexibility of these activities, which do not depend on specific functions. Spatial flexibility notably affects educational and artistic activities, which are more informal and adaptable, whereas organizer's popularity influences the aggregation of all activity types, leading to clusters of popular organizations.

Each activity type exhibits a distinct spatial pattern. For artistic activities, the impact in traditional *Hutong* areas, where activities are more concentrated, is significantly different from that in other regions with concentrated cultural parks. Sports participants near city outskirts prioritize accessibility and organizer's popularity, whereas indoor sports favor central commercial districts. Educational and social activities share some similarities, as they are both typically found in areas with convenient transportation services. Educational and social activities share similarities in transportation access but differ in location; educational activities often occur in mixed-use spaces such as old residential areas near universities. Organizers increasingly opt for commercial districts in central urban areas, with a heightened demand for organizer's popularity and accessibility as events move toward the city's outskirts.

4.5. Implications for adaptive urban planning and governance

Our findings on pop-up activity distribution patterns and their influencing factors offer valuable insights for developing more adaptive urban approaches that span both planning and governance domains. First, the center-periphery disparities revealed in our analysis suggest the need for differentiated strategies: central areas may benefit from governance policies that manage high activity concentrations through flexible space allocation systems and streamlined temporary use permits, while peripheral areas require planning interventions including strategically placed activity nodes supported by improved accessibility and mixed-use development to stimulate pop-up activities.

Second, the positive influence of mixed land use on pop-up activities indicates that urban planners should prioritize functional diversity in both new developments and urban regeneration projects. This could include planning requirements for flexible, multi-purpose spaces in commercial developments, governance mechanisms that create incentives for temporal sharing of specialized facilities (e.g., allowing school auditoriums to host community events during off-hours), and flexible zoning regulations that facilitate temporary activations of underutilized spaces.

Finally, the network effects of organizer influence point to the value of facilitating stakeholder connections in urban governance processes. Municipal authorities could develop institutional platforms connecting space owners with potential activity organizers, reducing transaction costs and information asymmetries that often hinder temporary space activation. These planning and governance implications collectively suggest a shift toward more flexible, network-oriented urban management models that can better accommodate the dynamic nature of contemporary urban activities while maintaining necessary regulatory oversight.

5. Conclusion

In the context of the ambiguous use of urban spaces, this study constructs an artistic ecosystem framework to analyze the factors influencing the spatial and temporal evolution of pop-up activities based on longitudinal data. This approach is useful in guiding the adaptive use of urban spatial resources from a bottom-up perspective and provides a practical basis for decision-making in urban space management and design, shifting from function-oriented to activity-based strategies. The spatial distribution of pop-up activity responsiveness and aggregation in Beijing is influenced by three primary dimensions: activity attributes (core circles), functional ambience (sub-core circles), and urban service conditions (associated circles). These influences exhibit temporal variability and are characterized by spatial heterogeneity. The impact on aggregation remains relatively stable, whereas the influence on responsiveness varies more, indicating a degree of uncertainty regarding the attractiveness of these activities. In the core circle, the influence of spatial flexibility increases annually, reflecting a trend toward the composite use of urban space, whereas the declining impact of organizer's popularity indicates a diversification of activities. In the sub-core circle, pop-up activities continue to depend on specific functional spaces to some extent, with the artistic and social ambience remaining as factors that exert a relatively strong influence.

Beijing's pop-up activities depend primarily on advantageous locations equipped with comprehensive amenities, although their role as catalysts in marginally declining areas remains limited. Campus neighborhoods, open spaces, office complexes, art parks, and commercial districts have emerged as key venues for pop-up activities. Historical and cultural tourism areas, along with commercial centers—exemplified by the area east of the city center—have become hubs for numerous activities, where factors such as atmosphere, transportation, and land use collectively are crucial. By contrast, peripheral areas develop localized high-impact zones due to resource scarcity. Temporally, the influence of organizer's popularity, artistic ambience, transportation facilities, and housing prices on activity responsiveness increasingly clusters toward the city center, reflecting the uneven development across different city areas. Distinct factors influence different activity types, which exhibit diverse spatial patterns. Educational and artistic activities, which constitute the largest share, are affected more by spatial flexibility in terms of aggregation, with educational activities being particularly maneuverable. These spatial and temporal distribution patterns and their influencing mechanisms are crucial for advancing our understanding of the nature of pop-up activities in the Chinese context. Although it is not feasible to encompass all types, this analysis reveals the urban spatial production and consumption processes underlying bottom-up urbanization.

However, this study has some limitations that require further analysis. First, the formation of a pop-up ecosystem is a complex process, making it challenging to quantify and evaluate factors such as external policies and social and economic changes. Second, pop-up activities on social platforms do not encompass broad spontaneous behavioral data, which are challenging to collect in large quantities and lead to bias in the study sample. Third, this study examines Beijing, a city with a concentric circular structure but lacks exploration and comparison with other types of cities.

To address these limitations, future research could incorporate more heterogeneous data sources such as mobile positioning data to track actual attendance patterns, social media sentiment analysis to gauge activity reception, and qualitative interviews with organizers and participants. These mixed-method approaches would provide deeper insights into the social dimensions of pop-up activities that quantitative spatial analysis alone cannot capture, particularly regarding the complex ecosystem formation processes. Additionally, extending this analytical framework to cities with different morphological structures would enhance the theoretical robustness of the artistic ecosystem framework while revealing how varying urban configurations influence temporary activity patterns. Such comparative studies would better validate the mechanisms of the artistic ecosystem of pop-up activities and offer practical guidance for its development in different urban contexts.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This research was supported by the Key Laboratory of New Technology for Construction of Cities in Mountain Area of China (Grant No. LNTCCMA-20240104), the National Natural Science Foundation of China (Grant No. 52278034), Tianjin Philosophy and Social Science Planning Project (Grant No. TJSR23-005), and Open Research Project of Beijing Urban Governance Research Base (Grant No. BUGP-220230850). We would like to thank Elsevier Language Services for their support, and extend our gratitude to Wenpei Zhou and Linghong Ke for their assistance with data organization in this research.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foar.2025.05.009.

References

Akaike, H., 1998. Information theory and an extension of the maximum likelihood principle. In: Parzen, E., Tanabe, K., Kitagawa, G. (Eds.), Selected Papers of Hirotugu Akaike. Springer, pp. 199—213.

Andres, L., 2013. Differential spaces, power hierarchy and collaborative planning: a critique of the role of temporary uses in shaping and making places. Urban Stud. 50 (4), 759—775.

Andres, L., Grésillon, B., 2013. Cultural brownfields in European cities: a new mainstream object for cultural and urban policies. Int. J. Cult. Pol. 19 (1), 40—62.

Beekmans, J., Boer, J.D., 2014. Pop-up City: City-Making in a Fluid World. BIS Publishers.

Behr, A., Brennan, M., Cloonan, M., Frith, S., Webster, E., 2016. Live concert performance: an ecological approach. Rock Music Stud. 3 (1), 5—23.

Bishop, P., Williams, L., 2012. The Temporary City. Routledge.

Brunsdon, C., Fotheringham, A.S., Charlton, M.E., 1996. Geographically weighted regression: a method for exploring spatial nonstationarity. Geogr. Anal. 28 (4), 281—298.

Chen, M., 2019. Study on the Differences and Influencing Factors of Community O2O Online and Physical Commercial Spatial Distribution in Guangzhou. South China University of Technology [Unpublished Master's Thesis].

Chen, S., Li, Z., 2021. Analysis and planning research of community informal space based on the characteristics of residents' daily activities. Urban Archit. Space 3, 84—87.

Chen, W., Yang, Y., 2012. From virtual communities to real life: extension path of watercress city products. J. Hengyang Normal Univ. 4, 101—104.

Colomb, C., 2012. Pushing the urban frontier: temporary uses of space, city marketing, and the creative city discourse in 2000s Berlin. J. Urban Aff. 34 (2), 131—152.

Couclelis, H., 2000. From sustainable transportation to sustainable accessibility: can we avoid a new tragedy of the commons? In: Janelle, D.G., Hodge, D.C. (Eds.), Information, Place, and Cyberspace: Issues in Accessibility. Springer, pp. 341—356.

Du, R., Yu, Z., Liu, Z., 2014. Social influence of online and offline based on activities. Chin. J. Comput. 1, 238—245.

Fang, Y., 2019. Spatial Distribution Characteristics of Online Popular Restaurants in Shanghai and Comparison with Ordinary Restaurants. East China Normal University [Unpublished Master's Thesis].

Ferreri, M., 2015. The seductions of temporary urbanism. Ephemera 15 (1), 181.

Fotheringham, A.S., Brunsdon, C., 1999. Local forms of spatial analysis. Geogr. Anal. 31 (4), 340—358.

Fotheringham, A.S., Brunsdon, C., Charlton, M., 2003. Geographically Weighted Regression: the Analysis of Spatially Varying Relationships. John Wiley & Sons.

Fotheringham, A.S., Charlton, M.E., Brunsdon, C., 1998. Geographically weighted regression: a natural evolution of the expansion method for spatial data analysis. Environ. Plan. A Econ. Space 30 (11), 1905—1927.

Franck, K., Stevens, Q. (Eds.), 2006. Loose Space: Possibility and Diversity in Urban Life. Routledge.

Harris, E., 2015. Navigating pop-up geographies: urban space-times of flexibility, interstitiality and immersion. Geography Compass 9 (11), 592—603.

Hou, J. (Ed.), 2010. Insurgent Public Space: Guerrilla Urbanism and the Remaking of Contemporary Cities. Routledge.

Huang, B., Wu, B., Barry, M., 2010. Geographically and temporally weighted regression for modeling spatio-temporal variation in house prices. Int. J. Geogr. Inf. Sci. 24 (3), 383—401.

Iveson, K., 2013. Cities within the city: do-it-yourself urbanism and the right to the city. Int. J. Urban Reg. Res. 37 (3), 941—956.

Jiang, J., 2005. Discussion on the theory framework of artistic ecology. Hum. Geogr. 4, 119—124.

Kenyon, S., 2008. Internet use and time use: the importance of multitasking. Time Soc. 17 (2—3), 283—318.

Li, C., Wang, X., 2013. The framework of creative industrial ecological system based on ecology. J. Wuhan Univ. Technol. 5, 689—694.

Liu, J., 2014. The operation of douban tongcheng and the characteristics of artistic dissemination. Journal. Lover 9, 57—59.
Liu, Y., Fang, S., 2021. Research on the protection and utilization of intangible artistic heritage in Suzhou grand canal from the perspective of artistic ecology. Econ. Res. Guide 35, 22—26.
Lydon, M., Garcia, A., 2015. A tactical urbanism how-to. In: Tactical Urbanism. Island Press/Center for Resource Economics, pp. 171—208.
Martin, M., Hincks, S., Deas, I., 2020. Temporary use in England's core cities: looking beyond the exceptional. Urban Stud. 57 (16), 3381—3401.
Moore, J.F., 1993. Predators and prey: a new ecology of competition. Harv. Bus. Rev. 71 (3), 75—86.
Odum, E.P., Barrett, G.W., 1971. Fundamentals of Ecology. Saunders.
Overdiek, A., Warnaby, G., 2020. Co-creation and co-design in pop-up stores: the intersection of marketing and design research? Creativ. Innovat. Manag. 29 (Suppl. 1), 63—74.
Pfeufer, N., Suwala, L., 2020. Utilizing temporary spaces. Location strategies of pop-up restaurants in Berlin. Raumforschung und Raumordnung. Spatial Res. Plann. 78 (1), 71—87.
Pratt, A.C., 1997. The artistic industries production system: a case study of employment change in Britain, 1984-91. Environ. Plan. A Econ. Space 29 (11), 1953—1974.
Scott, M., Szili, G., 2018. Pop-up polanyi: cultural entrepreneurs and the "vacancy fix". City Cult. Soc. 14, 22—27.
Shi, C., Warnaby, G., Quinn, L., 2021. Territorialising brand experience and consumption: negotiating a role for pop-up retailing. J. Consum. Cult. 21 (2), 359—380.
Shi, Y., Dong, X., 2021. Research on the construction of the cultivation path of maker artistic ecosystem in higher vocational education. J. Wuhan Polytech. 1, 102—106.
Taube, J., Warnaby, G., 2017. How brand interaction in pop-up shops influences consumers' perceptions of luxury fashion retailers. J. Fash. Mark. Manag.: Int. J. 21 (3), 385—399.
Van der Hoeven, A., Hitters, E., 2019. The social and artistic values of live music: sustaining urban live music ecologies. Cities 90, 263—271.
Wang, D., Fu, Y., 2019. Mobile signaling data helps Shanghai community life circle planning. Shanghai Urban Plann. Rev. 6, 23—29.
Wang, J., 2020. Research on O2O Invisible Consumption Space of Nanjing Old City Under "Internet +" Environment. Southeast University [Unpublished Master's Thesis].
Wang, M., 2012. The changing patterns of virtual community communication and the return to real life: a case study of Douban Tongcheng. J. Jilin Telev. Radio Univ. 2, 74—75.
Wang, Y., Lin, W., Feng, C., 2019. The impacts of information and communication technologies (ICT) on the spatial distribution of urban customer services: a case study of online takeaway industry in Beijing. Urban Dev. Stud. 6, 100—107.
Warnaby, G., Medway, D., 2022. Productive possibilities? Valorising urban space through pop-up? Qual. Mark. Res. 25 (5), 557—569.
Yang, Q., He, D., Gao, P., 2018. Spatial pattern and influencing factor analysis of experience business in Shanghai. Urban Probl. 3, 34—41.
Yao, W., 2019. Landscape Design of Shilin Taichuang Park parent-child Interactive Farmhouse. Kunming University of Science and Technology [Unpublished Master's Thesis].
Zhang, H., Li, Q., 2020. Potential of roads as temporary public space in the view of tactical urbanism: taking Donghu South Road of Wuhan city as an example. Huazhong Archit. 9, 63—68.
Zhang, M., Xiong, G., 2013. Production of consuming spaces: an artistic approach based on theories of everyday life. Hum. Geogr. 2, 38—44.