

Unmasking the spatial-temporal characteristics of knowledge workers' third-place remote work

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Abstract

Knowledge workers tend to choose third places as alternatives for remote work. Since previous studies lack high-precision spatial-temporal data collection approaches and analysis for third-place remote workers, this study aims to investigate the spatial-temporal characteristics of knowledge workers engaging in remote work at third places using refined data collection methods. We recruited 20 knowledge workers in Beijing, China, collected their spatial-temporal data using activity diaries and wearable devices, including Global Positioning System (GPS) trackers and wearable cameras, for seven days, and visualized their spatial-temporal characteristics, encompassing work time allocation, commute duration, and spatial distribution of various workplaces. The results show that: (1) Temporally, in addition to heterogeneity in work rhythms such as fragmented versus continuous sessions and weekday-weekend contrasts, these workers work an average of 6.3 hours daily for 6.6 days a week, with 46.7% of their work time spent in third places and a 34-minute commute. (2) Spatially, most third places are located close to home with some suburban-center movements, and workers typically use 4.5 different third places for remote work and prefer third places within 5 kilometers or beyond 15 kilometers from home.

Keywords

third place, knowledge worker, remote work, time use, spatial distribution

Third place, as a type of informal public gathering place like café and library (Oldenburg, 1989), is growing popular for remote work among knowledge workers. Knowledge workers, such as programmers, lawyers, and designers, are professionals who leverage their expertise to create value for their organizations (Davenport, 2005; Drucker, 1959). The development of information and communications technology (ICT)

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and the outbreak of the COVID-19 pandemic have led to a rise in third-place remote work (Mouratidis and Papagiannakis, 2021). A study has show that nearly a third of remote workers work in third places, and one-tenth of remote workers prefer working in third places (Lund et al., 2020). Li et al. (2024) also demonstrated that 11.27% of total employees in Beijing opt for working in third places, with 4.35% favoring commercial ones in 2022.

A growing body of studies has begun examining the intersection between third places and remote work. Existing studies mainly focus on three aspects. Firstly, studies identify why remote workers choose third places and what amenities influence workers' preferences. Garrett et al. (2017) found that workers often come to seek a balance between social presence and autonomy, and Henriksen et al. (2018) showed that Wi-Fi stability and acoustic comfort significantly shape workers' choices of third places. Secondly, research on how third places shape work practices reveals that such spaces support creativity and cognitive transitions. Nagayama (2023) demonstrated that third places facilitate task switching and flexible workflow management for mobile knowledge workers. Thirdly, research focusing on the spatial distribution of third-place remote work and its urban determinants reveals that popular third places tend to cluster in high-density mixed-use areas with strong transit accessibility (Li et al., 2024). Despite these insights, existing work mainly focused on why and how remote workers use third places, but less is known about the spatial patterns in how remote workers engage with these spaces. As a result, the empirical foundation supporting policy-making and spatial planning for hybrid work infrastructures remains limited. Besides, previous studies have largely relied on self-reported surveys, which are subject to recall bias, underreporting of short trips, and limited temporal accuracy, and thus lack high spatiotemporal resolution in data collection approaches and analysis for the behaviors of remote workers in third places (Mariotti et al., 2022; Zhou et al., 2018). Such high-resolution data are crucial for formulating urban design guidelines for third places and fostering the development of hybrid work models. Thus, this study aims to examine the spatial-temporal characteristics of knowledge workers working remotely in third places with refined data acquisition and analytical methods, providing a data foundation for future fine-grained investigations of flexible work-related mobility patterns.

Data for this study come from an experimental survey conducted from September 18 to November 21, 2022 in Beijing. The survey recruited 20 knowledge workers aged 21 to 50 from various industries who worked remotely in third places more than three times a week through online platforms. We divided participants into three groups due to the limitations in the number of available devices and collected data in high spatiotemporal resolution over seven consecutive days. Participants were required to wear portable Global Positioning System (GPS) trackers to record their trajectory and wearable cameras (iON SnapCam Lite) to automatically capture pictures of their daily lives every 30 seconds (Zhang et al., 2021). Furthermore, participants were requested to complete activity diaries. We finally obtained 158 GPS trajectories and 158 activity diaries, along with 160,878 photos taken by wearable cameras.

Following data collection, the activity diaries, GPS trajectories, and camera images were matched and integrated using timestamp synchronization. Specifically, we first processed the activity diaries by filling missing activities and refining activity timings according to timestamps from GPS trackers. Camera images were used to validate the contextual accuracy of activity diaries and to help correct ambiguous or missing records. Workplace details, including latitude, longitude, and workplace type, were then manually extracted and verified from GPS trajectories and visual cues from wearable-camera images through a month-long process and were appended to the attributes of the activity diaries. This multimodal cross-verification reduced classification errors common in single-source mobility data and ensured high spatial and temporal precision. Subsequently, daily working hours and different third place locations of participants were analyzed and visualized based on activity diaries using Python scripts. While the data collection was organized in three temporal groups due to device availability, analytical categories were reorganized based on participants' actual workspace combinations across seven days, resulting in four behavior-based categories: third place only, third place and home, third place and office, as well as third place, home, and office. This behavior-based grouping better reflects real-world working patterns than logistical grouping. Finally, we

visualized the processed data from spatial and temporal perspectives respectively, as shown in Figure 1. Figure 1(a) depicts the daily time allocation for various activities, the daily working hours, and commute duration, with each bar representing an individual's daily time usage. Figure 1(b) illustrates the spatial distribution and connectivity among participants' homes, third places, traditional workplaces, and other locations that are related to travel to and from third places. Figure 1(c) summarizes the key spatial and temporal patterns, including weekly working days, daily working hours, the proportion of working time spent in different types of places, commuting duration, the number of third places used, and their distance from home. It is worth noting that Panel (III) of Figure 1(c) uses color to maintain consistency with the categorical color scheme used in Figures 1(a) and 1(b), while other charts in Figure 1(c) visualize distributions of temporal, numerical, or distance attributes and therefore employ grayscale palettes to avoid unintended categorical associations.

Figure 1(a) reveals pronounced variation in temporal work rhythms across individuals and underscores the heterogeneous and context-dependent nature of third-place work behaviors. Individuals differ both in third-place working time and in visiting frequency, since some participants engage in long, continuous work sessions in third places while others rely on short, intermittent bursts of third-place work. Weekend work also appears among several individuals, reflecting occupational flexibility. Moreover, it shows differences in the frequency of third-place use, the coexistence of fragmented versus consolidated work patterns, distinctions between workers who primarily stay at home or the office and those who frequently shift among multiple settings, and noticeable contrasts between weekday and weekend routines. Figure 1(b) complements these temporal patterns by highlighting the spatial dimension of third-place work. Most third places cluster within short distances of participants' homes, indicating a clear preference for local accessibility. It also clarifies that many long-distance trips stem from suburban-center or center-suburban commuting patterns. For example, participants 1, 7, 8, 12, 13, 15, and 16 commute from suburban areas into the city center to work in third places, while participants 4, 6, 11, and 15 exhibit the opposite flow. Building on these temporal and spatial variations observed at the individual level, Figure 1(c) summarizes the aggregate characteristics of third-place remote work. Third-place remote workers work an average of 6.3 hours daily for 6.6 days a week, with 46.7% of work time spent in third places and a 34-minute commute. They utilize 4.5 third places for work on average in a week, favoring those within 5 kilometers (66.7%) and beyond 15 kilometers (18.5%) from home.

The results, varying in time use patterns while aligning in spatial distribution of preferred third places in comparison with other studies, reinforce the conclusions of prior studies and highlight the divergence in Beijing's work situation from that of developed countries. These remote workers have shorter daily working hours but more workdays, with a higher proportion of work time spent in third places (46.7%) than the one-sixth reported in the monthly U.S. Survey of Working Arrangements and Attitudes (SWAA) (Caros et al., 2023). Besides, their 34-minute commute duration is shorter than the average commute time in Beijing (48 minutes) (China Academy of Urban Planning and Design, 2023) but is longer than commutes to public places (18 minutes), co-working spaces (26 minutes), and the homes of friends and family members (FFH) (22 minutes) demonstrated by SWAA (Caros et al., 2023). However, the spatial distribution of their working third places aligns with other studies which suggest that the commuting trips of teleworkers exhibit a higher standard deviation compared to those of non-teleworkers (Helminen and Ristimäki, 2007). In our case, this pattern likely reflects both the preference for convenient and accessible third places and the use of such spaces near long-distance destinations, including client offices, conference facilities, and hospitals.

While these findings provide insight into the spatial-temporal characteristics of third-place remote work, the study remains exploratory due to its small sample size. The averages reported in Figure 1(c) should therefore be interpreted as indicative tendencies rather than population-level estimates, and cross-city comparisons must be treated with caution given the unique scale and transportation characteristics of Beijing. Nevertheless, the study demonstrates the analytical value of integrating high-resolution GPS data,

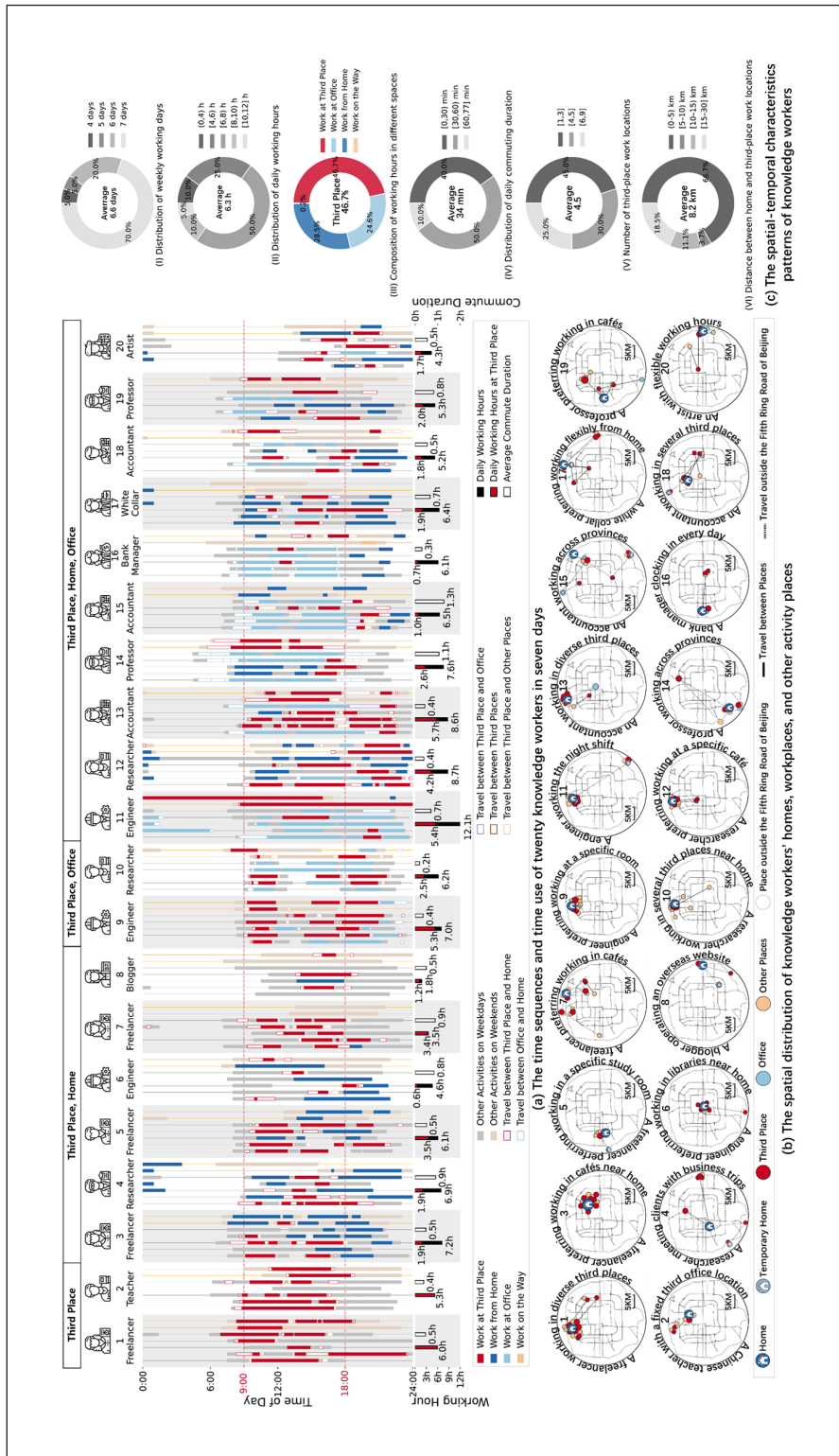


Figure 1. The spatial-temporal characteristics of knowledge workers' third-place remote work. The simplified base map of Beijing in (b) shows the Fifth Ring Road and major arterial roads within this boundary at a unified scale. The size of nodes in (b) represents the frequency of visits to different locations.

wearable-camera imagery, and activity diaries, enabling the identification of qualitative behavioral patterns that traditional survey methods are unable to capture.

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Ethical considerations

This study has been reviewed and approved by the Institutional Review Board (IRB) of Tsinghua University [Project number: THU01-20230128].

Consent to participate

All participants were required to complete written informed consent forms before their participation in the experiment.

Consent for publication

Not applicable

Author contributions

Junhao Xia: Conceptualization, methodology, software, data curation, formal analysis, investigation, visualization, validation, writing—original draft.

Wenzhu Li: Conceptualization, methodology, software, data curation, formal analysis, investigation, validation, writing—original draft.

Chunjiang Li: Conceptualization, methodology

Ying Long: Conceptualization, resources, writing—review & editing, supervision, project administration, funding acquisition.

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Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability statement

There are ethical restrictions on sharing of deidentified data for this study. The ethics committee has not agreed to the public sharing of data as we do not have the participants' permission to share their anonymous data.

References

Caros NS, Guo X, Zheng Y, et al. (2023) The impacts of remote work on travel: Insights from nearly three years of monthly surveys. *arXiv:2303.06186*. Available at: <http://arxiv.org/abs/2303.06186> (accessed 22 August 2025).

- China Academy of Urban Planning and Design (2023) 2023 Commuting monitoring report for major cities in China. Available at: <https://bj.bcebos.com/v1/mapopen/cms/report/2023tongqin/index.html> (accessed 22 August 2025).
- Davenport TH (2005) *Thinking for a Living: How to Get Better Performances and Results from Knowledge Workers*. Harvard Business Press.
- Drucker P (1959) *The Landmarks of Tomorrow*. Harper and Row.
- Garrett LE, Spreitzer GM and Bacevice PA (2017) Co-constructing a sense of community at work: The emergence of community in coworking spaces. *Organization Studies* 38(6): 821–842.
- Helminen V and Ristimäki M (2007) Relationships between commuting distance, frequency and telework in Finland. *Journal of Transport Geography* 15(5): 331–342.
- Henriksen IM and Tjora A (2018) Situational domestication and the origin of the cafe worker species. *Sociology* 52(2): 351–366.
- Li W, Zhang E and Long Y (2024) Unveiling fine-scale urban third places for remote work using mobile phone big data. *Sustainable Cities and Society* 103: 105258.
- Lund S, Madgavkar A, Manyika J, et al. (2020) *What's Next for Remote Work: An Analysis of 2,000 Tasks, 800 Jobs, and Nine Countries*. McKinsey Global Institute, pp.1–13.
- Mariotti I, Giavarini V, Rossi F, et al. (2022) Exploring the “15-minute city” and near working in Milan using mobile phone data. *TeMA – Journal of Land Use, Mobility and Environment* S2: 39–56.
- Mouratidis K and Papagiannakis A (2021) COVID-19, internet, and mobility: The rise of telework, telehealth, e-learning, and e-shopping. *Sustainable Cities and Society* 74: 103–182.
- Nagayama S (2023) Does working at third places work? Multi-locational work for engagement, creativity, and well-being. *Journal of Creativity* 33(3): 100070.
- Oldenburg R (1989) *The Great Good Place: Cafés, Coffee Shops, Community Centers, Beauty Parlors, General Stores, Bars, Hangouts, and How They Get You through the Day*. Paragon House.
- Zhang Z, Long Y, Chen L, et al. (2021) Assessing personal exposure to urban greenery using wearable cameras and machine learning. *Cities* 109: 103006.
- Zhou X, Yeh AGO, Li W, et al. (2018) A commuting spectrum analysis of the jobs–housing balance and self-containment of employment with mobile phone location big data. *Environment and Planning B: Urban Analytics and City Science* 45(3): 434–451.

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