Co-Creation and Urban Exploration: A Log-Based Comparison of Two In-the-Wild Deployments

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***Abstract*—This study presents a descriptive, log-based comparison of two real-world deployments of a location-based storytelling walking application, "TokoTokoBanashi," conducted at the Juso Art Festival in Osaka in 2024 and 2025. The application supports urban exploration by allowing users to visit "story spots" shown on a map and unlock self-contained stories by taking photographs on-site, without a predefined route. The two deployments differed in several design and operational conditions, including content authorship (2024: developer-curated; 2025: resident co-created), as well as interface and implementation details. Rather than isolating causal effects, this study adopts an exploratory descriptive case comparison of two operational settings. Using location and interaction logs, we analyze visitors' behavior in terms of spot selection, staying near spots, and overall movement scale. We introduce indicators to characterize these aspects and report how behavioral tendencies differed between the two deployments. The results illustrate how design conditions, including the introduction of co-creation practices, can be reflected in different combinations of visiting, staying, and moving patterns in real-world usage.**

***Index Terms*—location-based storytelling, urban exploration, co-creation, log-based analysis, field deployment.**

I. Introduction

Gamification-based approaches have been widely adopted in tourism and have shown certain effectiveness in enhancing engagement and supporting place-related understanding in situ [1], [2]. At the same time, it has been pointed out that an excessive emphasis on task completion or behavioral guidance may undermine immersion [3]. Moreover, activities such as check-ins can become ends in themselves, potentially leading users to prioritize task completion over engagement with places [4]. From this perspective, location-based content should support experiential engagement with places and their meanings, rather than merely guiding users efficiently.

In this study, we focus on a location-based storytelling walking application, *TokoTokoBanashi*, which encourages exploratory urban walking through narratives accessible only at specific locations. Users freely choose which story spots to visit and unlock stories through on-site interactions, enabling non-linear exploration.

In the 2025 deployment of *TokoTokoBanashi*, we extended the application with a co-creative approach in which local residents participated in both story writing and spot selection, whereas in 2024, the content was curated by the developers. This change in content authorship—that is, whether stories and places are developer-curated or resident co-created—may affect how visitors choose spots, move between them, and stay at each place. However, few studies have examined, based on behavioral logs, how such differences in authorship are reflected in actual urban walking behavior.

This study presents a descriptive comparison of two real-world deployments conducted at the Juso Art Festival in Osaka in 2024 and 2025. Based on location and interaction logs, we define indicators of spot selection, movement, and staying behavior, and compare behavioral tendencies between the two deployments. As this study is based on real-world usage logs, we focus on describing how differences in content authorship and related design conditions are reflected in visitors' urban walking behavior, rather than identifying causal effects.

Based on this background, we address the following research questions:

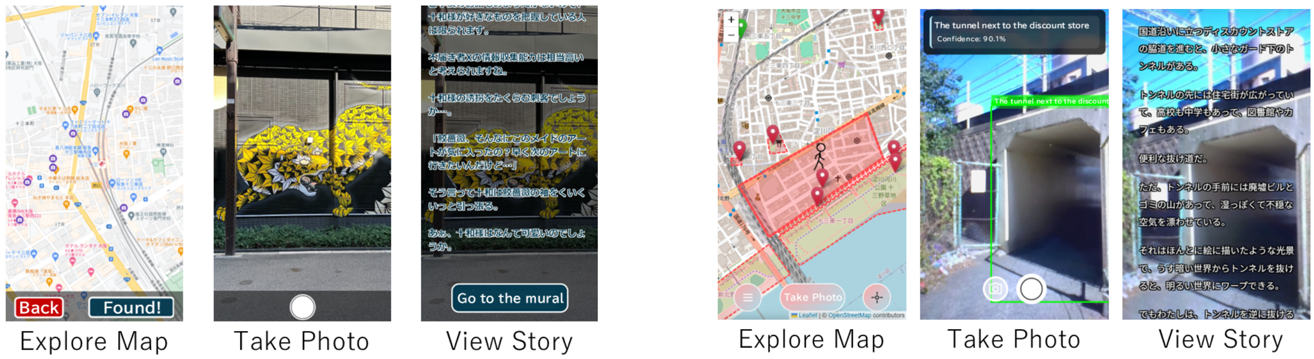
- **RQ1 (Spot Selection):** How are differences in content authorship (developer-curated vs. resident co-created) observed as differences in visitors' spot selection behavior?
- **RQ2 (Walking and Staying Behavior):** How are differences in content authorship observed as differences in visitors' walking and staying behavior?

II. Related Work

A. Location-Based Storytelling and Action-Linked Interaction

Location-aware and gamified applications have been widely used in tourism and urban walking contexts to support engagement and exploration. While gamification can support engagement and learning [1], [2], prior studies point out risks that achievement-oriented designs (e.g., check-ins, missions, badges) can foreground task completion and shift users' attention away from places themselves [3], [4]. These discussions motivate approaches that emphasize interpretation, perception, and experience rather than efficient task completion.

Locative media and location-based storytelling tie narratives to specific places and make being "in place" and moving through space integral to the experience [5], [6]. Such experiences have been conceptualized as trajectories in time and space, with design trade-offs between route-based guidance and roaming-based exploration [7]. Location-gating, as a form



(a) TokoTokoBanashi interface in 2024

(b) TokoTokoBanashi interface in 2025

Fig. 1. Interfaces of the application in the two deployments (2024 and 2025). The basic interaction structure is shared, while some interface feedback differs. The map components are based on OpenStreetMap data © OpenStreetMap contributors and rendered using Leaflet. Key labels are translated into English.

of sensing-based access control, strengthens the coupling between narrative and embodied action by embedding physical conditions into content access [8]. Location-gating and related sensing-based approaches can be interpreted as suggesting that access to narrative content can be tied not only to location but also to users' physical actions. In camera- or recognition-based interaction, access to narrative content often requires embodied actions such as looking, framing, and capturing real-world scenes. This form of camera- or recognition-based interaction can be understood as an instance of augmented interaction [9], in which computational systems support and enhance users' interaction with the real world. This line of work provides a perspective for interpreting movement and staying behavior as reflections of action-linked narrative experiences.

B. Co-Creation and Local Narratives

Co-creative approaches emphasize that experience value is shaped through participation among multiple actors [10]. Residents' narratives and local knowledge can assign meanings to ordinary places and deepen visitors' engagement [11], while participatory destination narratives aim to incorporate local stories rather than relying on top-down branding [12]. These studies suggest that changes in content authorship may alter not only what is told but also how visitors engage with places.

C. Log-Based Evaluation of Visiting, Moving, and Staying

Mobility research has established methods to analyze trajectories and staying behavior using GPS traces, providing foundations for describing visit selection, movement scales, and dwell/stay patterns as behavioral indicators [13]–[15]. Building on these approaches, this study evaluates urban walking experiences by analyzing behavioral logs of visiting, moving, and staying.

D. Positioning of This Study

This study connects (i) critiques of achievement-centered gamification in tourism [3], [4], (ii) location-based storytelling that couples narrative, place, and embodied action [5]–[8], and (iii) co-creation research on residents' narratives [10]–[12]. Focusing on *content authorship* (who writes stories and selects places), we examine how two real deployments (developer-curated vs. resident co-created) are reflected in visitors' spot selection, movement, and staying, using log-based indicators grounded in mobility analysis [13], [14].

III. Application and Deployment

Figure 1 shows the interfaces of *TokoTokoBanashi* in the two deployments (2024 and 2025). *TokoTokoBanashi* is a mobile web application in which users roam among story spots shown on a map and unlock short, self-contained stories by taking photographs on-site. There is no predefined route, and users are free to choose which spots to visit and in what order.

To promote two aspects of user behavior—(1) localized engagement through embodied attention to physical surroundings and (2) exploratory movement across multiple spots—story access was designed to be triggered by on-site photo-taking. Internally, this was achieved using on-device object recognition (YOLOv8) for most spots, with area-based recognition additionally introduced in the 2025 deployment for some locations. Through these mechanisms, story access is coupled with embodied attention to objects and scenery via photographing.

In both years, typical user interaction consisted of repeatedly: (i) consulting the map and walking, (ii) attending to the environment and taking a photo at a chosen spot, and (iii) reading the unlocked story.

The primary difference between the two deployments lies in the content design, which reflects the difference in authorship (developer-curated in 2024 vs. resident co-created in 2025). In 2024, the stories were structured as sequential narratives spanning multiple locations, encouraging users to move from one spot to another. In contrast, the 2025 stories, co-created with local residents, were primarily composed of self-contained, everyday experiences tied to individual locations. As these stories did not assume transitions between spots, they were expected to support more localized engagement rather than continuous movement.

Although the overall system was designed to support exploratory movement, the 2025 deployment prioritized the collection of authentic, resident-authored stories without enforcing structural continuity across locations. As a result, the

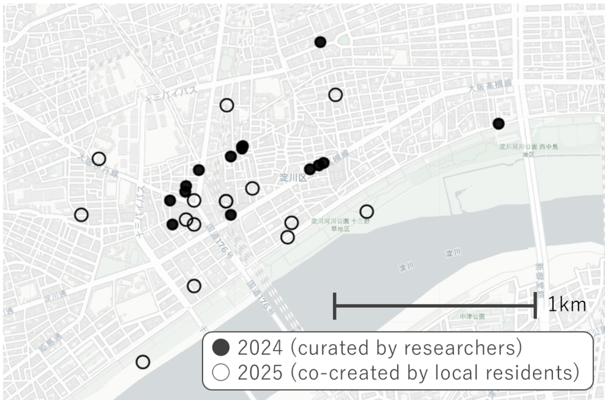


Fig. 2. Spatial distribution of story spots used in the analysis within the Yodogawa area (15 spots per deployment). The base map is based on OpenStreetMap data © OpenStreetMap contributors and rendered using Leaflet.

content design did not explicitly guide users toward inter-spot transitions, potentially weakening the intended exploratory behavior.

Additionally, in the 2025 deployment, visual feedback indicating visited spots was introduced. This feature was intended to make users aware of their progress and potentially encourage further exploration by providing a sense of completion. Although the visual feedback mechanism may resemble collection-based systems such as stamp rallies, the core interaction differs in that access to content is contingent on embodied interaction with physical objects through photo-taking. Such feedback may also introduce completion-oriented behavior, which could influence user exploration patterns.

While minor differences exist in recognition methods and interface feedback, the core interaction flow remained consistent across deployments. Accordingly, the present comparison should be interpreted as a descriptive comparison between two operational cases with differing content designs and implementation conditions, rather than as a controlled experiment isolating a single factor.

These design considerations provide a basis for interpreting user behavior observed in the subsequent sections.

The application was publicly available during the Juso Art Festival in 2024 and 2025 (about ten days each year). Visitors accessed it via a QR code or link and used it in their smartphone browsers without prior registration. Researchers did not provide in-person instructions; thus, the dataset consists of naturally occurring usage logs.

To focus on meaningful urban walking activity, we restrict the analysis to logs recorded within Yodogawa Ward, Osaka, and to the 15 story spots used in each year's deployment, as shown in Figure 2. The resulting user counts were 37 (2024) and 40 (2025).

The primary logs consist of GPS-based location traces and story viewing events (`story_view`). Although `photo_upload` logs, which record photo-taking events, were available in the 2025 deployment, they were not collected in 2024; therefore, visits are operationally defined by `story_view`, which indicates that on-site photo-taking was successfully completed and the corresponding story was unlocked.

Location logs were collected on-device every few seconds, but the server upload scheme differed: batched uploads in 2024 versus periodic uploads in 2025. Due to OS/background constraints and network conditions, the recorded intervals can become sparse, and the 2025 data include more long gaps.

The dataset contains anonymized user IDs and no directly identifying personal information. Technical data such as location and IP addresses were used only for research purposes. For 2025 resident-created stories, consent was obtained during submission, and users could refuse location collection via browser settings.

IV. Analysis Method

This study compares two real-world deployments (2024/2025) without controlling participant attributes or situational conditions. Accordingly, we conduct an exploratory, descriptive analysis rather than causal inference. Our analysis is designed to characterize urban walking experiences from three complementary perspectives: (i) spot selection, (ii) movement between spots, and (iii) staying/engagement near spots.

From raw location and interaction logs, we extract walking sessions representative of each user's activity, construct visit sequences based on realized story views, and compute three groups of indicators: Spot Selection (SS), Walking Behavior (WB), and auxiliary scale metrics (S).

a) Spot Selection (SS1, SS2): Spot selection is evaluated in terms of how many of the target spots resulted in a realized visit. A visit is operationally defined by the occurrence of `story_view`, which indicates that on-site photographing and recognition succeeded and the story was actually accessed. SS1 is the number of visited spots, and SS2 is the unvisited ratio among the 15 target spots used in the analysis:

$$\mathrm{SS1} = |\{\texttt{story\_id} \mid \texttt{story\_view} \text{ occurred}\}| \quad (1)$$

$$\mathrm{SS2} = 1 - \frac{\mathrm{SS1}}{15}. \quad (2)$$

Users with no `story_view` records are assigned $\mathrm{SS1} = 0$ and $\mathrm{SS2} = 1.0$.

b) Walking Behavior (WB1–WB5): Walking behavior is characterized from two aspects: movement between visits and staying near visited spots. WB1 and WB2 describe properties of movement segments between consecutive visits, namely detour ratio and straight-line distance. WB3, WB4, and WB5 describe staying behavior near visited spots, including total staying time, relative staying time (i.e., the proportion of staying time relative to active time), and average staying time per visited spot. Because some metrics can be influenced by a small number of long-stay users, we report medians in addition to means.

c) Auxiliary Scale Metrics (S1–S3): To capture the scale of activity, we compute auxiliary metrics: temporal span and effective active time (S1 series), total travel distance (S2), and

TABLE I

MEANS AND MEDIANS OF THE MAIN BEHAVIORAL METRICS (SS, WB, AND S) WITH SAMPLE SIZES FOR THE 2024 AND 2025 DEPLOYMENTS.

Metric	Unit	Statistic	2024	2025	n_{2024}	n_{2025}
SS1	stories	mean	2.919	1.450	37	40
		median	1.000	1.000	37	40
SS2	–	mean	0.805	0.903	37	40
		median	0.933	0.933	37	40
WB1	–	mean	2.130	1.720	15	7
		median	1.956	1.450	15	7
WB2	m	mean	110.787	177.924	15	7
		median	124.423	164.135	15	7
WB3	min	mean	9.538	6.738	24	18
		median	7.125	3.755	24	18
WB4	–	mean	0.551	0.466	24	18
		median	0.645	0.262	24	18
WB5	min	mean	2.519	3.695	20	15
		median	2.079	3.291	20	15
S2	m	mean	797.033	324.912	37	40
		median	286.140	42.366	37	40
S3	m	mean	327.124	169.414	37	40
		median	79.787	14.782	37	40

Note: Sample sizes differ by metric due to data availability and filtering criteria.

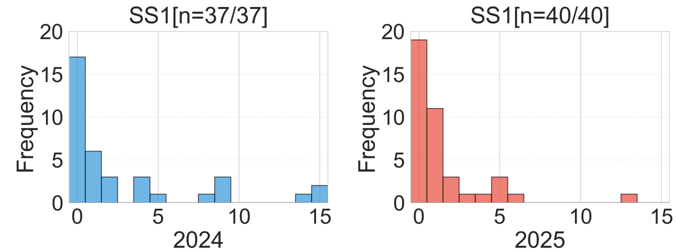


Fig. 3. Distribution of SS1 (number of visited spots) in 2024 and 2025.

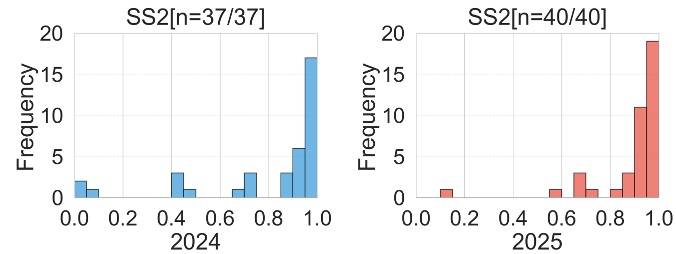


Fig. 4. Distribution of SS2 (unvisited ratio) in 2024 and 2025. Larger values indicate that a larger portion of the target spots remained unvisited.

movement range measured by the bounding-box diagonal (S3). These metrics contextualize SS and WB results in terms of the temporal and spatial scale of use.

A. Data Inclusion and Robustness Considerations

Because reliable estimation of trajectories and stays requires a certain minimum log density, the set of users contributing to each metric differs. SS and scale metrics are computed for all users, whereas WB metrics are computed only when sufficient location logs and/or visit events are available. The exact sample sizes for each metric are reported in the Results section.

The 2024 and 2025 deployments used different schemes for uploading location logs (batched vs. periodic), which can affect log density and missingness patterns. To examine whether such differences strongly affect the results, we conduct a robustness check by downsampling location logs to a fixed temporal interval and recomputing the main WB and S metrics. If the overall tendencies remain similar before and after downsampling, we interpret the year-to-year differences as not being attributable solely to logging-density artifacts.

Finally, visits are defined by `story_view`, i.e., realized viewing of a story. Therefore, physical arrivals that did not lead to successful recognition or viewing are treated as unvisited. In addition, the 2025 deployment introduced area-based gating for some spots, which may affect the realization rate of `story_view`. These specification differences cannot be fully eliminated and should be taken into account when interpreting the results.

V. RESULTS

Table I summarizes representative values (means/medians) of the main metrics with sample sizes. As this is a case comparison based on naturally occurring usage logs, we report observed tendencies rather than causal claims. Sample sizes differ by metric due to data availability. WB1–WB2 are available only for a small subset in 2025 ($n = 7$) and are treated as reference information.

Figures 3 and 4 compare SS1/SS2 distributions. The median SS1 is 1.00 in both years, indicating that visiting only a few spots is dominant. However, the mean SS1 and dispersion are smaller in 2025, and the mean SS2 is higher (Table I), suggesting that visits are more concentrated on a small number of spots per user in 2025.

A. Staying and Behavioral Engagement Near Spots (WB3–WB5)

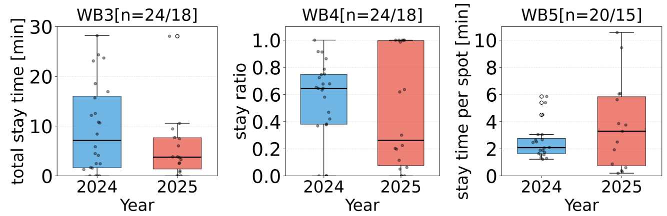
Figure 5 compares staying-related metrics. WB3 (total staying time) and WB4 (ratio of staying time) are lower in 2025, while WB5 (average staying time per visited spot) is higher (Table I). This combination indicates that, although users in 2025 typically visited fewer spots, they tended to allocate relatively longer time to the spots they visited. Movement metrics WB1–WB2 show lower WB1 and larger WB2 in 2025, but they are computed for a small subset in 2025.

B. Movement Scale (S2–S3)

Figure 6 shows that both S2 and S3 are substantially smaller in 2025 (Table I), indicating that the overall movement scale tends to be reduced in 2025. Together with the SS results, this indicates that user activity in 2025 more often remained within a limited spatial range.

C. Robustness Check by Downsampling

To examine the influence of year-dependent log-density differences, we downsampled location logs and recomputed key metrics. Table II shows that the main tendencies of WB3, WB4, S2, and S3 are preserved, suggesting that the



(a) WB3 (b) WB4 (c) WB5

Fig. 5. Distributions of staying-related metrics near story spots in 2024 and 2025. Each dot represents an individual user; boxes indicate median and interquartile range. WB5 is defined only for users with SS1> 0.

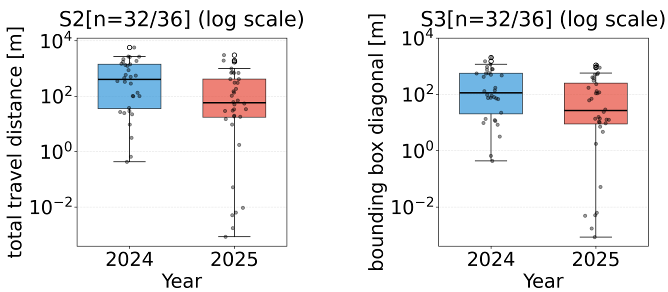


Fig. 6. Distributions of spatial-scale metrics in 2024 and 2025: (left) S2: total travel distance, and (right) S3: movement range (bounding box diagonal). Both plots are shown in log scale due to wide dynamic ranges.

observed year-to-year differences cannot be explained solely by differences in log density.

VI. Discussion

Because this study compares real deployments rather than a controlled experiment, we avoid causal claims and treat the year-to-year differences as composite outcomes of bundled changes (e.g., content authorship, visited-spot visualization, verification schemes, and logging/upload settings).

RQ1 (Spot Selection): within-user concentration of visits. The median of SS1 was 1.00 in both years; however, in 2025, the mean and variance were lower, while the non-visit rate (SS2) was higher. This indicates that each user's actual visits were concentrated on a small number of spots. Many co-created stories focused on everyday, self-contained experiences, vividly depicting local scenes and personal episodes (e.g., scenes in shopping streets or cafes). Such structures do not assume movement to other spots and lack links that prompt subsequent visits, limiting the expansion of visited locations. Thus, in this dataset, the extension of co-creation practices is reflected not in an increase in the number of visits but rather in the redistribution of a limited number of visits.

RQ2 (Staying and engagement): concentration of time allocation near visited spots. Stay-related indicators in 2025 exhibit a contrasting pattern: total and relative stay time (WB3/WB4) decreased, while stay time per visited spot (WB5) increased.

Moreover, we examined the relationship between content length (number of characters) and time spent per visited spot. In 2024, no clear correlation was observed (mean: $r = -0.006$, median: $r = -0.071$), whereas in 2025, a negative correlation trend was observed (mean: $r = -0.63$, median: $r = -0.40$). In both years, long content was not necessarily associated with longer stays, indicating that content length does not directly determine time spent. Thus, the concentration of stay time observed in 2025 is better explained by changes in visiting behavior rather than by an increase in content length.

TABLE II
Comparison of metrics before and after downsampling ($\tau = 10$s) for robustness checking across deployments. Original and downsampled values are computed from the same set of users (i.e., n is identical within each metric).

Metric	Version	Year	mean	median	n
WB3	original	2024	9.54	7.12	24
WB3	original	2025	6.74	3.75	18
WB3	downsampled	2024	9.23	6.91	24
WB3	downsampled	2025	6.74	3.75	18
WB4	original	2024	0.55	0.64	24
WB4	original	2025	0.47	0.26	18
WB4	downsampled	2024	0.55	0.63	24
WB4	downsampled	2025	0.47	0.26	18
S2	original	2024	797.03	286.14	37
S2	original	2025	324.91	42.37	40
S2	downsampled	2024	663.85	209.62	37
S2	downsampled	2025	323.87	41.58	40
S3	original	2024	327.12	79.79	37
S3	original	2025	169.41	14.78	40
S3	downsampled	2024	318.10	75.34	37
S3	downsampled	2025	169.23	14.78	40

The qualitative characteristics of stories written by residents provide a complementary perspective for understanding these behavioral tendencies. Many stories in 2024 unfold across multiple locations, often following a narrative structure in which users move between spots to reconstruct a sequence of personal memories evoked by murals. In contrast, many stories in 2025 are self-contained and tied to individual locations, depicting everyday experiences such as walking through the town after moving in, experiences at familiar restaurants, and emotional changes in parks or along riversides. These differences in spatial structure are consistent with the observed differences in behavioral patterns, namely dispersed exploratory movement in 2024 and concentrated localized stays in 2025.

From this perspective, the locally concentrated staying patterns in 2025 (WB5), together with fewer visits (SS1) and reduced movement scale (S2/S3), are consistent with story structures that encourage localized engagement rather than extended exploration. However, WB5 captures only "time spent near spots" and does not allow us to distinguish between reading, observation, resting, or other activities; therefore, it should be interpreted as a difference in behavioral time-allocation patterns rather than direct evidence of internal or psychological engagement. Importantly, this does not imply that co-created content is less engaging, but rather that its effects may manifest in qualitative dimensions not directly observable in behavioral logs. Mobility metrics (WB1/WB2) suggest a tendency toward more direct movement across fewer visits, but they are computed for a small subset in 2025 and are intended only as reference information.

Contribution of this study. Taken together, the results suggest that evaluating co-created storytelling solely by quantitative expansion (e.g., more visits or larger movement ranges) can be misleading, as it fails to distinguish qualitative differences in experience, such as "visiting many spots with short stays at each" and "visiting fewer spots with longer stays at specific locations." Therefore, we adopt a framework that captures the breadth of visits and the concentration of staying by combining multiple indicators: (i) visit breadth (SS1/SS2), (ii) local time allocation near visited spots (WB5 alongside WB3/WB4), and (iii) overall movement scale (S2/S3). The contribution of this study lies in presenting a framework that enables the description and comparison of qualitative differences in experience from multiple perspectives—often overlooked in evaluations based on quantitative expansion.

Note that this result is influenced by implementation conditions: it may involve multiple intertwined design and implementation changes, including the partial introduction of area-based gating. Also, behavioral logs do not directly capture meaning-making processes, making it difficult to isolate the effects of authorship. Future work should incorporate complementary data and stepwise validation to more clearly distinguish the effects of authorship from those of other design factors.

VII. Conclusion

This study presented an exploratory analysis of how differences in design and operational conditions—including a shift in content authorship (2024: developer-curated; 2025: resident co-created)—were reflected in visitors' urban walking behavior. The analysis was based on behavioral logs from two deployments of the location-based storytelling application *TokoTokoBanashi* at the Juso Art Festival.

To address RQ1 and RQ2, we used metrics capturing spot selection, staying and engagement near spots, and overall activity scale. In both years, most users visited only a small number of spots; however, visits in 2025 were more strongly concentrated within individuals. While total and relative staying time decreased in 2025, staying time per visited spot increased, suggesting a shift toward more locally concentrated time allocation. The overall movement scale was also smaller in 2025, indicating a contraction of the experience scale. These tendencies remained consistent despite differences in logging specifications, as confirmed by downsampling-based checks.

Nevertheless, this comparison does not isolate the effect of authorship alone, but should be understood as a descriptive comparison of two operational cases that also differ in bundled design and implementation conditions.

This study demonstrates that differences in content design and associated design conditions are associated with distinct behavioral patterns of visiting, staying, and moving. These patterns can be interpreted as reflecting a shift toward more localized engagement rather than exploratory movement. These findings suggest that design choices in location-based storytelling systems can shape how users explore and engage with urban spaces.

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