

TRANSPORT FINDINGS

The Disparity in Transit Travel Time between Koreans and Japanese in 1930s Colonial Seoul

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Findings

Transportation is a key element to understanding the socio-spatial structure of colonial cities and the lives of individuals living under colonial governance. This study investigates the disparity in transit-based travel time between colonial rulers (Japanese) and subjects (Koreans) in Colonial Seoul (*Keijo*) in 1936 using modern GIS and open-source transport analysis tools. Findings suggest a significant disparity in travel time to a major urban facility (i.e., City Hall) between the two population groups of the largest colonial city in the Korean peninsula.

1. Questions

Transport is a key element to understanding the socio-spatial structure of urban areas (Kawabata and Shen 2006). However, a nuanced understanding of transport geography and planning in colonial cities has been limited due to the lack of integrated research methods such as digital humanities (e.g., Donnellan 2019). Most previous studies on transport in colonial cities have adopted solely qualitative approaches, such as content analysis of historical newspaper articles (e.g., Hazareesingh 2001). Recent advancements in digital technologies and open-source analysis tools provide unprecedented opportunities for researchers to understand transport in the distant past.

This study aims to demonstrate the capabilities of GIS and transport analysis toolkits for understanding the disparity in transit-based travel time between Koreans (i.e., colonial subjects) and Japanese (i.e., colonial rulers) in Colonial Seoul (officially *Keijo* by the Japanese Governor-General of Colonial Korea) in 1936.

Specifically, we ask the following two research questions:

- How can we use GIS and transport analytics tools to measure transit-based travel time in Colonial Seoul (*Keijo*)?
- How does transit-based travel time differ between Japanese (colonial rulers) and Koreans (colonial subjects)?

Answering these questions would significantly contribute to the literature of colonial cities by providing broader insights into disparities in travel time via public transit networks.

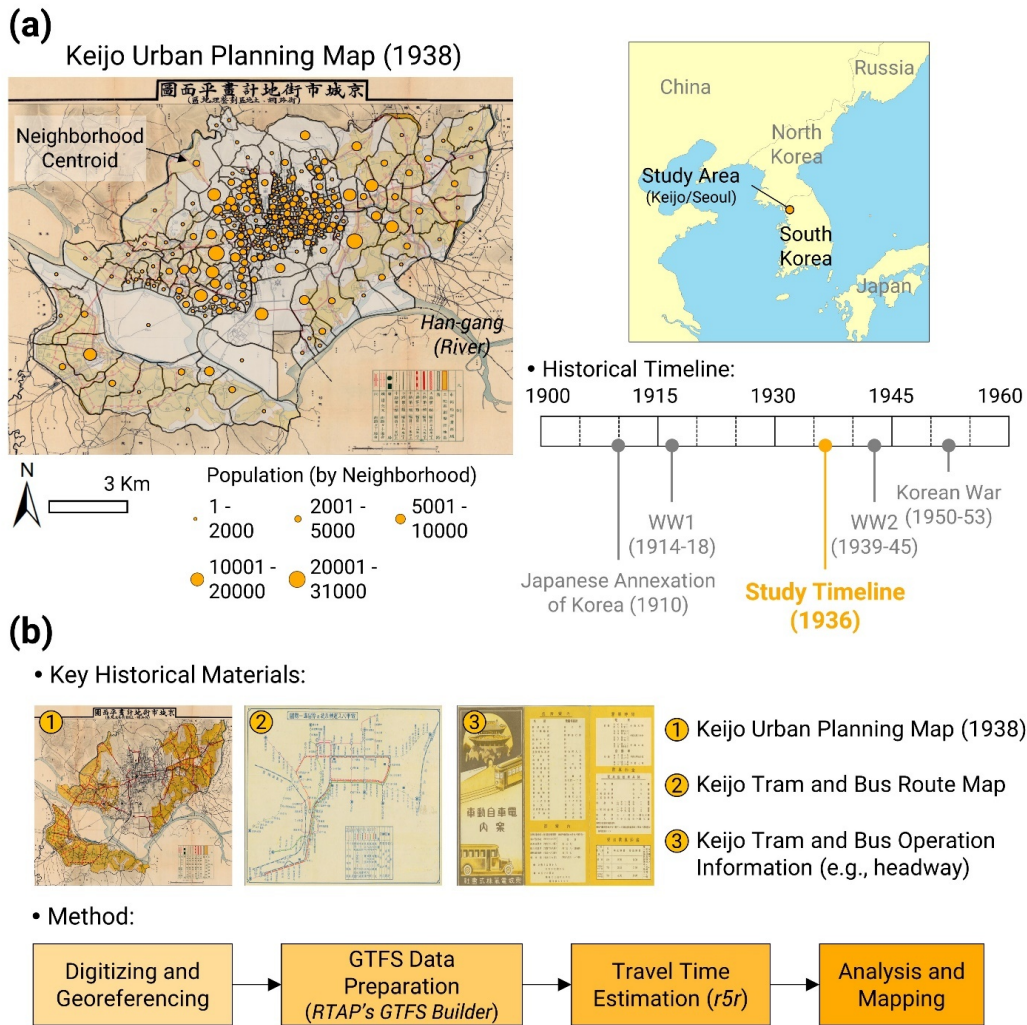


Figure 1. (a) Study area and timeline; (b) Key historical materials and research design.

Note: *Keijo* indicates Colonial Seoul.

2. Methods

We focused on *Keijo* in 1936 (Figure 1) when it was experiencing a massive expansion of its administrative boundaries and explosive population growth. Serious transport issues (e.g., congestion) began in the early 1930s as the number of transit passengers increased dramatically and Japanese monopolized the supply and operation of the public transport system of *Keijo* (e.g., Choi and Kim 2013).

Two main data sources were used for generating 1) administrative boundaries and 2) public transit networks. First, we georeferenced *Keijo Urban Planning Map* (1938) and *The Map of Greater Keijo* (1936) to digitize the administrative boundaries of 258 neighborhoods (called “Dong”) in the study area. We also used the *Keijo Occupational Census* dataset, surveyed in 1936, to populate the digitized administrative units. The total number of Koreans is 541,737, and that of Japanese is 126,673. These datasets were provided by Seoul Museum of History and the National Library of Korea.

Next, in order to construct the public transit network of *Keijo*, we first digitized the *Keijo Tram and Bus Route Map* (mid-1930s), integrated transit schedule information to the digitized network, and finally generated a General Transit Feed Specification (GTFS) dataset for the city of *Keijo*. We used the National Rural Transit Assistance Program (RTAP) GTFS Builder to build the GTFS dataset (U.S. Department Transportation 2021).

Using the GTFS dataset as a basis, we leveraged an open-source transport analysis tool – *r5r* R-package (Pereira et al. 2021)– to estimate total transit travel times as well as out-of-vehicle walking/waiting times, which are important factors for measuring transit-based accessibility (Kim and Lee 2019; Lee and Miller 2020). We also used the *r5r* toolkit to measure variances in travel times from each neighborhood unit to City Hall within a two-hour time window (6-8 AM). *r5r* computed travel times from centroids of 258 neighborhood to City Hall at 6 AM and every minute for 2 hours after. The maximum walking distance was assumed as 3,500 meters, according to the maximum distance between each centroid to the nearest tram or bus station. Travel times retrieved at different points (e.g., 5-percentile, 95-percentile) of the distribution were used to assess each neighborhood’s travel time variation.

3. Findings

Figures 2(a) and **(b)** illustrate the Korean-Japanese population ratio and total travel times, respectively. Note that 27 trips were excluded as they were not made by transit (i.e., walking only). **Figure 2(a)** also highlights that, after the Japanese Annexation of Korea in 1910, most new public transit systems (black lines) in *Keijo* were added to support Japanese people’s mobility. Specifically, added route-meter-per-population of Korean and Japanese populations are 0.21 and 0.72, respectively. **Figures 2(c)** and **(d)** illustrate the out-of-vehicle walking and waiting times, respectively. The higher out-of-vehicle walking time indicates that people walked longer distances to/from the stations. The higher out-of-vehicle waiting time indicates that public transit services were less frequent. Welch’s *t*-tests were conducted to examine whether there were significant differences in these travel time variables between Japanese- and Korean-dominant neighborhoods (**Table 1**). Results indicate that the averages of total travel time, out-of-vehicle walking time, and out-of-vehicle waiting time were significantly higher for Koreans than for Japanese, demonstrating disparities in transit-based travel time between the two population groups.

Figure 3(a) is an isochrone of the total travel time to City Hall. It demonstrates that southern *Keijo* had shorter travel times (i.e., better access) to City Hall (compared to other areas at a similar distance). This is because Japanese rulers had settled in these areas and built new tram lines to meet their mobility needs.

Figure 3(b) illustrates the variations in travel time from each neighborhood to City Hall within the 6-8 AM time window. A longer vertical bar indicates a higher variation in travel time from a neighborhood to the destination at the

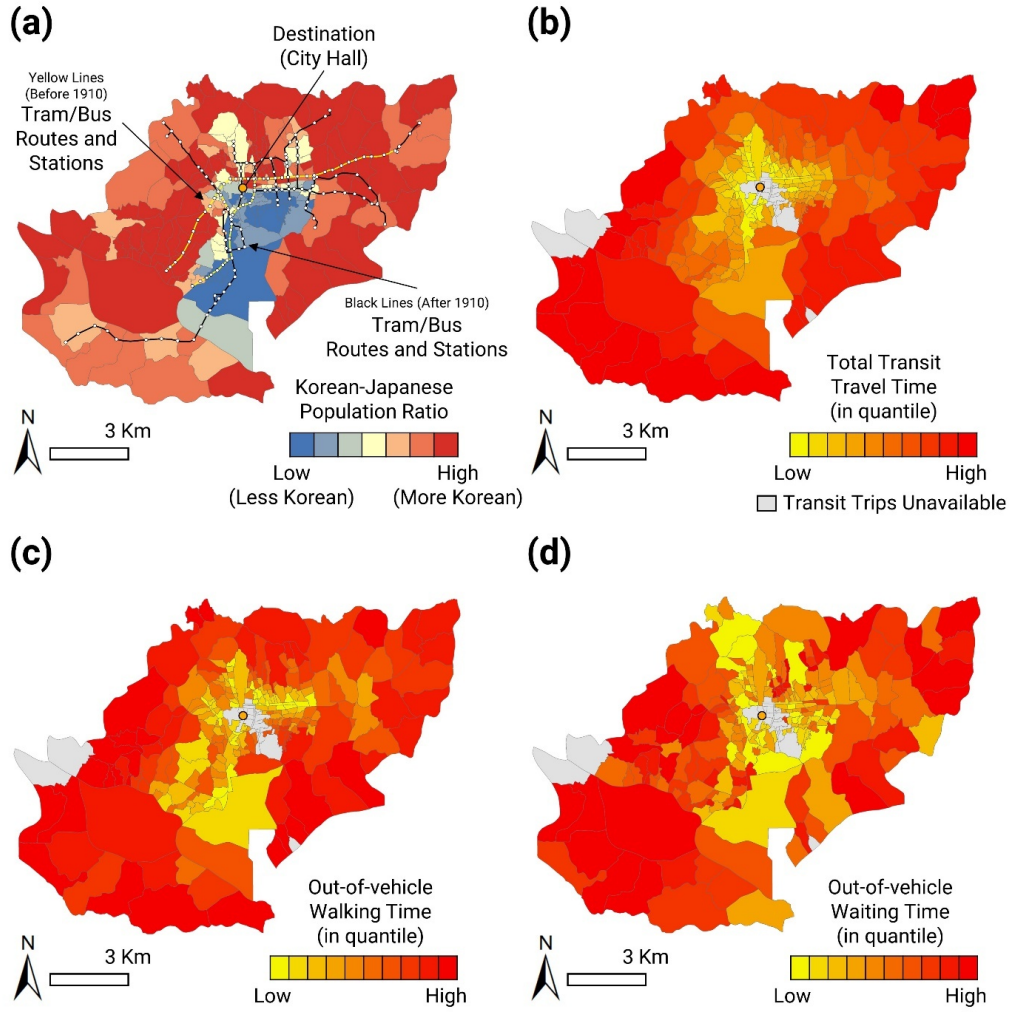


Figure 2. (a) Korean-Japanese population ratio; (b) total travel time; (c) out-of-vehicle walking time; (d) out-of-vehicle waiting time.

Table 1. Comparison of total travel times and out-of-vehicle walking/waiting times between Japanese- and Korean-dominant neighborhoods.

		Total Travel Time	Walking Time	Waiting Time
Japanese-dominant Neighborhood (n=42)	Mean (min)	22.458	14.083	2.446
	SD	7.429	7.920	1.566
	Min (min)	8.750	1.850	0.033
	Max (min)	44.383	38.850	6.050
Korean-dominant Neighborhood (n=189)	Mean (min)	36.006	19.889	4.376
	SD	21.058	14.393	3.478
	Min (min)	7.750	1.933	0.000
	Max (min)	91.783	59.767	32.283
Welch's <i>t</i> -test		***	***	***

Note: *** denotes $p < 0.001$.

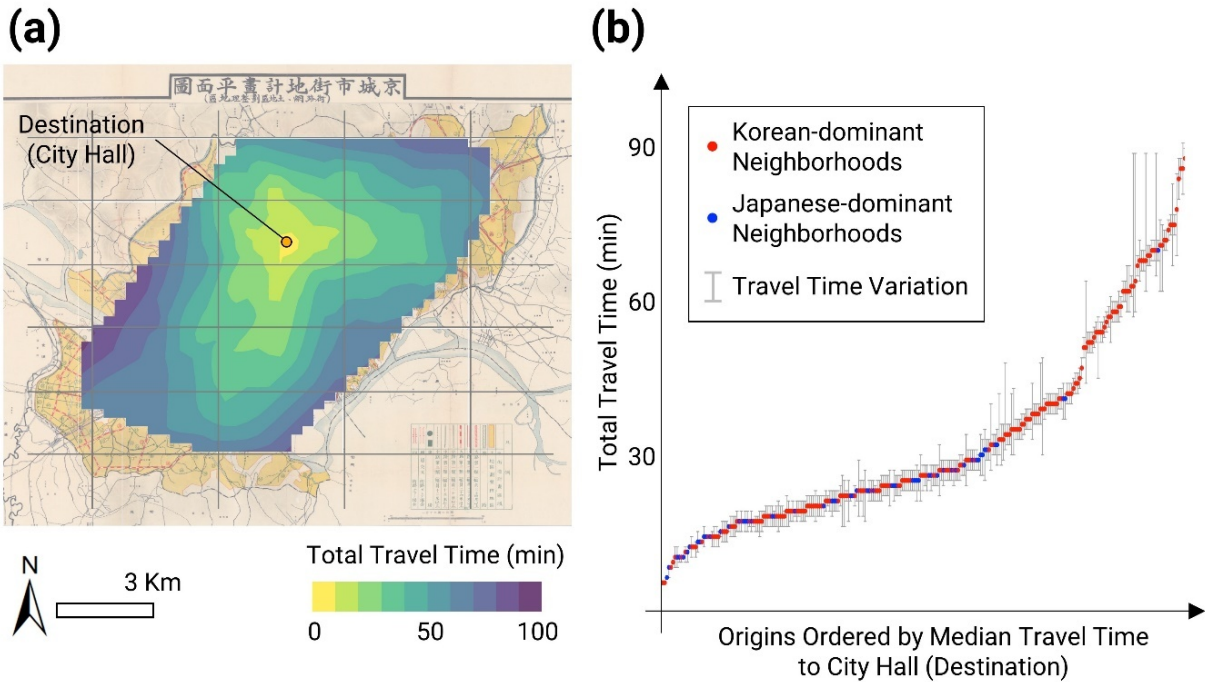


Figure 3. (a) Isochrone of total travel time to City Hall; (b) Travel time variation of Korean-dominant and Japanese-dominant neighborhoods.

Table 2. Mean travel time variance of Japanese- and Korean-dominant neighborhoods.

	Mean of travel time variance (min)	Median of travel time variance (min)
Japanese-dominant Neighborhood (n=42)	3.29	4
Korean-dominant Neighborhood (n=189)	5.50	4
<i>t</i> -test	***	-

Note: *** denotes $p < 0.001$.

given time window. This figure demonstrates that the travel time variations of Korean-dominant neighborhoods (red dots) are generally larger than those of Japanese-dominant neighborhoods (blue dots).

The mean travel time variance of Korean- and Japanese-dominant neighborhoods is 5.50 and 3.29 minutes, respectively (Table 2). The *t*-test confirms that the mean of travel time variance is significantly higher for Koreans than for Japanese.

Overall, our findings demonstrate the significant disparity in transit-based travel time between colonial rulers and subjects. Although previous qualitative studies reported similar results (e.g., Choi 2010; Kim 2007), their findings did not provide a more comprehensive understanding of colonial cities' transport issues, such as the disparity in travel time. Our research fills the gap by providing a broader yet more detailed picture of historical public transit issues

using GIS and open-source transport analysis tools. Our findings also manifest the significant potential of digital humanities methods for understanding historical urban transport issues, especially in colonial cities around the globe.

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