Social Inclusion
2026 • Volume 14 • Article 11557
https://doi.org/10.17645/si.11557

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Open Access Journal

Does Telework Make People Experience More Segregation in Daily Activity Spaces?

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Submitted: 20 October 2025 **Accepted:** 9 January 2026 **Published:** 9 March 2026

Issue: This article is part of the issue "Digital Transition and New Forms of Spatial Inequality" edited by Tiit Tammaru (University of Tartu), Kadi Kalm (University of Tartu), and Rūta Ubarevičienė (Lithuanian Centre for Social Sciences), fully open access at https://doi.org/10.17645/si.i468

Abstract

Telework reshapes daily mobility, but its implications for lived social exposure remain underexplored. This study examines whether and how telework affects experienced racial segregation by integrating socioeconomic characteristics, built-environment context, and activity–travel behavior in a structural equation modeling analysis. Using pooled cross-sectional data from the Puget Sound Regional Travel Surveys (2017, 2019, 2021), we distinguish residential segregation (home census block group) from experienced segregation measured across non-work activity destinations using an entropy-based index of multi-group racial diversity. Results show that telework is associated with an increase in experienced racial segregation, primarily through mobility reorganization: Telework increases non-work activity participation but reduces the spatial extent of daily activity spaces, and the localization effect dominates. Residential segregation remains a strong baseline determinant, yet telework contributes additional exposure differences beyond the residential context. Telework adoption is structurally patterned by socioeconomic and built-environment conditions, while density and accessibility shape exposure indirectly via activity behaviors. These findings imply that telework policy is not socially neutral; hybrid arrangements and compact, mixed-use, amenity-rich environments may mitigate telework-related exposure segregation.

Keywords

activity space; mobility; segregation; telework; travel behavior

1. Introduction

Understanding how people encounter—or avoid—social diversity in everyday life is central to debates on urban inequality and spatial justice. Yet segregation research has long been dominated by residential measures derived from static census geographies. This perspective can miss an important dimension of social separation: Individuals are mobile, and their lived exposure to (non-)diversity is produced not only where they live, but also where they routinely go and spend time. Building on time–geographic and mobility-based scholarship, we conceptualize experienced segregation as the degree of social diversity embedded in the set of places individuals visit during daily life (Farber et al., 2015; Wong & Shaw, 2011). Prior work shows that activity spaces can either mitigate or reproduce segregation, depending on how urban opportunities and mobility constraints shape daily routines.

A major post-pandemic transformation with the potential to restructure such exposure is telework. Remote and hybrid work reduces or eliminates routine commuting, alters time budgets, and reorganizes daily activity scheduling. A growing literature documents telework's implications for travel demand (e.g., reduced peak-hour travel and fewer commute trips), but far less is known about its consequences for social exposure through everyday mobility. Telework may contract activity spaces and increase reliance on nearby destinations, which could heighten experienced segregation when surrounding neighborhoods are socially homogeneous. At the same time, telework could also increase temporal flexibility and enable engagement with a wider range of destinations. Whether telework ultimately increases or decreases experienced segregation is therefore an empirical question that depends on the opportunity landscape and individuals' activity–travel responses.

This study addresses this gap by examining whether and how telework is associated with experienced racial segregation in daily activity spaces, and through which behavioral pathways this relationship operates. Focusing on the US context—where racial segregation remains spatially and historically salient—we operationalize experienced segregation using a multi-group entropy-based index that captures the racial diversity of the places individuals encounter through their everyday activities. By conceptualizing segregation as an exposure outcome rather than an individual attribute, the analysis centers on how telework-induced changes in daily activity behavior—such as activity frequency and spatial extent—translate into systematic differences in exposure to racial diversity across urban environments.

Empirically, we use travel-survey data from the Puget Sound region (three pooled cross-sectional waves: 2017, 2019, and 2021) to measure both residential segregation (home census block group) and experienced segregation (the set of non-work activity destinations visited). We estimate a structural equation model that treats telework as an intermediate mechanism linking socioeconomic characteristics and built-environment context to two key activity-behavior dimensions—activity frequency and spatial extent—and, ultimately, to experienced segregation. This approach allows us to quantify both direct and mediated pathways, while keeping the residential context conceptually distinct from mobility-based exposure.

The contribution of this article is twofold. First, it advances mobility-based segregation research by explicitly linking experienced segregation to a major contemporary shift in work organization—telework—rather than treating activity-space segregation as a descriptive outcome alone. Second, it provides an integrated behavioral account of how telework reshapes exposure through changes in daily activity participation and travel range, net of residential segregation, socioeconomic characteristics, vehicle ownership, and built environment.

The remainder of the article is structured as follows. Section 2 reviews research on experienced segregation and telework-related mobility change. Section 3 describes the study area, data, and variables. Section 4 presents the segregation measurement and SEM approach. Section 5 reports results. Section 6 discusses theoretical and policy implications and outlines directions for future research.

2. Literature Review

2.1. Experienced Segregation in Daily Life

Segregation is increasingly understood as a mobility-based and multi-contextual phenomenon, shaped not only by where people live but also by where they routinely go in daily life. In contrast to traditional residential measures derived from static census geographies, experienced segregation (or activity-space segregation) captures the degree of social diversity individuals encounter across the locations they access through everyday activities (Farber et al., 2015; Wong & Shaw, 2011). This perspective is behavior-based and exposure-oriented, reflecting daily mobility patterns rather than a single residential context, and offering a more direct lens on lived social separation. Empirical studies consistently show that activity spaces are often socially homogeneous—even in residentially diverse regions—because daily mobility is structured by time constraints, uneven opportunity distributions, and selective destination choices (Farber et al., 2015; Müürisepp et al., 2022; Wang et al., 2016). As a result, experienced segregation may either mitigate or reinforce residential segregation, depending on how mobility expands or constrains exposure. These findings highlight that the relationship between residential and activity-space segregation is context-dependent rather than deterministic. Methodological advances using travel surveys, GPS tracking, and mobile phone data have enabled increasingly fine-grained measurement of such exposure, while also underscoring that experienced segregation is sensitive to how exposure is defined and weighted (Pereira et al., 2019).

2.2. Telework and Daily Activity–Travel Behavior

Telework represents a major transformation in the organization of daily activities and travel. By reducing or eliminating routine commuting, telework alters time constraints, scheduling flexibility, and destination needs. Existing research consistently documents reductions in commute trips and peak-period travel (Mokhtarian & Salomon, 1997; Ory & Mokhtarian, 2006), but its effects on non-work travel are more mixed. Some studies find overall reductions in mobility, while others observe substitution and rescheduling effects, whereby time saved from commuting is reallocated to discretionary or maintenance activities (de Abreu e Silva & Melo, 2018; Zhu, 2012). Telework adoption is also socially stratified, strongly associated with occupation, income, education, and access to digital infrastructure. Consequently, its mobility impacts are heterogeneous and embedded within broader socioeconomic and urban contexts, with implications that extend beyond travel demand alone.

2.3. Telework as a Mechanism Reshaping Experienced Segregation

By reorganizing daily mobility, telework has direct implications for experienced segregation. The removal of routine access to centralized and potentially diverse workplaces may contract activity spaces and increase reliance on nearby destinations, thereby amplifying exposure to socially homogeneous environments—particularly in segregated residential contexts (Elldér, 2020; Mouratidis & Peters, 2022). At the same time,

increased temporal flexibility may enable more discretionary mobility and access to a wider range of environments, depending on local opportunity structures and individual mobility resources. Despite these conceptual links, empirical evidence remains limited. Telework studies rarely examine exposure-based outcomes, while activity-space segregation research has seldom treated telework as a central mechanism reshaping daily exposure. It therefore remains unclear whether telework increases, decreases, or redistributes experienced segregation, and through which behavioral pathways. This study addresses this gap by examining how telework influences experienced segregation through changes in activity frequency and spatial extent, while accounting for residential context, socioeconomic characteristics, and the built environment.

3. Research Data

This study uses data from the Puget Sound Region Travel Surveys collected between 2017 and 2021. The Puget Sound region in Washington State—covering the King, Kitsap, Pierce, and Snohomish counties and including the city of Seattle (Figure 1)—is home to over 4 million residents and 1.5 million households. The survey provides detailed information on individual and household sociodemographics, geographic context, and daily travel behavior, including trip frequency, travel time, and mode choice. A stratified sampling design was used, with recruitment quotas by county, household characteristics, and demographic composition, and survey weights were applied to align the sample with American Community Survey population benchmarks. The survey oversampled block groups with policy-relevant characteristics, including low-income households, zero-vehicle households, non-auto commuters, and younger households. In this study, we focus on working individuals who either commute or telework.

Figure 1. Spatial distribution of sampled households in the Puget Sound region.

The US provides an analytically salient context for examining experienced segregation given its persistent patterns of racial and spatial inequality. Within this setting, the Puget Sound region offers a particularly informative case. The region combines substantial sociodemographic heterogeneity, mixed land use, and a highly polycentric urban structure, generating meaningful variation in daily activity spaces. Its economy is

strongly oriented toward technology- and knowledge-intensive industries, where telework is both feasible and prevalent. At the same time, pronounced racial and socioeconomic divides—such as those between more diverse, lower-income areas in South Seattle and South King County and wealthier, predominantly White suburban areas in the northern suburbs and Eastside cities—reflect long-standing patterns of housing inequality, income stratification, and uneven transit access. These regional characteristics provide critical context for interpreting how telework reshapes daily mobility and experienced segregation.

The dependent variable is racial segregation, operationalized in two forms: residential segregation and mobility-based experienced segregation, both measured using an entropy-based index. Residential segregation is calculated from the racial composition of an individual's home census block group, capturing the immediate residential social environment (the choice of spatial unit and MAUP [modifiable areal unit problem] considerations are discussed in Appendix A in the Supplementary File). Experienced segregation is derived from the racial diversity of all census block groups visited during daily activities, reflecting exposure beyond the residential context. Together, these measures enable a direct comparison between static residential segregation and dynamic, mobility-based social exposure (see Figure 2 and Section 4.1).

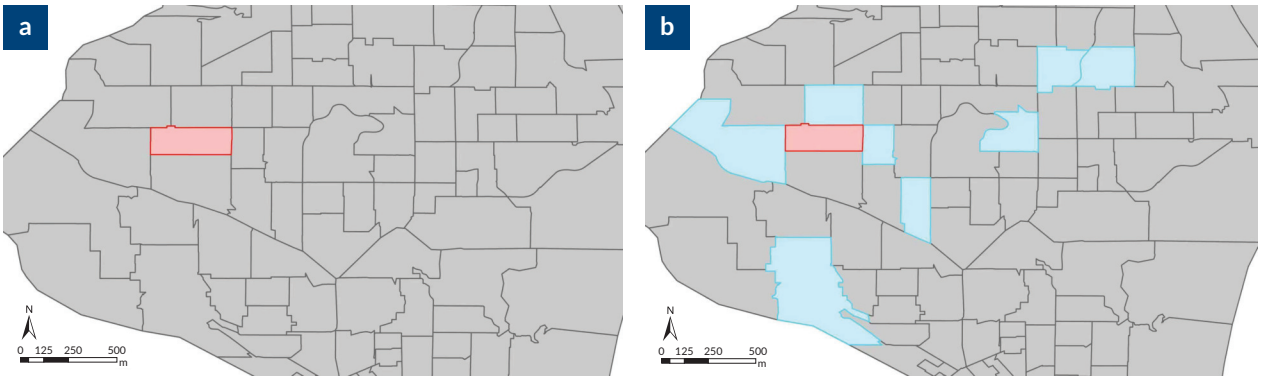

Figure 2. Illustrations of individuals' home neighborhoods and visited activity spaces: (a) residential neighborhoods; (b) visited non-work activity spaces. Notes: The red region is the census block group of people's home address, and the blue regions are the neighborhoods that people visited for their daily activities; work-related activities are excluded, as they typically involve fixed destinations and limited personal choice, whereas non-work trips better reflect voluntary engagement with diverse social environments.

Explanatory variables include built-environment characteristics and individual, socioeconomic, demographic, and household factors. The inclusion of built-environment variables is motivated by the extensive literature demonstrating their role in shaping activity participation and travel behavior. Telework, as a form of activity organization, is embedded within the surrounding urban context rather than an isolated behavioral choice. We adopt the 5D built-environment framework—Density, Design, Diversity, Distance to transit, and Destination accessibility—to capture key spatial attributes in a parsimonious manner. Rather than modeling direct effects on segregation, the analytical framework emphasizes indirect pathways, whereby the built environment influences telework adoption and activity behavior (activity frequency and spatial extent), which in turn shape experienced segregation. Descriptive spatial distributions of the 5D measures are provided in Appendix B in the Supplementary File.

Individual- and household-level data are drawn from the Puget Sound Regional Travel Survey, while built-environment indicators are compiled from multiple external sources, including the Environmental Protection Agency Smart Location Database, OpenStreetMap, the General Transit Feed Specification data,

and regional land-use datasets. All built-environment variables are aggregated to the census block group level to ensure spatial consistency with the survey data. Table 1 reports variable definitions and descriptive statistics for the segregation outcomes, activity measures, and explanatory variables (including the 5D built-environment indicators), by telework status.

Table 1. Variable definition and descriptive statistics.

		Teleworker	Non-teleworker	Full sample
		(*n* = 2,473)	(*n* = 8,962)	(*n* = 23,794)
Endogenous variables				
Residential segregation	Residential race segregation index	0.40	0.40	0.41
Experienced segregation	Experienced race segregation index	0.37	0.35	0.37
Radius of activities	The average distance of non-work daily activities (km)	4.72	5.72	5.72
Number of activities	The frequency of non-work daily activities per day	2.73	2.27	2.70
Independent variables				
Socioeconomic variables				
Age	16–34	37%	48%	36%
	35–54	48%	40%	31%
	55+	16%	12%	34%
Gender	Male	46%	51%	48%
	Female	53%	49%	52%
Household income	Under $49,999	15%	17%	19%
	$50,000–$99,999	24%	29%	27%
	$100,000 or more	61%	53%	54%
Vehicle ownership	Yes	87%	86%	87%
	No	13%	14%	13%
Racial ethnicity	White	75%	77%	81%
	African American	3%	3%	2%
	Asian	17%	15%	13%
	Hispanic	5%	5%	4%
Built-environment variables (census block group level)		Teleworker	Non-teleworker	Full sample
		(*n* = 849)	(*n* = 1,231)	(*n* = 2,926)
Density	Population density (1,000 persons/km^2)	5.90	6.67	5.76
Design	Intersection density (100 counts/km^2)	0.72	0.78	0.71
Diversity	Land-use entropy [a] normalized	0.77	0.79	0.76
Destination accessibility	Job accessibility (10^5 jobs reached by public transit within 45 minutes)	3.46	3.73	3.33
Distance to transit	Transit service frequency (100/within a 0.25-mile [approximately 400 meters] buffer of the CBG boundary)	0.92	0.96	0.87

Notes: For the calculation of the entropy index, please refer to Section 4.1; CBG = census block group.

4. Methodology

4.1. Entropy-Based Segregation Index

To measure experienced segregation in individuals' activity spaces, we employ an entropy-based diversity index. This measure is particularly suitable for the present study because it captures multi-group social diversity across individuals' visited locations, rather than focusing on pairwise relations between specific social groups. Moreover, entropy-based indices have been widely applied in prior research on experienced and exposure-based segregation, facilitating comparability with existing studies. Alternative segregation measures, such as isolation, exposure, and dissimilarity indices, are also commonly used in the literature. However, these measures are typically designed to capture pairwise group interactions or residential sorting patterns and are therefore less well suited for assessing overall diversity within multi-group activity spaces. While exposure-based indicators (e.g., exposure-to-nonself indices) can provide valuable insights into specific intergroup exposure dynamics at the individual level, we adopt the entropy-based index as our primary measure given the study's focus on overall experienced diversity. Future research may complement this approach by incorporating exposure-based measures to examine more fine-grained intergroup exposure processes.

To measure entropy index, the entropy value (H) is calculated by summing the negative product of the proportion of each racial group (p_i) and the logarithm of that proportion across all k racial groups (Equation 1). This value reflects the level of diversity: Higher entropy indicates greater racial mix. To standardize the measure across contexts with different numbers of racial groups, the entropy is normalized (H_{norm}) by dividing by the maximum possible entropy ($\log(k)$; Equation 2). Finally, the segregation index is derived as 1 minus the normalized entropy ($1 - H_{\text{norm}}$), such that values close to 0 indicate low segregation (high diversity), while values close to 1 indicate high segregation (low diversity or racial homogeneity; Equation 3). This index can be applied to both residential neighborhoods and visited activity spaces to assess segregation in static and dynamic contexts:

$$H = -\sum_{i=1}^{k} p_i \log(p_i) \quad \text{(Equation 1)}$$

where k: number of groups (e.g., racial categories); p_i: proportion of group i in the observed population (e.g., population from group i among all population); the logarithm is typically base 2 (for bits) or base e (natural log).

$$H_{\text{norm}} = \frac{H}{\log(k)} \quad \text{(Equation 2)}$$

$H_{\text{norm}} \in [0, 1]$, where 0 indicates complete segregation (only one group present), and 1 indicates maximum diversity (all groups equally represented).

$$\text{Segregation Index} = 1 - H_{\text{norm}} \quad \text{(Equation 3)}$$

where 0 represents no segregation (full diversity), and 1 represents full segregation (only one group present).

4.2. Structural Equation Modeling

Structural equation modeling (SEM) allows for the simultaneous estimation of multiple linked regression equations, often referred to as a "structural" or "path" model, where causal relationships between variables are represented as paths. Variables that are independent of others in the model are termed exogenous, while those serving as predictors in one equation and dependent variables in another are called endogenous. SEM also accommodates "latent" or "unobserved" variables, which are defined by underlying indicators known as manifest variables. The measurement model specifies the relationships between latent variables and their indicators, while the structural model captures the relationships between exogenous and endogenous variables.

SEM can depict both direct effects between variables and indirect effects mediated by other variables, such as the impact of attitudes on travel behavior through residential choice. Understanding SEM results often involves calculating direct and indirect effects. A direct effect occurs when one variable influences another without mediation, while an indirect effect involves mediation by one or more variables. The total effect of one variable on another is the sum of its direct and indirect effects. The standardized total effects are displayed in this study, which means the sum of the direct and indirect standardized effects. Standardized effects illustrate how much one unit change in the standard deviation of an exogenous/endogenous variable can lead to the number of unit changes in another interested endogenous variable.

Figure 3 presents the conceptual framework guiding the SEM, which formalizes how telework reshapes experienced segregation in daily activity spaces through changes in mobility behavior, while accounting for residential context, socioeconomic characteristics, and the built environment. At the core of the framework, experienced segregation (Exp_Seg) is conceptualized as an outcome of both contextual exposure and behavioral exposure. Contextual exposure is captured by residential segregation (Res_Seg), reflecting the social composition of individuals' home neighborhoods. Behavioral exposure is captured through daily activity patterns, measured by the number of non-work activities (Num_act) and the spatial extent of activities (Radius_activity). Telework plays a central mediating role by restructuring these activity behaviors and directly influencing experienced segregation.

Formally, the model specifies the following structural relationships:

$$\text{Exp\_ Seg} = f(\text{Res\_ Seg} + \text{Telework} + \text{Num\_ act} + \text{Radius\_ activity} + \text{Vehicle} + SE + BE)$$

Experienced segregation (Exp_Seg) is modeled as a function of residential segregation (Res_Seg), telework status, activity frequency (Num_act), activity-space extent (Radius_activity), vehicle ownership (Vehicle), socioeconomic characteristics (SE), and built-environment attributes (BE). This specification captures both direct effects (e.g., telework directly altering exposure) and indirect effects operating through mobility behavior and transport resources.

$$\text{Telework} = f(\text{Vehicle} + SE + BE)$$

Telework adoption is modeled as an endogenous behavior shaped by vehicle ownership, socioeconomic status and the built environment. This reflects well-documented structural inequalities in access to telework opportunities and the role of urban context in enabling or constraining remote work.

$$\text{Num\_act} = f(\text{Telework})$$

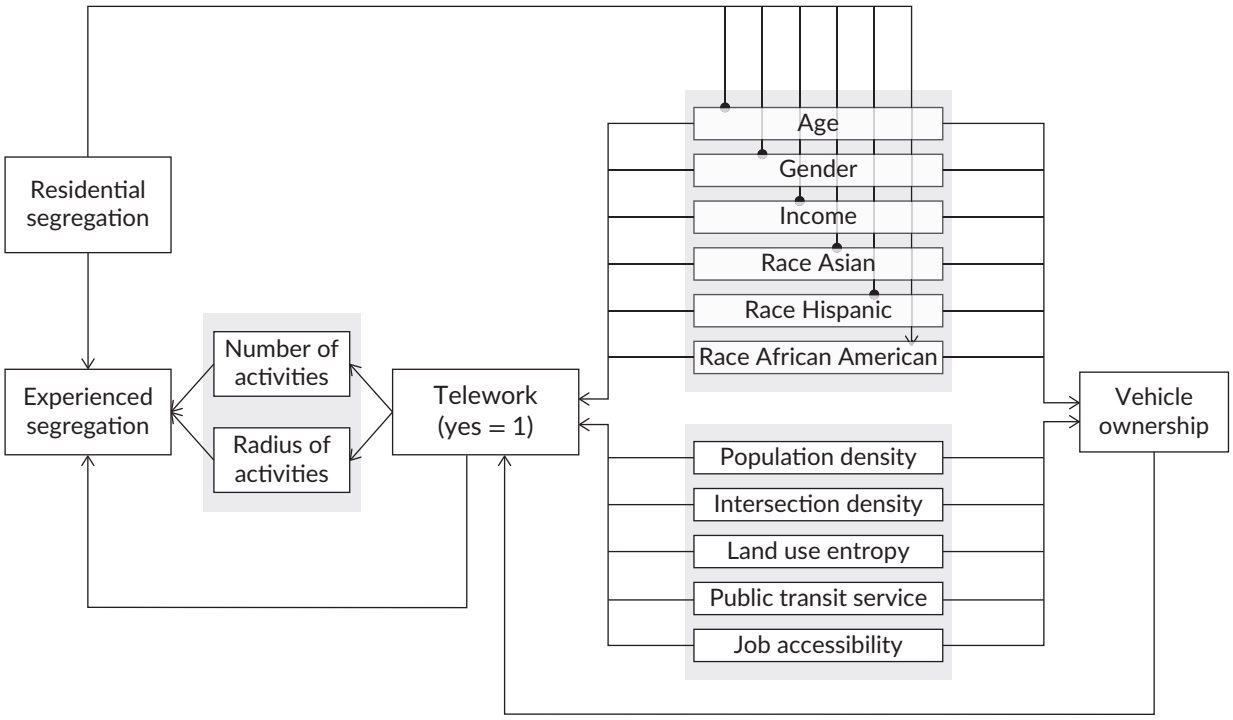

Figure 3. Research framework of the SEM model construct. Note: Each arrow in the figure represents a hypothesized directional relationship between two variables, where the variable at the tail of the arrow serves as the explanatory variable and the variable at the arrowhead represents the outcome.

The number of non-work activities is specified as a function of telework, capturing how remote work reorganizes daily activity participation by reducing time constraints associated with commuting and reshaping discretionary travel.

$$\text{Radius\_activity} = f(\text{Telework})$$

The spatial extent of daily activity spaces is modeled as a function of telework, reflecting the contraction or localization of mobility patterns when routine commuting is reduced or eliminated.

$$\text{Vehicle} = f(SE + BE)$$

Vehicle ownership is modeled as a function of socioeconomic characteristics and the built environment, acknowledging that access to private vehicles is jointly shaped by individual resources and urban form (e.g., density, transit provision).

$$\text{Res\_Seg} = f(SE)$$

Residential segregation is specified as a function of socioeconomic characteristics, reflecting structural sorting processes that link income, race, and demographic attributes to residential location patterns.

In all equations, $f(\cdot)$ denotes a structural relationship estimated within the SEM framework, rather than a specific functional form. Each function represents a linear structural equation capturing the net direct effects of the included predictors on the outcome variable, while allowing indirect effects to propagate through the system of equations. This formulation enables the simultaneous estimation of multiple, interdependent pathways linking telework, activity behavior, and experienced segregation.

4.3. Modeling Performance

The model demonstrates an acceptable overall fit to the data based on multiple complementary goodness-of-fit indices (see Appendix C in the Supplementary File for additional details). The root mean square error of approximation (RMSEA = 0.046) is below the commonly recommended threshold of 0.06, indicating a close fit between the specified model and the observed data (Browne & Cudeck, 1993; Hu & Bentler, 1999; Kline, 2016). The standardized root mean square residual (SRMR = 0.042) is also well below the recommended upper limit of 0.08, providing further evidence of good absolute model fit. Although the comparative fit index (CFI = 0.440) and Tucker–Lewis index (TLI = 0.821) fall below conventional cutoffs (CFI/TLI $\geq$ 0.90), this outcome is not unexpected in large-sample SEMs with categorical variables, multiple observed predictors, and diagonally weighted least squares estimation, where the independence baseline model often fits poorly (Kline, 2016). In such contexts, absolute fit indices such as RMSEA and SRMR are considered more informative for assessing model adequacy than incremental fit measures. The chi-square statistic is significant (χ^2 = 1,182.6, $p < 0.001$), which is expected given the large sample size and does not, by itself, indicate poor model fit.

5. Results

5.1. Descriptive Analysis of Segregation in the Puget Sound Region

Figure 4 presents four spatial distributions of segregation in the Seattle metropolitan area, comparing residential segregation and experienced segregation in activity spaces across different population groups. All panels are based on a normalized racial entropy index, where darker shades indicate higher levels of segregation (i.e., lower racial diversity and more homogeneous neighborhood contexts). Figure 4a shows residential segregation, capturing the racial composition of individuals' home census block groups. High levels of residential segregation are observed in peripheral and suburban areas, particularly in parts of Snohomish County and eastern King County, while more central areas around Seattle exhibit comparatively lower residential segregation. Figure 4b displays experienced segregation in activity spaces for all respondents, reflecting the racial diversity of neighborhoods individuals visit for non-work activities (i.e., only the home census block group itself). Compared to residential segregation, experienced segregation in activity spaces is generally lower and more spatially dispersed, indicating that daily activities expose individuals to a broader range of neighborhood contexts than their residential locations alone. Figure 4c focuses on on-site workers. Their experienced segregation in activity spaces shows a wider spatial spread and lower overall segregation levels than the residential pattern, suggesting that regular commuting and out-of-home activities increase exposure to more diverse neighborhood environments. Figure 4d presents experienced segregation in activity spaces for teleworkers. In contrast to on-site workers, teleworkers exhibit higher levels of segregation in several suburban and peripheral areas. This pattern warrants further investigation into how telework affects experienced segregation, a topic discussed in the following section. We also computed global spatial autocorrelation indicators (Moran's I) to assess clustering intensity. The results show that residential segregation exhibits the strongest spatial clustering (Moran's I = 0.5461), followed by experienced segregation for all individuals (0.4358). Clustering is weaker for activity-space segregation among non-teleworkers (0.3515) and teleworkers (0.3399), indicating that experienced segregation is more spatially dispersed than residential segregation.

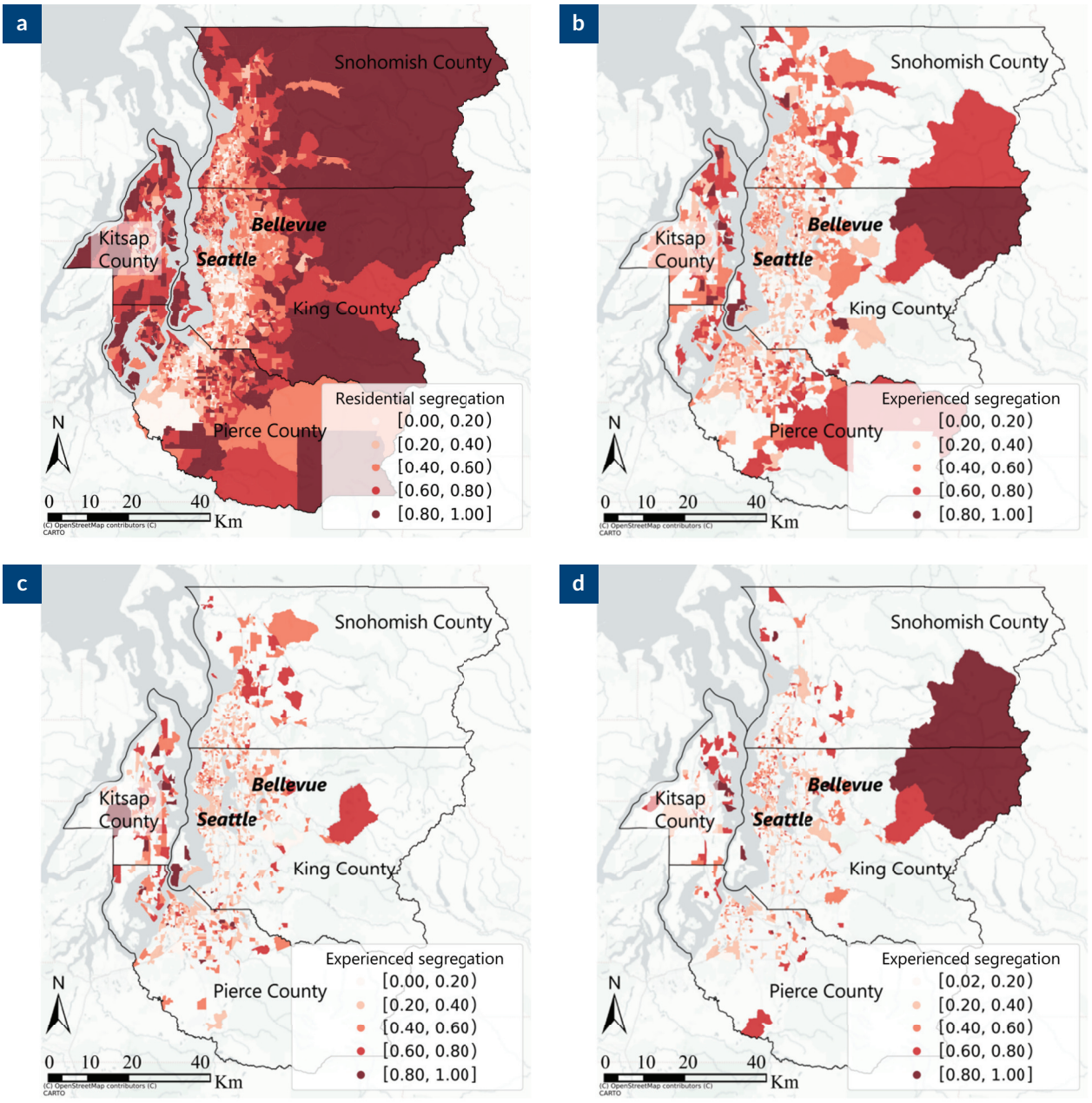

Figure 4. Spatial distribution of (a) residential segregation; (b) experienced segregation (all people); (c) experienced segregation (on-site worker); and (d) experienced segregation (teleworker).

5.2. SEM Results

The SEM reveals several key patterns in how individual attributes, travel behaviors, and built-environment factors contribute to both residential and experienced racial segregation. While the explained variance remains modest for most behavioral outcomes, the interrelationships among predictors offer valuable insight into the mechanisms that underlie segregation in everyday mobility (Figure 5 and Table 2). The results at the census tract level are attached in Appendix D in the Supplementary File.

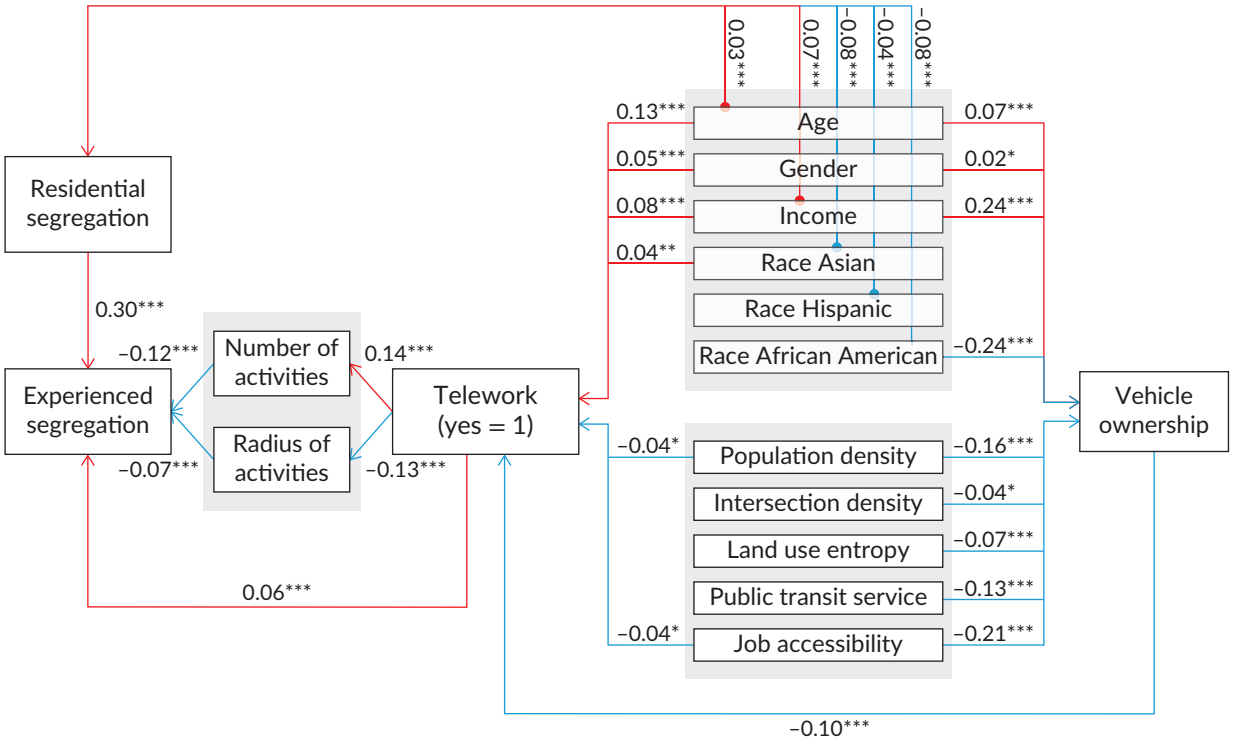

Figure 5. Illustration of how telework influences experienced segregation. Notes: Activity here means non-work activity A path represents a hypothesized directional relationship between two variables, where the variable at the tail of the arrow serves as the explanatory variable and the variable at the arrowhead represents the outcome; for clarity of presentation, all standardized coefficients are rounded to two decimal places; significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 2. SEM results.

	Vehicle ownership	Telework	Number of activities	Radius of activities	Residential segregation	Experienced segregation
Telework			0.1373 (0.1373)	−0.1283 (−0.1283)		0.0507 (0.0577)
Number of activities						−0.1193 (−0.1193)
Radius of activities						−0.0731 (−0.0731)
Residential segregation						0.2958 (0.2958)
Vehicle ownership		−0.0985 (−0.0985)	0.0076	0.0126		−0.0050
Age	0.0748 (0.0748)	0.1265 (0.1339)	0.0174	−0.0162	0.0339 (0.0339)	0.0164
Gender		0.0536 (0.0536)	0.0070	−0.0066		0.0026
Income	0.2441 (0.2441)	0.0554 (0.0794)	0.0076	−0.0071	0.0668 (0.0668)	0.0226
Race Asian		0.0361 (0.0361)	0.0049	−0.0046	−0.0804 (−0.0804)	−0.0220

Table 2. (Cont.) SEM results.

	Vehicle ownership	Telework	Number of activities	Radius of activities	Residential segregation	Experienced segregation
Race Hispanic			0.0021	−0.0020	−0.0371 (−0.0371)	−0.0102
Race African American	−0.0432 (−0.0432)		0.0011	−0.0010	−0.0780 (−0.0780)	−0.0227
Population density	−0.1641 (−0.1641)	−0.0227 (−0.0389)	−0.0031	0.0029		−0.0012
Intersection density	−0.0357 (−0.0357)	0.0035	−0.0008	0.0007		−0.0003
Land use entropy	−0.0718 (−0.0718)	0.0210	−0.0013	0.0012		−0.0005
Public transit service	−0.1306 (−0.1306)	0.0129	0.0045	−0.0042		0.0017
Job accessibility	−0.2132 (−0.2132)	0.0210	−0.0026	0.0024		−0.0010
R^2	0.331	0.032	0.019	0.016	0.021	0.110

Notes: Values in parentheses represent direct effects; cells report the total effect; when shown, the value in parentheses is the direct effect; the indirect effect is computed as *total minus direct*; if no parenthetical value is provided, the direct effect is zero, and thus the total effect equals the indirect effect; all effects reported in Table 5 are statistically significant at $p < 0.10$; for the exact significance levels, please refer to Figure 5.

5.3. Telework, Activity Behavior, and Experienced Segregation

5.3.1. Behavioral Pathways Linking Telework to Experienced Segregation

The central result of this study is that telework is systematically associated with higher levels of experienced segregation in daily activity spaces, and that this association operates primarily through reorganization of daily activity behavior rather than residential context alone. As shown in Figure 5 and Table 2, telework exhibits a positive total effect on experienced segregation (total effect = 0.051), even after controlling for residential segregation, socioeconomic characteristics, vehicle ownership, and built-environment conditions.

This effect is largely behaviorally mediated. Telework reshapes daily activity organization in two opposing ways. On the one hand, telework is associated with a higher number of non-work activities (0.137), reflecting increased temporal flexibility and greater engagement in discretionary or maintenance activities. On the other hand, telework is associated with a substantial contraction of activity-space extent, as indicated by a negative effect on the distance between home and non-work activity locations (−0.128). These two mechanisms have contrasting implications for exposure: While greater activity frequency tends to broaden social exposure, more localized activity spaces restrict access to socially heterogeneous environments. The results show that the localization effect dominates, leading to a net increase in experienced segregation among teleworkers.

Daily activity behavior itself plays a key role in shaping experienced segregation. A higher number of non-work activities is associated with lower experienced segregation (−0.119), suggesting that participation across multiple destinations increases exposure to diverse social contexts. Similarly, a larger activity-space radius is associated with lower experienced segregation (−0.073), underscoring the importance of spatial

reach for social exposure. Together, these findings demonstrate that experienced segregation is not simply a function of who individuals are or where they live, but of how daily mobility is organized.

Residential context nevertheless remains a strong baseline determinant. Residential segregation exerts a large and positive direct effect on experienced segregation (0.296), confirming that individuals living in more segregated neighborhoods tend to encounter more homogeneous social environments in their daily activities. Importantly, however, the effect of telework persists after accounting for residential segregation, indicating that changes in daily mobility introduce additional layers of segregation beyond the residential domain.

5.3.2. Structural Conditions Shaping Telework

Telework adoption is not random, but is systematically structured by socioeconomic characteristics, transport resources, and the built environment. Older individuals and those with higher incomes are more likely to telework, reflecting occupational and institutional inequalities in access to remote work opportunities. Vehicle ownership is negatively associated with telework (total effect = −0.098), suggesting that telework is more prevalent among individuals less dependent on private automobiles.

Built-environment characteristics further condition telework adoption, primarily through their influence on mobility resources. Higher population density is negatively associated with telework, indicating that telework is more common in lower-density or suburban contexts. At the same time, built-environment attributes such as higher population density, better public transit service, and greater job accessibility are all associated with lower levels of vehicle ownership. These relationships highlight how urban form indirectly shapes telework participation by structuring transport resources and mobility constraints.

5.3.3. Socioeconomic and Built-Environment Effects on Experienced Segregation

Once residential context and daily activity behavior are explicitly modeled, socioeconomic characteristics exhibit relatively modest total effects on experienced segregation. Income shows a small positive association with experienced segregation, while racial minority status—particularly African American and Asian—is associated with lower experienced segregation net of residential segregation. These effects are substantially smaller in magnitude than those associated with residential segregation, telework, and activity behavior.

Built-environment characteristics also display systematic but modest total effects on experienced segregation. None of the built-environment variables exert strong direct effects; instead, their influence operates entirely through indirect pathways involving vehicle ownership, telework adoption, and daily activity organization. Higher density, better transit provision, and greater job accessibility primarily affect exposure by conditioning whether daily mobility is localized or spatially expansive.

Together, these patterns indicate that experienced segregation is not driven primarily by individual socioeconomic attributes or urban form alone, but emerges from how social position and the built environment jointly shape daily mobility behavior. This finding reinforces the conceptual distinction between segregation as an exposure outcome and socioeconomic or spatial characteristics as upstream structural conditions.

5.4. Summary of Results

In summary, the results demonstrate that telework functions as a key mechanism reshaping experienced segregation, operating primarily through changes in daily activity frequency and spatial extent. While residential segregation remains a dominant determinant of exposure, it does not fully account for differences in experienced segregation. Instead, contemporary work arrangements reorganize daily mobility, altering how far people travel, how frequently they engage in activities, and which social environments they encounter. These findings highlight the importance of integrating telework into mobility-based and multicontextual frameworks of segregation.

6. Discussion and Conclusion

6.1. Theoretical and Policy Implications

By explicitly modeling telework as a mediating mechanism between structural conditions and social exposure, this study advances mobility-based and multi-contextual theories of segregation. Telework reshapes experienced segregation by altering activity frequency and the spatial extent of daily mobility, increasing the relative importance of proximate environments in shaping everyday exposure. In residentially homogeneous contexts, this localization effect amplifies exposure-based segregation even without residential relocation. Experienced segregation thus emerges from the interaction of socioeconomic position, urban form, and telework-induced mobility reorganization rather than from any single factor.

Telework adoption is itself socially structured, reflecting occupational inequalities, access to mobility resources, and the built environment. As such, telework functions as a transmission channel through which broader structural inequalities are translated into differentiated mobility patterns and unequal exposure to social diversity. This perspective challenges interpretations of telework as an individual lifestyle choice detached from socio-spatial structure. The findings also clarify the distinct roles of socioeconomic characteristics and the built environment. Socioeconomic factors such as income and race exert stronger marginal effects on experienced segregation, reflecting persistent inequalities in residential sorting and resource access. Built-environment characteristics, by contrast, operate primarily through indirect pathways: Density, transit provision, land-use diversity, and job accessibility shape vehicle ownership, telework adoption, and activity organization, thereby conditioning whether mobility localization leads to social isolation or continued exposure to diverse environments.

From a policy perspective, the results suggest that telework has social consequences that extend beyond travel demand and environmental outcomes. While telework increases flexibility and reduces commuting, it may also reinforce localized forms of segregation by contracting daily activity spaces. Hybrid work arrangements or periodic on-site work may help sustain access to more socially diverse environments associated with workplaces and commuting corridors. At the same time, compact urban form, mixed land use, and accessible public amenities can mitigate telework-related segregation by increasing the likelihood that localized activities still involve exposure to heterogeneous social environments. Telework policy and urban form therefore jointly shape the social implications of post-pandemic work arrangements.

6.2. Conclusion and Future Research Directions

The implications of reduced exposure to diversity extend beyond abstract metrics and into concrete urban inequality. When daily activity spaces grow more homogeneous, opportunities for bridging social capital decline, limiting informal learning, awareness of public goods and services, and access to broader job, education, and civic networks. Telework's localization can also yield benefits—stronger neighborhood attachment, routine stability, and local cohesion—but these gains are uneven. In marginalized areas with weak services or amenities, localization can reinforce cumulative disadvantage by further isolating residents from resource-rich environments.

These findings speak to the digital transition's reshaping of spatial inequality. As an ICT-enabled behavior, telework contracts spatial exposure and concentrates mobility within local—and often segregated—settings. In doing so, it can reproduce or intensify inequalities, not only by curbing access to diversity but by embedding new patterns of exclusion into digitally mediated work–life arrangements. Mitigation requires mobility policies that widen not only physical access but also experiential exposure and equity in everyday spatial interactions.

Although this study focuses on Puget Sound, the mechanisms have broader—yet context-dependent—implications. The positive link between telework and experienced segregation is likely stronger in low-density, car-oriented metros where fragmentation, zoning, and weak multimodal options limit cross-group contact. By contrast, transit-rich, mixed-use cities (e.g., Amsterdam, Paris, Seoul) can sustain diverse encounters even within localized routines due to compact form and dense amenities. Institutional and cultural factors—workplace norms, housing markets, and digital infrastructure—also condition telework uptake and its spatial effects; in settings with stronger planning and equity agendas, localization need not increase segregation.

For future research, several avenues are suggested. First, there is a need to explore how different occupational sectors and employer policies, as well as the access to ICT services, shape people's telework behaviors. Second, while this study focuses on racial segregation, future research could extend the analysis to include income segregation or develop a comprehensive indicator that captures exposure to both racial and income-based segregation. Third, more nuanced mobility data—such as GPS trajectories or mobile phone records—can help better capture the temporal and spatial dynamics of exposure to diversity. More specifically, future research could distinguish between different forms and intensities of teleworking to assess whether mobility-centered cocooning effects on experienced segregation vary across institutional settings, neighborhood contexts, and types of daily activities (Boterman & Musterd, 2016). Finally, the mechanisms and magnitude of telework effects may differ between pre-pandemic and pandemic contexts, as well as geographic contexts, which could explicitly examine whether and how the relationship between teleworking and experienced segregation varies across different temporal or institutional settings, including pandemic versus non-pandemic periods. To conclude, this study provides empirical evidence that telework is associated with higher levels of experienced racial segregation, even after accounting for residential patterns and built-environment factors. While telework modestly increases non-work activities, it also reduces travel distances, thereby limiting individuals' exposure to racially diverse environments. These findings underscore the need to integrate mobility-based exposure into frameworks of spatial segregation, moving beyond traditional residential-only analyses.

Acknowledgments

The authors would like to thank the anonymous reviewers and the editors for their constructive comments and suggestions, which helped improve the clarity and quality of this manuscript.

Funding

This work was supported by the National Key R&D Program of China (2024YFC3807900), the National Natural Science Foundation of China (No. 52208009 and No. 52278011), the Jiangsu Provincial Research Department of Natural Resources (2025017), as well as Research Foundation – Flanders (FWO) (1258625N).

Conflict of Interests

The authors declare no conflict of interests.

Data Availability

The R script with processed aggregated data is made publicly accessible through the Open Science Framework. The link is https://osf.io/n458d/overview?view_only=cd5770cbc678471e92c69d0cc32d05f9. The raw research data are available upon request.

LLMs Disclosure

LLMs were used in a limited capacity to assist with language polishing and stylistic refinement of the manuscript. All scientific content, analyses, interpretations, and conclusions were conceived, conducted, and validated by the authors. The authors take full responsibility for the integrity and originality of the work.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

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