Race/Ethnic Segregation of Routine Activity Spaces Among Urban Neighborhood Residents: A Multilevel Network Approach

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Research on residential segregation by race/ethnicity has typically employed census units to differentiate places by levels of within-unit homogeneity. Residents of "integrated" places combine those of different race/ethnicity with potential consequences for the likelihood of sharing day-to-day routine activity space exposures such as shopping, working, school, and leisure locations. To date, however, research on segregation has placed limited emphasis on understanding how different aggregate levels of residential segregation/integration shape actual routine activity space exposures. Specifically, we ask whether race/ethnic heterogeneity at the neighborhood level influences the level of activity space "sorting" by group.

Two competing theoretical approaches to this question have been offered. The classic "contact" hypothesis (Allport 1954) suggests that, under certain conditions, residential spatial propinquity can increase the likelihood of shared activity locations across groups. In this view, all else equal, residents who are exposed to members of other groups in residential public space who are engaged in similar, conventionally-oriented activities (e.g., shopping at a grocery store) will develop familiarity, trust, and an enhanced willingness to share more intimate spaces (e.g., church, child care). Thus the likelihood of residents of the same neighborhood who are of different race/ethnicity sharing a given activity location will increase as the level of neighborhood race/ethnic integration increases.

In contrast, Putnam (2007) has argued that neighborhood race/ethnic integration *decreases* the likelihood of sharing activities across groups. When brought into close contact, residents of different groups (when jointly represented in sufficient numbers) will experience increased distrust and seek to avoid shared public spaces. This tendency to "hunker down" leads to the expectation that residents of differing race/ethnicity or income will be less likely to share a given routine activity location as the level of neighborhood integration increases.

We assess these competing hypotheses by examining data on activity locations of residents of 65 Los Angeles census tracts using the Los Angeles Family and Neighborhood Study (L.A.FANS). We fit multilevel P2 network models to dyadic tie data (shared activity locations among sampled households) in order to examine the extent to which (1) racial/ethnic homophily in household dyads increases the likelihood of sharing an activity location; (2) the effect of racial/ethnic homophily on the likelihood of sharing an activity location varies across neighborhoods; (3) residential integration amplifies or attenuates the impact of racial/ethnic homophily on sharing activity locations.

Methods

Data

We use data from the first wave of L.A.FANS (Sastry et al., 2006). The L.A.FANS data—which were collected between 2000 and 2001—are based on a stratified random sample of individuals residing in 65 census tracts in Los Angeles County, California. Although high poverty tracts were oversampled, the sample covers the entire income range of neighborhoods. Within each tract, households were randomly selected and a randomly selected adult (RSA) was interviewed within each household (analytic sample N=2,503).

Dependent Variable. The outcome of the analysis is the occurrence of a "tie" between two households based on sharing an activity location within the *ecological network* ("eco-network") characterizing a given census tract. The eco-network can be understood as the two-mode or affiliation network linking sampled households to activity locations for each tract. In order to construct the dependent variable, we first identified neighborhood eco-networks using LAFANS's geographic coordinate data. Respondents provided location data (ultimately geo-coded) for household members' various routine activities, such as grocery shopping, healthcare, a place other than home or work where the RSA spends the most time, school (if a child resided in the household), employment, religious services, relatives' homes, childcare, and places other than home where the child spends the night. We used RSA non-home activity locations and those of a randomly sampled child (if present). We only included locations with valid XY coordinates within California. On average, households reported 5.04 non-home activities that have valid XY coordinates. Because some activities overlap geographically, the average number of unique XY coordinate locations per household is 4.2.

We used these location data to construct two-mode eco-networks for the 65 sampled tracts. The first mode consists of households that reported at least one valid non-home location (in 5 networks 2 households have no ties, and in 19 networks one household has no ties). A mean of 39.8 households are represented within each tract-based eco-network. The second mode consists of the activity clusters—which we define below—containing the locations nominated by sampled households within the focal tract. On average, there are 84.92 clusters per network. For these networks, households within each tract are indirectly tied through shared participation in activity clusters, and activity clusters are indirectly tied through households.

We define activity clusters by applying a k-means clustering strategy to the coordinates of all unique non-home locations reported by LAFANS households. In doing so, we grouped locations into a set number (i.e., "k") of mutually-exclusive point clusters based on distance in space. The algorithm involves a series of iterations whereby random points are selected to serve as centroids (Kanungo et al., 2002). Points are then matched to their nearest centroids. This process is repeated and concluded when the mean squared distance from each point to its nearest centroid is minimized. When this criterion is reached, points sharing a centroid form what we term "activity clusters"—that is, geographically proximate activity settings. In this study, we chose k=2,500 because this number of clusters resulted in an average within-cluster distance between XY coordinates that might plausibly represent a “shared” location. The median distance between activity location points within each cluster and the cluster centroid is 128.7 meters.

Independent variables. In addition to whether RSAs comprising dyads share race/ethnicity (race/ethnic homophily), we include a number of covariates describing the degree of RSA heterophily with respect to age, education level, marital status, residential tenure (how long the RSA has lived in the neighborhood), parental status, and the distance between the two households. We present preliminary results below for these household homophily/heterophily covariates. Final models will present multilevel data including tract level covariates (e.g., herfindahl index of diversity) and individual (RSA/household) level predictors.

Analytic Strategy

We employ a multilevel P2 approach (Zijlstra 2006) to model the probability that household dyads share a given activity location. In this approach, two mode network data are “projected” onto a single mode (households). Each household dyad has the potential to be linked through each location in the eco-network. The model takes the following form:

$$\ln\left(\frac{\varphi_{ijk}}{1-\varphi_{ijk}}\right) = \beta_{0k} + \beta_{1k}(RacialHomophily)_{ijk} + \sum_{q=2}^{Q} \beta_q X_{qijk} + b_{ik} + c_{jk}$$

$$\beta_{0k} = \gamma_{00} + \gamma_{01}(Race/EthnicDiversity)_k + \sum_{s=2}^{S} \gamma_{0s} X_{sk} + u_{0k}$$

$$\beta_{1k} = \gamma_{10} + \gamma_{11}(Race/EthnicDiversity)_k + u_{1k}$$

β_{1k} – Coefficient for effect of dyad race/ethnic homophily

γ_{01} – Coefficient for average effect of tract level race/ethnic diversity

γ_{11} – Coefficient for cross-level interaction (tract level race/ethnic diversity * household dyad level racial homophily)

b_{ik} – Dyad random effect

c_{jk} – Activity location (cluster) random effect

u_{k00} – Tract intercept random effect

u_{k10} – Tract racial homophily coefficient random effect

Effectively, the data structure is cross-classified (actors and activity location clusters) within tracts. A significant and positive coefficient for β_1 would indicate that residents of the same race/ethnicity are more likely to share activity space locations, offering evidence of within-neighborhood “sorting” by race/ethnicity. A significant cross-level interaction γ_{11} would offer evidence of amplification or attenuation of the race/ethnic homophily effect due to neighborhood level integration. The model will also be extended to include individual/household level predictors.

Preliminary Results

Table 1 shows preliminary results from multilevel P2 models of dyad level ties through activity locations. Results offer strong evidence that race/ethnic homophily significantly increases the likelihood of sharing routine activity locations. Thus, on average, the model indicates that households engage in structured spatial sorting (by race/ethnicity) in the course of everyday activities. The effects of race/ethnicity on sharing activity locations hold net of educational, residential tenure, age, and parental status heterophily (all negatively and significantly associated with sharing activity locations) as well as the distance between households (also powerfully negatively associated with sharing activity locations). Thus the activity space sorting effect of race/ethnicity is not due to the other potential demographic correlates considered, nor is the effect due to the possible tendency of RSAs of different race/ethnicity to reside further away from one another within a tract. The model also offers evidence of significant random variation in the effects of race/ethnic homophily across tracts (not shown).

Analyses of tract level integration cross-level interactive effects with dyad level race/ethnic homophily will be conducted in order to adjudicate between the competing hypotheses offered by the contact hypothesis and Putnam. More refined race/ethnic dyad covariates will also be considered (e.g., Latino-Latino, white-white, white-Latino, etc.) as spatial sorting (and the potential modifying effects of tract-level integration) may vary by the type of dyad considered. Models will also incorporate more extensive dyad and household level controls. We will consider the implications of the results for substantive concerns about the role of conventionally understood neighborhood integration as a vehicle for producing integrated activity space exposures. The analyses will also be discussed in the context of an emerging focus on fine-grained segregation processes as captured by increasingly rich activity space data (e.g., cell phone data) and challenges associated with modeling large-scale ecological network data.

References

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Table 1. Multilevel P2 Models of Shared Activity Location

Independent Variables	Coeff		Std Err
Racial/ethnic homophily	.178	***	.032
Marriage heterophily	-.020		.013
Age heterophily	-.001	*	.000
Educational heterophily	-.011	***	.002
Residential tenure heterophily	-.085	***	.014
Parental status	-.272	***	.015
Residential distance	-2.471	***	.399
Intercept	-4.997	***	.060

[a] Neighborhood level *N* = 65; Household level *N* = 2,503.