Exposure of Neighborhood Racial and Social Composition in Activity Space

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MASS Meeting

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Overview

1. Introduction
   - Beyond the residential context
   - Isolation vs. Compelled mobility

2. New Measures & Results
   - Measures
   - CHART
   - CMAP

3. Conclusion & Discussion
The literature is predominantly focused on segregation in the *static* residential space (Massey & Denton, 1988). But people experience segregation during routine activities (*dynamic*) that cross the border of their own neighborhood.

These are largely due to data limitations in the past. With activity space data, we can do more!
Competing hypotheses

Classic *geographic isolation approach*: consistency of segregation across residential locations and activity spaces (Wilson 2012; Wang et al., 2018).

- People tends to be geographically isolated in their residential environment, spatially contiguous contexts, and places that are compositionally similar (homophily)

*Compelled mobility approach*: people are drawn out of their home environment to typically Whiter and more resourced locations to seek resources, even for those residing in Black-segregated neighborhoods (Small & McDermott, 2006; Browning et al., 2022).
Segregation in Residential & Activity space

- Home is THE anchor point of routine activities
  - start and end point of trips
  - physical, social, and financial constraints

- Adjust for residential context
- Exclude home activities
The Current Study

1. understand activity-space-based exposure after accounting for the local context at the **individual** level

2. at the **individual** level, to what extent are any observed tendencies for exposures to deviate from the local context explained by travel related to employment and education, particularly among residents of disadvantaged neighborhoods?
Graphical Illustration (+MSA)

\[ SO_i = \sum_{t}^{T_i} E_{tij} \cdot w_{ti} - N_i \]

where

- \( E_{tij} \) represents the characteristic of the neighborhood \( j \) person \( i \) is located in at time \( t \)
- \( w_{ti} \) is a time weight
- \( N_i = \sum_{j}^J E_{ij} \cdot w_{ij} \)
Two Datasets:

- **CHART**
  - A probability sample of 450 urban seniors in 10 Chicago NBHD
  - GPS + Ecological Momentary Assessment + Baseline
  - GPS algorithm: 20m geofenced
  - Identify at-home activities: 50m buffer (calibrate against ATS)

- **CMAP**
  - Non-probability sample
Data: CHART

- CHART wave 2
- ACS Census Tracts
* (also BG)
- Chicago MSA (99%+)
- Exposure to %White
- Outside home (50m buffer)
Sources of Uncertainty in Identifying Home

Found Location Data

- Extract home based on the space/time distribution of location points
- Source of uncertainty
  - Algorithmic error
  - Reporting error
  - Geocoding error (esp. rural area)
  - Street address problem
- Purposive Location Data
  - Geocode self-reported home addresses

Geographic coordinates of home

- Buffer around coordinates
- Building footprints and extensions
- Land parcels and extensions
- Administrative units: census tract, block group
- Street address problem
- Large building complex problem
- Altitude/high-rise problem
- Oversize

e.g., DBSCAN of night points
Definitions of home

Street address buffer

Footprint & parcel
Results: Community Area CA

Origin-based Community Area adjustment

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Liang Cai (UChicago) Exposure in Activity Space June 23, 2023
Results: 1’ nbhd

Origin-based 1st order contiguity neighbor adjustment
Results: 1-2’ nbhd

Origin-based 1-2nd order contiguity neighbor adjustment
### Residential, activity space, and adjusted characteristics

**Characteristics of MSA, City, Residential Context, and Activity Space: CHART (N=287)**

<table>
<thead>
<tr>
<th></th>
<th>%White</th>
<th>%Black</th>
<th>%Hispanic</th>
<th>%Non-Poor</th>
<th>%Non-Poor White</th>
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</thead>
<tbody>
<tr>
<td><strong>Global Ref.</strong></td>
<td></td>
<td></td>
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<tr>
<td>Chicago MSA Average</td>
<td>49.411</td>
<td>21.400</td>
<td>21.387</td>
<td>94.868</td>
<td>35.604</td>
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<tr>
<td>Chicago City Average</td>
<td>30.604</td>
<td>36.248</td>
<td>25.854</td>
<td>88.889</td>
<td>14.482</td>
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<td><strong>Residential Ref.</strong></td>
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<td></td>
</tr>
<tr>
<td>Home CT</td>
<td>20.431</td>
<td>43.973</td>
<td>30.630</td>
<td>75.958</td>
<td>7.317</td>
</tr>
<tr>
<td>Reference Points (home CT incl.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Comm. Area</td>
<td>20.164</td>
<td>40.308</td>
<td>34.640</td>
<td>79.545</td>
<td>7.016</td>
</tr>
<tr>
<td>1’ Neighbor CTs</td>
<td>21.532</td>
<td>41.913</td>
<td>30.912</td>
<td>80.878</td>
<td>6.742</td>
</tr>
<tr>
<td>1-2’ Neighbor CTs</td>
<td>21.840</td>
<td>41.970</td>
<td>28.612</td>
<td>81.973</td>
<td>6.379</td>
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<td>1-3’ Neighbor CTs</td>
<td>22.098</td>
<td>43.214</td>
<td>26.570</td>
<td>82.547</td>
<td>6.251</td>
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<td>1-4’ Neighbor CTs</td>
<td>22.750</td>
<td>43.638</td>
<td>25.595</td>
<td>83.943</td>
<td>6.555</td>
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<td>1-5’ Neighbor CTs</td>
<td>23.628</td>
<td>42.875</td>
<td>25.667</td>
<td>85.476</td>
<td>7.298</td>
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<tr>
<td><strong>Observed Activity Space</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity Space (non-home)</td>
<td>25.841</td>
<td>41.381</td>
<td>26.146</td>
<td>80.765</td>
<td>10.100</td>
</tr>
<tr>
<td>Deviation (Observed – Ref.)*</td>
<td>-23.571</td>
<td>19.981</td>
<td>4.759</td>
<td>-14.105</td>
<td>-25.534</td>
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<tr>
<td>Chicago MSA</td>
<td>-4.763</td>
<td>5.133</td>
<td>0.292</td>
<td>-8.124</td>
<td>-4.382</td>
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<tr>
<td>Reference Points (home CT incl.)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home/Origin Comm. Area</td>
<td>5.676</td>
<td>1.073</td>
<td>-8.494</td>
<td>1.220</td>
<td>2.547</td>
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<tr>
<td>1’ Neighbor CTs</td>
<td>4.309</td>
<td>-0.532</td>
<td>-4.766</td>
<td>-0.113</td>
<td>2.891</td>
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<tr>
<td>1-2’ Neighbor CTs</td>
<td>4.000</td>
<td>-0.589</td>
<td>-2.466</td>
<td>-1.207</td>
<td>3.366</td>
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<tr>
<td>1-3’ Neighbor CTs</td>
<td>3.742</td>
<td>-1.833</td>
<td>-0.424</td>
<td>-1.782</td>
<td>3.505</td>
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<tr>
<td>1-4’ Neighbor CTs</td>
<td>3.090</td>
<td>-2.257</td>
<td>0.551</td>
<td>-3.178</td>
<td>3.271</td>
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<tr>
<td>1-5’ Neighbor CTs</td>
<td>2.213</td>
<td>-1.493</td>
<td>0.479</td>
<td>-4.711</td>
<td>2.514</td>
</tr>
</tbody>
</table>

*Deviation is the difference between average characteristics of all visited contexts and the reference points. MSA: Metropolitan Statistical Area. CT: Census Tract. Standard deviations in parentheses.
Prediction: adjusted exposure to %White

a. MSA Adjustment

b. 1-3’ Neighborhood Adjustment

From Poor Black NBHD?
- No
- Yes
Data

CMAP’s **My Daily Travel** project is a large-scale publicly available transportation survey conducted between Aug. 2018 and April 2019. It samples over 12,000 households (head and members) in 8 Chi-MSA counties to ensure a good representation* of the total population in the region.

For the purpose of this study, we focus on respondents who are 1) from the City of Chicago, 2) the first/major participant of the households (one per hh), 3) reporting more than 5 hours non-home time*, 4) black, white, or Hispanic. The analytical sample size is 3,369.

Again, we look at **non-home** activity space. The unit of analysis here is **census tract** as a result of data limitation. We obtain neighborhood characteristics from **ACS** (2018).
CMAP: Respondents Distribution

a. Trip Locations of White Respondents  
b. Trip Locations of Black Respondents  
c. Trip Locations of Hispanic Respondents
### CMAP: Descriptive Stats vs. CHART

<table>
<thead>
<tr>
<th></th>
<th>CHART Mean</th>
<th>CHART SD</th>
<th>CMAP Mean</th>
<th>CMAP SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Female</td>
<td>0.589</td>
<td></td>
<td>0.655</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>74.726</td>
<td>6.669</td>
<td>37.384</td>
<td>13.136</td>
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<tr>
<td>Race</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>0.505</td>
<td></td>
<td>0.188</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>0.282</td>
<td></td>
<td>0.690</td>
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<tr>
<td>Hispanic</td>
<td>0.213</td>
<td></td>
<td>0.121</td>
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<tr>
<td>Household Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (&lt;$25,000)</td>
<td>0.516</td>
<td></td>
<td>0.164</td>
<td></td>
</tr>
<tr>
<td>Medium ($25,000 - $50,000)</td>
<td>0.394</td>
<td></td>
<td>0.182</td>
<td></td>
</tr>
<tr>
<td>High (&gt;=$50,000)</td>
<td>0.090</td>
<td></td>
<td>0.655</td>
<td></td>
</tr>
<tr>
<td>Education</td>
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<tr>
<td>Less than high school</td>
<td>0.301</td>
<td></td>
<td>-</td>
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<tr>
<td>High school</td>
<td>0.178</td>
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<td>0.089</td>
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<tr>
<td>Some college</td>
<td>0.252</td>
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<td>0.167</td>
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<tr>
<td>College</td>
<td>0.269</td>
<td></td>
<td>0.406</td>
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<tr>
<td>Graduate degree</td>
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<td>0.337</td>
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<tr>
<td>Work/School</td>
<td>0.385</td>
<td></td>
<td>0.928</td>
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</tr>
<tr>
<td><strong>Neighborhood Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor Black Census Tract</td>
<td>0.240</td>
<td></td>
<td>0.045</td>
<td></td>
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<tr>
<td>Non-Poor White Census Tract</td>
<td>0.073</td>
<td></td>
<td>0.260</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>287</td>
<td></td>
<td>3,369</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

- For CHART, this category includes those with higher-than-college education.
- For CMAP, this group only includes those with college education.
- \(0 = \) not employed in any form in CHART. \(0 = \) not enrolled in school or working in CMAP.
- All respondents with valid activity space measures.
Prediction: adjusted exposure to %White

a. MSA Adjustment

b. 1-3’ Neighborhood Adjustment

From Poor Black NBHD?
- Red: No
- Blue: Yes
Conclusion

- Less segregation in activity space than in residential spaces
- Activity space contexts mimic the racial/ethnic and socioeconomic landscape of respondents’ broad residential environment, variously defined
- Even after adjusting for the residential context, people on average are drawn to whiter, less black, and non-poor contexts. There remains non-trivial systematic exposure in where people spend time by race after adjustments
Conclusion cont.

- After residential-based adjustment, Black younger (CMAP) adults from poor Black neighborhoods are disproportionately drawn out of Black neighborhoods into more affluent and Whiter neighborhoods.
- Older (CHART) adult activity spaces align more closely with their residential areas; however, activity spaces of poor-Black-neighborhood-residing CHART Blacks are systematically poorer and, less consistently, more Black and less White after local area adjustment.
  - Age effect?
  - Cohort effect?
- *Push/Pull factors (job opportunities, institutions, social networks, escape violence, etc.)
Issues/Puzzles/Limitations

- Samples: urban older adults CHART & non-probability CMAP
- Contextual uncertainty (ever-changing pop. comp. *institutional resources)
- Temporality and co-presence
- Co-presence $\neq$ social interaction: environmental and functional characteristics
Thank you!

Questions/Comments:
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