

How does built environment affect activity space of people living in different income level areas?

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Introduction

- People's daily activity is closely related to health, well-being and people's satisfaction toward their communities.
- Activity space as one dimension of daily activity, which is more related to people's opportunities to get access to their job, education, entertainment, etc.
- It is necessary for planners to consider it in their planning process.



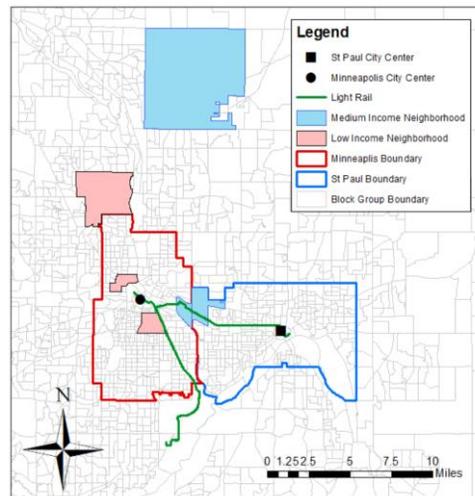
Research question

- ❑ How does built environment affect activity space of people living in different income level areas?



Data

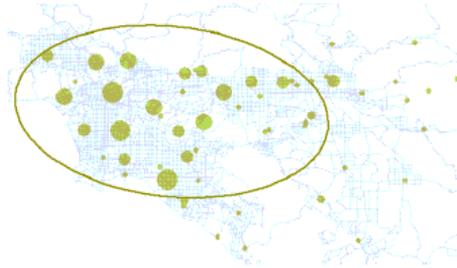
- ❑ Neighborhood Environment, Daily Activities, and Well-Being Study
- ❑ Minneapolis-St Paul (Twin cities) metropolitan area
- ❑ Six neighborhoods (four in urban areas and two in rural areas)
- ❑ Low income (< 35 K) and medium income (35 K – 80 K) neighborhoods
- ❑ Daynamica™
- ❑ 400 respondents (313 left for data analysis after data cleaning)



Study area and distribution of the respondents' homes

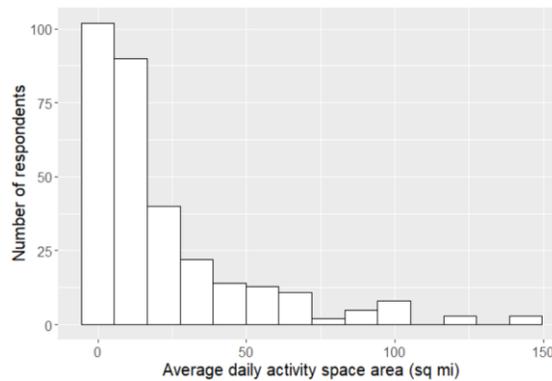
Standard Deviational Ellipse (SDE)

- ❑ The ellipse is referred to as the standard deviational ellipse
- ❑ The method calculates the standard deviation of the x-coordinates and y-coordinates from the mean center to define the axes of the ellipse.
- ❑ SDE could catch the dispersion of the points' distribution



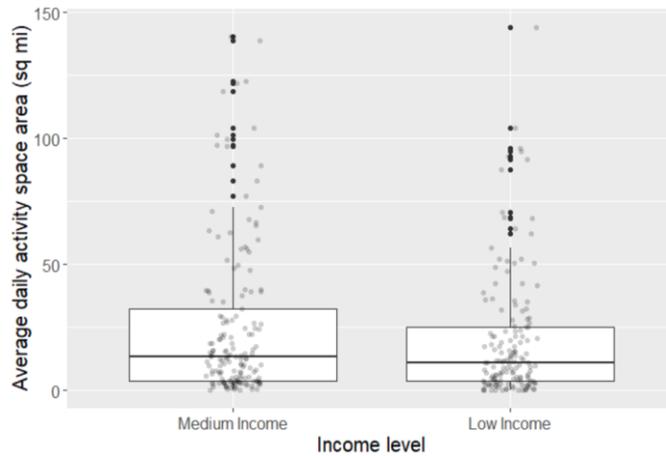
<https://pro.arcgis.com/en/pro-app/tool-reference/spatial-statistics/h-how-directional-distribution-standard-deviation.htm>

Standard Deviational Ellipse (SDE)



- ❑ Right-tailed distribution pattern
- ❑ Maximum: 144 sq mi
- ❑ Minimum: 0.000006 sq mi (15.5 sq meter)
- ❑ Mean: 22.54 sq mi
- ❑ Median: 11.98 sq mi
- ❑ For comparison, the area of city of Minneapolis is 57.5 sq mi

Results



- Medium-income mean: 25.12 sq mi
- Low-income mean: 19.80 sq mi
- T test result: significant different in level of 90%

Method

- Negative binomial regression with interaction term between built environment variables and income level variable

$$A = \beta_1 X_1 + \beta_2 X_2 + \beta_3 (X_2 \times I) + C_0$$

A : Average daily SDE area (sq mi)

X_1 : Demographic variables and temperature

X_2 : Built environment variables

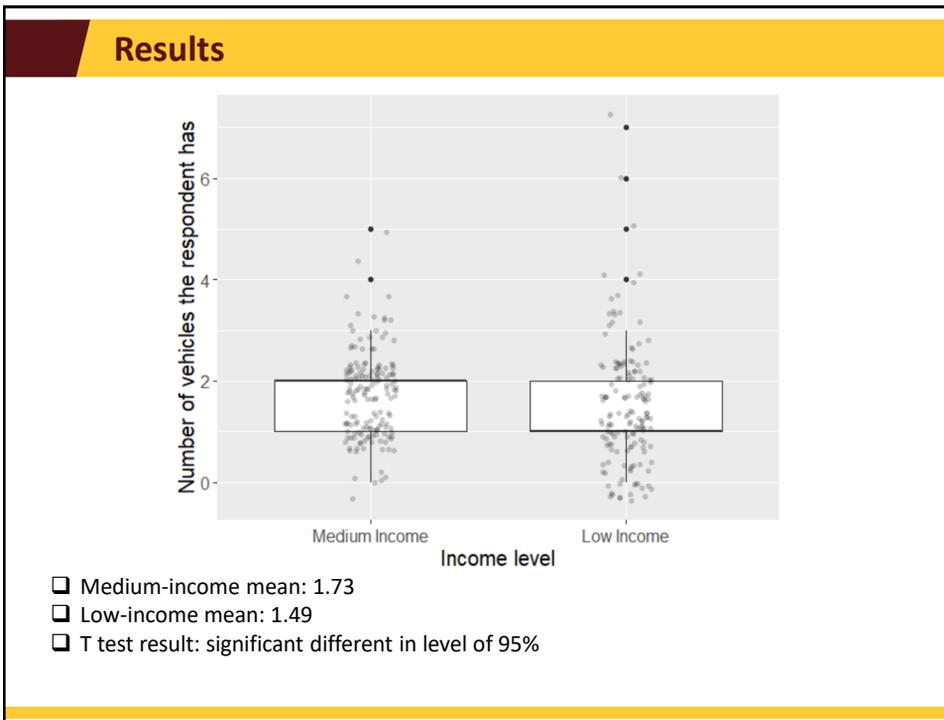
I : Dummy variable indicating whether the correspondent is living in the low-income area

C_0 : Constant

Results

	Variable	Coefficient	Pr (> z)
	Low-income area	0.093	
	Average daily temperature in F	-0.008	*
Demographic	Age	-0.007	.
	Male	0.202	
	Employment status	0.316	*
Built Environment	Population density	-0.106	*
	Distance to transit stop	0.111	
	Distance to Minneapolis	0.032	
	Land use entropy	-0.599	
	Intersection number	-0.0005	
	Low-income area: Population density	0.073	
	Low-income area: Distance to transit stop	-1.449	.
Interaction	Low-income area: Distance to Minneapolis	0.043	
	Low-income area: Land use entropy	-0.318	
	Low-income area: Intersection number	-0.001	

Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1



Conclusions

- ❑ The people living in the low-income areas has a smaller activity space than those in median-income areas in average level
- ❑ Comparing to people living in the medium-income areas, living closer to transit stops enlarge more of the activity space for people in the low-income area