WHAT MAKES TRAVEL "LOCAL": DEFINING AND UNDERSTANDING LOCAL TRAVEL BEHAVIOUR

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Background

- Shift in planning priorities away from mobility to accessibility and providing "local" amenities and services

- Local travel has been linked to: environmental, health and social benefits.

Background

- However, what is the most effective way to measure "local" travel?
  - (total daily distance travelled, standard ellipse, area of activity space, total number of trips?)

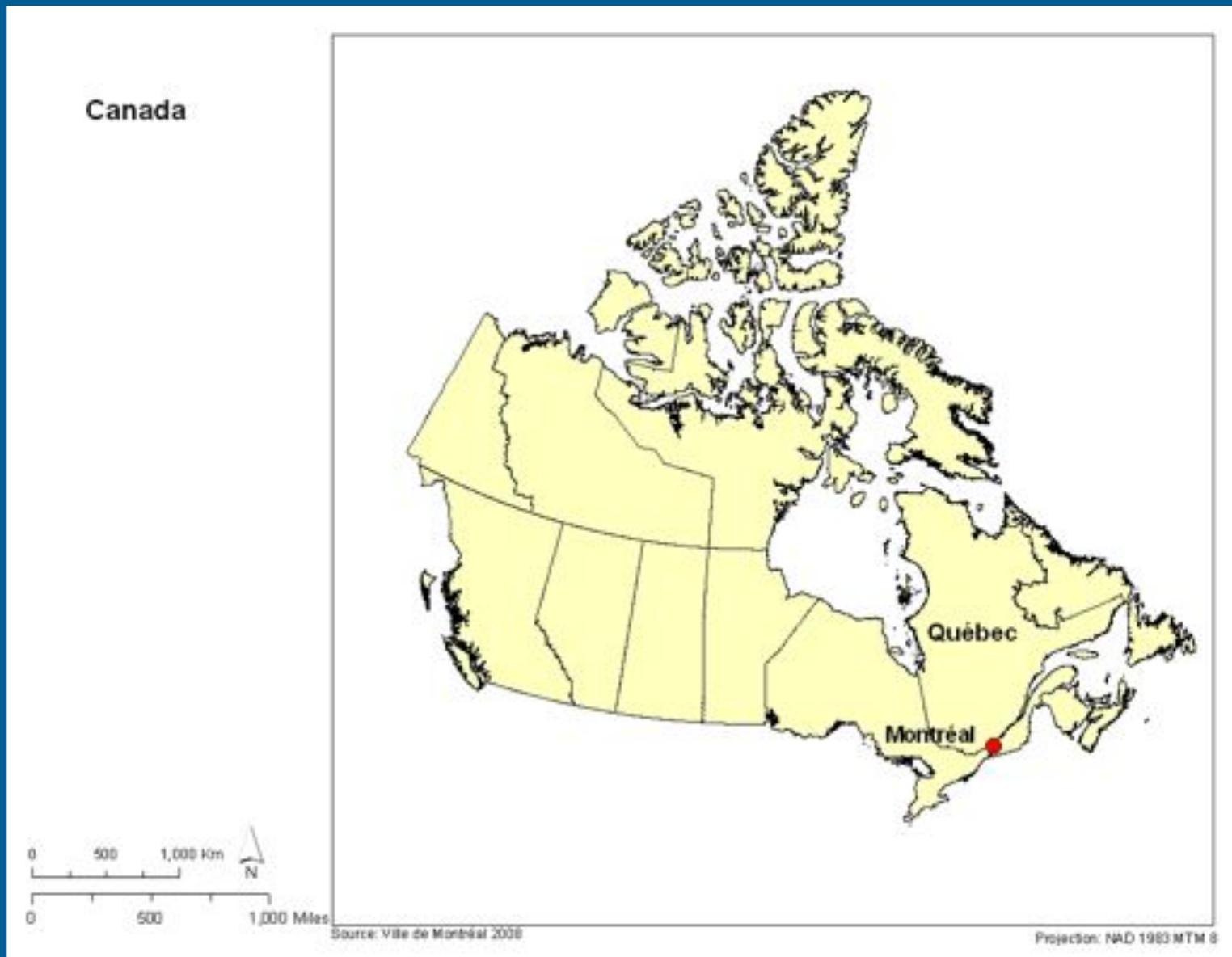- Are people limiting travel due to high levels of accessibility? Or due to mobility or time constraints?

Hypothesis

- Regional and local accessibility will impact the size and dispersal of a household's activity space

- However, and more interestingly, this effect may vary by characteristics of the household (income, time constraints, family obligations)

Research Goals

- To develop a manner to accurately measure the size and spatial dispersal of household activity space using GIS

- To relate this measure to elements of regional and local accessibility
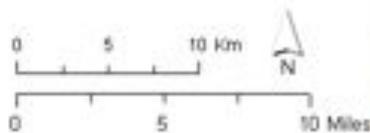
- To compare this effect across household types

Study Context

Canada

Québec

Montréal

0   500   1,000 Km
0   500   1,000 Miles

N

Source: Ville de Montréal 2008

Projection: NAD 1983 MTM 8

Study Context

Montréal Metropolitan Region

Legend:
- • Train Stations
- — Commuter Rail Line
- • Metro Stations
- — Metro Line
- — Major Roads

North Shore

Laval

Montréal

South Shore

0 5 10 Km
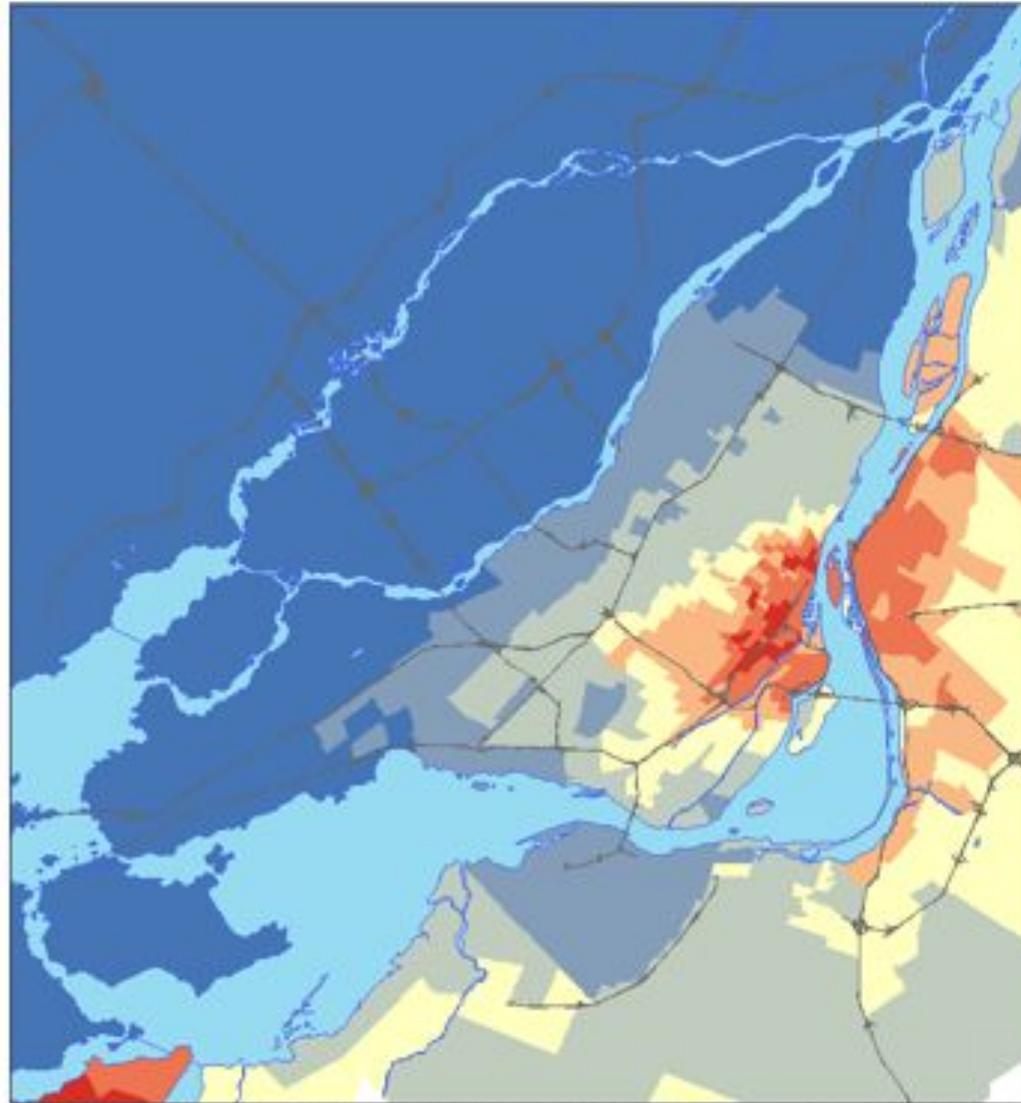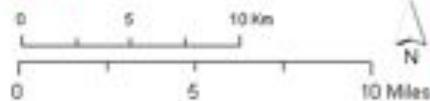0 5 10 Miles
N

Source: Ville de Montréal 2008

Projection: NAD 1983 MTM 8

Regional Accessibility
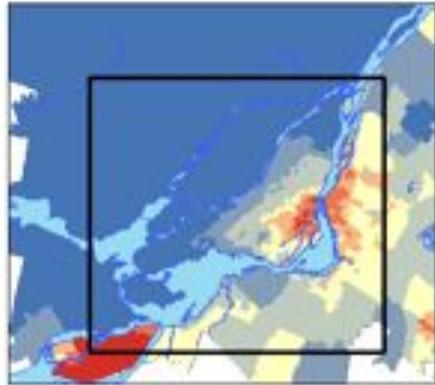
Accessibility to jobs by automobile accounting for competition from workers

— Highway

Accessibility level

- 0.05 - 3.76
- 3.77 - 8.67
- 8.68 - 14.73
- 14.74 - 21.92
- 21.93 - 30.44
- 30.45 - 41.71
- 41.72 - 155.19

Source: Statistiques Canada 2006, MTQ 2009, AMT 2008, Ville de Montréal 2008

Projection: NAD 1983 MTM 8

Local Accessibility

- Local accessibility........ short local walking ......no effect on total distances.

- Mixed-use urban areas ....travel shorter distances and make fewer car trips

- Walkscore.com

Activity Space

- Geographical area containing all locations an individual has direct contact with as a result of his daily activities (Horton and Reynolds, 1971)

- Individual travel outcomes are heavily influenced by household-level characteristics (Bhat, 1996)

- Measure activity space with convex hull approach (Builiung, 2006)

Measures of the Activity Space

- Total distance traveled

- Area

- Compactness

- Spatial dispersal factor

Measures of Activity Space

- Compactness

$$C = \frac{A}{p^2}$$

where

C is the compactness of the polygon

A is the area of the polygon

p is the perimeter of the polygon

Measures of Activity Space

Spatial Dispersal

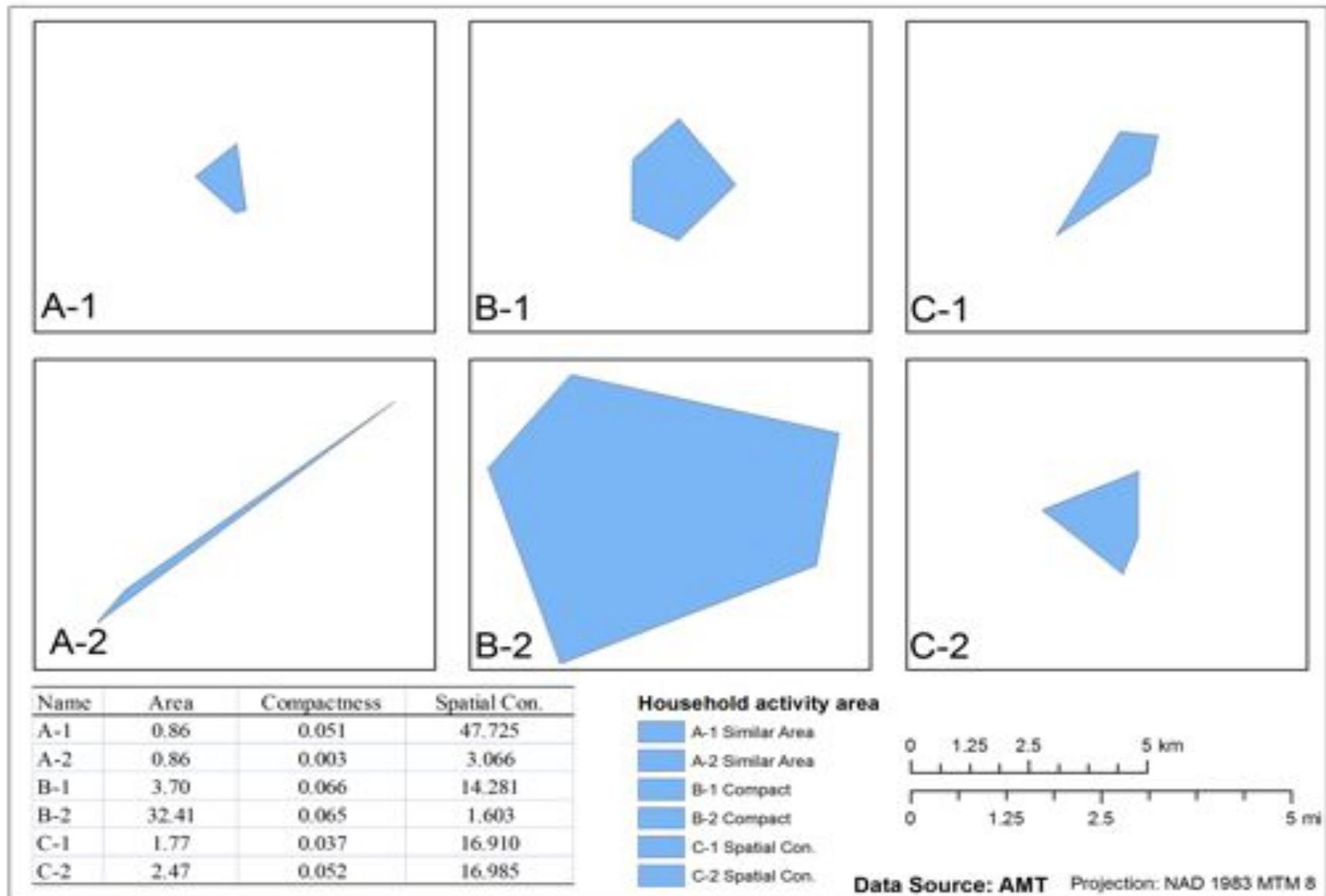$$Spatial\ Dispersal = \frac{A}{A_{max}} * \frac{A}{p^2}$$

where

A is the area of the polygon
A_{max} is the area of the largest polygon
p is the perimeter of the polygon

Measures of the Activity Space

Name	Area	Compactness	Spatial Con.
A-1	0.86	0.051	47.725
A-2	0.86	0.003	3.066
B-1	3.70	0.066	14.281
B-2	32.41	0.065	1.603
C-1	1.77	0.037	16.910
C-2	2.47	0.052	16.985

Household activity area

- A-1 Similar Area
- A-2 Similar Area
- B-1 Compact
- B-2 Compact
- C-1 Spatial Con.
- C-2 Spatial Con.

Data Source: AMT   Projection: NAD 1983 MTM 8

Measures of Activity Space

- Spatial Dispersal will misrepresent the travel behavior if the underlying road network is not taken into account.

- Local Travel Index

Measures of Activity Space

- LTI = Z score (compactness)+ inverse Z score (total distance traveled by household)

  - This results in a high (unitless) value for a "good" spatial dispersal of a household's activity space
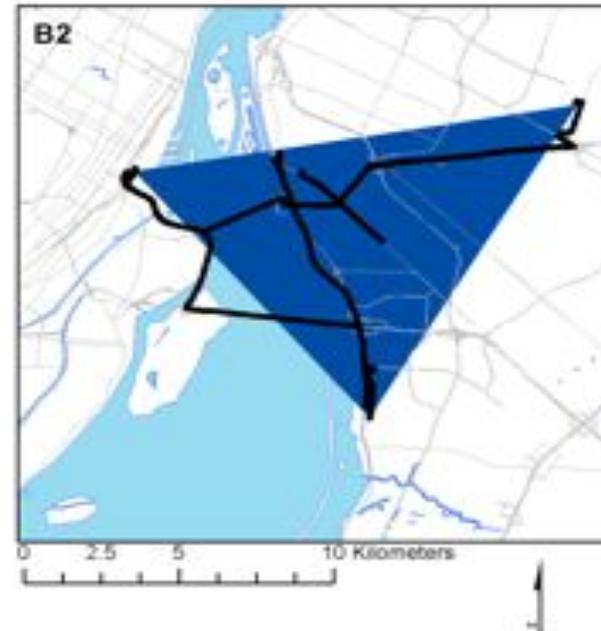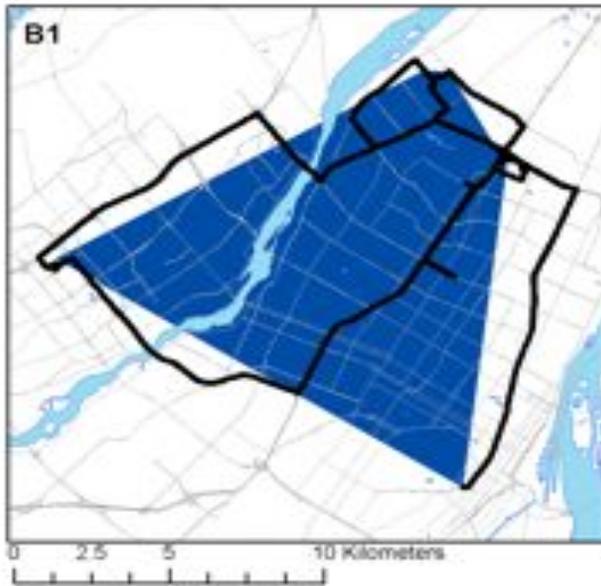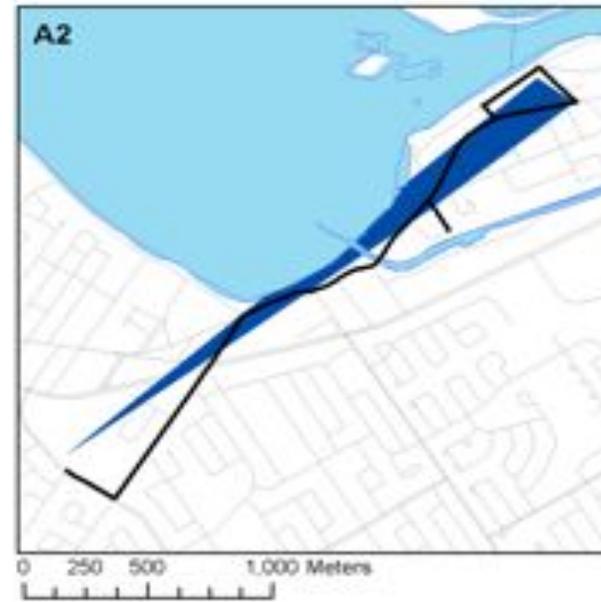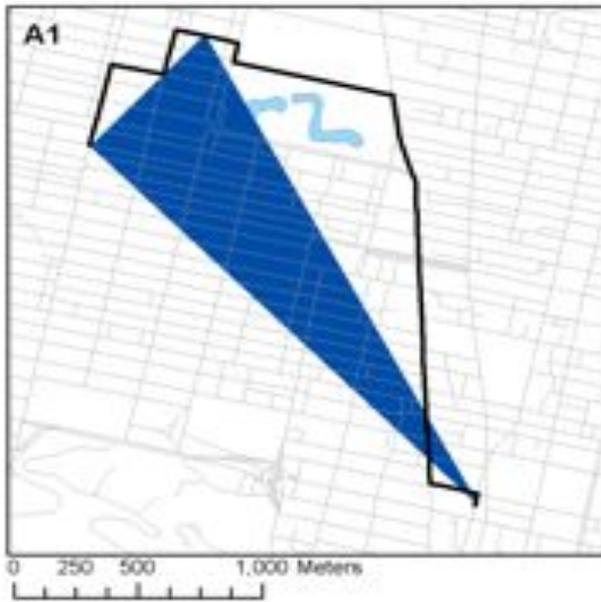
	A1	A2	B1	B2
Dispersal (z-score)	0.141	0.142	-0.106	-0.100
Distance [(z-score)	-1.195	-1.055	-0.511	-0.247
Index	-1.337	-1.197	-0.405	-0.146

Projection: NAD 1983 MTM 8
Source: AMT, DMTI

Cluster Analysis
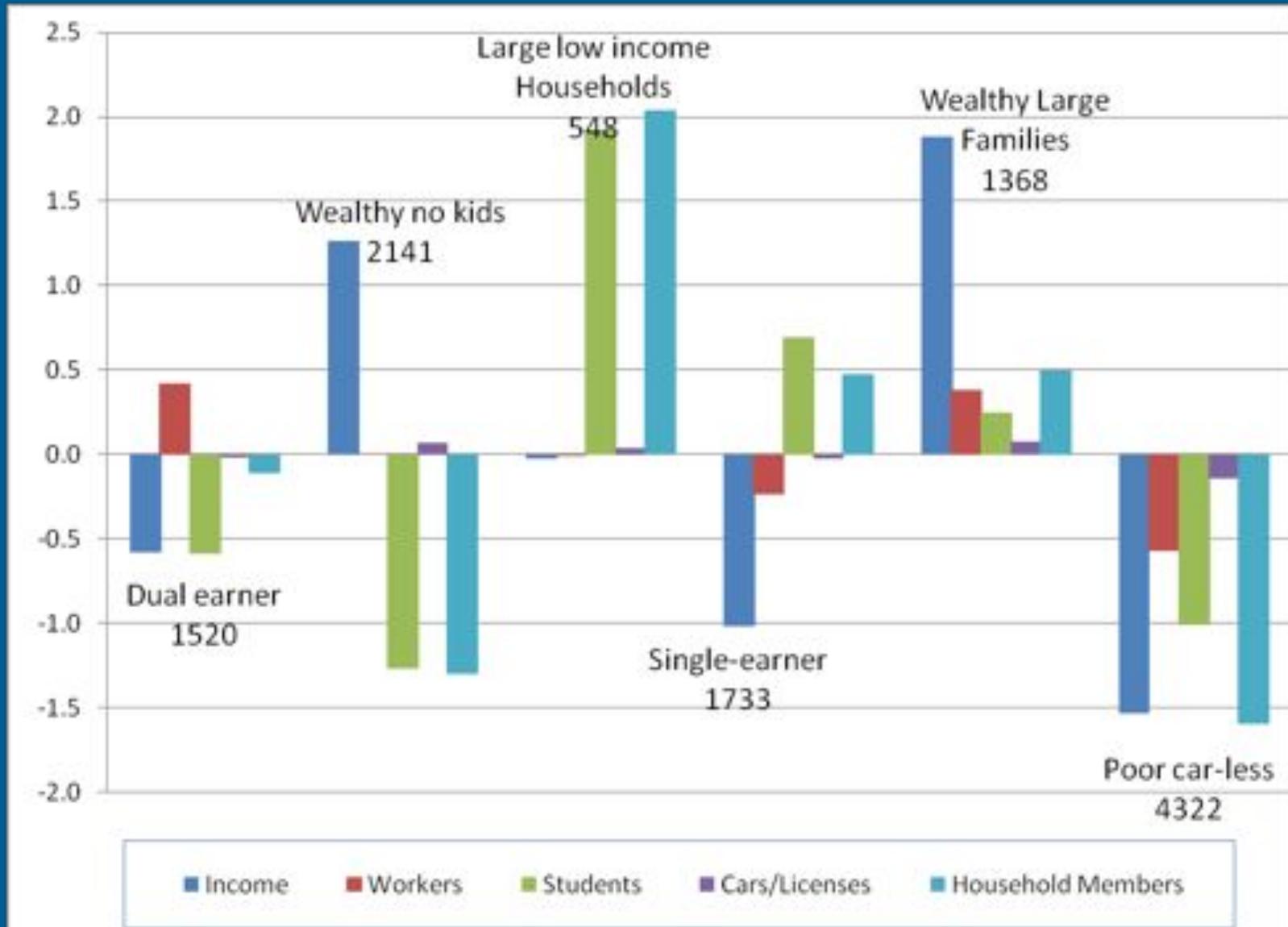
Statistical Analysis: LTI

Variable	Coefficient	t-stat
Dual earner households	0.090	0.250
Large low income	1.262**	2.140
Single earner households	2.740***	6.820
Wealthy large families	-1.871***	-4.490
Poor Car-less	2.921***	10.830
Percentage of trips by walking	11.310***	25.200
Regional accessibility	0.096***	11.470
Local Accessibility	0.159***	32.420
Number of different trip purposes	0.179	0.750
Number of trips	-1.209***	-30.040
Work trip dummy	-2.004***	-4.810
Shopping trip dummy	1.761***	6.100
School trip dummy	-0.504	-1.550
Social dummy	-0.785**	-2.320
Leisure dummy	-0.864***	-2.970
Pick up or drop someone off dummy	1.412***	4.490
Constant	-1.373	-2.420

N=11633 Reference cluster is "wealthy no kids"

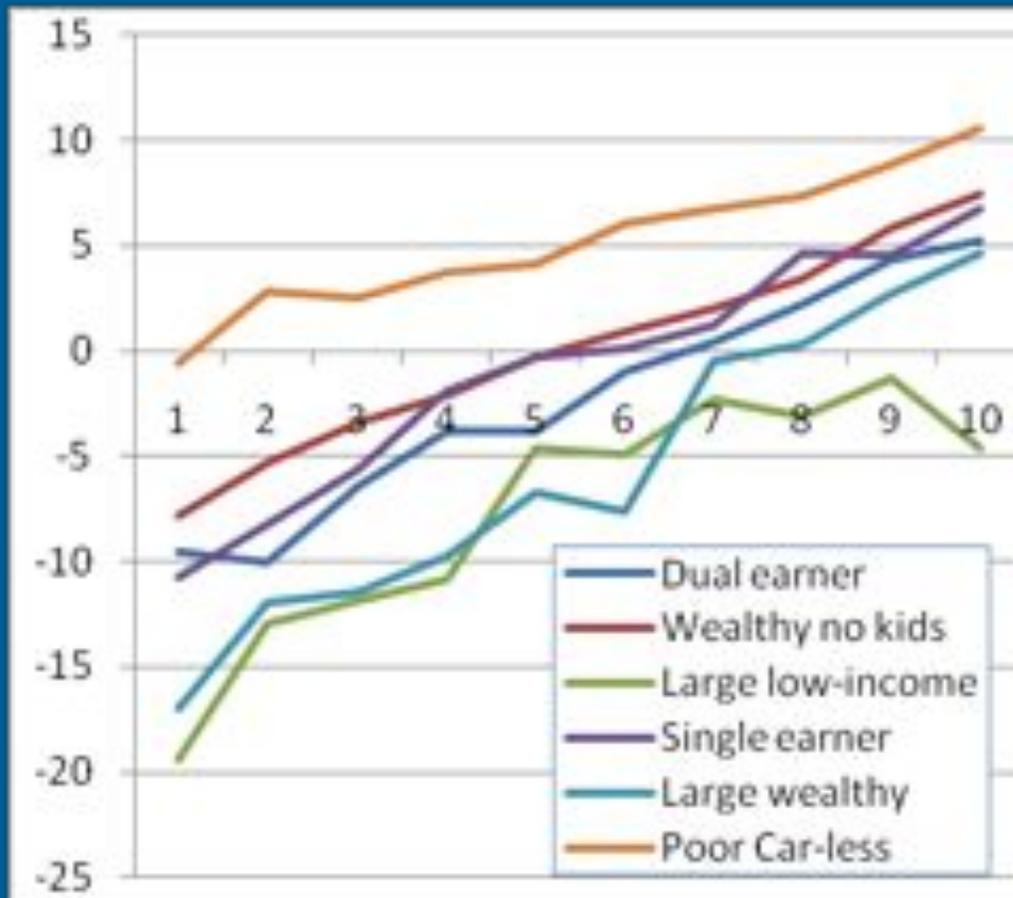*** represents significance at 99%, ** = 95%, * = 90%

Adjusted R-square = 0.416

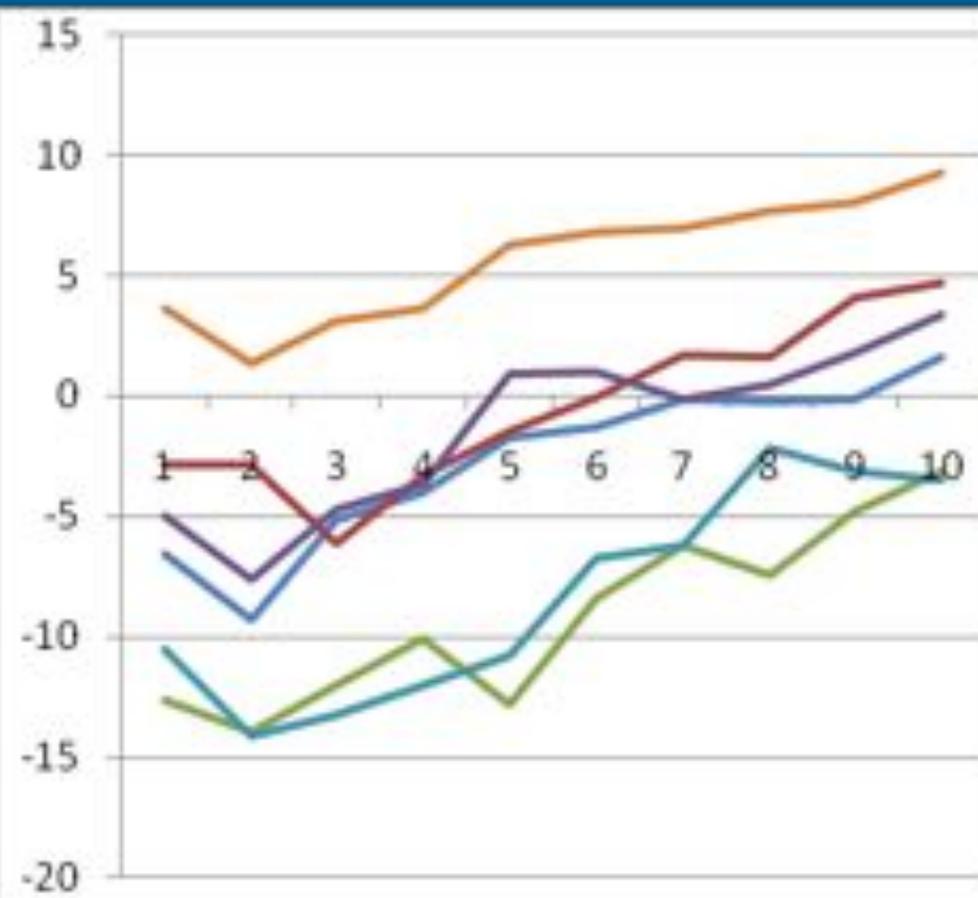# Statistical Analysis: Local and regional accessibility effects on activity space

Cluster	Local Accessibility β(t-value)	Regional Accessibility β (t-value)	R square	N
Dual earner	0.1972 (13.49)***	0.1104 (4.37) ***	0.296	1520
Wealthy no kids	0.1661 (17.04) ***	0.1121 (6.43) ***	0.351	2141
Large low-income	0.2048 (5.86) ***	0.1415 (2.26)**	0.241	548
Single earner	0.1855 (12.9) ***	0.0777 (3.04) ***	0.330	1733
Large wealthy	0.2573 (14.14) ***	0.1710 (5.51) ***	0.323	1368
Poor Car-less	0.0870 (15.07) ***	0.0745 (8.01) ***	0.318	4322

Effect of regional and local access.

Regional Accessibility

Local Accessibility

Legend:
- Dual earner
- Wealthy no kids
- Large low-income
- Single earner
- Large wealthy
- Poor Car-less

Conclusion

- The proposed method appears to be an accurate way of measuring activity space

- Statistical models –with a high level of explanatory power—show that both local and regional accessibility are correlated with the measure.

- Local accessibility is found to have a greater impact on LTI compared to regional measures of accessibility

Conclusion

- Wealthier households with high car access are more dispersed and travelling longer distances than poorer households regardless of levels of accessibility

- This research shows that household characteristics explain much of the variation in the localization of travel

- Equity implications

THANK YOU

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Statistical Analysis: all variables

Variable	Mean	Std. Dev.	Min	Max
Number of different trip purposes	2.77	0.94	2	8
Number of trips	8.07	4.09	3	42
Work trip dummy	0.92	0.27	0	1
Shopping trip dummy	0.35	0.48	0	1
School trip dummy	0.57	0.49	0	1
Leisure dummy	0.29	0.46	0	1
Social dummy	0.15	0.36	0	1
Pick up or drop someone off dummy	0.55	1.11	0	16
Percentage of trips by walking	11.34	21.74	0	100
Doubly constrained accessibility measure	14.97	11.85	0	51
Walkscore	50.82	21.42	0	100
Spatial Dispersal	12.21	111.37	0	5229
Total Distance travelled	51208.80	42077.42	533.75	478794.0
LTI	0.00	1.50	-48.20	8.05