Investigating the Relationship Between Proximity to Subway Stations and Transit Use in Montreal and Toronto

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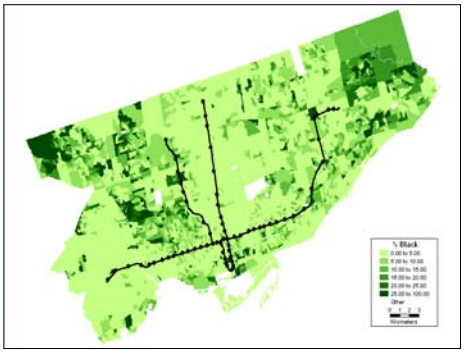
SALUTE systematic analysis of land-use transportation & equity

McGill

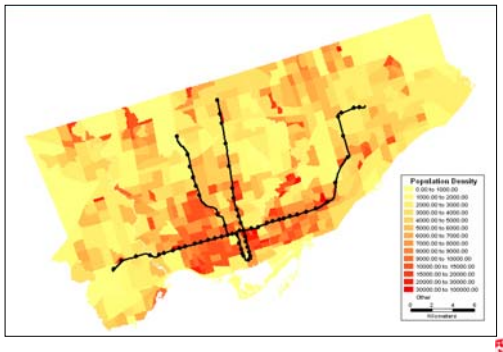
Percentage of Black Population, Toronto (2000)



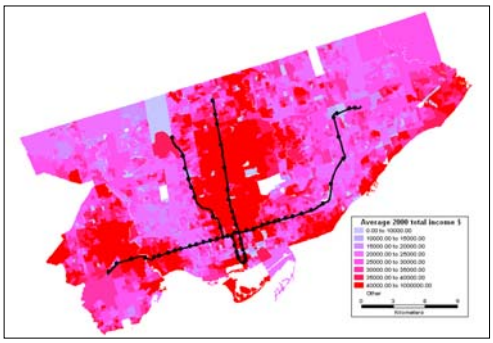
Introduction

- What are the determinants of work mode split in Montreal and Toronto?
- How crucial is density in determining transit mode split?
- What is the impact of racial minorities on transit mode split?
- What is the impact of subway on work mode splits?
- Spatio-Temporal Context and Objectives
  - Island of Montreal and amalgamated City of Toronto
  - Census data from the year 1996 and 2001

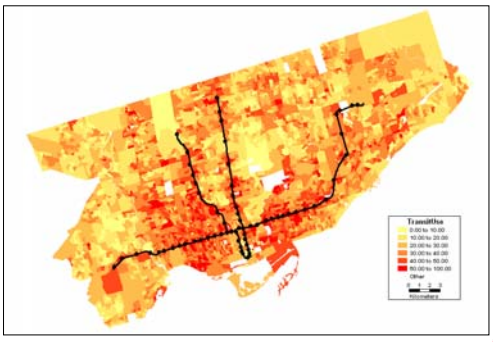
Population Density, Toronto (2000)



Average Household Income, Toronto (2000)



Transit Mode Split, Work Trips, Toronto (2000)



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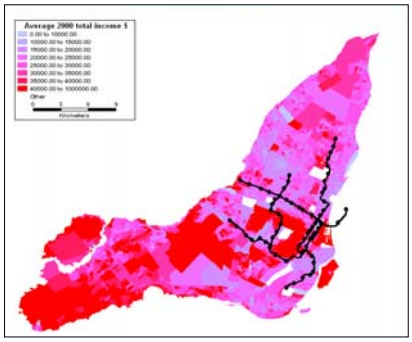

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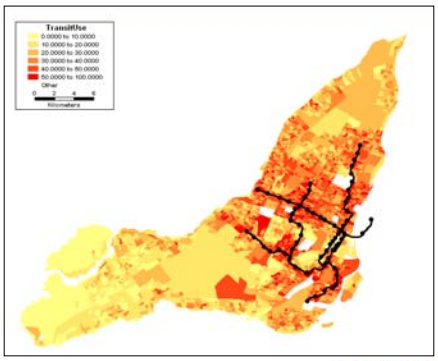
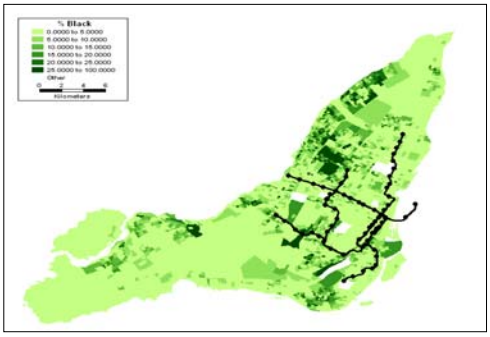
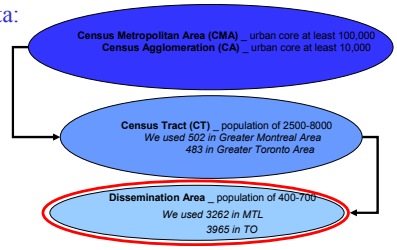


Percentage of Black Population, Montreal (2000)



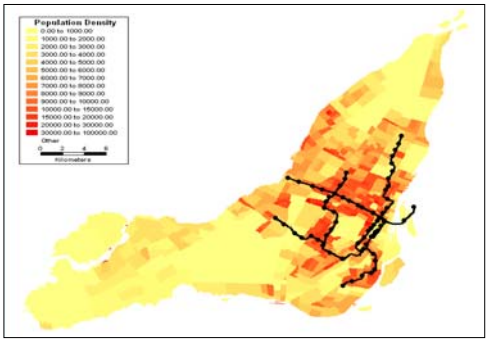
Methodology (i)

- Data:



+ Digital maps of subway systems (DMTI)

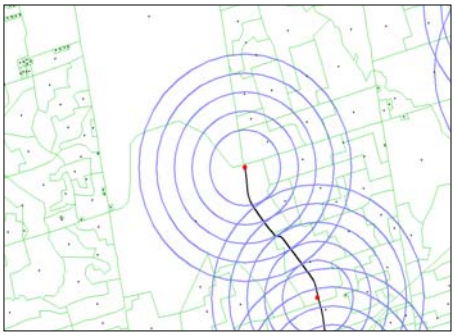
Population Density, Montreal (2000)



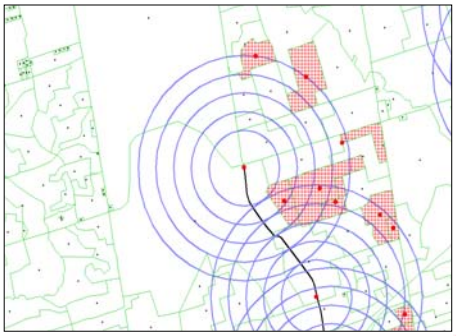
Methodology (ii)

- Multiple Linear Regressions for each city
  - Mode Split = f (distance to nearest subway)
  - Mode Split =f (socio-demographic zonal attributes)

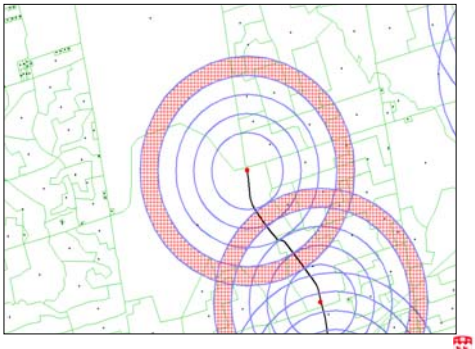
Methodology (iii)



Methodology (vi)



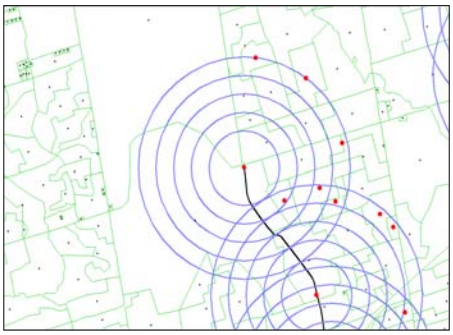
Methodology (iv)



Methodology (vii)

[Contains a station]	[Within 500 m]	[Within 750 m]	[Within 1000 m]	[Within 1250 m]	[Within 1500]	[I
0	0	0	1	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	1	0	0	0	
1	0	0	0	0	0	
0	0	0	1	0	0	
0	0	1	0	0	0	
0	1	0	0	0	0	
0	1	0	0	0	0	
0	1	0	0	0	0	
0	0	1	0	0	0	
0	0	1	0	0	0	
0	0	1	0	0	0	
0	0	0	1	0	0	
0	0	0	0	1	0	
0	0	0	1	0	0	
0	0	0	1	0	0	
0	1	0	0	0	0	
0	0	1	0	0	0	
1	0	0	0	0	0	
0	1	0	0	0	0	
0	0	0	0	0	1	
0	0	0	0	1	0	
0	0	0	1	0	0	

Methodology (v)



Results

- Transit Model vs. distance to subway
  - MONTREAL (transit use = 32.7%):
    - R-squared: **0.2077**
    - Most significant variables:
      - Metro station within 750m (+)
      - Metro station within 500m (+)
  - TORONTO (transit use=33.8%) :
    - R-squared: **0.1533**
    - Most significant variables:
      - Metro station within 500m (+)
      - Metro station within the zone(+)

Toronto - 1996

- Transit Model vs. distance to subway

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.652[a]	.425	.423	12.06096

a. Predictors: (Constant), POPULATION, WITHIN_100, P_HISP, CONTAINSST, WITHIN_125, P_WOMEN, WITHIN_750, P_BLACK, WITHIN_500, AVERAGE_19, P_65, DISTANCE_C

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	19.182	2.671		7.182	.000
	DISTANCE_C	-.881	.047	-.322	-18.882	.000
	P_WOMEN	.523	.053	.123	9.803	.000
	P_65	-.236	.023	-.165	-10.253	.000
	P_BLACK	.281	.020	.215	13.927	.000
	P_HISP	.183	.058	.044	3.168	.002
	CONTAINSST	8.555	1.665	.070	5.138	.000
	WITHIN_500	6.165	.732	.132	8.428	.000
	WITHIN_750	4.761	.837	.084	5.691	.000
	WITHIN_100	3.181	.903	.050	3.523	.000
	WITHIN_125	3.513	.890	.055	3.946	.000
	AVERAGE_19	-2.57E-04	.000	-.229	-15.407	.000
	POPULATION	3.285E-04	.000	.110	10.898	.000

a. Dependent Variable: TRANSITUSE

Montreal - 2001

- Transit Model vs. distance to subway

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.712[a]	.506	.504	10.34734

a. Predictors: (Constant), Tract Density, WITHIN_1500, CONTAINS_A, Black, p_women, WITHIN_1250, WITHIN_1000, WITHIN_750, Hispanic, Average Income, Household size, WITHIN_500, p_65+, DISTANCE_F

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	37.390	3.020		12.381	.000
	DISTANCE_F	-.506	.049	-.203	-10.249	.000
	p_women	.215	.057	.061	3.777	.000
	p_65+	-.146	.025	-.100	-5.796	.000
	Household size	-3.105	.474	-.109	-6.555	.000
	Black	.336	.025	.194	13.669	.000
	Hispanic	.339	.048	.092	7.017	.000
	CONTAINS_A	11.089	1.471	.096	7.539	.000
	WITHIN_500	10.256	.660	.260	15.534	.000
	WITHIN_750	5.941	.720	.126	8.251	.000
	WITHIN_1000	5.018	.778	.092	6.454	.000
	WITHIN_1250	4.671	.828	.078	5.642	.000
	WITHIN_1500	5.138	.885	.078	5.803	.000
	Average Income	-3.19E-04	.000	-.316	-22.343	.000
	Tract Density	1.129E-04	.000	.042	2.626	.009

a. Dependent Variable: Transit

Toronto - 2001

- Transit Model vs. distance to subway

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.672[a]	.452	.450	10.81076

a. Predictors: (Constant), POPULATION, WITHIN1000, CONTAINSST, P_HISP, WITHIN1500, P_WOMEN, WITHIN1250, WITHIN750M, P_BLACK, AVERAGE_20, HOUSEHOLD_, WITHIN500M, P_65, CBD_DISTAN

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	23.019	3.107		7.409	.000
	CBD_DISTAN	-.572	.046	-.226	-12.559	.000
	P_WOMEN	.491	.057	.123	8.641	.000
	P_65	-.313	.024	-.201	-13.103	.000
	HOUSEHOLD_	-2.521	.375	-.111	-6.716	.000
	P_BLACK	.265	.019	.196	14.238	.000
	P_HISP	.176	.044	.049	3.984	.000
	CONTAINSST	7.116	1.383	.063	5.144	.000
	WITHIN500M	9.812	.675	.210	14.545	.000
	WITHIN750M	5.740	.737	.102	7.789	.000
	WITHIN1000	3.653	.733	.064	4.987	.000
	WITHIN1250	3.311	.724	.058	4.573	.000
	WITHIN1500	2.384	.817	.037	2.919	.004
	AVERAGE_20	-1.46E-04	.000	-.251	-19.070	.000
	POPULATION	3.651E-04	.000	.165	11.872	.000

a. Dependent Variable: TRANSITUSE

Findings

- Zones located in the vicinity of subway stations have higher rates of transit use
- Income (though NOT density) is a better predictor of transit use than distance to subways
- There exists a correlation between the transit use and the racial composition of a zone. It is hypothesized that income is the common link

Montreal - 1996

- Transit Model vs. distance to subway

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.556[a]	.309	.305	12.40238

a. Predictors: (Constant), tract population density, CONTAINS_A, Percent 65+, WITHIN_150, WITHIN_125, WITHIN_100, Percent hispanic, WITHIN_750, Percent black, Average income, WITHIN_500, Percent women, Averaae household size, DISTANCE_F

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	9.788	3.769		2.597	.009
	DISTANCE_F	-.380	.070	-.143	-5.434	.000
	Percent women	.568	.069	.173	8.181	.000
	Percent 65+	-.255	.032	-.184	-8.057	.000
	Average household size	-1.710	.695	-.168	-2.458	.014
	Percent black	.435	.037	.217	11.641	.000
	Percent hispanic	.528	.069	.137	7.702	.000
	CONTAINS_A	11.242	1.760	.113	6.388	.000
	WITHIN_500	6.469	.862	.174	7.502	.000
	WITHIN_750	6.923	.962	.148	7.198	.000
	WITHIN_100	5.402	1.027	.101	5.258	.000
	WITHIN_125	4.392	1.134	.072	3.874	.000
	WITHIN_150	4.881	1.207	.072	4.042	.000
	Average income	-2.28E-04	.000	-.178	-9.516	.000
	tract population density	1.096E-04	.000	.044	2.136	.033

a. Dependent Variable: percent transit

Conclusions & Policy Implications

- There exists a statistical link between transit mode split and proximity to subway stations. A small statistical link.
- Is the extension of the subway to Laval justified given our results? More serious cost/benefit analysis required especially when dealing with such important projects…