



Residential Segregation

In Three Canadian Cities, 1881-1961

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University of Victoria



Outline

- Three Dissimilar Cities
- Methods
- Maps & Measures
- Conclusions & Future Research



THREE Cities, TWO Centuries

Victoria – London – Montreal

1881/1891

Rapid Industrialisation

First *National* Census of Canada

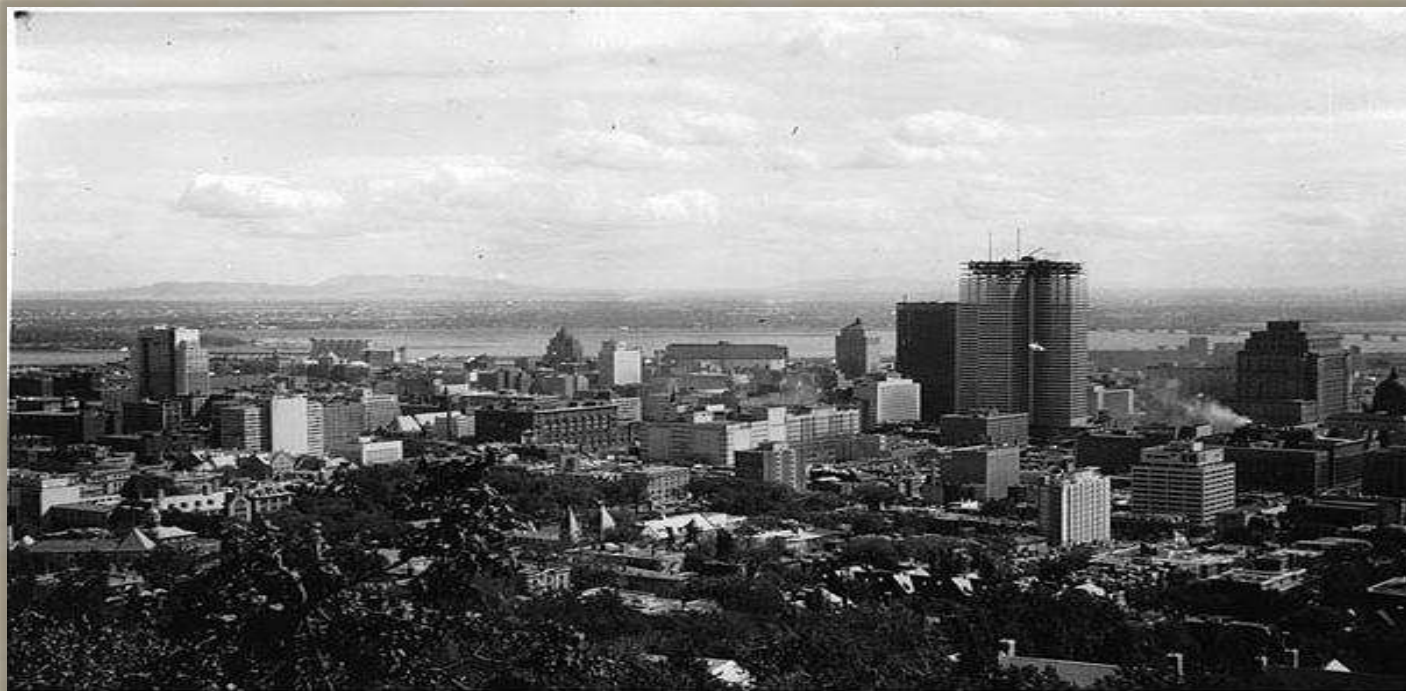
1961

Rapid Suburbanisation

Full set of sources required for
HGIS (digital census, FIPs)

Montreal

1881



1961

London

1961



1881

Victoria



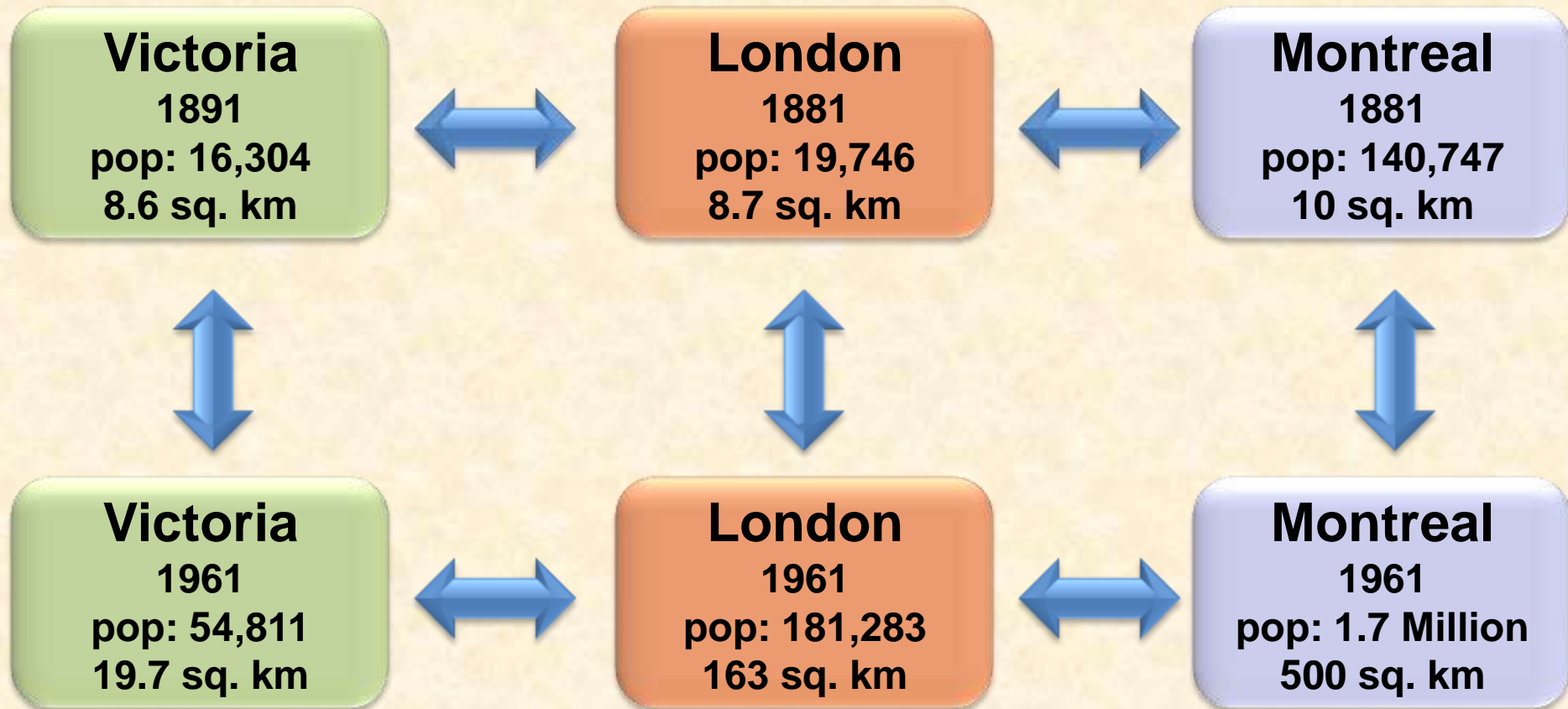
1891

1961

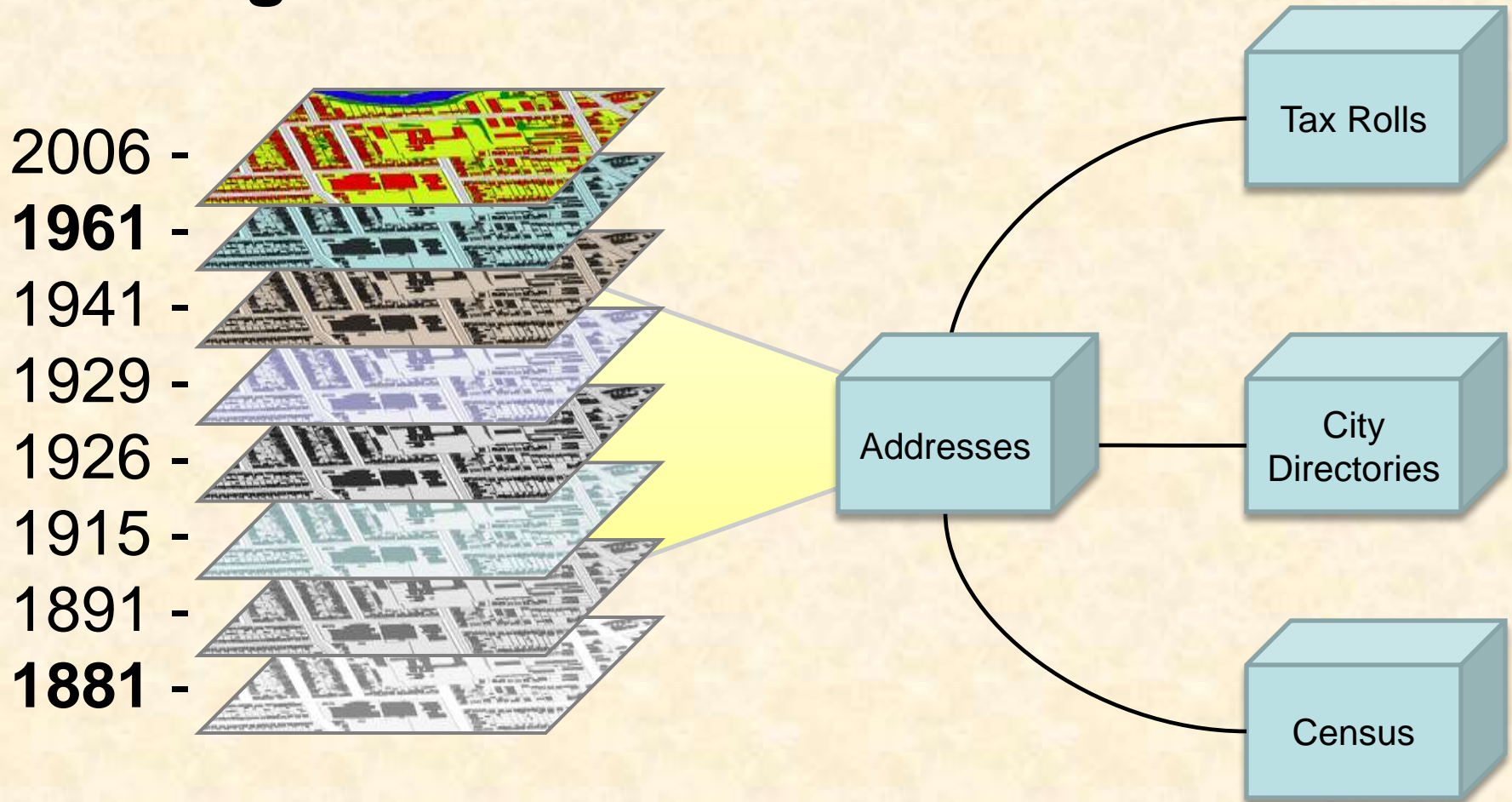


Comparing Three Cities

In Two Centuries Spatially and Temporally



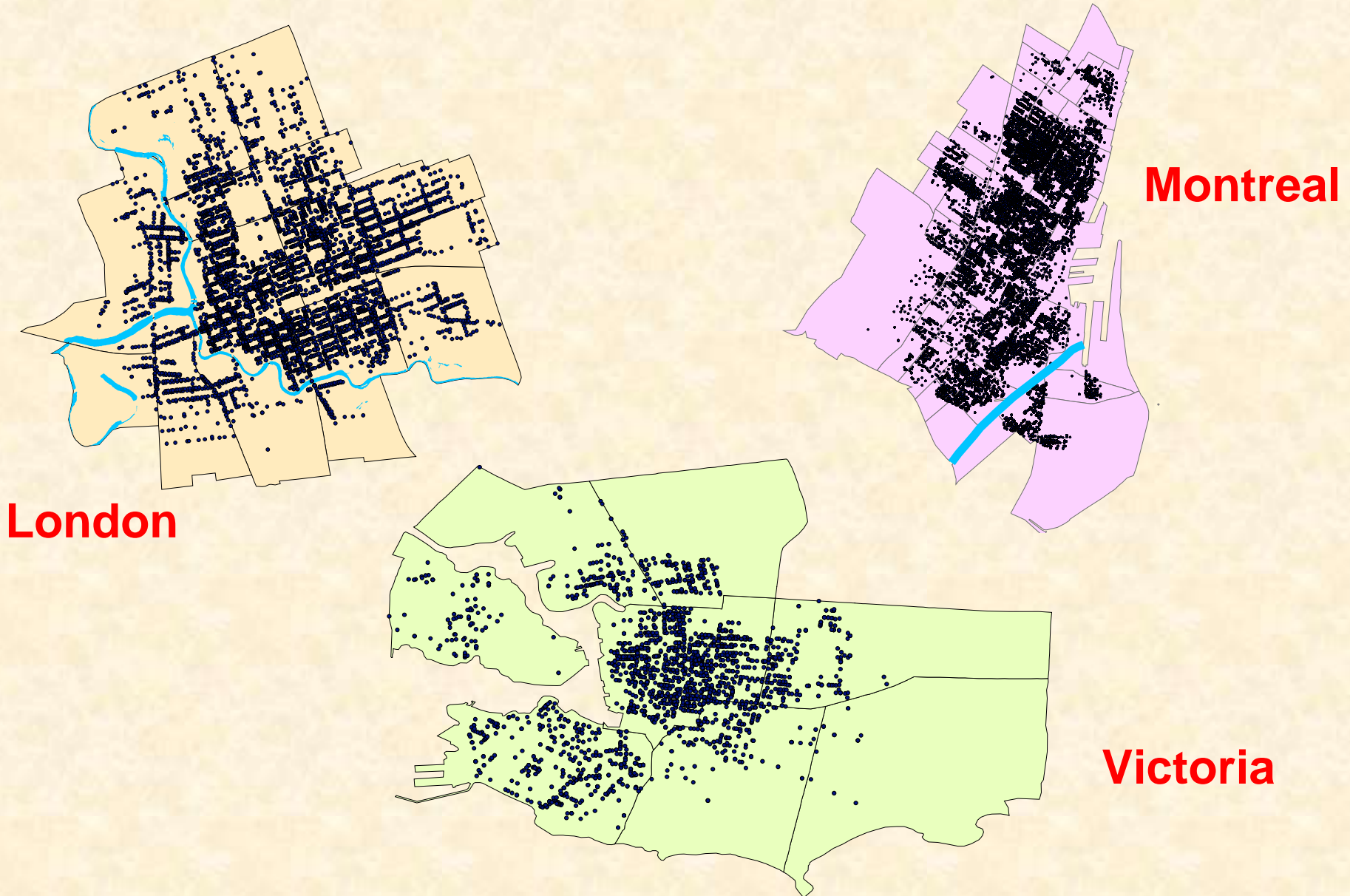
Building the H-GIS...



Connecting past and present

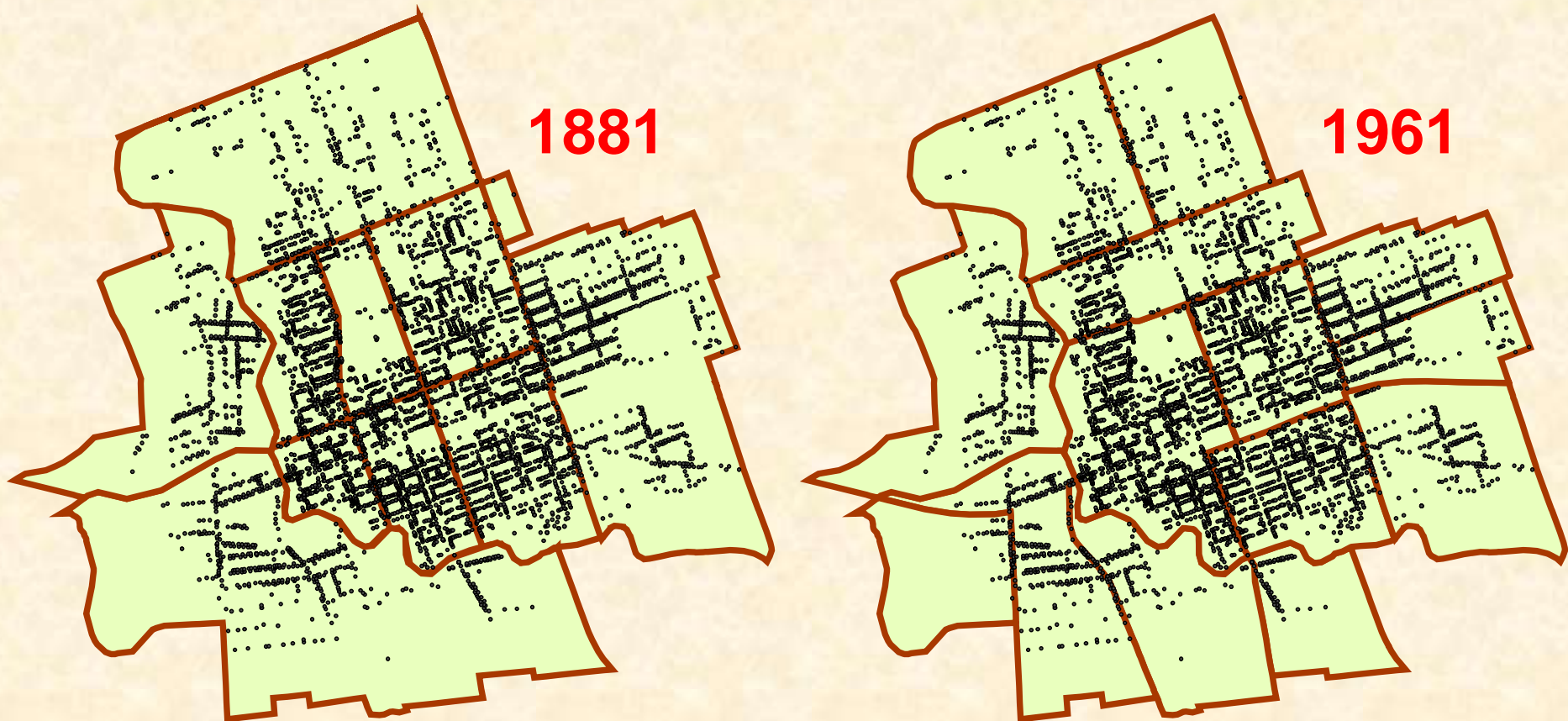
*Historical maps are digitized, rectified & georeferenced,
and integrated with census, tax rolls and city directory*

Historical GIS: *Power in Precision*

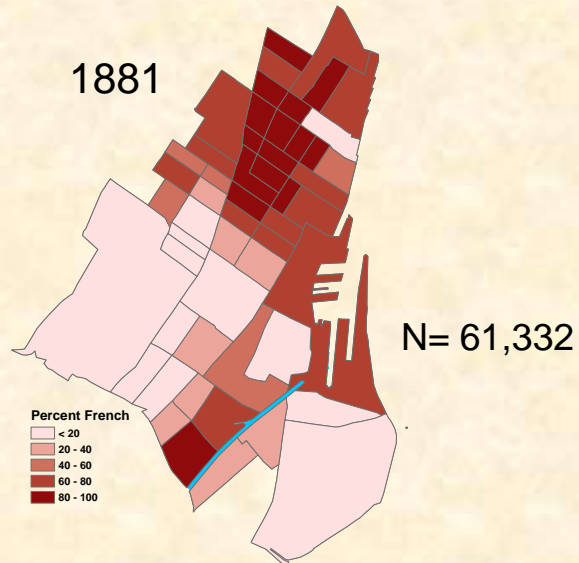


Overcoming MAUP

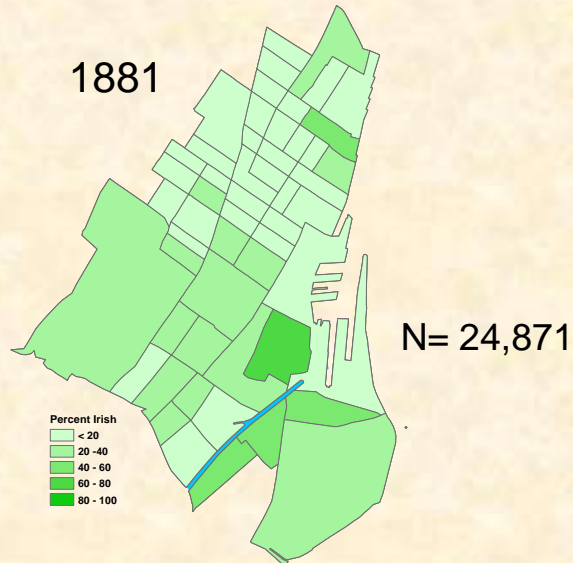
Modifiable Areal Unit Problem



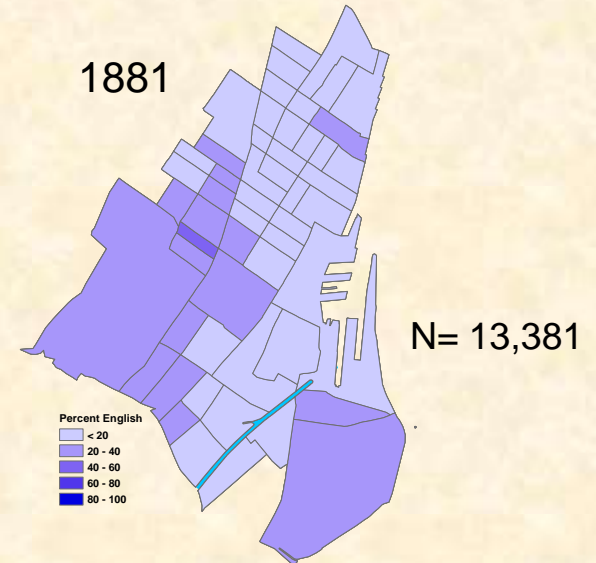
Montreal: Concentrations of largest cultural communities, 1881 & 1961



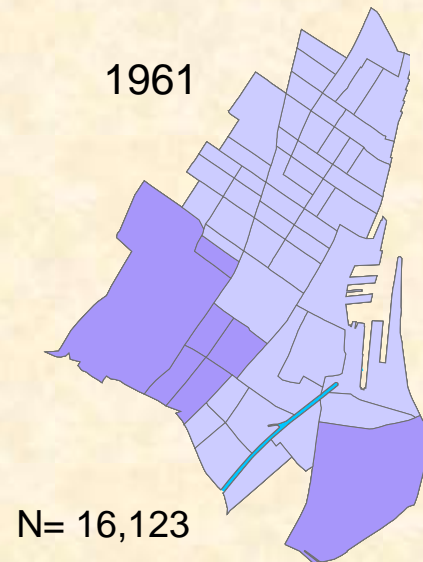
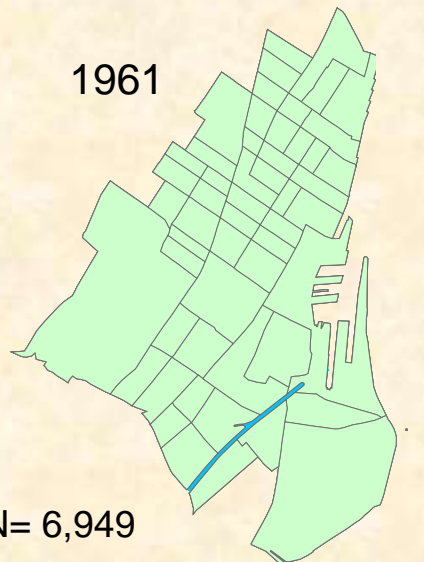
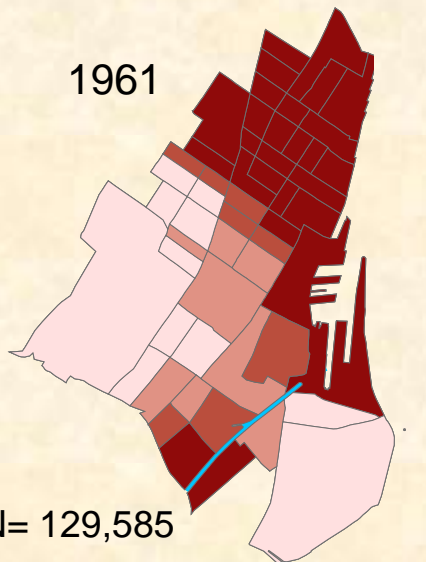
French



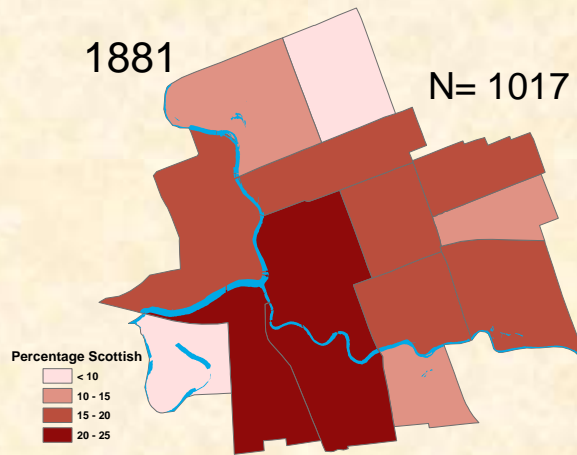
Irish



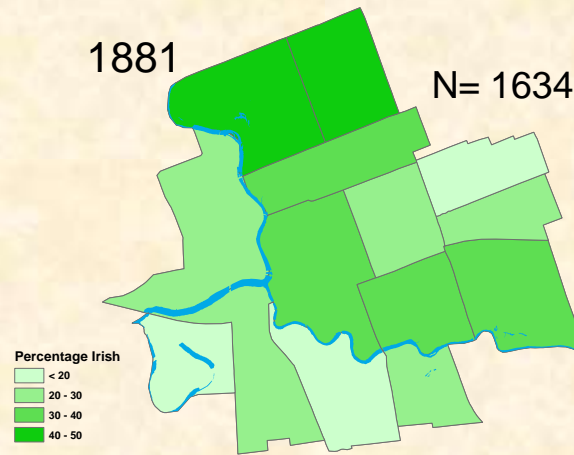
English



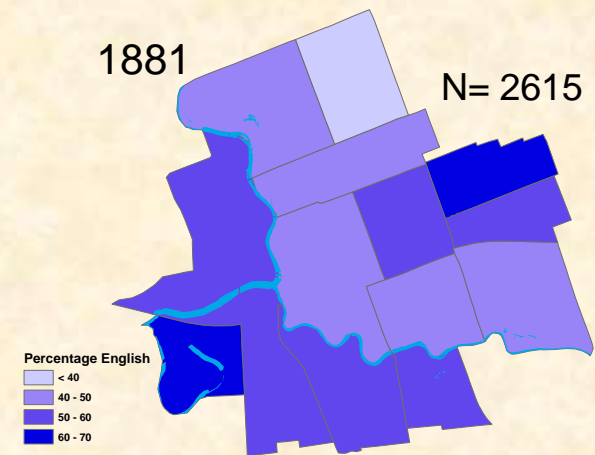
London: Concentrations of largest cultural communities, 1881 & 1961



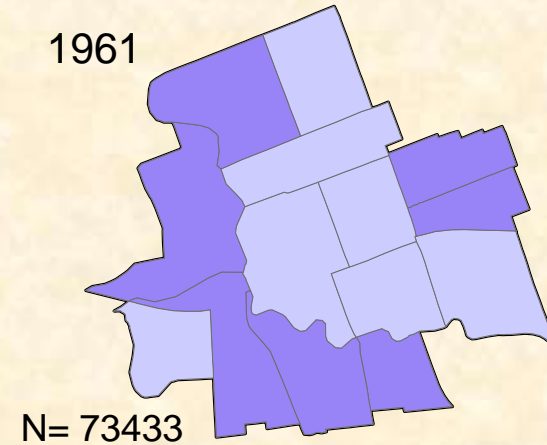
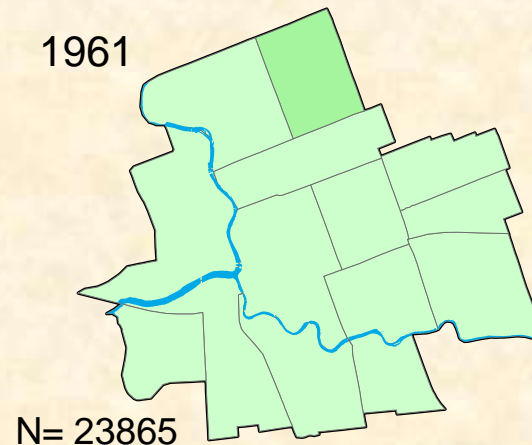
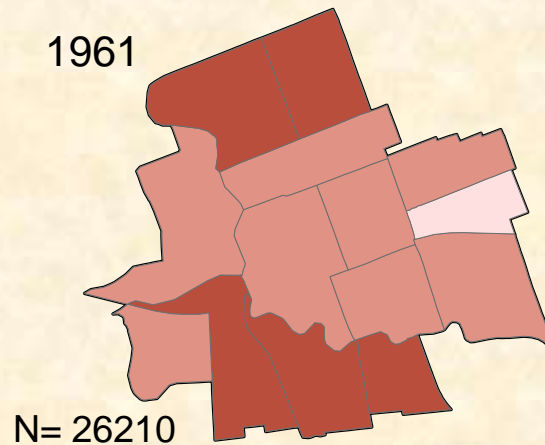
Scottish



Irish

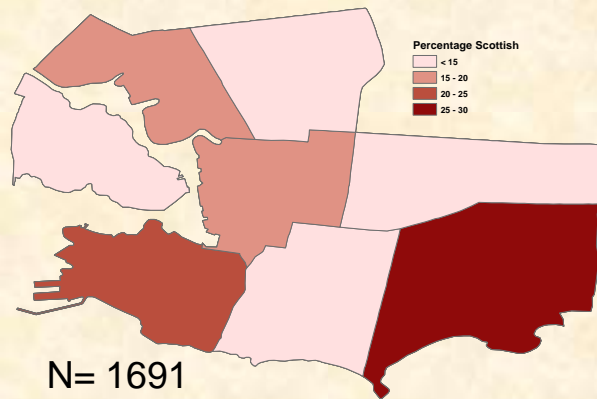


English



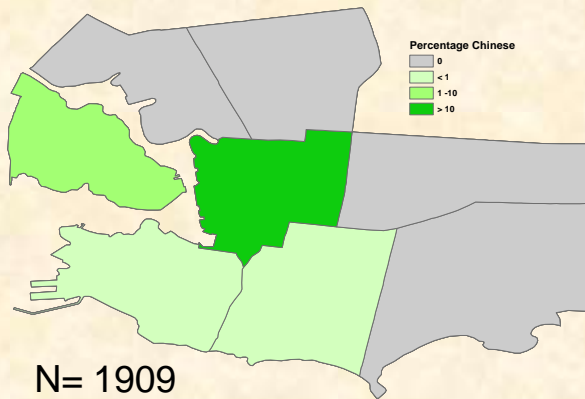
Victoria: Concentrations of largest cultural communities, 1891 & 1961

1891



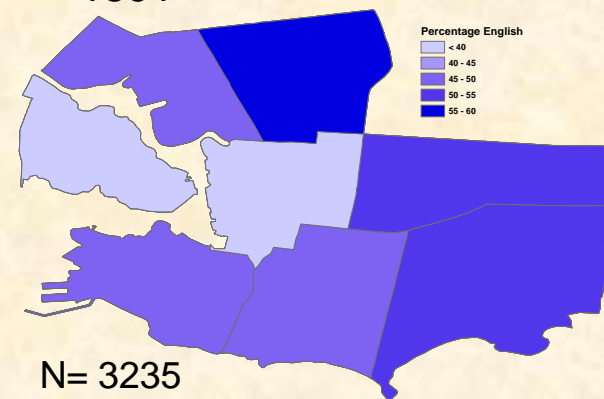
Scottish

1891



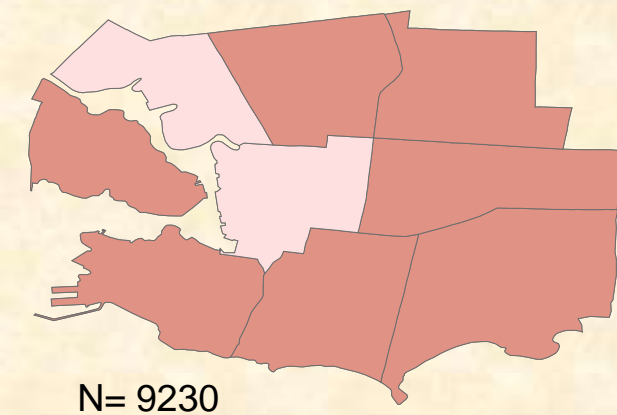
Chinese

1891

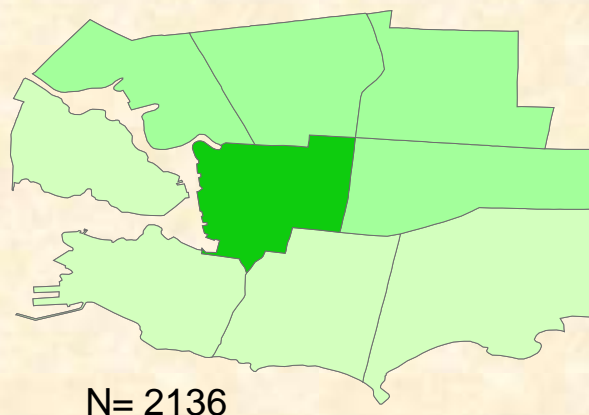


English

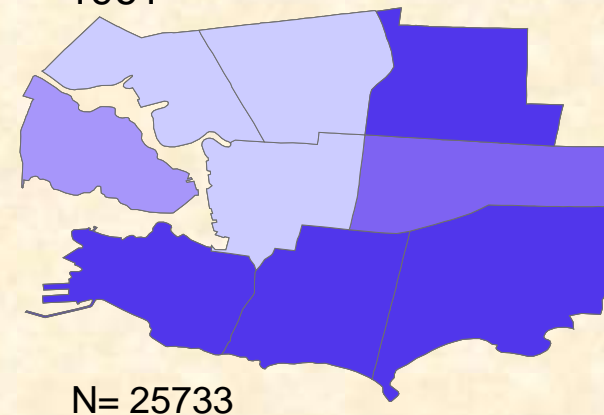
1961




1961



1961





Measuring *Segregation*

$$SI = \frac{1}{2} \sum_{i=1}^n \left| \frac{e_i}{E_T} - \frac{f_i}{F_T} \right|$$

After Duncan and Duncan (1955)

Segregation by Ethnicity in 3 Cities

1881

Montreal

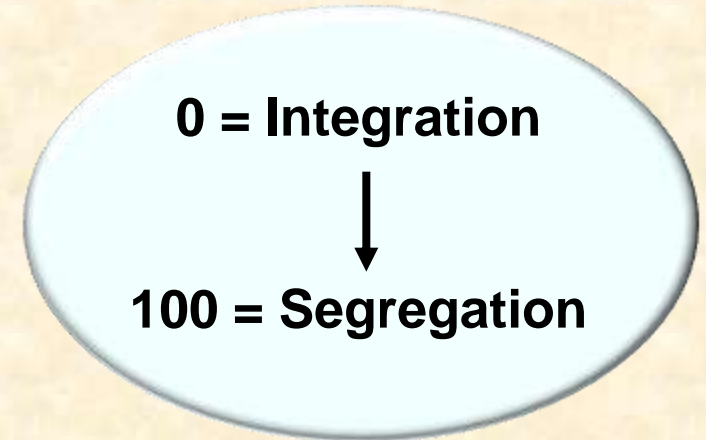
	English	French	Irish	Scottish	Jewish	All Other
English	0					
French	56.8	0				
Irish	25.2	55.6	0			
Scottish	1.7	63.7	31.8	0		
Jewish	52.6	74	58.4	52.8	0	
All Other	22.7	44.7	30.4	26.7	63.8	0

London

	English	Irish	Scottish	German	French	African	Allother
English	0						
Irish	8.1	0					
Scottish	5.4	6.9	0				
German	9.3	9.1	9.8	0			
French	13	12.9	14.2	10.8	0		
African	52.1	53.3	54.1	53	46.6	0	
Allother	7.7	6.6	6.2	7.2	11.3	51.5	0

Victoria

	English	Irish	Scottish	Chinese	German	French	All Other
English	0						
Irish	12.9	0					
Scottish	8.2	11.6	0				
Chinese	53.5	45.3	48.4	0			
German	12	12.4	13.1	51.2	0		
French	25.7	22.4	17.7	44	27.9	0	
All Other	12.6	7.7	6.6	49.2	11.1	20.6	0



Segregation by Ethnicity in 3 Cities

1881

1961

Montreal

	English	French	Irish	Scottish	Jewish	All
English	0					
French	56.8	0				
Irish	25.2	55.6	0			
Scottish	1.7	63.7	31.8	0		
Jewish	52.6	74	58.4	52.8	0	
All	22.7	44.7	30.4	26.7	63.8	0

	English	French	Irish	Scottish	Jewish	All
English	0					
French	56.4	0				
Irish	14.7	56.4	0			
Scottish	14.6	63.8	15.6	0		
Jewish	75.3	86.5	72.4	74.6	0	
All	38.8	52.8	35.7	42.6	79	0

London

	English	Irish	Scottish	German	French	African	All
English	0						
Irish	8.1	0					
Scottish	5.4	6.9	0				
German	9.3	9.1	9.8	0			
French	13	12.9	14.2	10.8	0		
African	52.1	53.3	54.1	53	46.6	0	
All	7.7	6.6	6.2	7.2	11.3	51.5	0

	English	Irish	Scottish	German	French	African	All
English	0						
Irish	13.6	0					
Scottish	11.1	10.3	0				
German	20.1	15.7	13.7	0			
French	37.5	30.4	30.8	36.2	0		
African	39.9	29.3	32.1	34.8	39.9	0	
All	11.6	8.3	8.3	17	33.2	34.6	0

Victoria

	English	Irish	Scottish	Chinese	German	French	All
English	0						
Irish	12.9	0					
Scottish	8.2	11.6	0				
Chinese	53.5	45.3	48.4	0			
German	12	12.4	13.1	51.2	0		
French	25.7	22.4	17.7	44	27.9	0	
All	12.6	7.7	6.6	49.2	11.1	20.6	0

	English	Irish	Scottish	Chinese	German	French	All
English	0						
Irish	5.5	0					
Scottish	4.6	3.2	0				
Chinese	55.3	53.8	54	0			
German	12.7	10.4	11.7	52	0		
French	15.1	12.9	13.5	50	8.8	0	
All Other	8.5	4.7	5	53.5	9.9	11.4	0

Segregation by Ethnicity in 3 Cities

1881

1961

Montreal

	English	French	Irish	Scottish	Jewish	All
English	0					
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Scottish	1.7	63.7	31.8	0		
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All	22.7	44.7	30.4	26.7	63.8	0

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German	9.3	9.1	9.8	0			
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French	37.5	30.4	30.8	36.2	0		
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Scottish	8.2	11.6	0				
Chinese	53.5	45.3	48.4	0			
German	12	12.4	13.1	51.2	0		
French	25.7	22.4	17.7	44	27.9	0	
All	12.6	7.7	6.6	49.2	11.1	20.6	0

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Scottish	4.6	3.2	0				
Chinese	55.3	53.8	54	0			
German	12.7	10.4	11.7	52	0		
French	15.1	12.9	13.5	50	8.8	0	
All Other	8.5	4.7	5	53.5	9.9	11.4	0

Segregation by Ethnicity in 3 Cities

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African	52.1	53.3	54.1	53	46.6	0	
All	7.7	6.6	6.2	7.2	11.3	51.5	0

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German	20.1	15.7	13.7	0			
French	37.5	30.4	30.8	36.2	0		
African	39.9	29.3	32.1	34.8	39.9	0	
All	11.6	8.3	8.3	17	33.2	34.6	0

Victoria

	English	Irish	Scottish	Chinese	German	French	All
English	0						
Irish	12.9	0					
Scottish	8.2	11.6	0				
Chinese	53.5	45.3	48.4	0			
German	12	12.4	13.1	51.2	0		
French	25.7	22.4	17.7	44	27.9	0	
All	12.6	7.7	6.6	49.2	11.1	20.6	0

	English	Irish	Scottish	Chinese	German	French	All
English	0						
Irish	5.5	0					
Scottish	4.6	3.2	0				
Chinese	55.3	53.8	54	0			
German	12.7	10.4	11.7	52	0		
French	15.1	12.9	13.5	50	8.8	0	
All Other	8.5	4.7	5	53.5	9.9	11.4	0

Segregation by Ethnicity in 3 Cities

1881

1961

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Scottish	1.7	63.7	31.8	0		
Jewish	52.6	74	58.4	52.8	0	
All	22.7	44.7	30.4	26.7	63.8	0

	English	French	Irish	Scottish	Jewish	All
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French	56.4	0				
Irish	14.7	56.4	0			
Scottish	14.6	63.8	15.6	0		
Jewish	75.3	86.5	72.4	74.6	0	
All	38.8	52.8	35.7	42.6	79	0

London

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Scottish	5.4	6.9	0				
German	9.3	9.1	9.8	0			
French	13	12.9	14.2	10.8	0		
African	52.1	53.3	54.1	53	46.6	0	
All	7.7	6.6	6.2	7.2	11.3	51.5	0

	English	Irish	Scottish	German	French	African	All
English	0						
Irish	13.6	0					
Scottish	11.1	10.3	0				
German	20.1	15.7	13.7	0			
French	37.5	30.4	30.8	36.2	0		
African	39.9	29.3	32.1	34.8	39.9	0	
All	11.6	8.3	8.3	17	33.2	34.6	0

Victoria

	English	Irish	Scottish	Chinese	German	French	All
English	0						
Irish	12.9	0					
Scottish	8.2	11.6	0				
Chinese	53.5	45.3	48.4	0			
German	12	12.4	13.1	51.2	0		
French	25.7	22.4	17.7	44	27.9	0	
All	12.6	7.7	6.6	49.2	11.1	20.6	0

	English	Irish	Scottish	Chinese	German	French	All
English	0						
Irish	5.5	0					
Scottish	4.6	3.2	0				
Chinese	55.3	53.8	54	0			
German	12.7	10.4	11.7	52	0		
French	15.1	12.9	13.5	50	8.8	0	
All Other	8.5	4.7	5	53.5	9.9	11.4	0

Segregation by Religion in 3 Cities

1881

1961

Montreal

	Catholic	Protestant	Jewish	All
Catholic	0			
Protestant	49	0		
Jewish	70.7	51.8	0	
All	48.7	48.8	63.9	0

	Catholic	Protestant	Jewish	All
Catholic	0			
Protestant	55.5	0		
Jewish	81.9	69.4	0	
All	58	52.5	78.4	0

London

	Catholic	Protestant	Other	All
Catholic	0			
Protestant	14.9	0		
Other	27.2	21.7	0	
All	15	12.8	22.4	0

	Catholic	Protestant	Other	All
Catholic	0			
Protestant	12.4	0		
Other	11.7	12.4	0	
All	12	11.7	11.4	0

Victoria

	Catholic	Protestant	Other	All
Catholic	0			
Protestant	17	0		
Other	12.6	10.6	0	
All	16.8	13	10	0

	Catholic	Protestant	Other	All
Catholic	0			
Protestant	15	0		
Other	12.6	18.9	0	
All	14.3	14	18.2	0

Segregation by Occupational Class in 3 Cities

1881

1961

Montreal

	High	Middle	Low	All
High	0			
Middle	21.5	0		
Low	19.7	22.2	0	
All	18	19.9	19	0

	High	White Middle	Blue Middle	Low	All
High	0				
White Middle	23.4	0			
Blue Middle	36.5	20.3	0		
Low	45.8	26.5	15.7	0	
All	35.7	14.6	14.5	27.9	0

London


	High	Middle	Low	All
High	0			
Middle	12	0		
Low	13.6	6.6	0	
All	12.2	7.8	6.7	0

	High	White Middle	Blue Middle	Low	All
High	0				
White Middle	21.7	0			
Blue Middle	31.8	16	0		
Low	34.4	17	12	0	
All	28.7	9	14.3	19	0

Victoria

	High	Middle	Low	All
High	0			
Middle	13.1	0		
Low	11.6	10.1	0	
All	12.6	11.3	6.9	0

	High	White Middle	Blue Middle	Low	All
High	0				
White Middle	14.2	0			
Blue Middle	33.7	21.7	0		
Low	28.1	17.1	21.8	0	
All	24.7	11	22.6	20.4	0

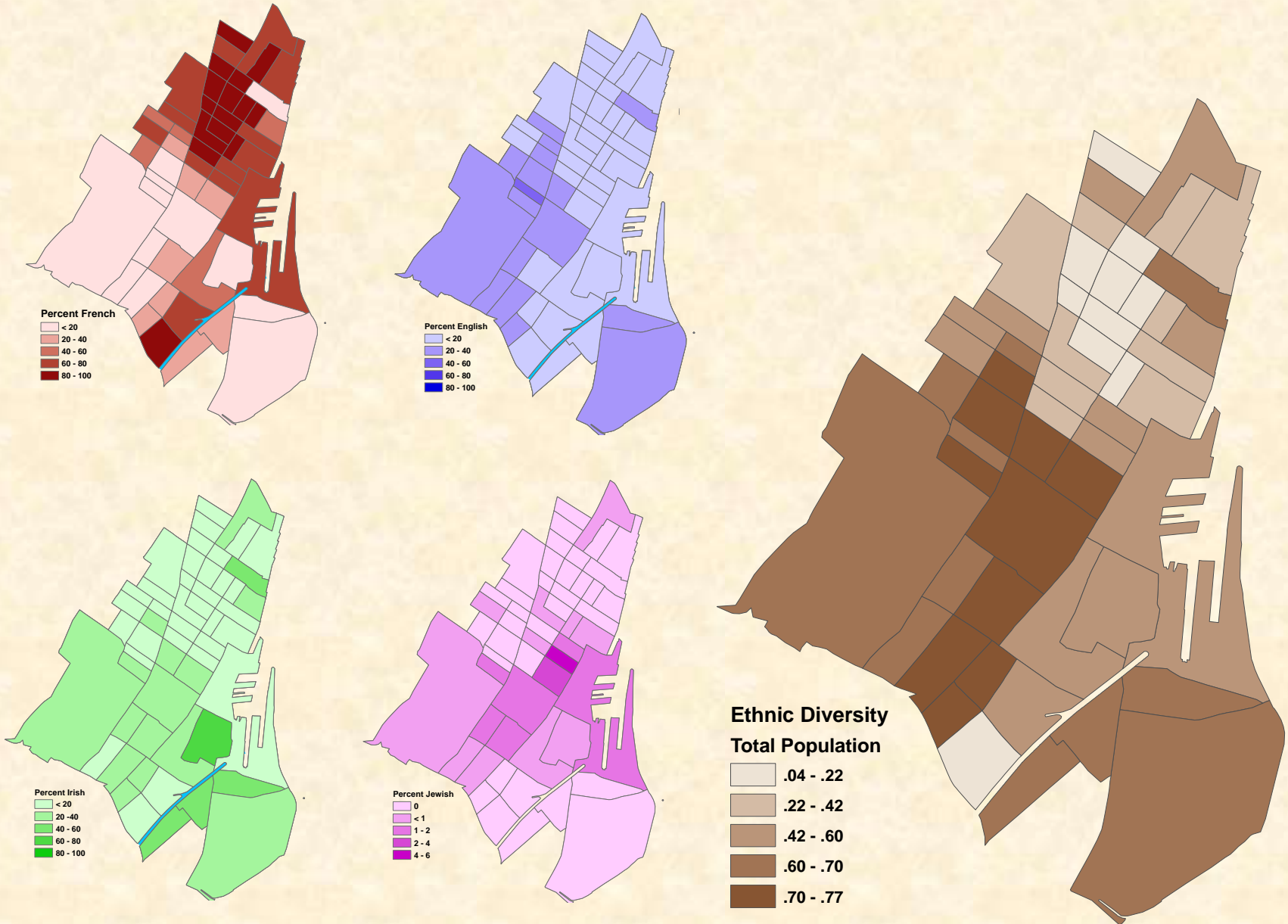


Measuring *Diversity*

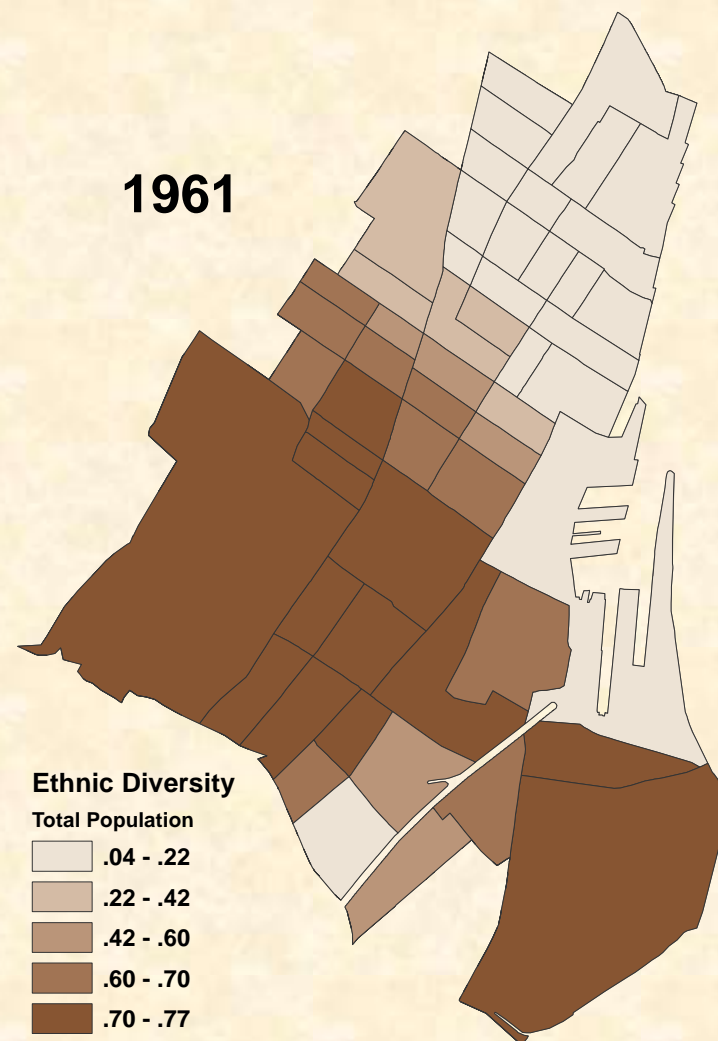
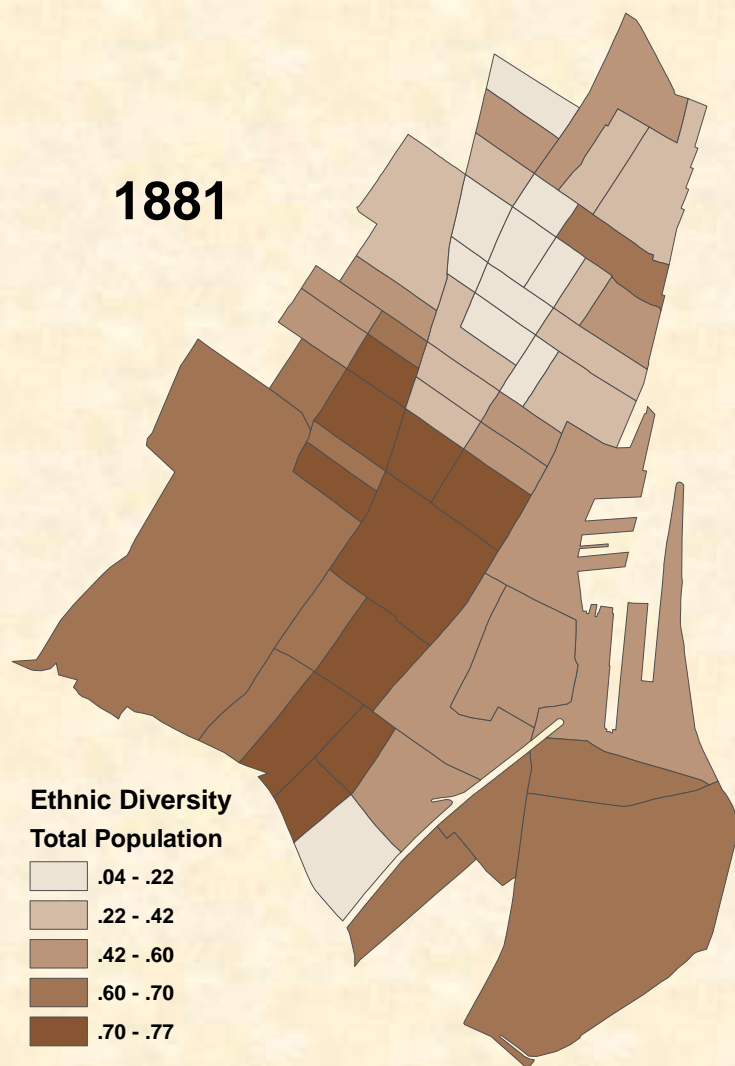
$$DI = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$$

Simpson (*Nature*, 1949)

Montreal Concentrations and levels of *Diversity*- 1881

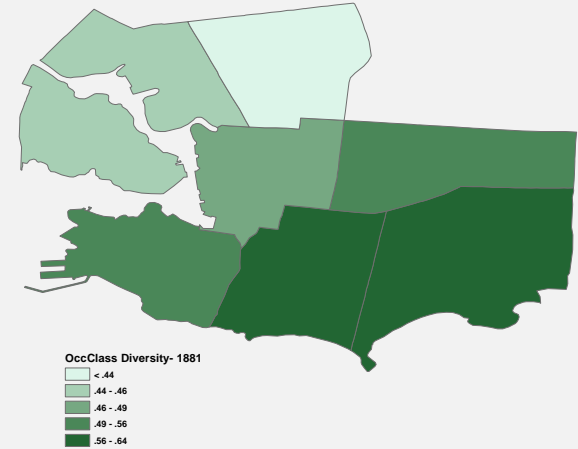
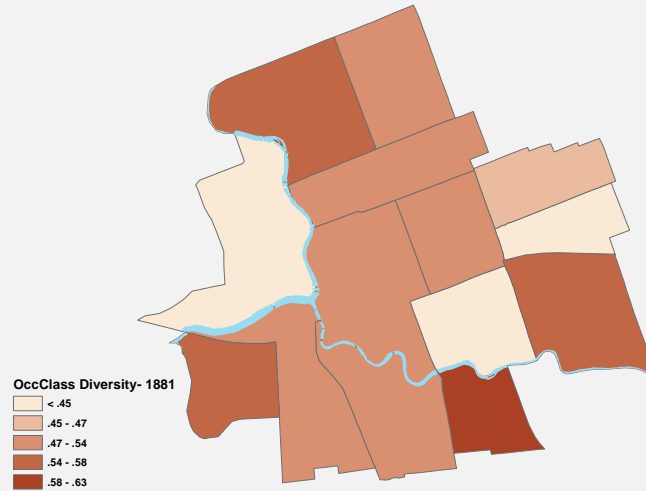
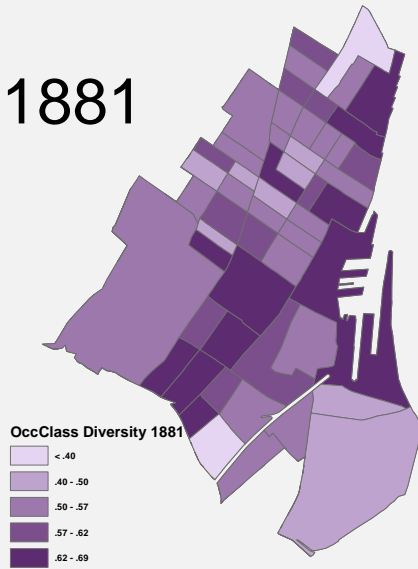


Montreal- *Diverse* Neighbourhoods, *Segregated* City

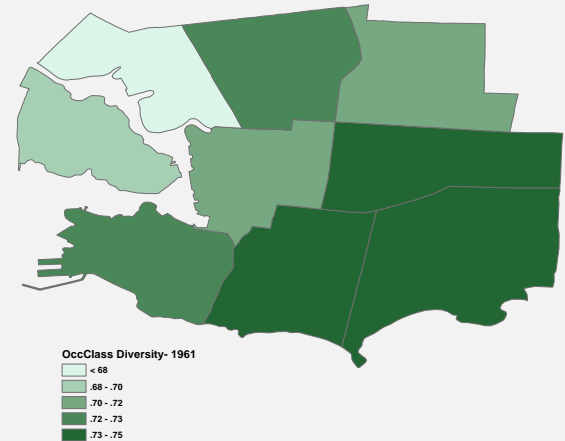
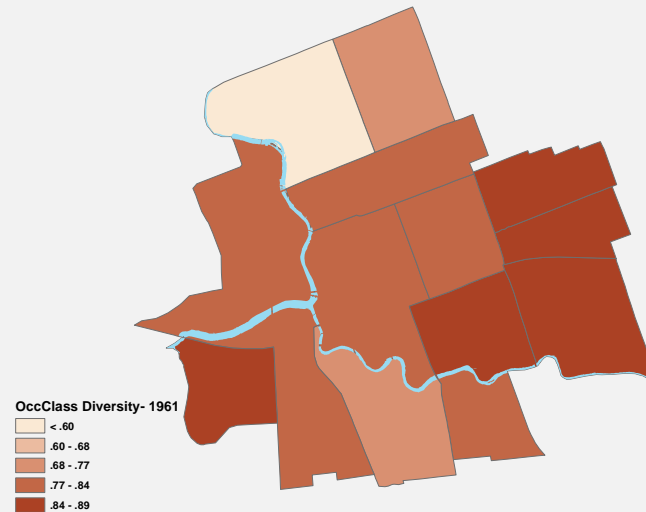
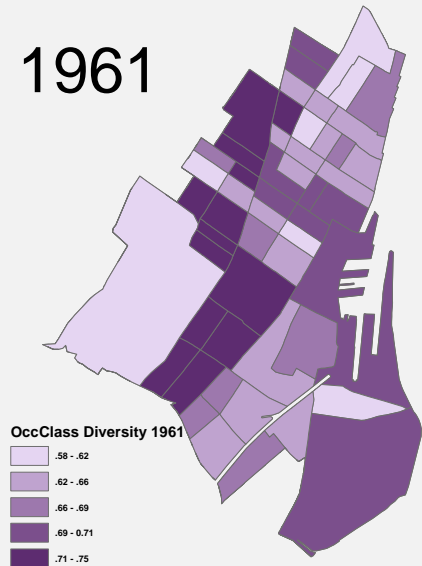


Diversity Of Occupational Classes

1881



1961



Conclusions

- Scope – 3 *Cities*, 2 *Centuries*
- Overcoming *MAUP* allows comparison
- Need to understand *stability*
- Need to understand *variability*
- Next step- Point Pattern Analysis



Conclusions

- Scope – *3 Cities, 2 Centuries*
- Overcoming *MAUP* allows comparison
- Need to understand *stability*
- Need to understand *variability*
- Next step- Point Pattern Analysis





Thank you!

For offering data, creativity, inspiration & sweat:

Lisa Dillon, Robert Sweeny, Peter Baskerville, Eric Sager, Mat Novak, Robert Lewis & many more!

For funding:

SSHRC, NCE-Geoide, & UWO

For more information:

spatialists@uwo.ca

Relative Sizes

	Montreal	London	Victoria
Mean Area of 1881 CTs	1.1 sq. km	1.3 sq. km	0.8 sq. km
Mean Area of 1961 CTs	0.9 sq. km	1.4 sq. km	0.8 sq. km
Mean Population 1881 per CT	1,698	829	274
Mean Population 1961 per CT	5,347	1,669	6,088