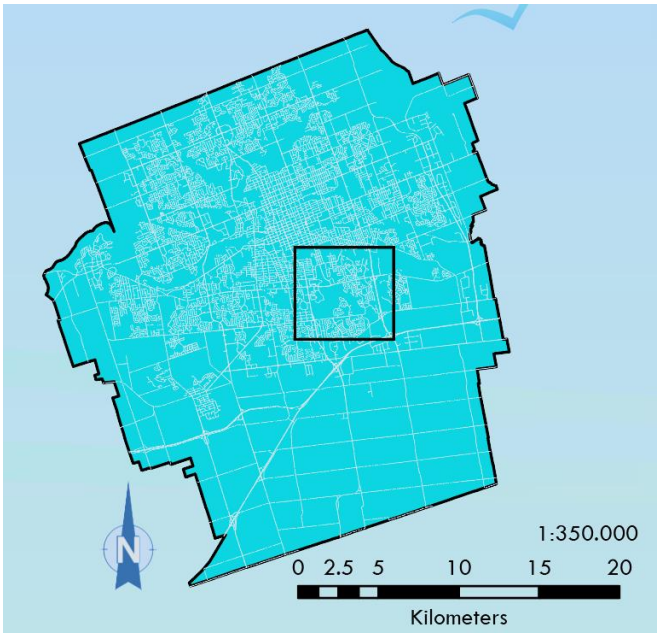

CITY OF LONDON BASED ON MY PERSONAL PREFERENCES.

USE OF AVERAGE AND WEIGHTED LINEAR COMBINATION METHODS.

PRESENTED TO

Professor Liz Sutherland

Celeita Romero, Nathalia

GIS METH-3015

SPATIAL ANALYSIS LOCATION PREFERENCE BASED ON AVERAGE AND WEIGHTED LINEAR COMBINATION METHODS.

PRESENTED BY: NATHALIA CELEITA TO PROFESSOR LIZ SUTHERLAND.

This report presents an assessment of different criterion to select a specific place to live in London, Ontario, based on personal preferences regarding amenities, features, or services ideal to live nearby. Five points of interest were created based on secondary data sources extracted from the City of London, and ArcGIS by running the location preferences tool in order to process the following analysis.

Multicriteria decision analysis (MCDA) is a structured and systematic decision-making approach that helps to evaluate and compare different alternatives based on multiple criteria or attributes. It is used to simulate or modelling human processes, by modeling their spatial behavior to help to understand the location of activities and the movement of people and their interests. Also, it is used when there are multiple factors or dimensions to consider in a decision-making process. (Nimick, 2019).

To develop a (MCDA), a set of criteria is established to evaluate the alternatives, and each criterion is assigned a weight or importance based on its relative significance. The criteria can be quantitative (e.g., cost, time) or qualitative (e.g., environmental impact, satisfaction). In the proposed assignment the MCDA allowed us to combine personal circumstances in a systematic manner to generate a rank for each criteria selected to live in London, Ontario.

First, in order to develop such analysis in ArcGIS Pro, is necessary to set up the environment by setting the projected coordinate system for London Ontario, which is 26917-NAD83/UTM zone 17N. In my selections, I choose the parks. Given that there are too many parks in the city, I selected to live near to the bigger parks, so by clicking on the Data Management Tools, I selected layer by attribute Area_Ha > 15, and my output was Larger Parks. Then, the 37 counts of parks were exported into a new layer ready for the next step.

Also, I select to live near some gym, and there were no layers with those attributes; as a result, by the inquiry tab, I selected Locate and typed gym in London On, and I found 18 counts. Therefore, I created a new layer and exported to my geodatabase ready to buffer.

Second, is necessary to import the features downloaded from the portal of The City of London Open Data classes to the geodatabase. (City of London, 2024). In this case the selected features founded were Cemeteries, Railways, Public Art, Roads, The City of London Polygon itself.

The selected features in order of importance being one (1) as not preferred, and five (5) as preferred area, and the ranks of distances are:

Preference Values	Preference Description	Ranks of distances
1.Cemeteries 	Not a preferred place to live because the cemeteries are related to sadness, contamination, decomposition, possible infection transmissions, and unpleasant view.	Selected ranks: 2000, 3000, 5000, 6000, 20000 meters.
2.Railways	Somewhat not preferred due to the negative noise caused in different hours of the day.	Selected ranks: 200, 300, 500, 600, 2000 meters.
3.Public Art 	Ambiguous: not serious or negative perception. Art places can be considered favorable to visit, but living near to a convoluted place because of tourists can be disadvantageous.	Selected ranks: 400,500,600,1000 meters.
4.Gym 	Somewhat preferred. My husband and I share our time in the gym. We enjoy exercising without the effort to drive to far from home, walking or running is preferred as cardio before a gym routine.	Selected ranks: 200, 400, 600, 800, 1000 meters.
5.Public Parks	Preferred Area because of the accessibility to nature. My family and I enjoy about being in the nature talking long walks. Also, the closeness to nature ensures a better quality of air, and trees reduce noise of the cities. If are larger parks surrounded by large woodlands and water, the better.	Selected ranks: 100, 200, 400, 600, 1000 meters.

To develop the analysis in ArcGIS, I developed a Multiple Ring Buffer: A tool that *"Creates buffers at specified distances around the input features. Those buffers can be merged and dissolved using the buffer distance values to create a non-overlapping buffer in a Planar Method*". (ArcGIS, 2024).

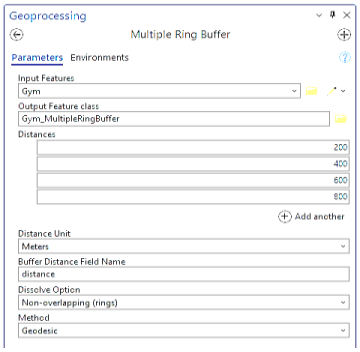

Figure 1. Multiple Ring Buffer, Analysis Tool. ArcGIS Pro (2024).

"PNum" states as preferred number, so a field with a short integer was made in each of the layers which means it was made 5 times. Then, the preferences were stated, and the distances were registered in a different field too, as is shown in *figure 2*. At that point, a union between all the outputs or "PNum" were made in order to develop the MCDA analysis. This step was made in the Geoprocessing tool. All the "PNum" layers as input features, and the output feature as personal preferences combined together for the next step.

PublicArtBuffer

Field: Add Calculate Selection: Select By Attributes

	OBJECTID *	Shape *	Shape_Length	Shape_Area	Distance	PublicArtPNum
1	1	Polygon	42935.469926	4700931.496874	200	5
2	2	Polygon	111564.112567	11404399.067635	400	4
3	3	Polygon	143181.044519	7106546.264725	500	3
4	4	Polygon	153635.408212	7753000.669469	600	2
5	5	Polygon	156475.882084	31114711.642217	1000	1

Figure 2. Attribute Table for a Public Art Layer Buffer, with entered distances and preferences. ArcGIS Pro (2024).

Once the union was made two more fields are necessary: Average Preferences, data type as float, and WLC Preference with the data type as float, as well. The techniques used as MCDA, were The Average Method (AVG), and the Weighed Linear Combination Method (WLC). The Average Method is a simple approach in which the relevant criteria are identified, the ratings are set, and the sum of those scores across all criteria are divided by the total number of criteria. The Weighted Linear Combinations is based on the selection of more than one attribute and the numeric assignation of importance, then those values are combined in a weighted average. ("Weighted Linear Combination," 2013.) The equations used to calculate such criteria in our exercise area are:

Equation AVG	([PrefNuma] + [PrefNumb]) / # of criteria	(!PubliArtPNum!*.15)+(!RailwaysPNum!*.16)+ (!CemeteryPNum!*.14)+(!GymPNum!*.35)+ (!ParksPNum!*.20) / 5
Equation WLG	([PrefNum] * x) + ([PrefNumArenas] *x) etc.	(!PubliArtPNum!*.15)+(!RailwaysPNum!*.16)+ (!CemeteryPNum!*.14)+(!GymPNum!*.35)+ (!ParksPNum!*.20)

Then, the calculation of the field with each equation inputted accordingly, was applied and preferences were classified from 1 to 5. Also, a percentage of the WLC was calculated to reflect numerically the rank of our preference.

Personal Preferences

Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete Copy

	OBJECTID *	Shape *	PublicArtPNum	RailwaysPNum	CemeteryPNum	GymPNum	ParksPNum	Shape_Length	Shape_Area	AVG	WLC	Percentage
1	1262	Polygon	3	3	3	5	5	336.942769	5132.568053	3.8	4.1	82
2	1551	Polygon	1	4	3	5	5	117.250047	627.219309	3.6	3.96	79.2
3	1389	Polygon	2	3	3	5	5	487.377437	13010.428828	3.6	3.95	79
4	1166	Polygon	4	5	1	4	5	445.220827	6113.516655	3.8	3.94	78.8
5	1243	Polygon	3	2	3	5	5	290.318211	4343.620554	3.6	3.94	78.8
6	1263	Polygon	3	3	3	5	4	367.553494	8134.715994	3.6	3.9	78
7	1104	Polygon	4	2	3	5	4	423.212964	8383.669649	3.6	3.89	77.8
8	1518	Polygon	1	3	3	5	5	278.18617	3471.700724	3.4	3.8	76
9	1599	Polygon	1	5	3	4	5	350.394842	4503.870393	3.6	3.77	75.4

Figure 3. Attribute Table for a Personal Preferences Union, with calculation in Average Method, and Weighted Linear Combination Method. ArcGIS Pro (2024).

Next, to differentiate the preferences AVG and WLC the set of layers was duplicated to represent each method. Under the symbology Preferences, the same schemes of graduated colors were selected for both.

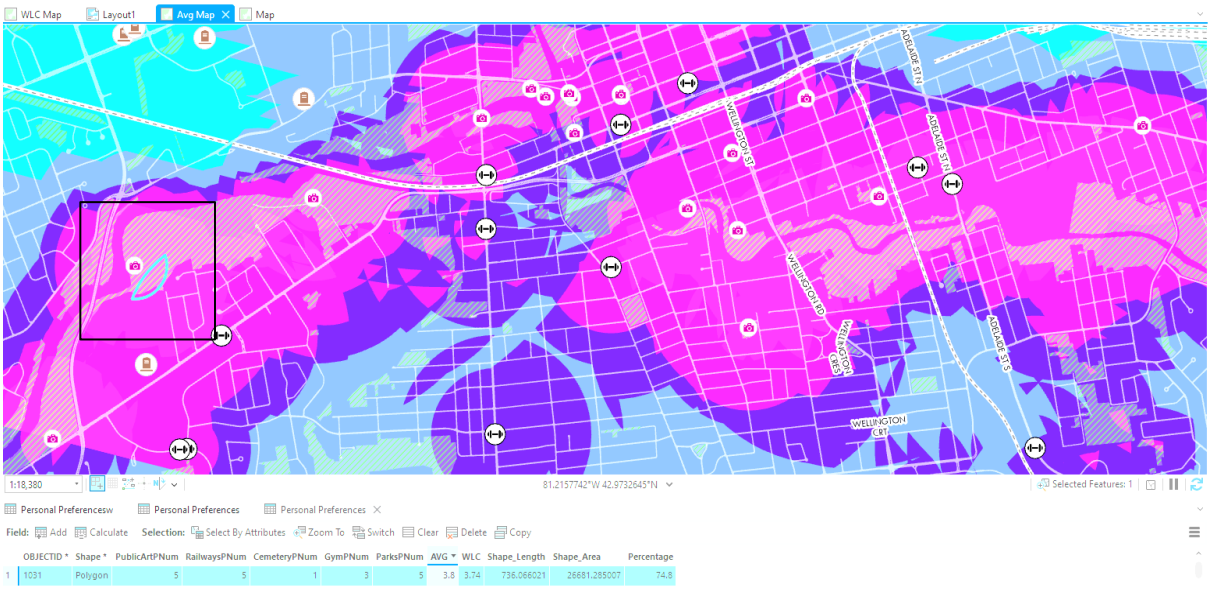

Figure 4. Results of the calculation in Average Method. ArcGIS Pro (2024).

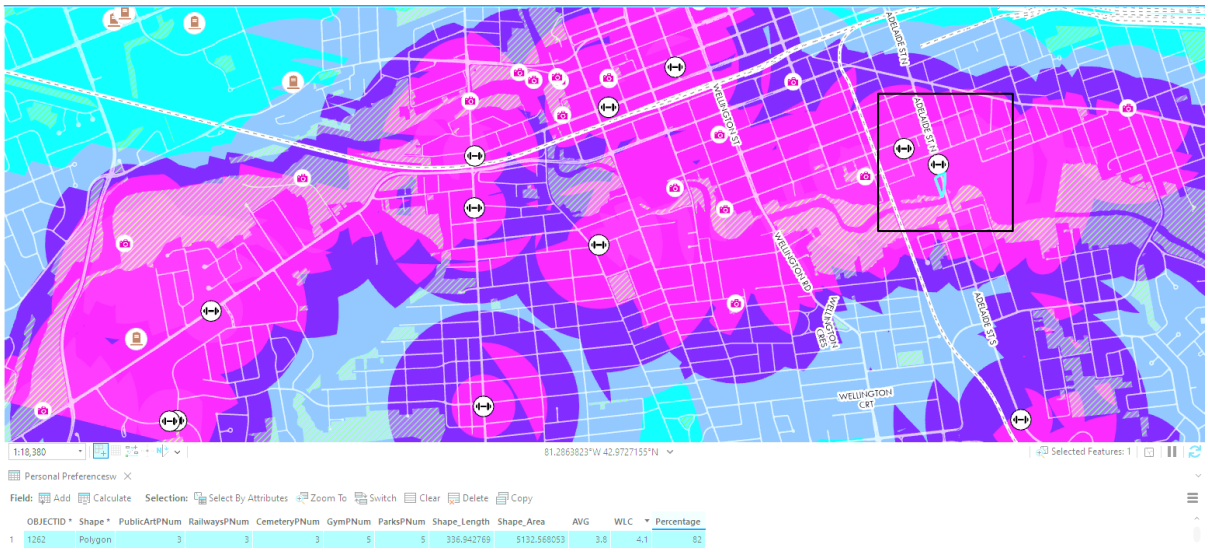

Figure 5. Results of the calculation in Weighted Linear Combination Method. ArcGIS Pro (2024).

Reflections:

- The attribute data values varied between the data associated with the location in both calculations, resulting in different outcomes for preferred locations in both methods.
- Both calculations require qualitative and quantitative information, which can be easily misinterpreted if the inputted data has different hierarchical importance, leading to varying results.
- Both methods are helpful in understanding human behavior and can provide different alternatives for a given problem.
- The distances applied to a preferred place are important for correct analysis, so the scale and measurements must be taken into consideration before determining any distance criteria.
- Units of measurement, as well as symbology, should be the same in order to provide clear differences between the two methods and obtain comparable results.

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