Isohedral Tiling of Non-Euclidean Circles over a Euclidean Plane to Maximize the Efficiency of Geographical Plotting of Services Offered to Cities

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Abstract

Taxicab Geometry was invented by professor Herman Minkowski (1864-1904). However, since then, not much has been utilized with the relatively new non-Euclidean geometry. Taxicab Geometry changes the whole field of geometry by changing just one concept. Instead of metric being measured by the root of the sum of the squares of the x-value change and the y-value change, it is the sum of the absolute value of the x-value change and the y-value change. This change models after a city, where transportation can only be done by vertical and horizontal lines. Therefore, to measure distance, add the vertical distance and the horizontal distance. Although Taxicab geometry is still an underdeveloped field, it has potential to produce a wide-variety of applications. A question that has haunted city planners for years is: "Where are the best locations to place facilities that offer services to the community?" Deciding where to place city hall may be easy. Obviously it should be in the middle of the town where everyone has access with minimal distance. However, what happens when a city planner has to determine where to place twelve elementary schools? The goal of developing Taxicab geometry is to expand our ability to plant locations that are the most efficent, and the most cost-effective. By analyzing Taxicab geometry with Euclidean principles, the answer to a great urban geography question can be answered, "What is the best way to design urban geography to maximize the efficiency of the ratio of the area that the facilities were built to serve to the area that the facilities are capable to serve?" Upon review, it was found that services offered to cities are only up to 50% effective in rectangular cities. It is therfore recommended to reconstruct the design of cities to fit a more Taxicab-friendly idea. This provides an optimal ratio of area that the facilities need to serve to the area that the facilities are capable to serve. Research was also done to determine whether the curvature of the Earth would cause a problem in the 'optimal city'. Therefore, there is a need to develop a spherical taxicab distance formula. However, it was determined that the spherical nature caused minimal differences within cities (due to the small relative size in comparison to the Earth).