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GEOB 479

Assignment 2 Crime Analysis and GIS-Paper Review

**Downs, J. A. (2016). Mapping sex offender activity spaces relative to crime using time-geographic methods. *Annals of GIS, 22*(2), 141-150. 10.1080/19475683.2016.1147495**

The study conducted by Downs (2016) addressed the issue of mapping observed or predicted space as a preventative tool in relation to policing of future crimes and solving of past crimes. Specifically, the crimes of interest were forced or attempted rape including sodomy. Though papers in the past have approached this subject through the potential paths method, the goal of this study was to extend past research and apply more complex models. In turn, Downs applied time based geography methods based on potential path areas. This approach required two steps, respectively a time-geographic density estimation (TGDE) and an intensity surface from the combined activity spaces of offenders. This approach was undergone using a data set of the home and work addresses of registered sex offenders in St. Louis. In order to adjust the research approach appropriately to the dataset Downs adapted the regular form of the intensity surface and calculation of TGDE. This was done in two steps. In the first step the densities of individual potential paths were calculated and then combined into a single formula. Secondly, the equation was altered to fit the scenario of precise spatial locations without the temporal knowledge of their movements. Precise spatial locations were known through the anchor points, which as previously mentioned were the home and work addresses. Additionally, Downs addressed that the temporal aspect does create more accurate results, but it is unlikely that criminal analysts would ever possess this data during speculation. In turn the modified version can be considered more robust as it maps the accessibility of activity spaces based on known anchor points.

The study area of St. Louis was selected as the state of Missouri which it resides in requires convicted sex offenders to register with law enforcement agencies. As well, both home and work addresses must be reported and updated any time a change occurs, meaning that the data is up to date. Furthermore, data was collected from the Missouri Sex Offender Registry (MSOR), which was accessed on 25 May 2013. Work and home addresses were geocoded using ArcMap which resulted in 87 pairs. For comparison all known case of forcible or attempted rape from 2012 were mapped. This data was retrieved from the St. Louis Metropolitan Police Department in x and y coordinates; 243 locations were included.

Final TGDE surfaces were created from the 87 pairs in the study sample. Moreover, measures of intensity were calculated from each node in the network, which numbered 9271. Using three separate travel distances of 200,500 and 1000 meters three surfaces were created for comparison. Calculations were then conducted using ArcMap’s Network Analyst extension. This included a series of steps for shortest path network distances, distances between homes and nodes, and distances between homes and workplaces. Shortest paths were as well calculated for each individual. The TDGE equation was then applied using the field calculator in ArcMap. When all the intensity values were known they were then applied using a Voroni Diagram to depict the values across continuous space. This surface then “quantified the areas which were most accessible to sex offenders” (Downs,2016 p.6) which could be compared to the 243 observed rape locations. Results were then compared using the Kolmorogov–Smirnov test.

The results of the 250m TDGE surface showed that the highest intensity areas occurred along the central and eastern parts of the city. Additionally, the highest intensity areas occurred mostly along the shortest paths between home and work. In turn about 90% of rape incidents were found to have occurred within the activity space of previous offenders. The median value was nearly double that of random points. As well the Kolmorogov–Smirnov test P-value results indicated significant results meaning that intensities at rape locations were higher than what would be expected at random. The highest intensity values occurred in all locations for each of the three distances, though as distance increased more of the map become covered by networks, respectively 68%,78% and 87%. Within the 500m scenario 95.5% of rape cases occurred in the activity space of the sex offenders and for the 1000m scenario 98%. Both scenarios as well indicated significant results for the Kolmorogov–Smirnov test. This paper in turn successfully addressed its research question while accurately and concisely describing its methods. The final surface maps for the TDGE were well portrayed and were easy to discern from each other. Furthermore, the author had a strong grasp of limitations such as time intervals. In conclusion we give this paper an 8.5/10