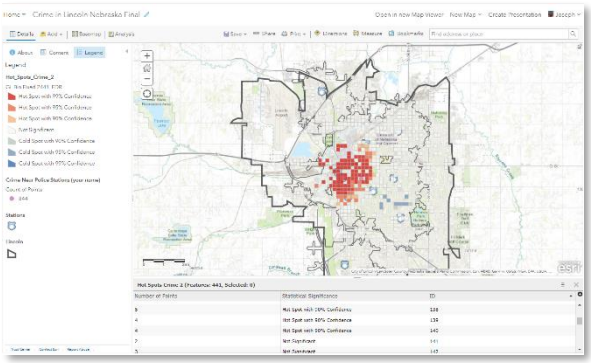
Analyzing Crime in Lincoln Nebraska

Summary. Analyze crime over space and time in a mid-sized city, including symbolizing, classifying, creating hot-spot and drive-times, and more. Level: University learners; can be used in upper secondary. 20 steps. Time required: 1-2 hours. Uses ArcGIS Online classic viewer; license required; your university probably already has license; trial available on www.esri.com.

Problem Statement. You have been recently hired as an analyst in Lincoln and your police chief asks you to assess crime patterns over space and time in the city, including near existing police stations, and any statistically significant hot spots.



Map that you will create and analyze as a part of this activity.

Analysis

1. Access ArcGIS Online and open the crime in Lincoln Nebraska map. (As of Feb 2022: Open in classic map viewer so that you can access the analysis tools). Examine the layers available to you and the tables of information behind each layer: Lincoln city limits, crime locations over multiple weeks in a recent year, police stations, points of interest, and districts. Note the location of downtown Lincoln, the airport, Interstate Highway 80, the major state university-- the University of Nebraska, with 2 campuses, the mall, and the zoo.
2. How many police stations exist in Lincoln? How many police districts exist? Why do you suppose a few districts have more than 1 station? What do you think is the largest district that is only served by one station?
3. Examine the crime layer. Access the Change Style tool > attribute: Offense > Options. Which of the 3 types of offense listed (larceny, assault, or auto theft) is the most common type of crime in Lincoln (listed under COUNT)?
4. Open the table associated with the crime data layer. How many crime points exist in the data set? If this data set covers one year, how many crimes occur on an average day?
5. Use the filter tool to determine the *day of the week* in which crime is most frequent. What is the 2nd most frequent day of the week when crime occurs? Name 2 reasons that could account for these being the top 2 days for crime. If you had the time of day in your data set, what block of time do you suspect most crimes occur (midnight-6am, 6am-Noon, Noon-6pm, 6pm-Midnight). Why? Would these times of day be different depending on the type of offense?
6. Use Change Style > Show Location Only > Create a heat map. On a heat map, the areas where more points exist receive a "hotter' or "brighter" color. What patterns do you notice on the heat map of crime? Are there any "hotter" areas for crime near the Westfield Gateway Mall to the east of downtown, or in or near the university campus or downtown, vs. elsewhere in the city? Note the major arterials (US 77, US 34, I-80, NE-2): Do more crimes occur near busy streets?
7. Change the basemap to Imagery with Labels. Zoom to the mall, the campus, and downtown. Note 2 patterns of crime in relationship to what you can detect on the satellite image. Do crimes seem to occur adjacent to busy streets, in parks, next to businesses, or near or on other types of features? Note that the actual locations of the crimes may not be exactly on the square meter depicted on the map; they may be slightly off for confidentiality reasons or lower specifications for spatial accuracy in acquiring and recording the locations. Change the basemap back to open street map to gather any additional information on the physical environment's influence on crime locations. Make 1-2 additional observations.
8. Compare the information that you gain from the heat map vs. the map of crime by type symbolized as point data that you were examining earlier. What are the advantages of each type of map?
9. Filter the data for Assault > Create a heat map. What patterns do you notice on the heat map for assaults?

10. Change Style to Show location only > Single Symbol. Is there a district, or a part of Lincoln, in which crime seems to be dominant?
11. Change Style > Offense > Select each type of offense, one by one: Is there a district, or a part of Lincoln, in which a specific *type* of crime seems to be dominant?
12. Save this map into your own ArcGIS Online organizational account with a suitable name for your map, such as "Lincoln Crime Analysis <your initials>. Remove all filters.
13. Use Analysis > Use Proximity > Create Drive Time to create 5 minute drive time areas around each police station. When done, visually inspect your results. Do the results surprise you? What percentage of the city of Lincoln would you say is inside the 5 minute drive time of any police station?
14. Based on the crime locations, the stations, and the 5 minute drive time, do you recommend an additional police station at this time, or a redrawing of the district boundaries, or not?
15. Use Analysis > Summarize Data > Aggregate Points to summarize data by 5 minutes from police station: (1) Layer containing points: Crime: (2) Layer containing aggregation areas: Square. Size: 900 feet. (3) (nothing to add). (4) Choose field to group: Offense. (5) Give the result a meaningful name such as aggregation of crime <your initials> > Run Analysis. Be patient while the analysis runs. When done: Open the table and sort descending on count of points. Each cell represents and aggregation of the point crime data for that area. Which cell contains the most points and where is it located? Name 2 pieces of additional insights that this new layer provides you.
16. Use Analysis > Analyze Patterns > Calculate Density > (1) Choose Layer: Crime. (2) Use count field (nothing to select). (3) Give the result a meaningful name, such as Crime Density <your initials>. This density layer, unlike the heat map, shows areas where crime occurrence is denser in terms of area (min and max per square mile) Where in Lincoln does the crime show the greatest density? What is the range of this density per square mile?
17. Use Analysis > Analyze Patterns > Find Hot Spots > (1) Choose Layer: Crime. (2) Point counts. Count points within fishnet grid. Define where points are possible: Lincoln (city limits). (3) Divide by (nothing to select). (4) Give the result a meaningful name such as crime hot spots <your initials>. This hot spot layer, unlike the heat map, and unlike the density surface, shows areas where crime occurrence is *significantly* more or less than in other areas of the city. Indicate where in the city significantly more crime occurs than in other areas. Indicate where significantly less crime occurs. Name 2 pieces of additional insight that this new layer provides you.
18. Name 2 additional data layers that you think would be helpful in this crime analysis. Name 1 additional *analysis method* that you think would be helpful in this crime analysis.
19. Use Share > Create web mapping application to share your results with others (your classmates or with the world). Choose layers and symbolize in a manner in which you think communicates the most important results. Summarize in 2 sentences what you have learned about mapping, analysis, crime mapping, and how GIS tools helped you to understand a situation or issue, and to make decisions.
20. Give a 5-minute oral or written presentation to your class and/or instructor on the results of your crime investigations, using your map and layers as an integral part of your presentation. For this presentation, you can use this web map; you can share the results and send the URL to others for them to inspect your map. You can also export your map as a PDF; or you could create a story map. Or, you can embed your map in a Prezi, Sway, PowerPoint, or a video for your presentation. Based on your research, articulate what your recommendations are to the city police chief for enhancing public safety: Additional stations, different patrols, community awareness, or some other program or action at this time? If so, what is it?

To review one possible final map after you complete your analysis, see this map.

Extend the lesson: (1) Use the Add data function to add crime data by census tract or block group from the ArcGIS Living Atlas of the World or from ArcGIS Online, and compare these new layer(s) against your crime point data. (2) Bring the crime data into Business Analyst Web and examine the type of business related to crime. Do crimes tend to be focused near certain types of businesses (check cashing, pawn shops, banks, others), or not?

Congratulations on thinking spatially and for using geospatial technology to help make the community safer! •