

DSC 465 Final Project: Impact of Seasonality on Chicago's Criminal Activity

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Introduction

The Chicago Crime Record dataset offers a comprehensive collection of public data pertaining to crime incidents in the City of Chicago. This dataset serves as a valuable resource for analyzing and understanding criminal patterns, trends, and factors influencing activity in the area. By examining the relationship between crime records and various relevant variables, such as location, time, and type of crime, this report aims to gain insights into the seasonality of crime and dive deeper into the specifics such as domestic vs non-domestic crime.

Our primary dataset consists of all 2022 crime reports. A secondary dataset uses crime report data from 2012 up to 2022, which we found to be helpful when trying to tell the story of our data. Both datasets were reduced to contain 22 columns. The data is split into 12 of categorical type, 2 of numerical type, 3 of date/time type, and 5 of geographical type. The variable definitions are listed below:

Variable	Description	Type
ID	A unique identifier for each entry.	Numerical
Case Number	A unique identifier for each reported case.	Categorical
Date	The date and time when the incident occurred.	Date/ Time
Block	The block address where the incident took place.	Categorical
IUCR	Illinois Uniform Crime Reporting code, a standardized code for the reported crime.	Categorical
Primary Type	The primary category or classification of the crime.	Categorical
Description	A brief description of the specific incident or offense.	Categorical
Location Description	The type of location where the incident occurred.	Categorical
Arrest	Indicates whether an arrest was made in relation to the incident.	Categorical
Domestic	Indicates whether the incident involves a domestic relationship.	Categorical
Beat	A designated police beat where the incident occurred.	Categorical
District	The police district where the incident occurred.	Categorical
Ward	The political ward associated with the location.	Numerical
Community Area	The community area where the incident occurred.	Categorical
FBI Code	A code representing the crime classification used by the FBI.	Categorical
X Coordinate	The X-coordinate of the location on a map.	Geographical
Y Coordinate	The Y-coordinate of the location on a map.	Geographical
Year	The year when the incident occurred.	Date/ Time
Updated On	The date and time when the data was last updated.	Date/ Time
Latitude	The latitude coordinate of the location.	Geographical
Longitude	The longitude coordinate of the location.	Geographical
Location	The geographic coordinates (latitude and longitude) of the incident location	Geographical

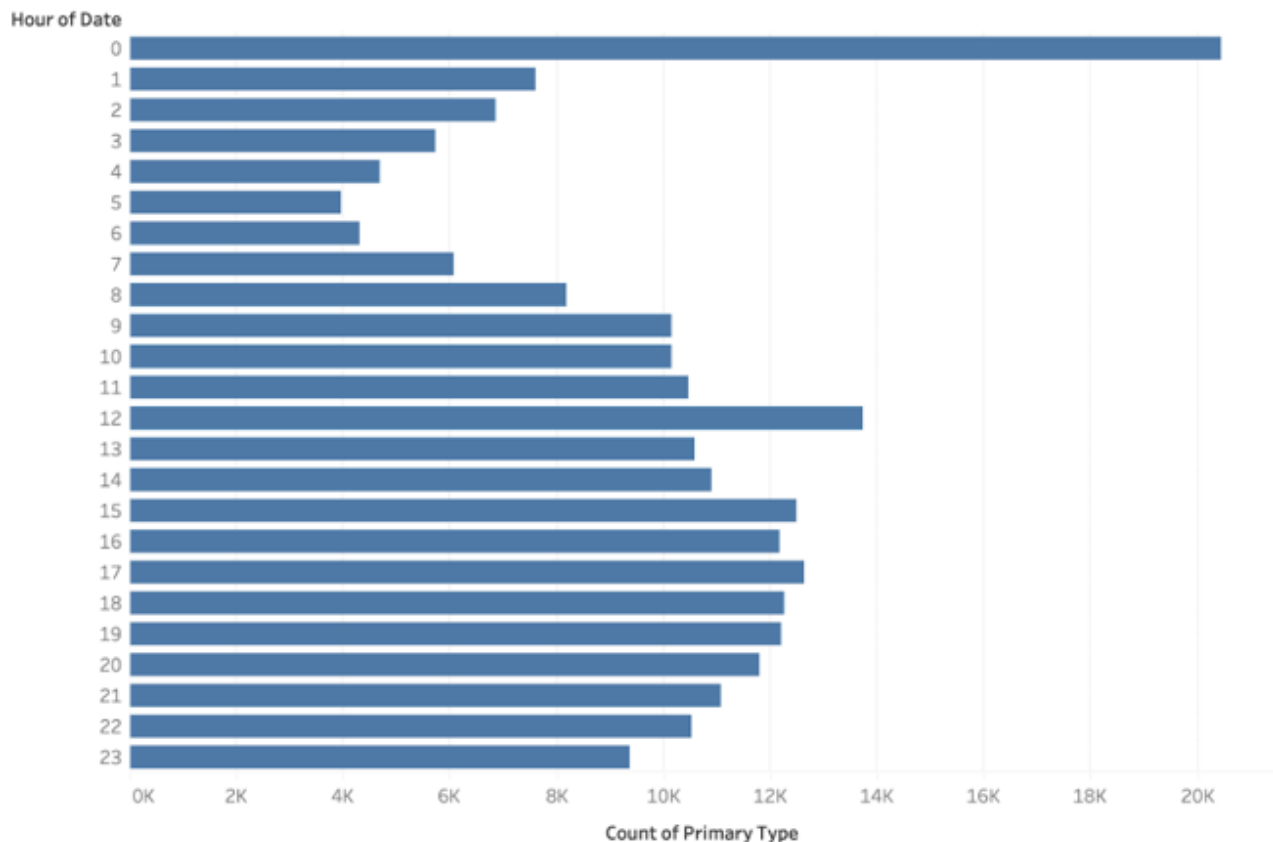
Exploratory Analysis

In the following segment, we will introduce the basic exploratory data analysis visualizations we conducted and discuss our data pre-processing. The three figures below show some samples of the exploratory work we performed.

Exploratory Sample #1 shows a breakdown of crimes in accordance with the time of day using bar charts on Tableau. We had no real goal during the EDA other than to expose certain trends and patterns in the data that were not apparent when first looked at. As one can see, hour 0 shows a much higher number of reports, indicating perhaps a further analysis in the future in regards to why this is the case. Nonetheless, it was an interesting visual that we decided not to utilize in the final story.

Exploratory Sample #1:

Number of Crimes by Hour of Day

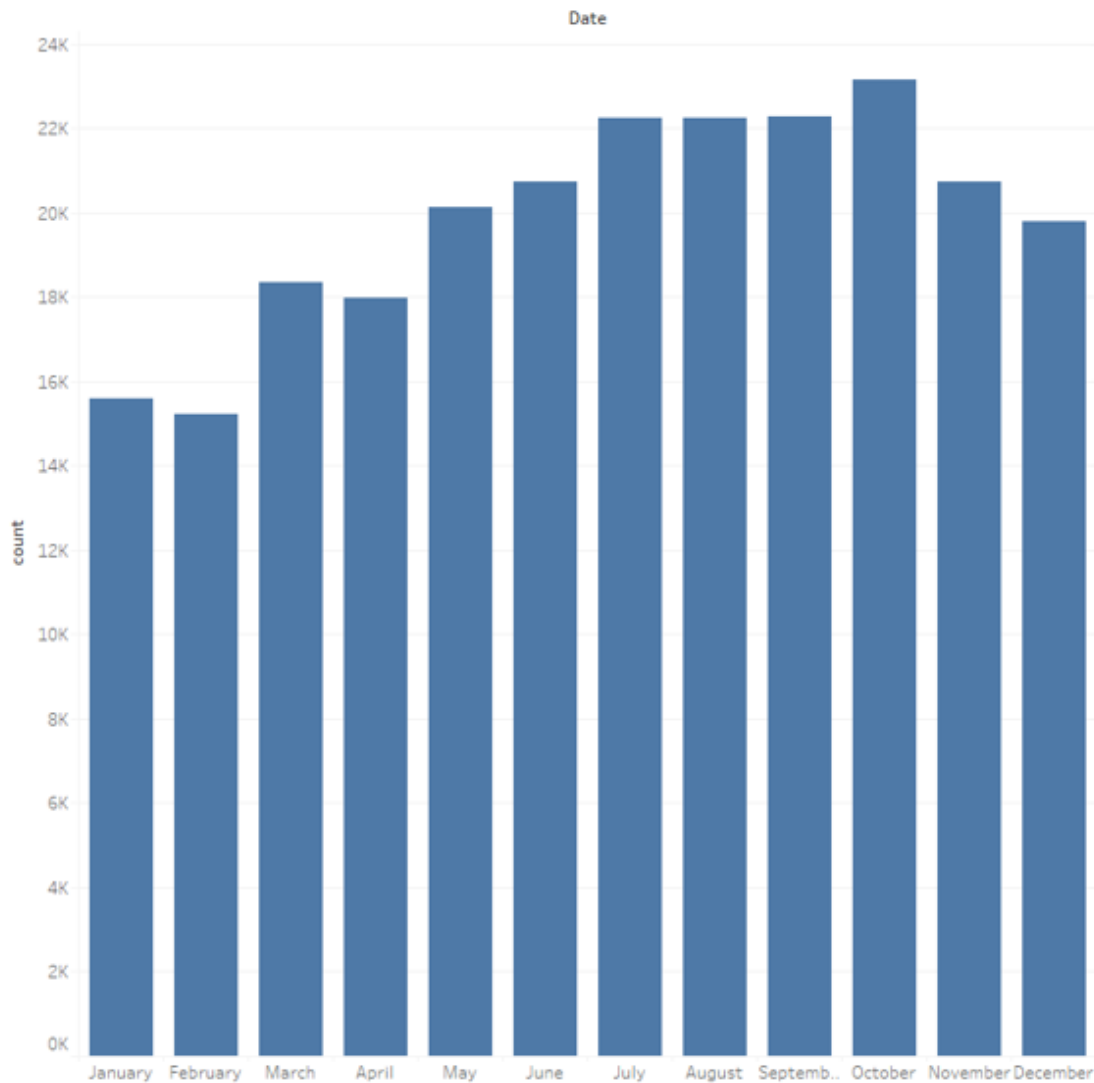


Count of Primary Type for each Date Hour. The data is filtered on Primary Type, which keeps 31 of 31 members.

Next we explored criminal activity by month using bar charts on Tableau (Exploratory Sample #2). We found an apparent seasonal pattern in crimes, where criminal activity is higher in the summer months compared to winter. Seasonality seems to be true in this graph, but as a group, it remained unclear (at this point) if seasonality was true amongst the specific types of crimes, such as crimes of opportunity. Additionally, we noticed that February had the lowest count of crimes of all months. We hypothesize that February carries the lowest number of crimes due to its lower temperatures. This graph will act as our main focus within the story to come.

Exploratory Sample #2:

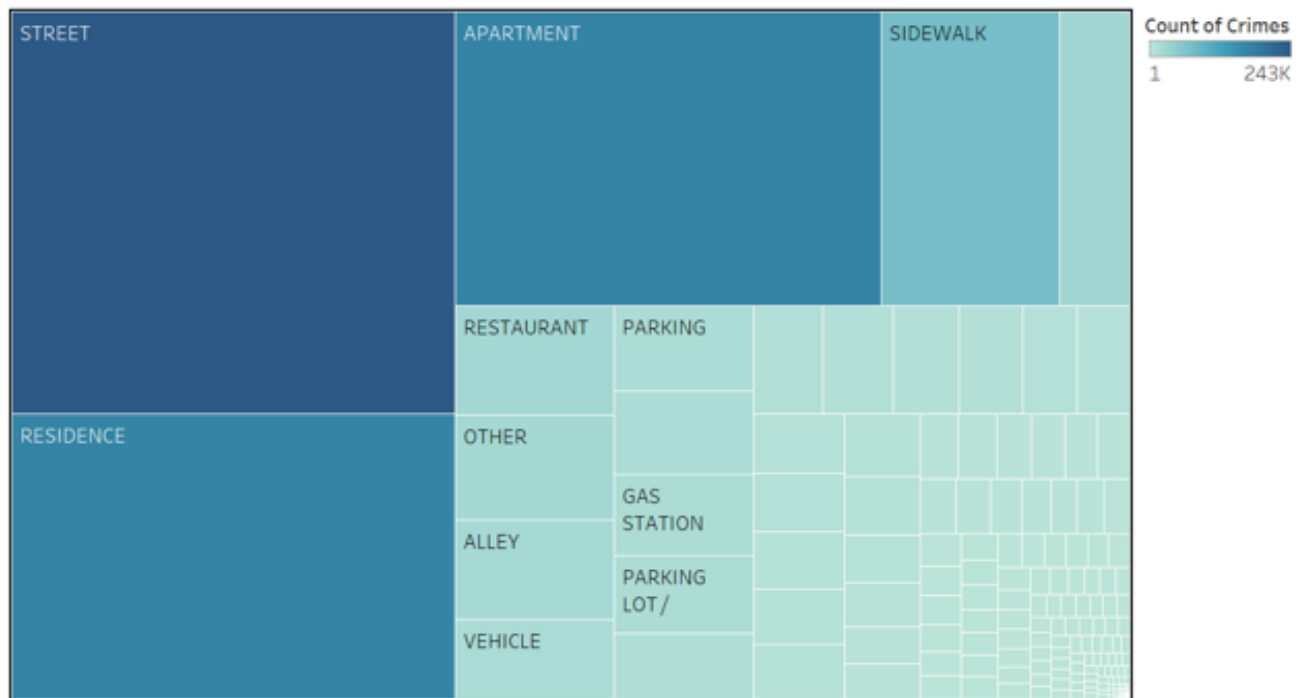
Number of crimes reported over the months of 2022



Exploratory Sample #3 breaks down the location of crimes in the dataset and is visualized using a treemap on Tableau. The figure shows that streets, residences, apartments, and sidewalks are the most popular places where crime occurs. While we did not specifically use this in our final story, digging deeper into why these places are the most common could help Chicago authorities make the city safer. The location of a crime being on a street or at a residence could also be an indicator of whether a crime is domestic or not, as domestic crimes will likely happen regardless of seasons. This aspect of the data may be interesting to explore.

Exploratory Sample #3:

Location of crime



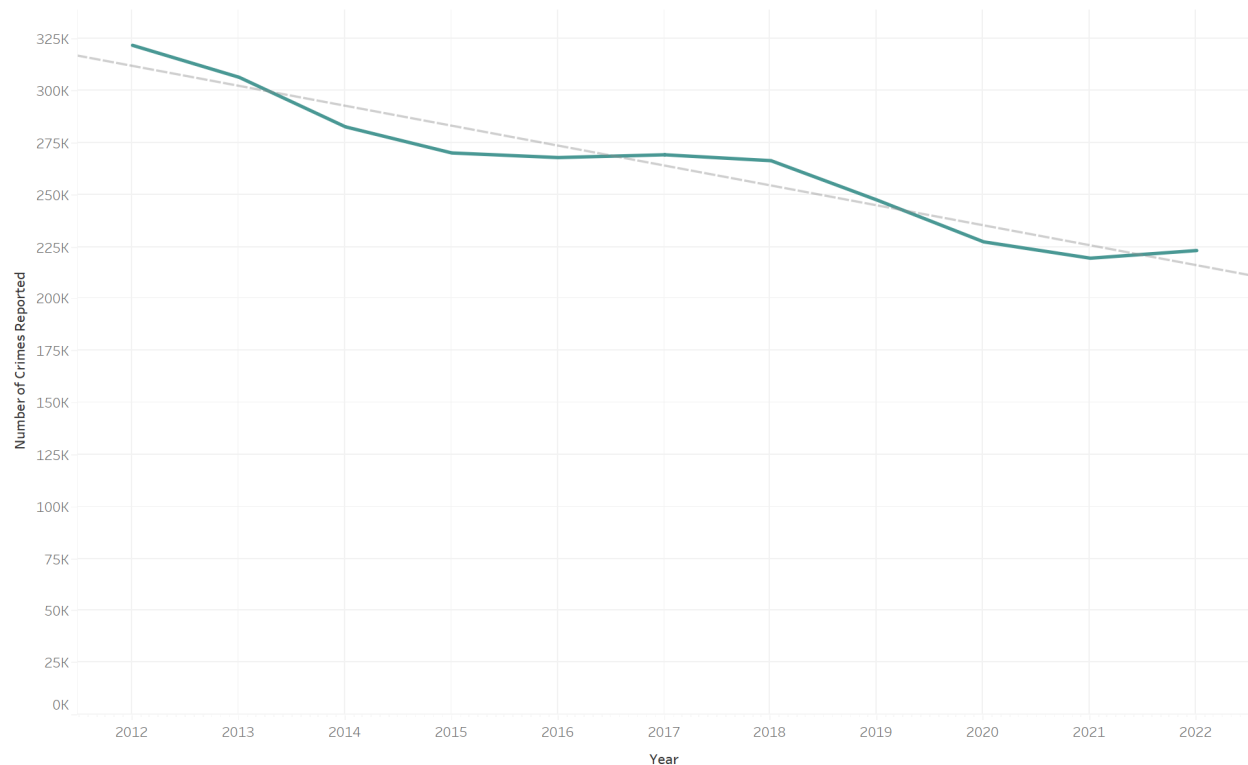
Location Description. Color shows count of Primary Type. Size shows count of Primary Type. The marks are labeled by Location Description.

Visualizations

Figure 1: City of Chicago Crime Reports from 2012 to 2022

The graph shows all crimes reported as yearly aggregates from 2012 to 2022. The plot was created using Tableau. The x-axis shows the year, while the y-axis shows the number of crime reports made for that year, plotted into a line graph. The crime count/ aggregates were smoothed using a moving average calculation to more clearly show the decrease in crime reports each year. A trendline was also added to more clearly show this descending trend. The goal of this graph is to show the historical trend in criminal activity decrease over the years giving the audience a general idea of the trend.

City of Chicago Crime Reports from 2012 to 2022



The line graph above shows the total number of crimes reported from 2012 to 2022 in the city of Chicago.

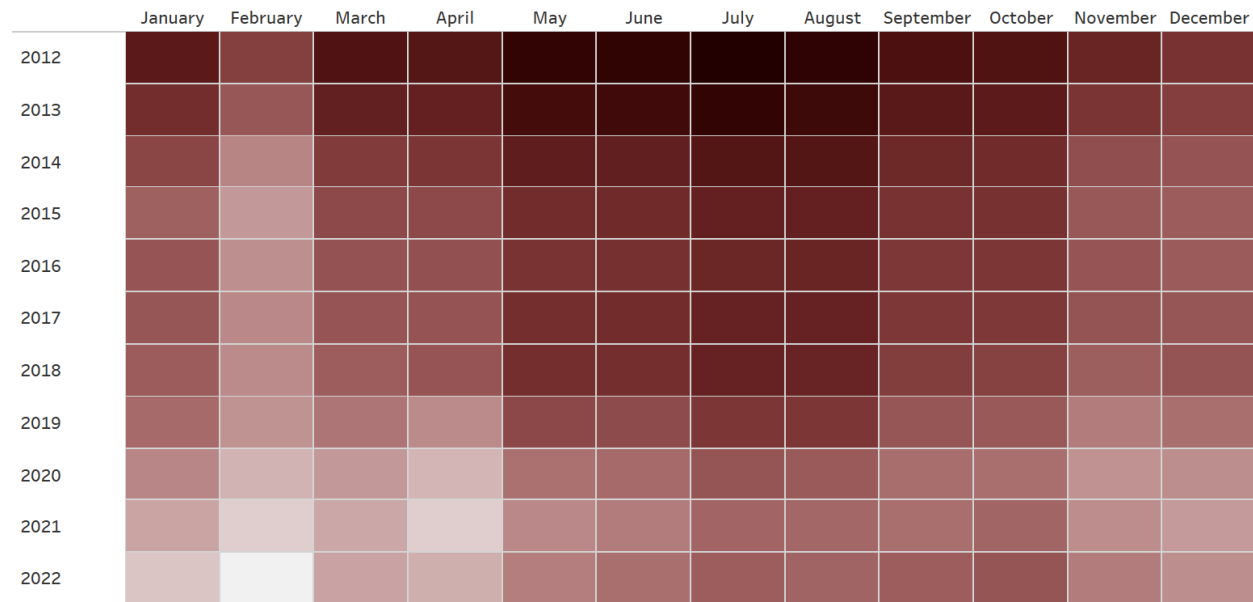
Figure 2: Change in Criminal Activity based on Seasonality in the Past Decade (2012 - 2022)

The heatmap takes a more granular look at changes in crime reports over the years 2012 to 2022, although this time with a focus on seasonality. The heatmap shows the number of crimes reported by month for the past decade. The plot was created using Tableau, with months on the x-axis and years on the y-axis. The heatmap provides us with a better perspective on seasonality and how that changed over the past decade. We use a sequential color scale that goes from white to a deep red, where the deepest reds are the most dangerous months of each year. The colorscale is also easy to view by those who are colorblind. The number of crimes was also calculated as a moving average to tone down anomalies that were specifically seen throughout the pandemic years. The moving average calculation is computed using the year variable.

This heatmap shows deeper tones of red/ pink in the summer months, with lighter tones in the winter months, especially February. We see that February is generally the safest month on record, while July and/or August are the most dangerous. While crime reports decreased significantly in 2020, 2021, and 2022, we still see darker hues in the summer months and lighter colors in the winter months. Seasonal changes

in criminal activity generally continued throughout the pandemic, despite the significant decrease in overall criminal activity.

Change in Criminal Activity based on Seasonality in the Past Decade (2012-2022)



The heatmap shows the trend of criminal activity for each year based on seasonality.

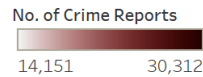


Figure 3: Monthly Domestic & Non-Domestic Chicago Crime Reports

Due to the significant change in criminal activity throughout the past decade, and unusual times (pandemic), we decided to switch our focus to understand the type of criminal activity impacting seasonality using 2022 data. We used 2022 data since it is the most recent full-year of data provided. 2022 remains a unique year due to work from home practices and entertainment beginning to resume throughout the year.

With that in mind, the stacked bar chart below shows the change in crime reports for domestic and non-domestic crimes over the months of 2022. The trend lines plotted are there to help guide/ show the rate of change in criminal activity based on domestic or non-domestic status. The number of crime reports and trend lines are smoothed using a moving average with a window of previous 1 value.

The goal of this stacked bar chart is to show that with seasonality in mind for 2022, we can see that non-domestic crimes rate of change is sharper than that for domestic crimes. This indicates that non-domestic crimes have a larger impact on seasonality than domestic crimes.

Seasonal Changes in Crime Reports based on Domestic or non-Domestic nature of incident - 2022

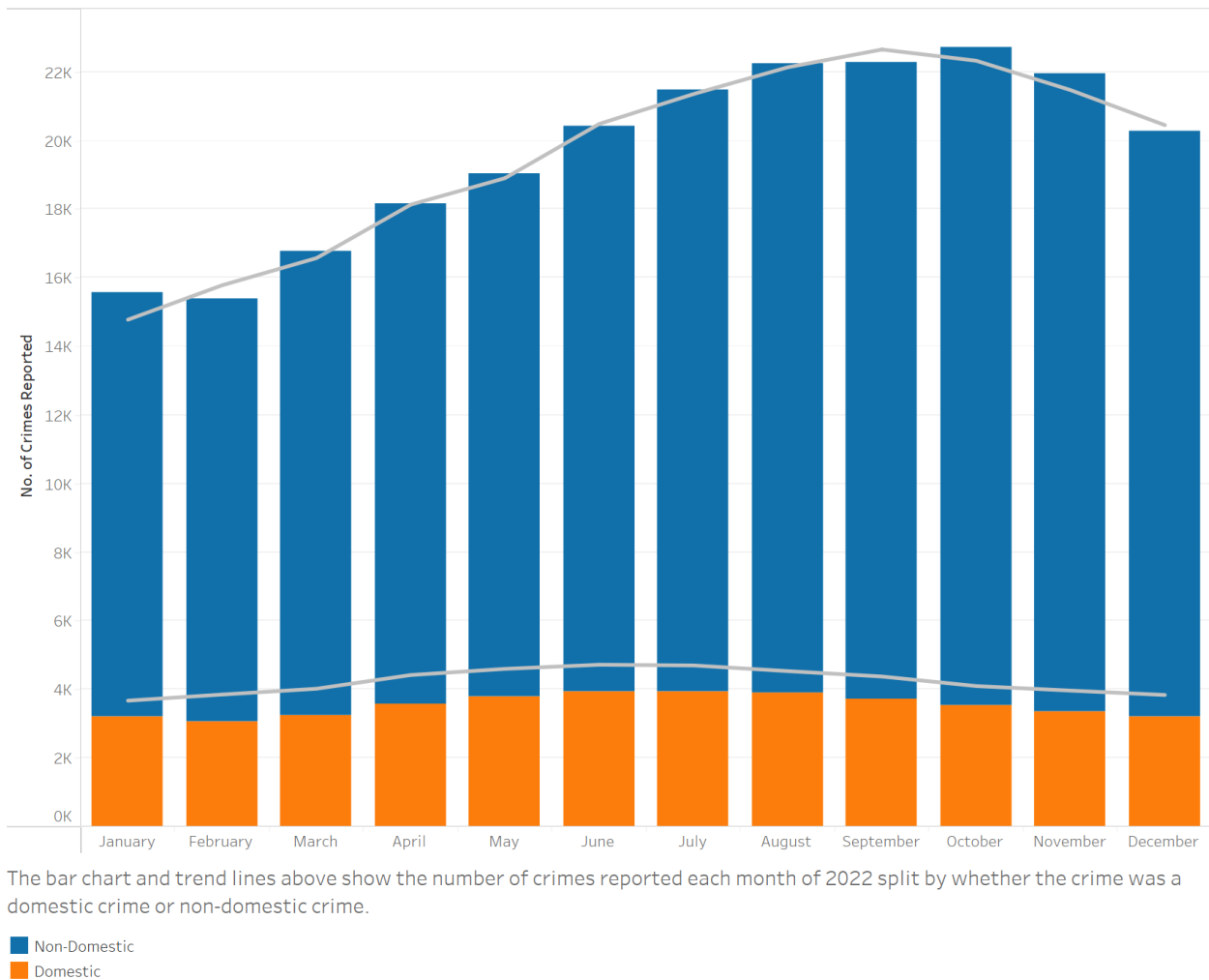


Figure 4: Seasonal Changes in Non-Domestic Crimes in 2022

Since non-domestic crimes were shown to account to the seasonality changes the most in 2022, the next step is to figure out what types of crimes made up non-domestic crimes in 2022. The multiple line graph below plots the 5 (five) highest reported crimes of 2022 that are labeled as non-domestic. The x-axis shows the months and the y-axis shows the number of crimes reported. The graph was created using R (code included in appendix), with `geom_smooth` LOESS method used to smooth out the lines to better show the trend. Continuing on with non-domestic crime, we wanted to shift our focus toward specific crimes. This graph better shows how theft and motor vehicle theft fluctuate the most with seasonality, followed by criminal damage.

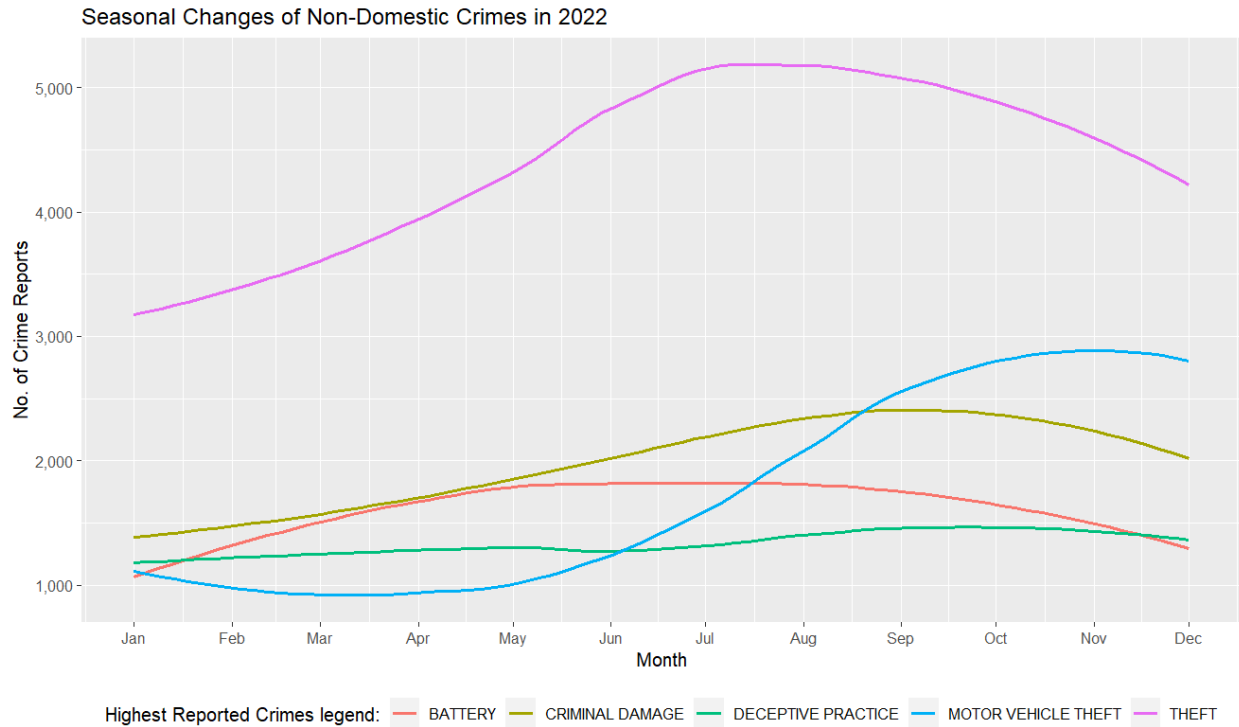
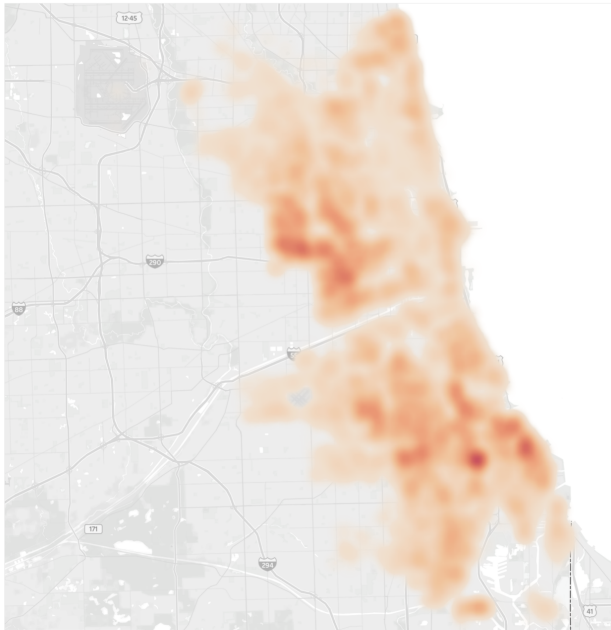


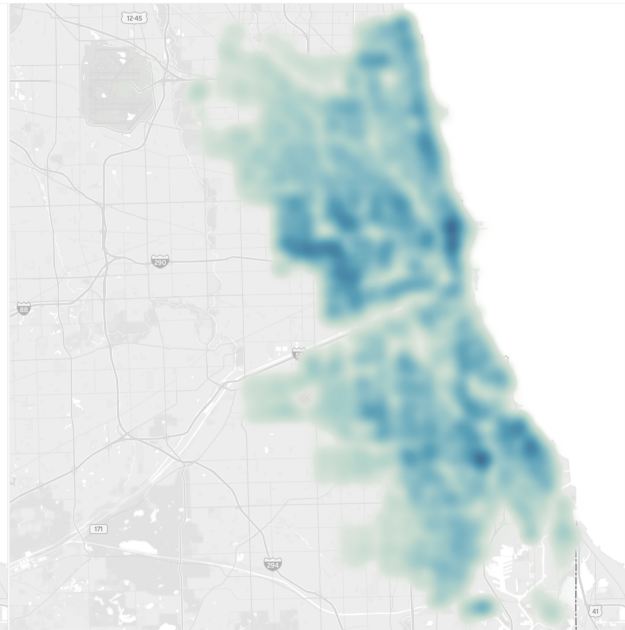
Figure 5: Domestic & non-Domestic Crime Locations - 2022

The density maps below are used to show the density of domestic and non-domestic crimes in Chicago throughout 2022. We have already established that non-domestic crime is affected by seasonality, especially within the five most common crimes. Using Tableau, we mapped the latitude and longitude of the crimes to pinpoint domestic and non-domestic crimes locations. We used density to show where the crimes were more frequent as shown below. When we looked at the crimes that occurred in 2022 by month and showed the difference between domestic and non-domestic crimes (Figure 3), we wanted to see if there was a specific location these types of crimes were more likely to happen. These geographic maps give the first spatial visual of where the crimes are geographically happening in the city in regards to non-domestic vs domestic; our main focus. We conclude that while non-domestic crimes are almost evenly spread across Chicago, domestic crimes are more likely to occur in the west side and south side of Chicago.

Density of Domestic Crime Locations 2022



Density of Non-Domestic Crime Locations 2022



Analysis & Discussion

Our objective in this project was to create visualizations to better understand seasonality in criminal activity across Chicago. We first explored the change in criminal activity over the course of 10 years; 2012 to 2022. Figure 1 shows this trend and clearly displays the decrease in crime reports over the past decade, with a minor increase into 2022 due to post-pandemic return-to-normal activities.

Figure 2 zoomed in on criminal activity for the past 10 years based on month. The heatmap showed that seasonality is apparent in each year, even during the pandemic despite that criminal activity was generally low. The safest months of the year are February, on average, while the most dangerous would be July and/or August.

Next we took 2022 as the example year to work with. 2022 is unique in many ways due to the slight increase in crime reports we saw in Figure 1, largely due to post-pandemic activities resuming and the establishment of new societal and workplace normals, as well as it is the most recent full-year of data provided by the dataset. The stacked bar chart in Figure 3 clearly displays the seasonal changes in criminal activity over the months of 2022, with non-domestic crimes showing the highest rate of variability over the months. If we zoom in on the highest reported crimes that make up the non-domestic group (figure 4), we find that theft and motor vehicle thefts fluctuate the most with seasonality throughout 2022.

Lastly, to provide spatial context, we created density maps using domestic and non-domestic crime locations in Chicago throughout 2022 (Figure 5). This spatial representation emphasized the geographic distribution of crime and helped identify hot spots and areas with overlapping high densities of domestic and non-domestic crimes.

In conclusion, our analysis and visualizations provided valuable insights into seasonal crime patterns in Chicago. We found that higher temperatures increase criminal activity in Chicago, while lower temperatures hinder criminal activity, especially crimes of opportunity. While pandemic related shutdowns decreased criminal activity, seasonality remained apparent across those years. We also found that non-domestic crimes are more likely to be impacted by seasonal changes than domestic crimes, with theft and motor vehicle theft leading in those fluctuations. We also found that while non-domestic crimes seem to evenly impact Chicago's neighborhoods, domestic crimes are largely concentrated across the Westside and Southside of Chicago.

While 2022 showed an increase in criminal activity, additional data from 2023 may help clarify the direction of criminal activity in Chicago and whether Chicago is, in fact, continuing to get safer. If more time was available, it would've been interesting to dive deeper into the change in location and/or density of domestic vs. non-domestic activity across Chicago throughout the decade. Another aspect of the data that we found to be interesting was the rise in "deceptive practice" as a non-domestic crime in 2022, which would be a good factor to explore in the future. This could also be explored further by year, or perhaps by looking at the decade's average although with slightly more weight given to "normal" years such as the 3 years prior to the start of the pandemic.

Appendix

Individual Reports

Wynona Lam The first few milestones contained a few graphs I created; however, they were ultimately not used in the final report as they did not pertain to the story we wanted to tell. Additionally, since I thoroughly enjoy writing reports and making presentations, I volunteered to complete all of that portion. To note, we also changed datasets mid-project as our initial one was way too difficult to use. Specifically on the technical side, I made 4 noticeable graphs and the basic exploratory ones that all of us had to make when working with the data on our own.

The first two graphs I made were scatterplots that tried to show the possible relationship between two variables in our first dataset, the walkability one. Specifically, I was trying to observe whether there was a positive correlation between the National Walkability Index (Our main variable of focus), and the total amount of nearby water or housing units. Unsurprisingly, the relationship was not strong for both, perhaps a little bit more apparent for total housing units. I do not believe this would be the best approach to storytelling, but these were supposed to be EDA, so I suppose they are fine in that regard. After this, we switched to our latest dataset, the specific crime records in Chicago. I was unable to contribute in time for milestone 3 due to work deadlines and travel to conferences; however, I was able to add some graphs afterward.

Again, I made two graphs, the first one focused on breaking down the top 5 most common places of crime and their respective breakdown of whether it resulted in an arrest or not. This was displayed through a mosaic plot and overall, I had a lot of fun making it. Mosaic plots are interesting where I had to transform the data to create a matrix, but other than that, they are very easy to make. It did a great job of separating information and will definitely be used more in future visualization endeavors. My second graph was much more simple and perhaps could have served well in the EDA. It essentially was a bar chart that showed the count of the top 3 most common crime types (Battery, Criminal Damage, and Theft) in 2022. It was fairly simple to make, where I told R to give me the top 3 crimes based on “n” and to filter those out.

As for the report and presentation, I made the documents, outlined everything, and allowed my teammates to input their graphs and explain somewhat briefly. I then made our story flow better, explained the EDA graphs, and wrote the intro and conclusion. The presentation was fairly simple, I created the themed PowerPoint and rearranged the slides in a way that made sense, making sure to include all the various plots deemed impertinent to the story our group wanted to tell. I then created a broad script for Christian and me to present over Zoom, since we decided two people should do the presenting to save switching back and forth time.

Overall, I learned a lot about storytelling with data. The making of graphs is quite easy if you have no audience or story to tell and are just making them to present data in a digestible way. However, once you introduce the need for a story, it makes everything ten times more difficult. We spent a lot of time discussing what graphs we needed to make to tell our story, so in a sense, we were working backward, which was very new to me. I appreciate the new perspective and moving forward, will definitely be changing my way of approaching graph creation. Lastly, I learned to never use the Walkability Index dataset.

Rawan Hammad Throughout the project, I worked with the group on trying to find a dataset which we ended up changing by milestone #3 due to its level of complexity. I was the main point of contact with the professor, where I joined office hours on a semi-weekly basis to discuss our project. I also helped find the new dataset and guide the team towards a story to tell with our data.

I created some exploratory visualizations including sample 2 above. I also created explanatory visualizations including figures 1, 2, and 3, and provided my feedback as well as collaborated with others on building their own visualizations.

The work we did taught me a few lessons about data selection. Our initial dataset, while interesting, was a challenge to work with considering the time constraint. The initial dataset lacked any ‘direct’ categorical

variables which made it hard to interpret much of the data. Instead, we decided to shift our focus onto a different, simpler dataset so we can focus on practicing creating visualizations rather than the data cleaning and manipulation aspect.

While I normally prefer to work with R, I found that Tableau might be a faster and easier solution for exploring data, or even making very pretty and easy to read visualizations. Throughout the project, I practiced using Tableau, and exploring all the different options and customizations. While I do enjoy using Tableau, I still think R is a more powerful analytical and visual tool as I encountered a few limitations manipulating data in Tableau. I like to add a lot of details to my plots, and I find it easier to add those with the endless options provided by ggplot2.

The most difficult part of this project was trying to come up with a story to tell. I'm used to creating visualizations by request, but it was overwhelming to try to come up with a story. This is where the exploratory work we did and the weekly meetings with both the professor and team helped a lot. We tried to extract an interesting pattern, which is crime activity and how it relates to seasonal changes in weather.

I also had to do some digging through my notes to decide which visualization is best to show which trends. A lot of this work was exploratory; I tried so many random variables and plotted them in different ways to try to send different messages. I found it helpful to go through the slides from our coursework and remind myself of what a good example of a specific visualization looks like. I also looked back into the different types of smoothing, although I ended up using mostly moving average and percentage changes in the various plots I created.

While there is a lot of technical skills to gain here, I cannot deny that I've learned a few new soft skills. This was my first-time using Discord in a classroom setting, and I found it to be quite effective. As the main point of contact with the professor, I often had to take lead on starting conversations about milestone submissions and communicating back relevant information to the team. It was also sometimes challenging to work as part of a team with all our varying schedules, but we made it work!

Christian Lopez For this project, I was consistently in touch with my group mates in order to ensure there was no miscommunication between ourselves. Between each milestone, I was involved and did what I claimed I would do. Looking at milestone two, with the previous walkability dataset, I first modified said dataset to decrease the large number of variables given to us. Recognizing that we weren't going to use all the variables (greater than 50), I cut said dataset down for simplification purposes as well as to ensure we used the same variables. Afterwards, like the rest of my groupmates, I messed around with the dataset to search for potential relationships to further focus on. As every group mate did, I found two reference graphs online and created two exploratory graphs (both geographic with different focuses). However, with the concerns that arose regarding our dataset, this would be scrapped as we would opt for a different dataset for the following milestone.

In milestone three, I created more draft exploratory visualizations using our new dataset. While other groupmates focused on the geographic visualizations, I kept my visualizations simple in search for a specific idea/story we could focus on for this project. With homework four I drafted more visualizations using different methods as we were approaching a final idea/story to focus on.

Finally with milestone four to now, we have settled on focusing on how crime is impacted across time, and more importantly between seasons. I created my visualizations I assigned myself and revised it based on groupmate suggestions. More specifically, I did graph four, five, and six. However, my graph for five was swapped out as I used a stacked bar chart and we wanted to include more diversity regarding visualizations. So while my stacked bar chart had the same information displayed, we found an area chart not only increased our visualization diversity, but also it looked cleaner. Lastly, I helped create the presentation video with Wynona.

From this project I have learned many things. Firstly, I learned that from this group setting, people approach data sets differently and are able to come up with visualizations I haven't thought of. Secondly, with a limited time frame, I learned to not be too ambitious with visualization plans. Lastly, with the focus on creating a story, I learned the difficulty of coming up with an intriguing story from a dataset and forming multiple

visualizations surrounding said idea. Truly, I have never been forced to create a story + visualizations in a group setting, so for me this was a new and unique experience. In the end, I believe the team performed well and I was personally able to create meaningful contributions to our final project.

Meaghan Lidd SUMMARY OF WORK (Meg)

Our group had two sets of data that we explored for the project. I supplied the data for the first set (which was on walkability) and helped to lead the group in some of the potentials that existed in that data set. I created multiple exploratory graphs, comparing different variables that existed in the walkability data set to the different locations that were mapped. We ran into a major issue when we wanted to utilize some of the data that was set up for use in ArcGIS to be able to use in Tableau and RStudio. I attempted to import a shape file of Illinois and link it to our walkability data so we could explore the data more in depth geographically; I unfortunately ran into issues with the linking the datasets as I was not able to get two of the columns to be the same. Due to this, we decided to turn to another dataset, crimes in Chicago.

For the crimes in Chicago, I started by drafting some exploratory maps, including geographic, bar charts, and stacked bar charts. The maps I first created looked at the difference between arrests vs non-arrest for homicides, human-trafficking, and kidnappings on a map of the city. I used different symbols with different colors to make the three different crimes stand out on the map. To explore the data more fully and to compare relationships as a whole, I created a bar chart of the number of crimes over different hours of the day during the 2022 year. I also created a stacked bar chart, showing the count of crimes over the 2012 - 2022 period, with the years stacked on the bars as different colors across each month, showing the fluctuation in crimes over the years over the different seasons. For my final visualization, I created the geographic maps on domestic vs. non-domestic crimes that occurred in 2022. I used a dashboard approach to nicely compare the difference between each set of data. I wanted to make sure the data was legible, visually pleasing, while also being informative without a lot of effort on the viewer's part.

I was active in group meetings and on our group chat and followed-through with everything that I was assigned or took on as a responsibility.

SUMMARY OF TAKEAWAYS (Meg)

This course has taught me how to analyze data, change it (without altering its underlying meaning) for my own purposes (melting, pivoting), and further, it has opened me up to a world of different types of visualization approaches and techniques. This project pushed me to play with our data to see what different revealings we could find, which often involved overcoming error and lots of fiddling to successfully display the data in appealing form. I was very excited to be able to use a dashboard in my final visualization, as it not only allowed me to create three maps, but it also helped to create more depth in one image. In using the dashboard, I was able to show two density maps in addition to a simple plotted map, to show more detail regarding the variables.

As I spent two weeks (maybe more) looking and exploring data that our team ended up not being able to utilize, I have more understanding for how complex datasets can be and how important it is to have data that is easy to work with to be able to fully flesh out possible results. When we switched to the second set of data, everyone in the group was quickly able to analyze and play with it, creating more thoughts, discussion, and visualizations.

Shwetha Vinay We as a group were working on the Walkability Index dataset. I have actively participated in discussions and raised concerns and got clarifications on the story we are delivering. I started working along with Christian to filter the dataset as it had too many variables. We both discussed and removed the redundant data variables and saved the data which we thought would be useful to create visualizations. I observed that it had many variables like employment areas, housing, parks, intersections, count of people with automobiles, use of public transport etc. The data basically showed which city/ state had the most walkability index and I created a few exploratory graphs using maps showing which state has the most walkability index. The data showed New York , Los Angeles, Chicago etc big cities with higher walkability

indexes. I used Tableau for creating visualizations. Later we decided to change the dataset to Chicago Crime owing to the issues of not having many categories in the Walkability Index.

I created the exploratory graphs location of the crime , I filtered the location and created a bubble chart for crime type, Homicide and another plot showing homicides count high during the months, over the course of 5 years 2018 to 2022. All the 5 years showed the homicides were high during Summer time. The count of homicides reduced in 2022 but still showed a high in summer. This along with other explorations from my teammates helped us to come up with a story of seasonality. Further exploring we found that all the other crimes also pertained to being high during the summer. I created a few visualizations using heat maps for location of crime based on domestic and non-domestic. It was not used as the story focused on seasonality and not locations which may help with Police enforcement, but that was not the purpose of our story. I worked on the count of crimes over the months of 2022 using a bar chart using Tableau.

Key Takeaways (Shwetha):

Throughout my data visualization project and collaborating with our group, I have gained several valuable insights and skills. Here are the key takeaways from my experience. I explored the geographic graphs,I learned how to effectively use R for filtering data, bar charts, stacked bars and mosaic plots to visualize categorical data. Although I used to see graphs and reports I never really understood how to decode. I used to like pie charts and, I randomly chose color before, now I know the importance. Now I have developed a keen eye for interpreting and extracting insights from various types of graphs. Understanding the different elements of a graph, such as axes, labels, and legends, helped me effectively communicate information and draw meaningful conclusions. Working with my team was a great learning experience, their expertise, support, and guidance was valuable to understand the importance of storytelling. I learnt some techniques in Tableau , R and created the exploratory graphs.Group work experience has not only expanded my technical skills but also emphasized the importance of effective communication and collaboration in achieving successful outcomes. My other course this quarter is Data Warehousing, and for the final project report we must create reports with visualizations from the data marts we have created. I am so grateful to have learnt Data visualization in this course. I may not be an expert but it is a first step towards this interesting subject which will definitely be useful in my career in future.

R Code for Figure 4

```
library(ggplot2)
library(readr)
library(tidyr)
library(tibble)
library(lubridate)
library(ggmosaic)
library(gridExtra)
library(grid)
library(caret)
library(tidyverse)
library(mosaic)
library(dplyr)
library(magrittr)
library(scales)
library(stringr)
```

```
packages = c('vcd', 'vcdExtra', 'tidyverse')

for(p in packages){
  if(!require(p, character.only = T)){
    install.packages(p)
  }
  library(p, character.only = T)
}
```

```
Crimes_2022 <- read_csv("Crimes_Modified_Date.csv")
#Change from char to Date.
modifiedDate <- c(as.Date(Crimes_2022$Date, format = "%m/%d/%Y"))
#Make it a data frame
toDate <- data.frame(modifiedDate)
#Combine the data frame.
Crimes_2022_Modified <- cbind(Crimes_2022, toDate)
CRIME_COUNT_BY_MONTH = Crimes_2022_Modified %>%
  group_by(month = lubridate::floor_date(modifiedDate, 'month'))

all_non_domestic = CRIME_COUNT_BY_MONTH %>%
  filter(Domestic == FALSE)

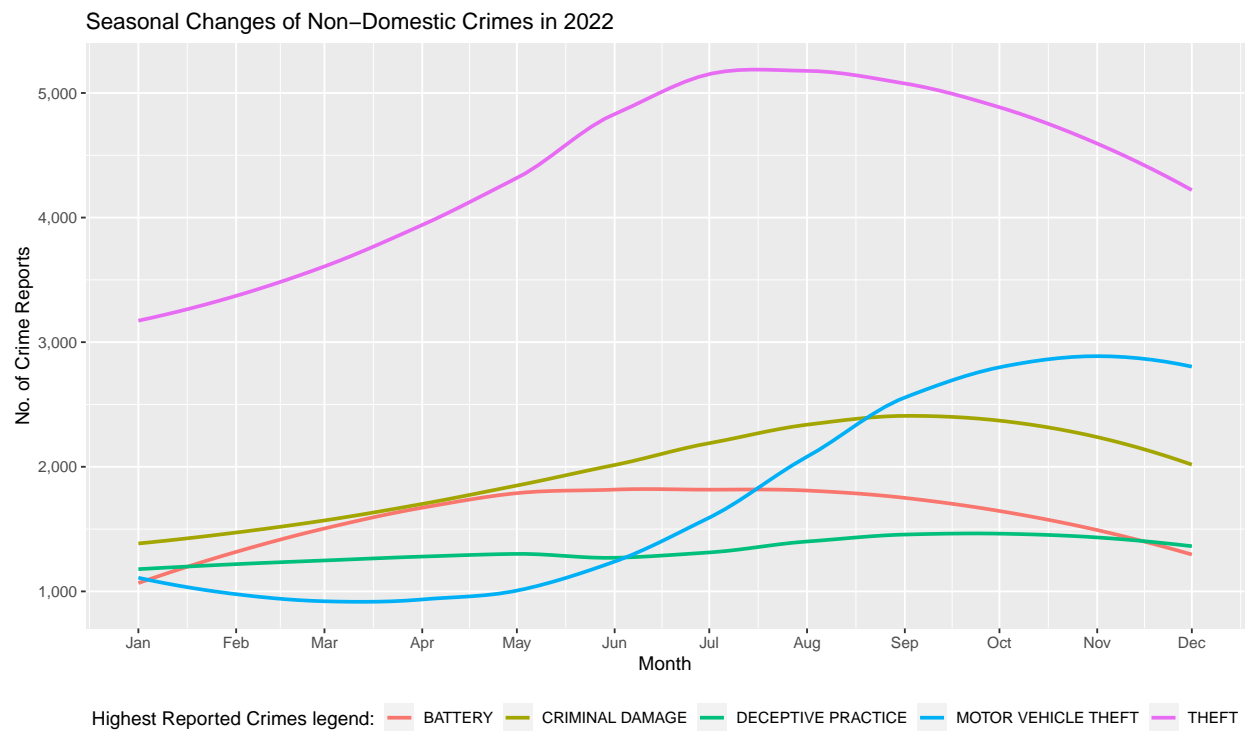
#Filter by top 5 non-domestic crime types.
five_domestic_crime = all_non_domestic %>%
  filter(Primary_Type == "THEFT" |
         Primary_Type == "CRIMINAL DAMAGE" |
         Primary_Type == "MOTOR VEHICLE THEFT" |
         Primary_Type == "BATTERY" |
         Primary_Type == "DECEPTIVE PRACTICE")

five_grouped = five_domestic_crime %>%
  group_by(Primary_Type, month) %>%
  summarize(Count = n())
```

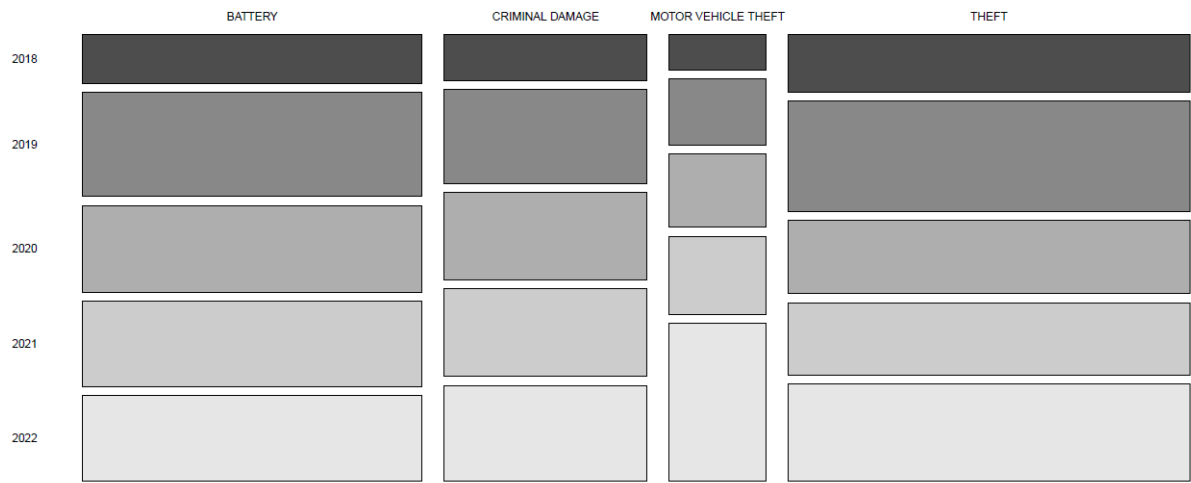


```
#five_domestic_crime
```

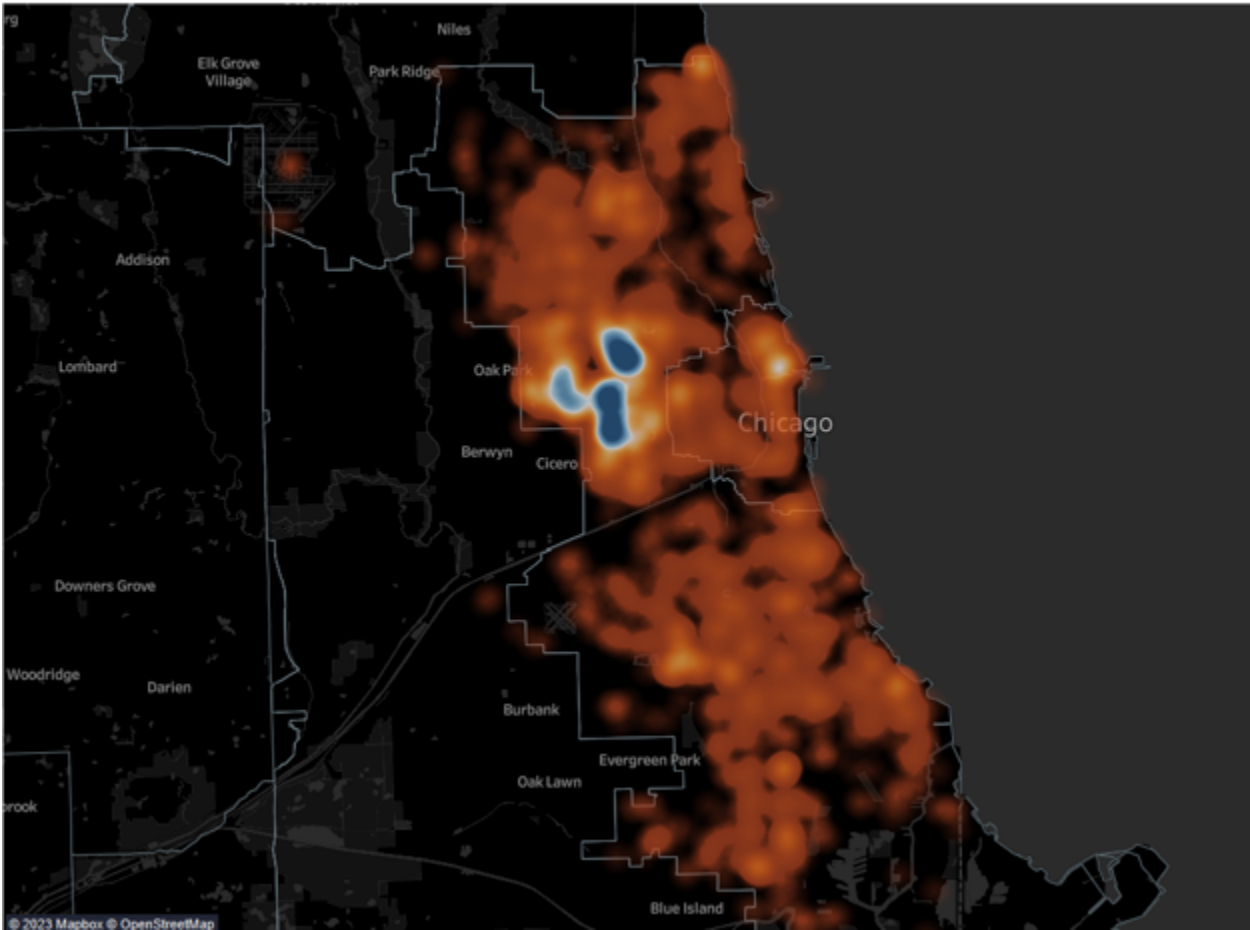
```
ggplot(five_grouped, aes(x = month,
                        y = Count,
                        colour = Primary_Type)) +
  ggtitle("Seasonal Changes of Non-Domestic Crimes in 2022") +
  scale_x_date(date_labels = "%b", date_breaks = "1 month") +
  geom_smooth(method = loess, se = F) +
  labs(colour='Highest Reported Crimes legend:') +
  ylab("No. of Crime Reports") +
  xlab("Month") +
  theme(legend.position = "bottom") +
  scale_y_continuous(labels = function(y) format(y,
                                                  big.mark = ",",
                                                  scientific = FALSE))
```



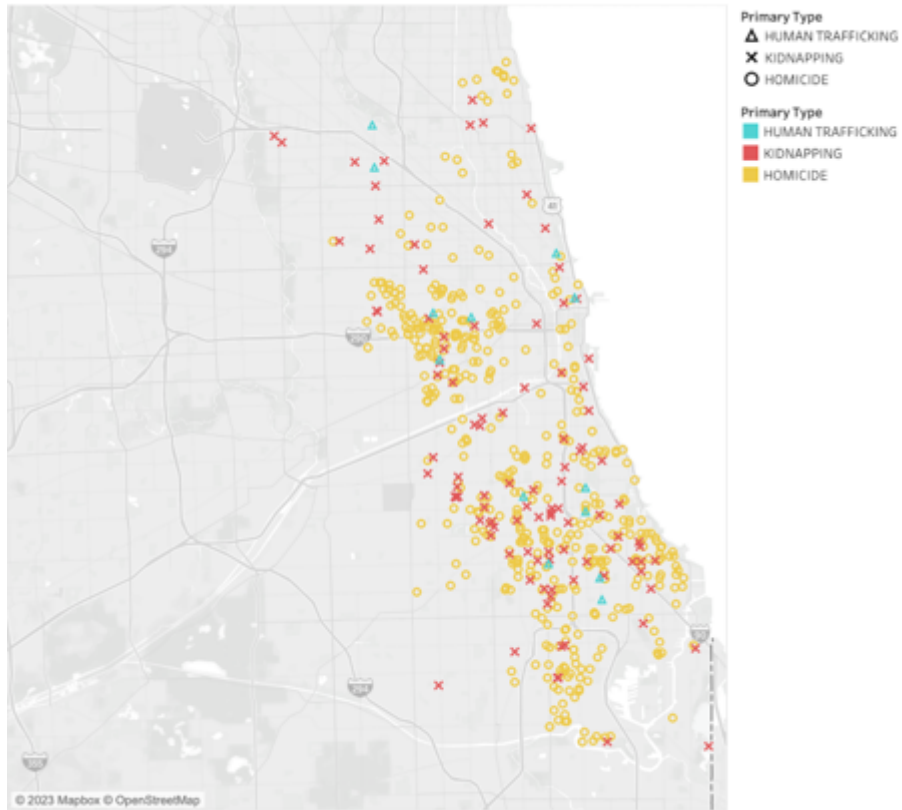
Other Exploratory Visualizations



Concentration of Narcotic-type crimes reported in 2022

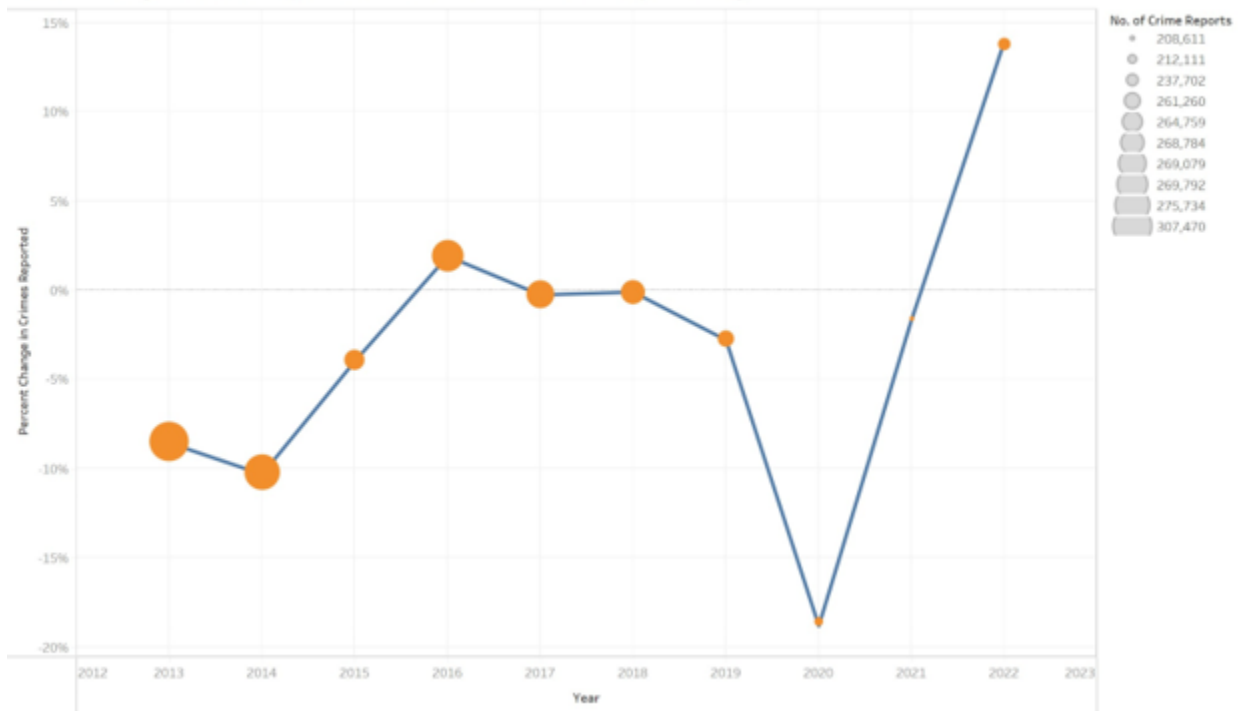


No Arrests Made for Human Traffickings, Homicides, and Kidnappings in Chicago 2022



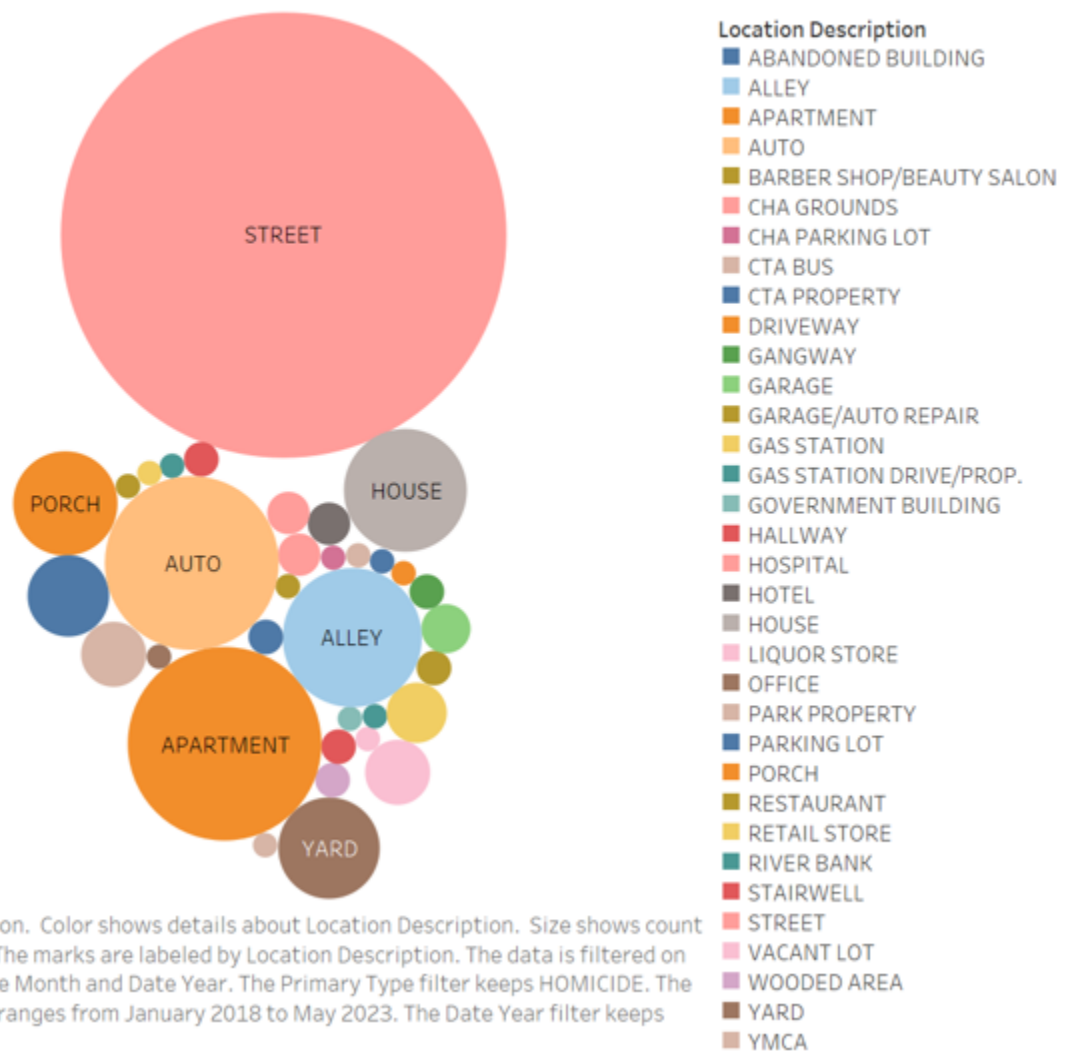
Map based on Longitude and Latitude. Color shows details about Primary Type. Shape shows details about Primary Type. Details are shown for Arrest. The view is filtered on Arrest and Primary Type. The Arrest filter keeps False. The Primary Type filter keeps HOMICIDE, HUMAN TRAFFICKING and KIDNAPPING.

Percent Change in Crimes Reported between 2012 and 2022 - City of Chicago

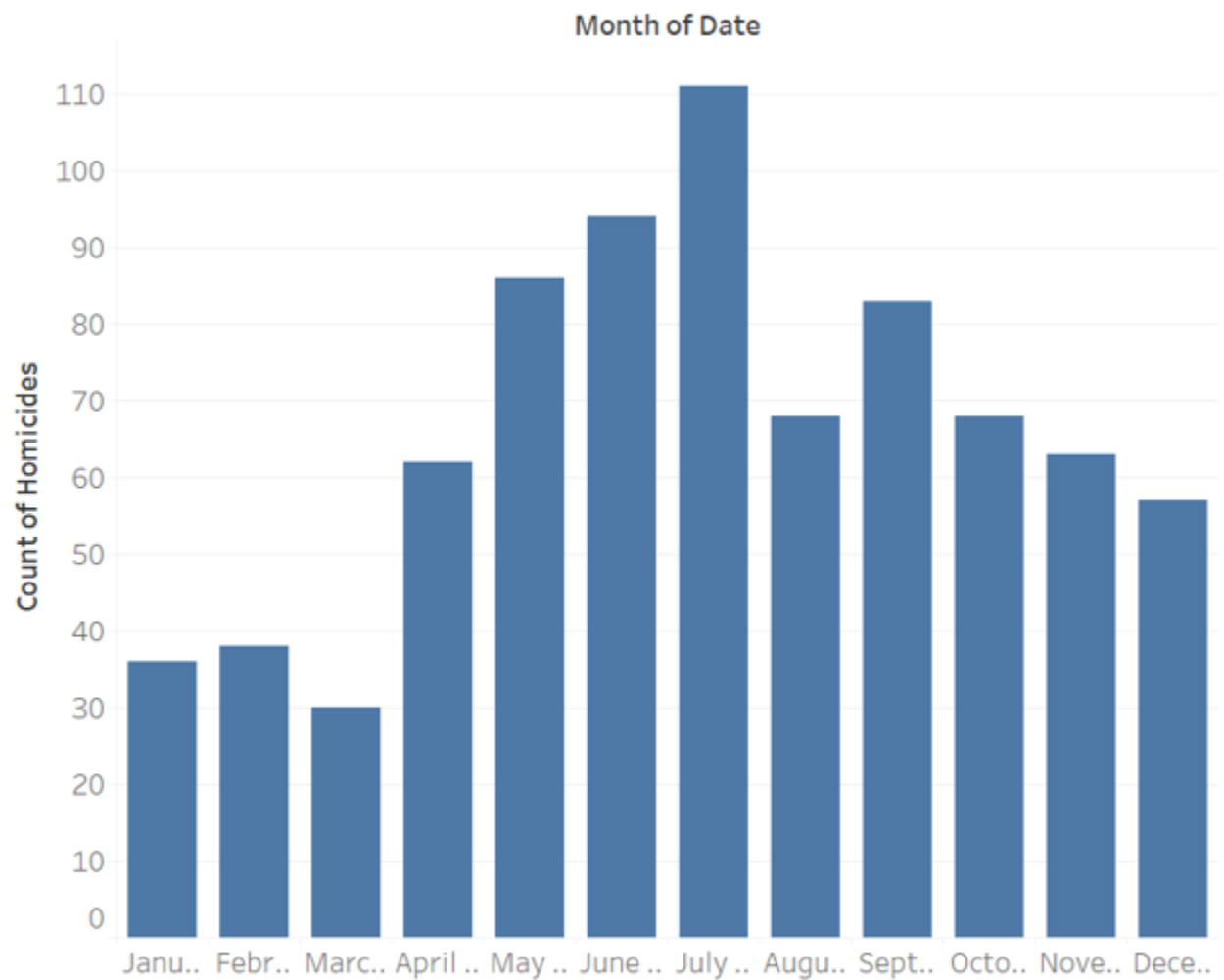


The graph above shows the percent change in crimes reported year after year, from 2012 to 2022. The size of the circle at each point indicates the number of crimes reported by Chicago Department of Public Safety for that year.

Homicide location

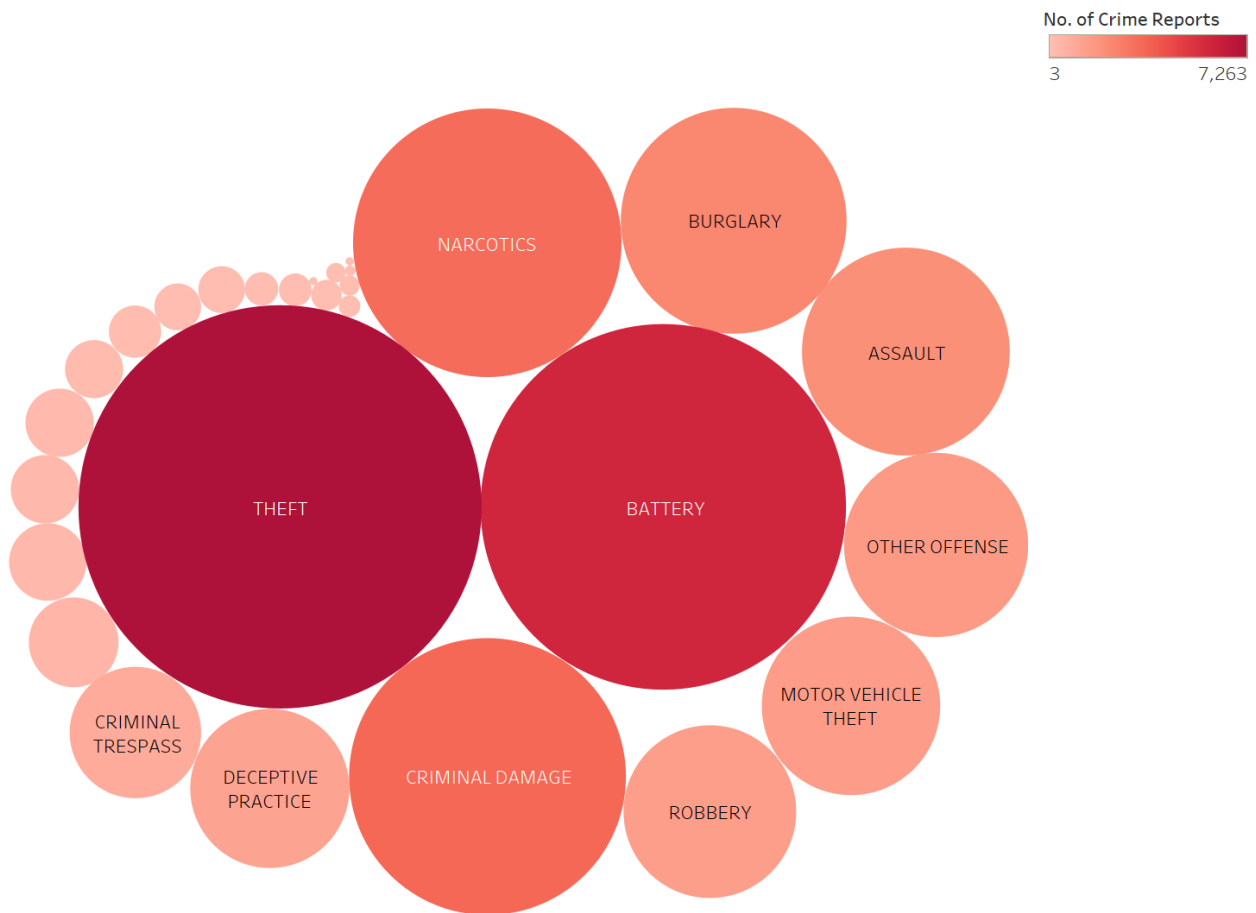


Homicide count high



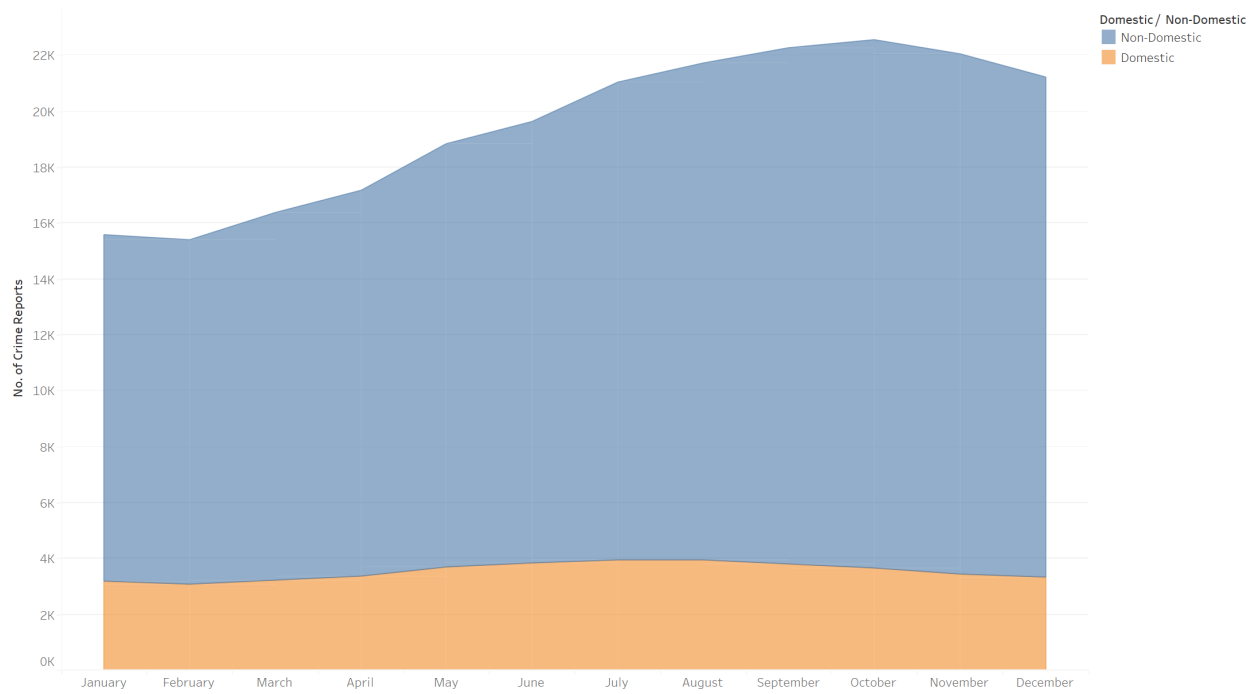
Count of Crimes_-_2020.csv for each Date Month. The data is filtered on Primary Type, which keeps HOMICIDE.

City of Chicago Crime Report Types for July 2012



The packed bubble chart above shows the primary types of crimes in July of 2012. Size and color indicate the number of crime reports associated with the type of crime.

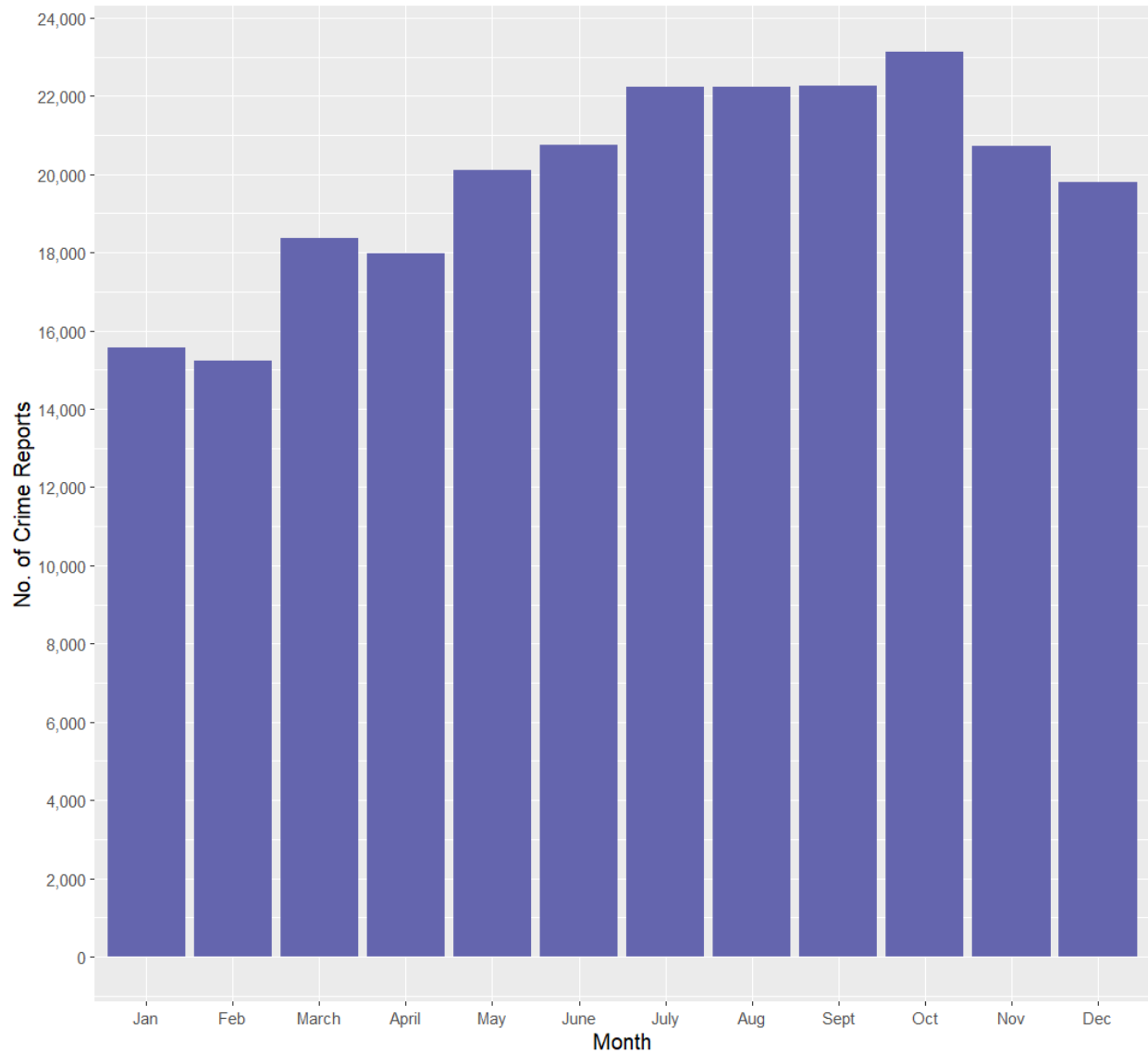
Seasonal Changes in Crime Reports based on Domestic or non-Domestic nature of incident



The area chart above shows the number of crimes reported split by whether the crime was a domestic crime or non-domestic crime. The chart shows that non-domestic crimes experienced a higher amount of seasonal fluctuation compared to domestic crimes, which remained mostly steady throughout the year.

Monthly Chicago Crime Reports

Year: 2022



The bar chart shows the seasonal/monthly change in crime reports in Chicago throughout the year 2022.