Staying Safe: Analyzing Crime in San Francisco

2020 Vision

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Introduction

The subject matter we're investigating is information about crime in San Francisco. In recent years, San Francisco hasn't been the safest place to live; the overall crime rate in San Francisco is 151% higher than the national average. According to SFChronicle, "homicides increased by 21.4% in San Francisco from March to June of this year," compared to 2019 (https://www.sfchronicle.com/bayarea/article/Which-crimes-are-up-down-in-SF-during-15408485.php). There is a 1 in 15 chance of becoming a victim of any crime. We wanted to use this dataset to obtain conclusions about specific factors that correlate to higher levels of crime, which will hopefully inform us of some key insights we can keep during future travels.

https://www.sfchronicle.com/bayarea/philmatier/article/SF-ranks-high-in-property-crime-while-it-ranks-14439369.php

Research Question: What factors can the general population associate with local crime in order to be the safest while in San Francisco (or in other cities with similar characteristics)?

Hypotheses: A later time (e.g. nighttime hours) correlates to a higher level or rate of crime. Location is correlated to levels of crime.

We are interested in these two hypotheses because we believe they can then lead to other interesting relationships between variables within this dataset. For example, if there is a strong correlation between night and rate of crime, then is there a correlation between which night of the week (ex. Sunday night) and rate of crime? With location, are there certain districts that have a specific crime that is common there? By delving further and examining these relationships, we will be able to understand if crime has any specific pattern in San Francisco.

Data

```r
set.seed(1)
sanfrancrime <- sanfrancrimeBIG %>%
  sample_n(15000)
  glimpse(sanfrancrime)
```

```
## Rows: 15,000
## Columns: 13
## $ IncidntNum <chr> "160074818", "166163532", "160697272", "160666750", "160...
## $ Category   <chr> "ASSAULT", "LARCENY/THEFT", "NON-CRIMINAL", "NON-CRIMINA...
## $ Descript   <chr> "THREATS AGAINST LIFE", "GRAND THEFT FROM LOCKED AUTO", ...
## $ DayOfWeek  <chr> "Tuesday", "Wednesday", "Sunday", "Tuesday", "Wednesday"...
## $ Date       <chr> "01/26/2016 12:00:00 AM", "06/15/2016 12:00:00 AM", "08/...
## $ Time       <time> 13:45:00, 08:06:00, 12:55:00, 16:00:00, 06:30:00, 15:55...
## $ PdDistrict <chr> "NORTHERN", "BAYVIEW", "SOUTHERN", "CENTRAL", "NORTHERN"...
## $ Resolution <chr> "NONE", "NONE", "NONE", "NONE", "NONE", "NONE", "NONE", ...
## $ Address    <chr> "FRANKLIN ST / PACIFIC AV", "CESAR CHAVEZ ST / ILLINOIS ...
## $ X          <dbl> -122.4249, -122.3866, -122.4136, -122.4065, -122.4197, -...
## $ Y          <dbl> 37.79461, 37.75033, 37.77951, 37.79515, 37.78967, 37.719...
## $ Location   <chr> "(37.7946072650051, -122.424873688619)", "(37.7503255046...
## $ PdId       <dbl> 1.600748e+13, 1.661635e+13, 1.606973e+13, 1.606668e+13, ...
```

The observations in the dataset are of crime data in San Francisco from 2016. We found our dataset at https://www.kaggle.com/roshansharma/sanfranciso-crime-dataset. Each observation in this datase is a crime whose various aspects have been recorded. There were originally 150,500 individual crimes/observations in this dataset. However, because of the nature of R Studio through OIT, we will be taking a random and reproducible sample from the larger dataset. We created this sample by using the function sample_n() on sanfrancrimeBIG to randomly select 15,000 observations. We chose 15,000 because it is still large enough to get an accurate portrayal of the total data set, yet is much more manageable to process.

There are 13 variables in the dataset: IncidntNum (double): gives the Incident Number of the crime Category (character): gives category of crime Description (character): gives description of crime DayofWeek (character): gives day of week the crime occurred on Date (character): gives date (day, month, and year) of crime Time (double): gives time of crime (in military time) PdDistrict (character): gives police district crime occurred in Resolution (character): gives kind of punishment given to the criminal to resolve the case Address (character): gives address where the crime happened X (double): gives latitude of crime location Y (double): gives longitude of crime location Location (character): exact location using latitude and longitude PdId (double): ID of police officer

The curator of the dataset got it from the final assignment for Coursera and IBM's Data Visualization Course. The information in this dataset is most likely directly from the San Francisco Police Department for their reported crimes during 2016. This dataset was originally used to practice analyzing and visualizing data through geo spatial mapping by using folium maps for geographical understanding.

Methodology

We will analyze the validity of our hypotheses using various statistical methods, including a Chi-square test, bootstrapping, and a logistic regression model, among others. Note: we plan on grouping violence based on violent vs nonviolent.

Variables we're considering: Category Day of Week Date Time PdDistrict Resolution

Results

Showcase how you arrived at answers to your question using any techniques we have learned in this class (and some beyond, if you're feeling adventurous). Provide the main results from your analysis. The goal is not to do an exhaustive data analysis, but rather let me know that you are proficient at asking meaningful questions and answering them with results of data analysis, that you are proficient in using R, and that you are proficient at interpreting and presenting the results. Focus on methods that help you begin to answer your research questions.

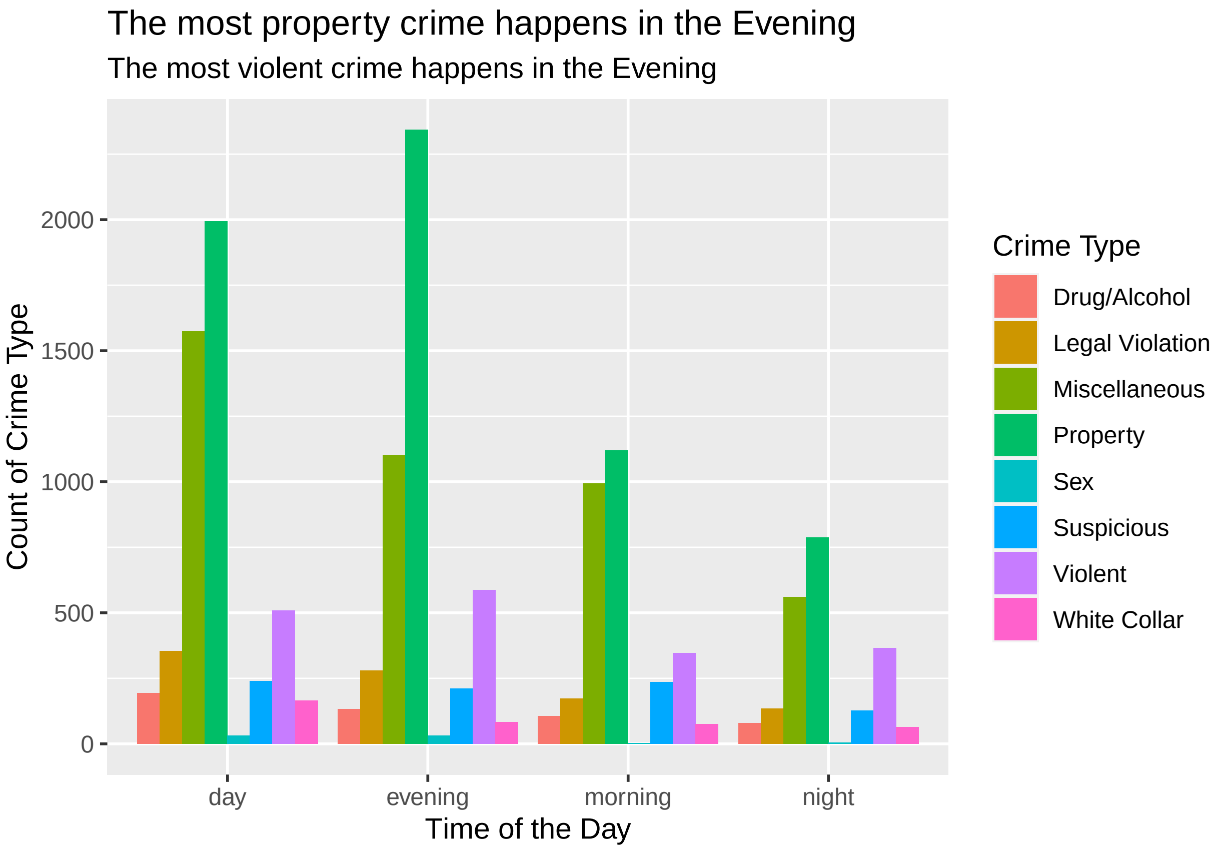
1- Relationship between crime type and time? Mihir

```r
important <- sanfrancrime %>%
  mutate(str = as.character(Time)) %>%
  mutate(hourstr = substr(str, 1, 2)) %>%
  mutate (hour = as.numeric(hourstr)) %>%
  select(Category, DayOfWeek, Date, PdDistrict, Resolution, hour)

important <- important %>%
  mutate(timerange = case_when( hour >= 0 & hour < 6 ~ "night",
                                hour >= 6 & hour < 12 ~ "morning",
                                hour >= 12 & hour < 18 ~ "day",
                                hour >= 18 & hour < 24 ~ "evening"))
```

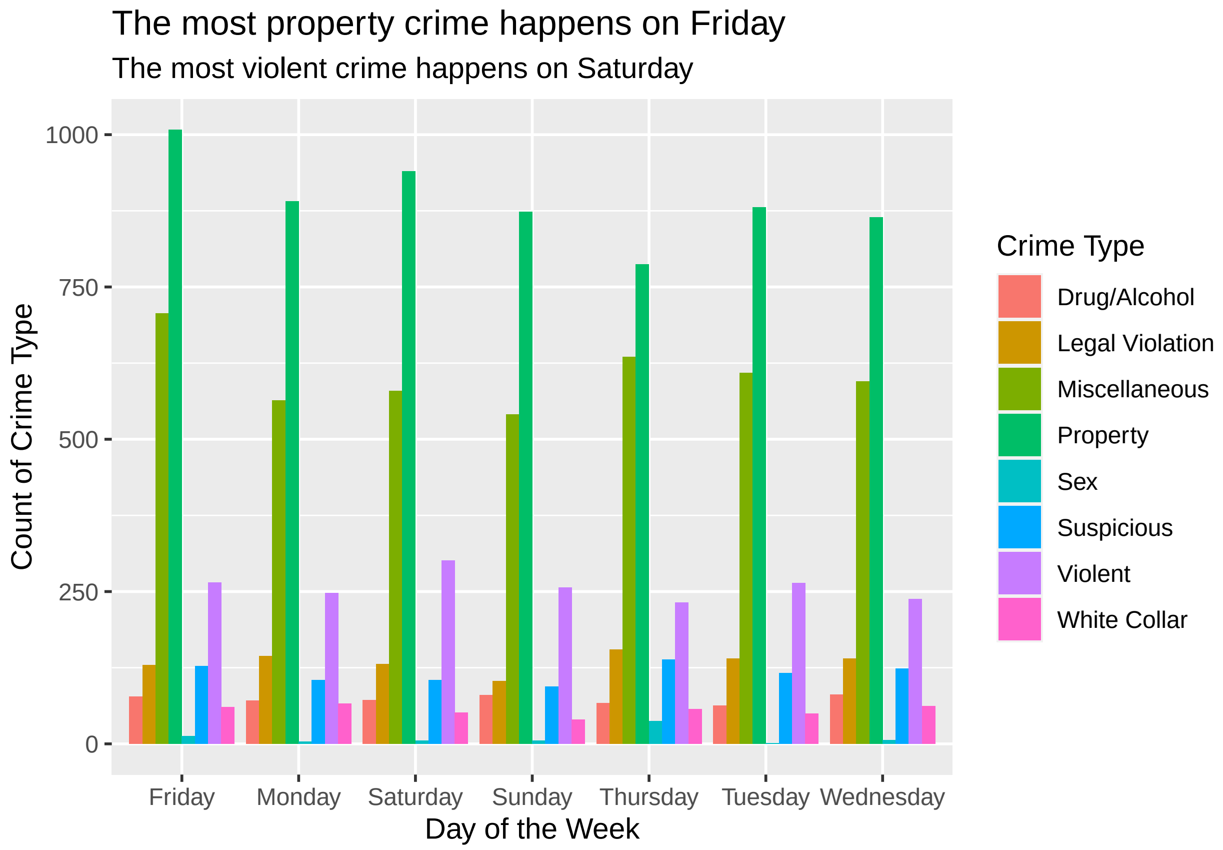
```r
important <- important %>%
  mutate(crimetype = case_when(

    Category == "BURGLARY" | Category == "LARCENY/THEFT" |
    Category == "STOLEN PROPERTY" | Category == "RECOVERED VEHICLE" |
    Category == "VEHICLE THEFT" | Category == "ARSON" |
    Category == "VANDALISM"  ~ "Property",

    Category == "ROBBERY" | Category == "ASSAULT" |
    Category == "KIDNAPPING" |
      Category == "SEX OFFENSES, FORCIBLE" ~ "Violent",

    Category == "BRIBERY" | Category == "BAD CHECKS" |
    Category == "EMBEZZLEMENT"| Category == "FORGERY/COUNTERFEITING" |
    Category == "FRAUD" | Category == "GAMBLING"|
    Category == "EXTORTION" ~ "White Collar",

    Category == "DRIVING UNDER THE INFLUENCE" | Category == "DRUG/NARCOTIC" |
    Category == "DRUNKENNESS"| Category == "LIQUOR LAWS" ~ "Drug/Alcohol",

    Category == "PORNOGRAPHY/OBSCENE MAT" | Category == "PROSTITUTION" |
    Category == "SEX OFFENSES, NON FORCIBLE" ~ "Sex",

    Category == "LOITERING" | Category == "TREA" |
    Category == "TRESPASS"| Category == "SUSPICIOUS OCC" |
    Category == "DISORDERLY CONDUCT" ~ "Suspicious",

    Category == "WARRANTS"|Category == "WEAPON LAWS" |
    Category == "SECONDARY CODES" ~ "Legal Violation",

    Category == "MISSING PERSON" |Category == "NON-CRIMINAL"|
    Category == "OTHER OFFENSES" |Category == "SUICIDE"|
    Category == "FAMILY OFFENSES" | Category == "RUNAWAY" ~ "Miscellaneous"))

glimpse(important)
```

```
## Rows: 15,000
## Columns: 8
## $ Category   <chr> "ASSAULT", "LARCENY/THEFT", "NON-CRIMINAL", "NON-CRIMINA...
## $ DayOfWeek  <chr> "Tuesday", "Wednesday", "Sunday", "Tuesday", "Wednesday"...
## $ Date       <chr> "01/26/2016 12:00:00 AM", "06/15/2016 12:00:00 AM", "08/...
## $ PdDistrict <chr> "NORTHERN", "BAYVIEW", "SOUTHERN", "CENTRAL", "NORTHERN"...
## $ Resolution <chr> "NONE", "NONE", "NONE", "NONE", "NONE", "NONE", "NONE", ...
## $ hour       <dbl> 13, 8, 12, 16, 6, 15, 8, 11, 22, 22, 23, 14, 0, 0, 2, 6,...
## $ timerange  <chr> "day", "morning", "day", "day", "morning", "day", "morni...
## $ crimetype  <chr> "Violent", "Property", "Miscellaneous", "Miscellaneous",...
```

```r
ggplot(data = important, mapping = aes(x = timerange)) +
  geom_bar(aes(fill = crimetype), position = "dodge") +
  labs(x = "Time of the Day", y = "Count of Crime Type",
       title = "The most property crime happens in the Evening",
       subtitle = "The most violent crime happens in the Evening",
       fill= "Crime Type")
```



```r
ggplot(data = important, mapping = aes(x = DayOfWeek)) +
  geom_bar(aes(fill = crimetype), position = "dodge") +
  labs(x = "Day of the Week", y = "Count of Crime Type",
       title = "The most property crime happens on Friday",
       subtitle = "The most violent crime happens on Saturday",
       fill= "Crime Type")
```



To determine the relationship between category and time, I have created 4 time intervals (morning, day, evening, and night) and categorized the crimes based on the type of crime. I will then be performing a Chi-Squared test between these categorical variables to determine if there is the relationship between them is statistically significant.

H_0 : NO relationship between the crime types created above and categories for time of day created above.

H_a : There IS a relationship between the crime types created above and categories for time of day created above.

α of 0.05

```
crimecount <- important %>%
  count(crimetype)

test <- important %>%
  group_by(crimetype) %>%
  count(timerange)

CrimeCategory <- c(rep(crimecount$crimetype[1], crimecount$n[1]),
               rep(crimecount$crimetype[2], crimecount$n[2]),
               rep(crimecount$crimetype[3], crimecount$n[3]),
               rep(crimecount$crimetype[4], crimecount$n[4]),
               rep(crimecount$crimetype[5], crimecount$n[5]),
               rep(crimecount$crimetype[6], crimecount$n[6]),
               rep(crimecount$crimetype[7], crimecount$n[7]),
               rep(crimecount$crimetype[8], crimecount$n[8]))

TimeOfDay <- c(
```

```r
rep(test$timerange[1], test$n[1]), rep(test$timerange[2], test$n[2]),
rep(test$timerange[3], test$n[3]), rep(test$timerange[4], test$n[4]),

rep(test$timerange[5], test$n[5]), rep(test$timerange[6], test$n[6]),
rep(test$timerange[7], test$n[7]), rep(test$timerange[8], test$n[8]),

rep(test$timerange[9], test$n[9]), rep(test$timerange[10], test$n[10]),
rep(test$timerange[11], test$n[11]), rep(test$timerange[12], test$n[12]),

rep(test$timerange[13], test$n[13]), rep(test$timerange[14], test$n[14]),
rep(test$timerange[15], test$n[15]), rep(test$timerange[16], test$n[16]),

rep(test$timerange[17], test$n[17]), rep(test$timerange[18], test$n[18]),
rep(test$timerange[19], test$n[19]), rep(test$timerange[20], test$n[20]),

rep(test$timerange[21], test$n[21]), rep(test$timerange[22], test$n[22]),
rep(test$timerange[23], test$n[23]), rep(test$timerange[24], test$n[24]),

rep(test$timerange[25], test$n[25]), rep(test$timerange[26], test$n[26]),
rep(test$timerange[27], test$n[27]), rep(test$timerange[28], test$n[28]),

rep(test$timerange[29], test$n[29]), rep(test$timerange[30], test$n[30]),
rep(test$timerange[31], test$n[31]), rep(test$timerange[32], test$n[32]))


table <- table(CrimeCategory, TimeOfDay)
table
```

```
##                   TimeOfDay
## CrimeCategory       day evening morning night
##   Drug/Alcohol      194     132     106    80
##   Legal Violation   354     280     173   135
##   Miscellaneous    1574    1103     993   560
##   Property         1994    2343    1119   788
##   Sex                32      31       3     5
##   Suspicious        239     210     235   126
##   Violent           508     586     346   365
##   White Collar      165      83      75    63
```

```r
chisq.test(table)
```

```
## 
##  Pearson's Chi-squared test
## 
## data:  table
## X-squared = 347.32, df = 21, p-value < 2.2e-16
```

The test statistic is 359.84, which has a chi squared distribution with 18 df under H_0. The p-value is $<$ 2.2e-16 which is less than the α of 0.05. This means there is sufficient evidence to reject the null hypothesis. As a result, I conclude that there is sufficient evidence to suggest that at the 0.05 significance level that there is a relationship between the crime types created above and categories for time of day created above.

```r
condensed <- important %>%
  mutate(isViolent = ifelse(crimetype == "Violent", 1, 0)) %>%
  select(DayOfWeek, PdDistrict, timerange, isViolent)
```

```
condensed
```

```
## # A tibble: 15,000 x 4
##    DayOfWeek PdDistrict timerange isViolent
##    <chr>     <chr>      <chr>         <dbl>
##  1 Tuesday   NORTHERN   day               1
##  2 Wednesday BAYVIEW    morning           0
##  3 Sunday    SOUTHERN   day               0
##  4 Tuesday   CENTRAL    day               0
##  5 Wednesday NORTHERN   morning           0
##  6 Monday    INGLESIDE  day               1
##  7 Monday    SOUTHERN   morning           0
##  8 Thursday  SOUTHERN   morning           0
##  9 Wednesday NORTHERN   evening           0
## 10 Friday    INGLESIDE  evening           0
## # ... with 14,990 more rows
```

```
mod1 <- glm(isViolent ~ DayOfWeek + timerange, data = condensed,
  family = "binomial")
tidy(mod1)
```

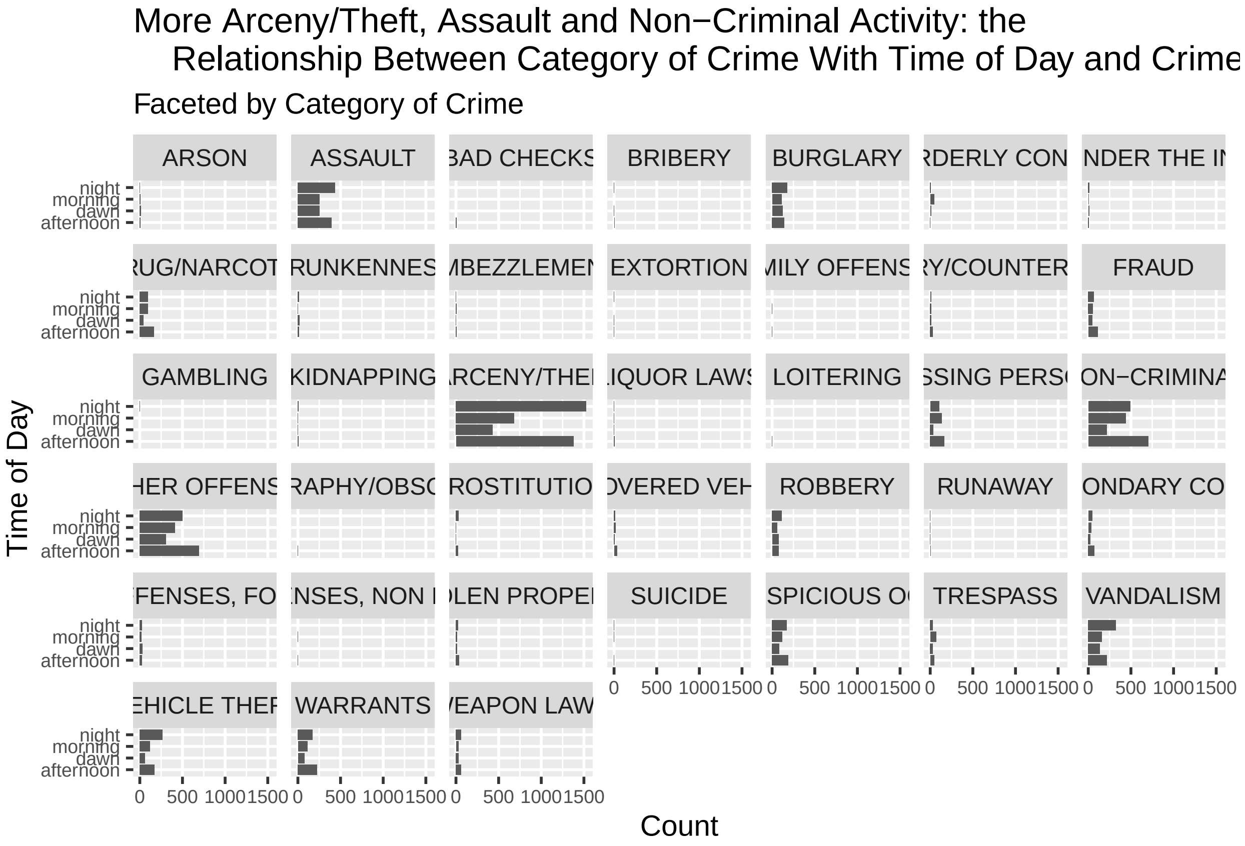
```
## # A tibble: 10 x 5
##    term                estimate std.error statistic   p.value
##    <chr>                  <dbl>     <dbl>     <dbl>     <dbl>
##  1 (Intercept)         -2.28       0.0765   -29.8    5.49e-195
##  2 DayOfWeekMonday      0.0771     0.0941     0.818  4.13e-  1
##  3 DayOfWeekSaturday    0.228      0.0903     2.52   1.16e-  2
##  4 DayOfWeekSunday      0.148      0.0937     1.59   1.13e-  1
##  5 DayOfWeekThursday    0.00391    0.0955     0.0410 9.67e-  1
##  6 DayOfWeekTuesday     0.127      0.0928     1.37   1.71e-  1
##  7 DayOfWeekWednesday   0.0348     0.0950     0.367  7.14e-  1
##  8 timerangeevening     0.227      0.0643     3.53   4.14e-  4
##  9 timerangemorning     0.137      0.0738     1.86   6.34e-  2
## 10 timerangenight       0.608      0.0743     8.18   2.75e- 16
```

Predicted logit(p) = -2.280 + 0.077* (Mon.) + 0.127* (Tues.) + 0.035* (Wed.) +
0.004* (Thur.) + 0.228* (Sat.) + 0.148* (Sun.) + 0.137* (morning) + 0.227* (evening) + 0.608* (night)

2- Relationship between time and crime? Tina

Question: Do more crimes generally occur at night in San Francisco? We will construct an effective, well-labeled visualization of the crime count and time.

```
sanfrancrime <- sanfrancrime %>%
  mutate(str = as.character(Time)) %>%
  mutate(hourstr = substr(str, 1, 2)) %>%
  mutate (hour = as.numeric(hourstr))

sanfrancrime <- sanfrancrime %>%
  mutate(timerange = case_when( hour >= 0 & hour < 6 ~ "dawn",
                                hour >= 6 & hour < 12 ~ "morning",
                                hour >= 12 & hour < 18 ~ "afternoon",
                                hour >= 18 & hour < 24 ~ "night"))



ggplot(sanfrancrime, mapping = aes(y = timerange)) +
  geom_bar() + facet_wrap(~ Category) + labs(
    x = "Count",
    y = "Time of Day",
    title = "More Arceny/Theft, Assault and Non-Criminal Activity: the
    Relationship Between Category of Crime With Time of Day and Crime Count",
    subtitle = "Faceted by Category of Crime") +
  theme(axis.text = element_text(size = 7))
```



```
# sanfrancrime <- sanfrancrime %>%
#   group_by(Category) %>%
#   summarise(count = n())
# sanfrancrime
```

After constructing our visualization of crime count and time, a few things are clear: first, we can see that certain categories of crime are far more prominent than others. For example, larceny/theft is more common, along with non-criminal crimes, assault, and other crimes. Most crimes seem to happen during the afternoon and night, with the least happening in the hours from 0 to 6 (or in the early morning).

Out of all the categories of crime listed, larceny/theft is mostly conducted during the evening, or between hours 18 & 24, ie between 6pm and 12am. This makes sense, as this is usually when night begins to set in, and it's a bit darker out, thus lending to increased obscurity and decreased acuity and vision-related impairments. Overall, this visualization was quite interesting to dissect, as there does seem to be a correlation between crimes and their time of occurrence, as more crimes occur during afternoons and evenings.

```
 # ggplot(data1) +
 #   geom_sf(color = "green", size = 1.5, fill = "orange", alpha = 0.50) +
 #   labs(title = "SF data with theme and aesthetics") +
 #   theme_bw()
```

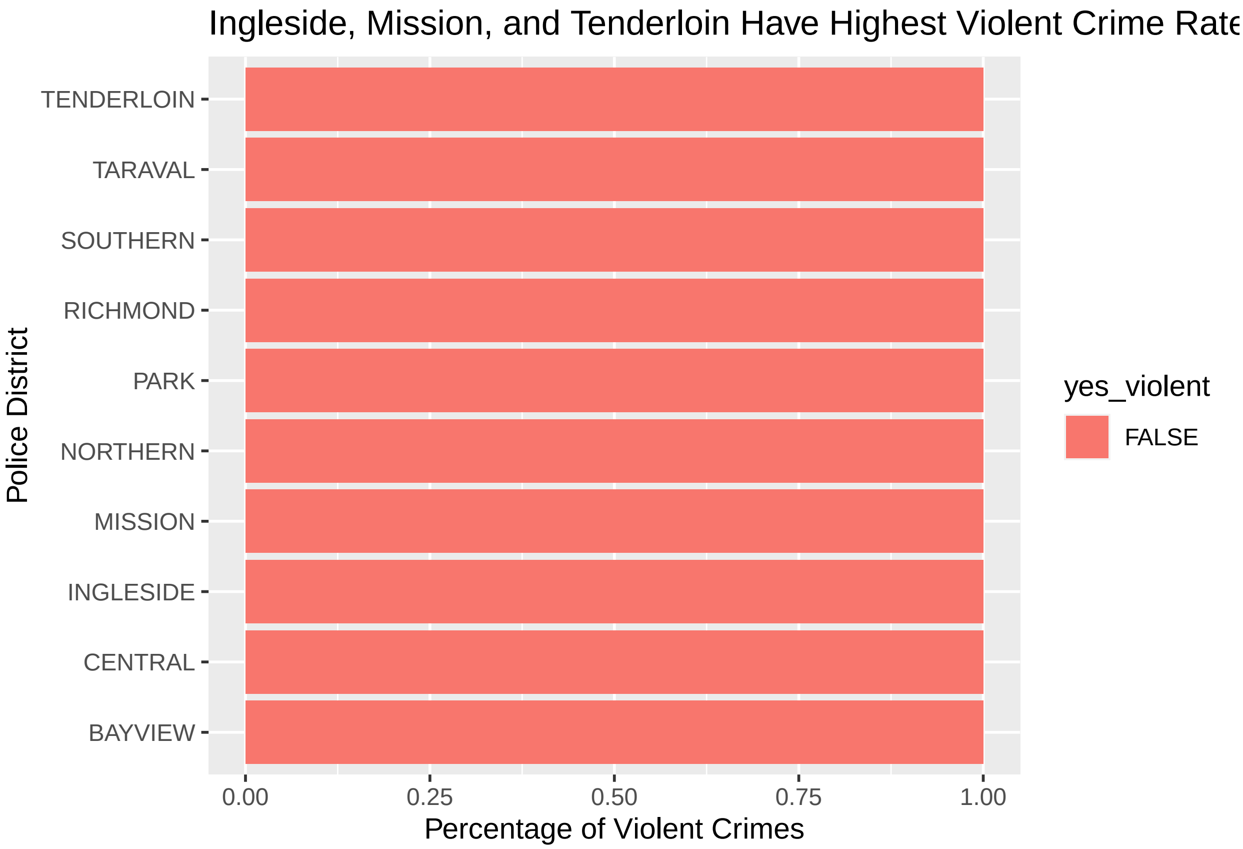
The purpose of this faceted barplot is to show which police districts have the highest rate of crime, as well as the highest proportion of violent crimes.

3- Which PD has the highest proportion of violent crime? Kyra

```r
pd_violent <- sanfrancrime%>%
  group_by(Category)%>%
  count()
pd_violent<- sanfrancrime%>%
  mutate(violent_crime = case_when(
    Category == "ASSAULT" | Category == "SEX OFFENSES FORCIBLE" |
      Category == "ROBBERY" | Category == "KIDNAPPING" ~ "YES",
    Category != "ASSAULT" | Category != "SEX OFFENSES, FORCIBLE" |
      Category != "ROBBERY" | Category !="KIDNAPPING" ~ "NO"))
important <- important%>%
  filter(PdDistrict!="NA")%>%
  group_by(PdDistrict)%>%
  mutate(yes_violent = crimetype == "violence related")%>%
  arrange(desc(yes_violent))


important%>%
  group_by(PdDistrict)%>%
  count(yes_violent)%>%
  mutate(perc = (n/sum(n)*100))%>%
  arrange(desc(perc))%>%
  filter(yes_violent=="TRUE")
```

```
## # A tibble: 0 x 4
## # Groups:   PdDistrict [0]
## # ... with 4 variables: PdDistrict <chr>, yes_violent <lgl>, n <int>,
## #   perc <dbl>
```

```r
ggplot(important, aes(x = PdDistrict, fill = yes_violent))+
  geom_bar(position = "fill") + coord_flip()+
  labs(title =
         "Ingleside, Mission, and Tenderloin Have Highest Violent Crime Rates ",
       y = "Percentage of Violent Crimes", x = "Police District")
```



Ingleside, Mission, and Tenderloin have the highest rates of violent crime. However, Mission, Southern, and Bayview have the highest number of violent crimes. Park and Richmond both have the lowest rates and total numbers of violent crimes. For all police districts, the percentage of violent crimes is lower than 16%.

By using logistic regression, we hope to answer the question of how much more likely a violent crime is to occur depending on the time range of the crime committed. This model below shows the predicted proportion of crimes that are violent given the predictor of time range. The three time ranges used are evening, morning, and night. We hypothesize that the highest proportion of violent crimes will occur at night because there are typically fewer witnesses at these hours.

4- How does time range affect whether crimes are violent? Kyra

```
mod<- lm(yes_violent~timerange,
         data = important)
tidy(mod)
```

```
## # A tibble: 4 x 5
##   term             estimate std.error statistic p.value
##   <chr>               <dbl>     <dbl>     <dbl>   <dbl>
## 1 (Intercept)             0         0       NaN     NaN
## 2 timerangeevening        0         0       NaN     NaN
## 3 timerangemorning        0         0       NaN     NaN
## 4 timerangenight          0         0       NaN     NaN
```

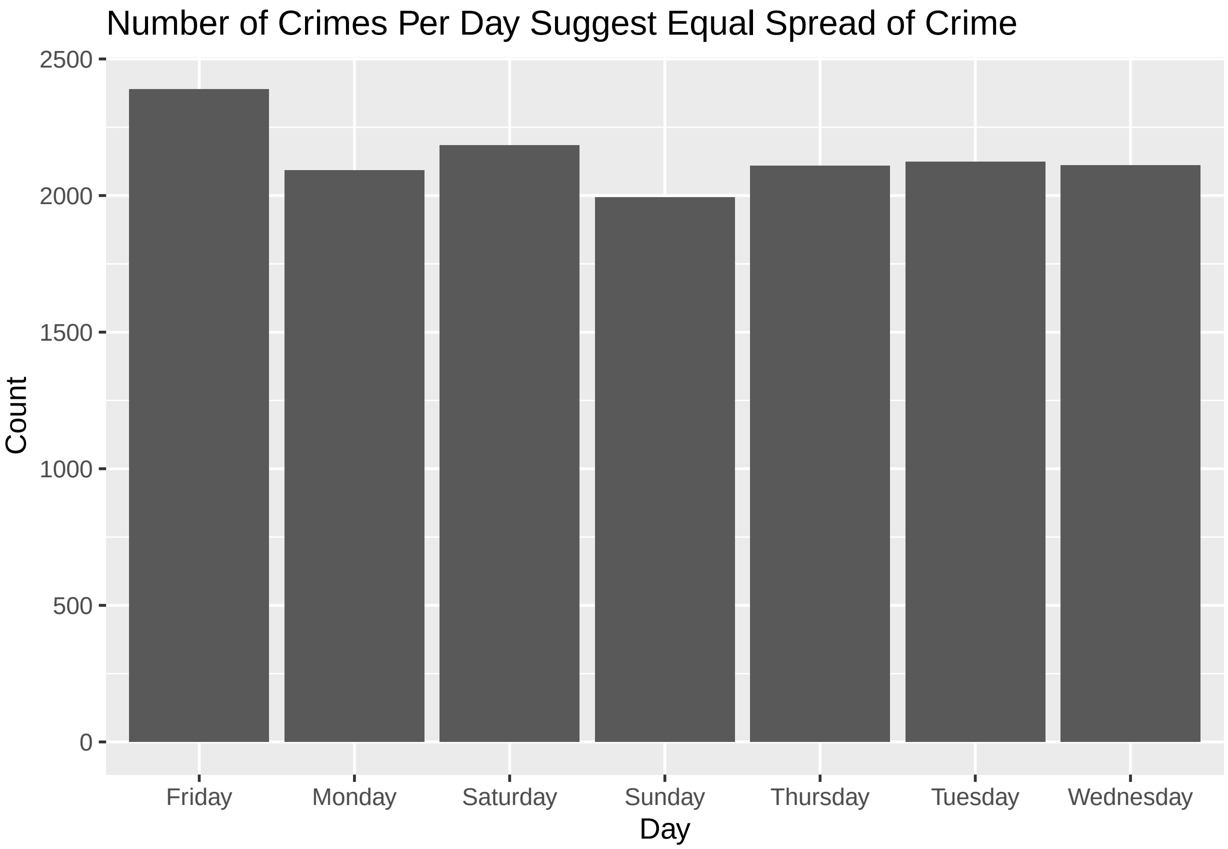
logit(yes_violent) = 0.10383 + 0.01188(evening) + 0.00227(morning) +0.06939(night)

5- Day of the week and category? Leah

```r
#library(forcats)
#sanfrancrime <- sanfrancrime%>%
  #mutate(DayOfWeek = factor(DayOfWeek, labels = c("Monday", "Tuesday", "Wednesday", "Thursday", "Frida
day <- sanfrancrime%>%
  group_by(DayOfWeek)%>%
  mutate(cpday = n())%>%
  select(DayOfWeek, cpday)
day
```

```
## # A tibble: 15,000 x 2
## # Groups:   DayOfWeek [7]
##    DayOfWeek cpday
##    <chr>     <int>
##  1 Tuesday    2124
##  2 Wednesday  2110
##  3 Sunday     1993
##  4 Tuesday    2124
##  5 Wednesday  2110
##  6 Monday     2093
##  7 Monday     2093
##  8 Thursday   2108
##  9 Wednesday  2110
## 10 Friday     2388
## # ... with 14,990 more rows
```

```r
ggplot(data = day, mapping = aes(x = DayOfWeek)) +
    geom_bar()  + labs(x = "Day", y = "Count",
      title = "Number of Crimes Per Day Suggest Equal Spread of Crime")
```



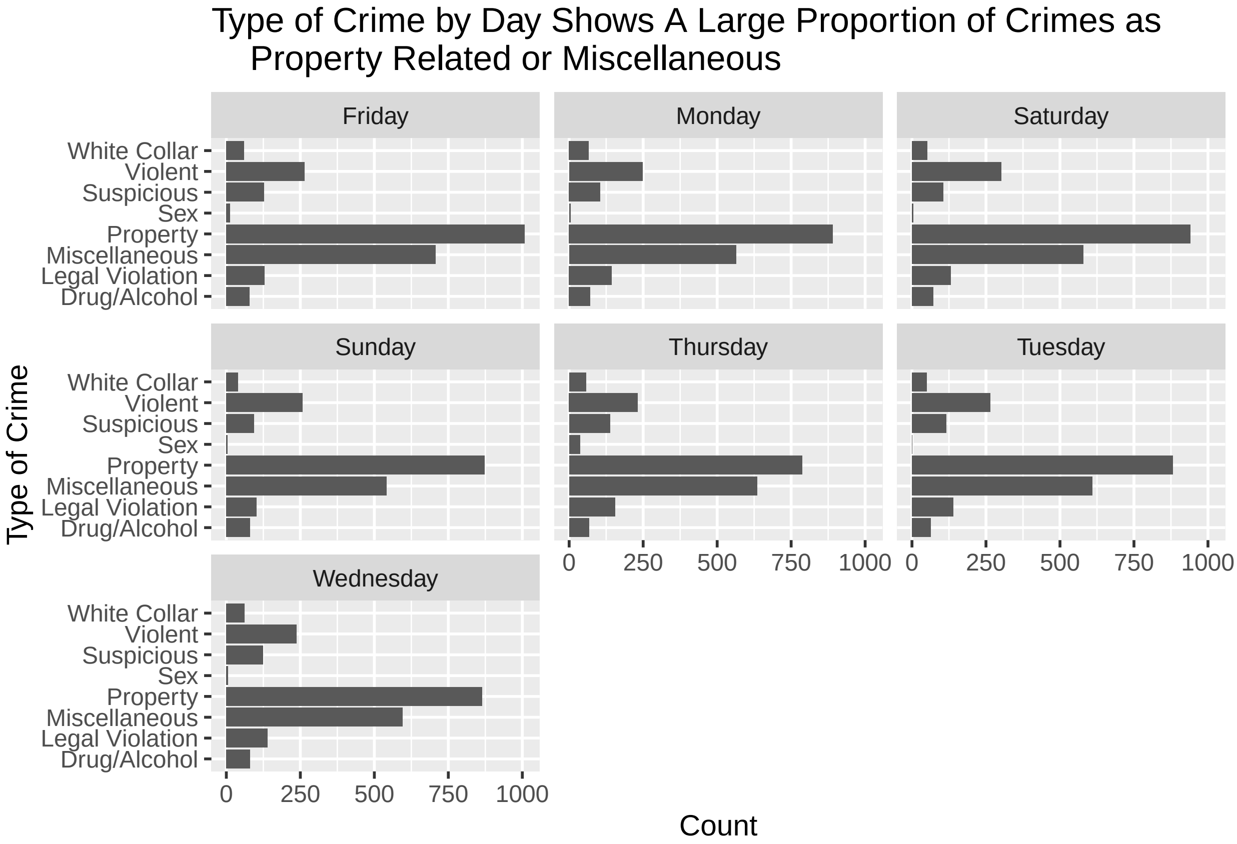
```
#need to change order of days of the week
```

One relationship we were interested in was if certain days had a higher rates of crime. We visualized this relationship by creating a bar graph that compares the day of the week and number of crimes each day during this time period. By looking at the visual, we are able to see that each has a relatively similar crime count compared to the other. In addition to this, there is no significant pattern that sticks out as well.

```
crimetypeday <-important%>%
  group_by(crimetype)%>%
  mutate(ctcount = n())
crimetypeday
```

```
## # A tibble: 15,000 x 10
## # Groups:   crimetype [8]
##    Category DayOfWeek Date  PdDistrict Resolution  hour timerange crimetype
##    <chr>    <chr>     <chr> <chr>      <chr>      <dbl> <chr>     <chr>
##  1 ASSAULT  Tuesday   01/2~ NORTHERN   NONE          13 day       Violent
##  2 LARCENY~ Wednesday 06/1~ BAYVIEW    NONE           8 morning   Property
##  3 NON-CRI~ Sunday    08/2~ SOUTHERN   NONE          12 day       Miscella~
##  4 NON-CRI~ Tuesday   08/1~ CENTRAL    NONE          16 day       Miscella~
##  5 NON-CRI~ Wednesday 02/0~ NORTHERN   NONE           6 morning   Miscella~
##  6 ROBBERY  Monday    03/2~ INGLESIDE  NONE          15 day       Violent
##  7 NON-CRI~ Monday    10/1~ SOUTHERN   NONE           8 morning   Miscella~
##  8 NON-CRI~ Thursday  02/0~ SOUTHERN   NONE          11 morning   Miscella~
##  9 WARRANTS Wednesday 05/0~ NORTHERN   ARREST, B~    22 evening   Legal Vi~
## 10 VEHICLE~ Friday    04/0~ INGLESIDE  NONE          22 evening   Property
## # ... with 14,990 more rows, and 2 more variables: yes_violent <lgl>,
## #   ctcount <int>
```

```
ggplot(data = crimetypeday, mapping = aes(y = crimetype)) +
  geom_bar() + facet_wrap(~ DayOfWeek) +
  labs(
    x = "Count",
    y = "Type of Crime",
    title = "Type of Crime by Day Shows A Large Proportion of Crimes as
    Property Related or Miscellaneous")
```



```
#need to fix crimetype names
# make miscellaneous crimes more specific?
```

The faceted bar graph shows the frequency of each crime rate on a given day of the week. When looking at the visualization, it is easy to see the large difference between types of crime that exist. On each day, the number of property related crimes and miscellaneous crimes are significantly greater than the 5 other crime types. When looking at the frequency of crime types from day to day, every day has a similar pattern of frequency. This further supports the observation from the previous visualization where crime and day of the week do not necessarily have a relationship.

Discussion

This section is a conclusion and discussion. This will require a summary of what you have learned about your research question along with statistical arguments supporting your conclusions. Also, critique your own methods and provide suggestions for improving your analysis. Issues pertaining to the reliability and validity of your data and appropriateness of the statistical analysis should also be discussed here. A paragraph on what you would do differently if you were able to start over with the project or what you would do next if you were going to continue work on the project should also be included.

#tna's disc: After constructing the faceted visualization of crime count and time, we learned that certain categories of crime are far more prominent than others. For example, larceny/theft is more common, along with non-criminal crimes and assault. Most crimes happen during the afternoon and night, with the least happening in the hours from 0 to 6 (or in the early morning). Out of all the categories of crime listed, larceny/theft is mostly conducted during the evening, or between 6pm and 12am. This makes sense, as this is usually when night begins to set in, and it's a bit darker out, thus lending to increased obscurity and decreased acuity and vision-related impairments. Overall, this visualization displayed more crimes occurring during afternoons and evenings.

We understand that we cannot extrapolate our analysis to every city; however, our conclusions will be generalizable to similar cities to a moderate degree. Other cities with similar infrastructure and economic conditions are more likely to utilize the analysis we've found. This analysis will not be applicable to Durham, NC, for example, because of the population density and overall difference in cities (SF is a bustling city, while Durham is a smaller, quaint town).

If we were to continue work on the project, we would add to our analysis by introducing data from different cities that are comparable to SF. It would be interesting to see the parallels in crime rates, as for many college students, traveling to their first job post-grad will be their first taste of independence and financial freedom – thus, safety is an important factor to take into consideration. Ultimately, expanding the population of interest to citizens in multiple cities would give a better picture of how cases of crime occur differently by region, state, country, or population density (urban vs. rural). Second, we would also adjust for additional potential confounding variables to improve the accuracy of our analysis and models.

#Kyra's discussion:

The bar graph that shows crime rates and violent crime proportions that is faceted by police districts shows valuable insight as to which police districts are faced with the highest crime rates. The police districts of Tenderloin, Mission, and Ingleside have the highest percentages of violent crime (17.7%, 16.6%, 16% respectively). However, it is Bayview, Northern, and Southern that have the highest total number of crimes (239, 202, 291 respectively). Park and Richmond were both consistent in having the lowest numbers of total crimes as well as violent crimes. Noting the success of these districts in maintaining low levels of crimes, it could be beneficial to restructure other districts to mirror their practices. Given that factors such as poverty level and unemployment rates are main drivers for crime[1], it would be valuable to assess these numbers for each police district. It would be valuable to know the differences in these factors for districts with more and less crime so that next steps can be taken to lower crime rates. For example, should a future study conclude that Park's public education system has higher test scores than that of Bayview, improving schools could be the best step for mitigating crime.

An important factor that this analysis is lacking is the populations of each police district. Having a larger population size would likely contribute to greater numbers of crime, even if per capita crime is lower. This information is not present in the dataset we used, but would be necessary to extrapolate a greater conclusion regarding which police district is most dangerous.

notes from OH: connect to the next level how can ur results inform policy decisions? interpret coefficients final repo should look like a paper from poli sci

links to use for the map: https://www.benjaminsorensen.me/project/sf_police/ https://data.sfgov.org/Public-Safety/Current-Police-Districts/wkhw-cjsf https://r-spatial.github.io/sf/articles/sf5.html#geometry-with-attributes-sf-1

References: [1] https://ucr.fbi.gov/hate-crime/2011/resources/variables-affecting-crime