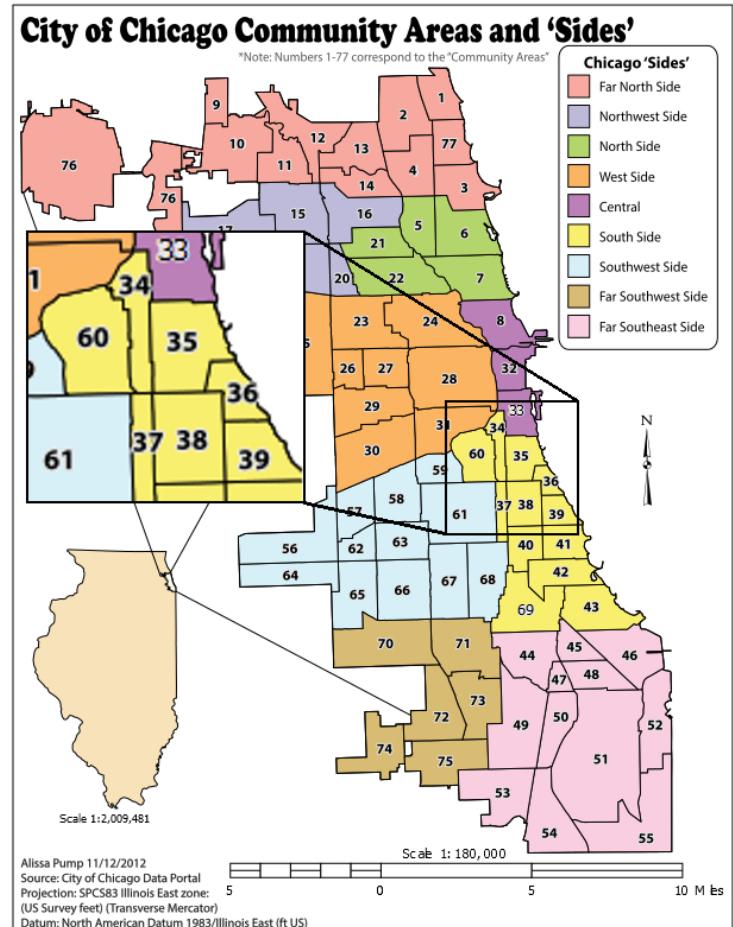


Neighborhood Safety

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Our research delves into the topic of crime and locality. We wanted to examine how the safety of the neighborhood near main campus (Grand Boulevard, community area 38) compares to the safety of the surrounding neighborhoods. For adjacent neighborhoods we considered Douglas (community area 38), which is directly by campus, and



Armour Square (community area 34) to the west. We initially considered including the neighborhoods of Oakland (to the south east) and Near South Side (farther north) as well, but ultimately decided to exclude them because of the drastic differences between those neighborhoods and the ones closer to campus. We also examine each individual neighborhood's level of crime during both the day and night, and then compare that result to the surrounding neighborhoods.

We first decided to test whether Grand Boulevard (gb) is safer than Douglas (d) or Armour Square (as). We did this by separately comparing the amount of crime in Douglas and Armour Square to that in Grand Boulevard.

Our hypotheses were as follows:

$$H_o : \theta_{gb} = \theta_{as} \quad \theta_{gb} = \text{Portion of sample for crime in Grand Boulevard}$$

$$H_a : \theta_{gb} > \theta_{as} \quad \theta_{as} = \text{Portion of sample for crime in Armour Square}$$

$$H_o : \theta_{gb} = \theta_d \quad \theta_{gb} = \text{Portion of sample for crime in Grand Boulevard}$$

$$H_a : \theta_{gb} > \theta_d \quad \theta_d = \text{Portion of sample for crime in Armour Square}$$

We used the following data representing crime in the individual areas:

Crime 2016			Level of Significance
θ_d	165	$\hat{\theta}_d = .0404$	$\alpha = .05$
θ_{gb}	2991	$\hat{\theta}_{gb} = .73$	Rejection Region = $(1.96, \infty)$
θ_{as}	933	$\hat{\theta}_{as} = .228$	
Total	4089		

Table 1.1

With the following formulae to produce:

gb and as	gb and as (populated)
$y = \frac{\hat{\theta}_{gb} - \hat{\theta}_{as}}{\sqrt{\frac{\hat{\theta}_{gb}(1-\hat{\theta}_{gb}) + \hat{\theta}_{as}(1-\hat{\theta}_{as})}{n}}}$	$y = \frac{.73 - .228}{\sqrt{\frac{.73(.27) + .0404(.772)}{4089}}}$
gb and d	gb and d (populated)
$y = \frac{\hat{\theta}_{gb} - \hat{\theta}_d}{\sqrt{\frac{\hat{\theta}_{gb}(1-\hat{\theta}_{gb}) + \hat{\theta}_d(1-\hat{\theta}_d)}{n}}}$	$y = \frac{.73 - .0404}{\sqrt{\frac{.73(.27) + .0404(.9596)}{4089}}}$

Table 1.2

And reached the following conclusions:

Comparison	gb and d = 52.56	gb and as = 90.81
Hypothesis	$H_o : \theta_{gb} = \theta_d$ $H_a : \theta_{gb} > \theta_d$	$H_o : \theta_{gb} = \theta_{as}$ $H_a : \theta_{gb} > \theta_{as}$
Conclusion	Reject H_o	Reject H_o

Table 1.3

Because 52.56 easily falls into the rejection region, we can reject the hypothesis H_o that the amount of crime in the Grand Boulevard neighborhood is equal to the amount of crime in the Douglas neighborhood. 90.81 falls in the rejection region as well, and so we can again reject the hypothesis H_o that the

amount of crime in Grand Boulevard is equal to the amount of crime in Armour Square. In short, the crime rate in Grand Boulevard is not equal to the crime rates in the surrounding neighborhoods.

Our second test measured whether the criminals of our sample neighborhoods prefer to commit crimes in the day or at night. Our hypotheses were as follows (per neighborhood) :

$$H_o : \theta_d = \theta_n \quad \theta_d = \text{Portion of sample for crime during the day}$$

$$H_a : \theta_d > \theta_n \quad \theta_n = \text{Portion of sample for crime at night}$$

And we used the following data representing crimes during the day and night:

Douglas			Grand Boulevard			Armour Square		
Day	Night	$\hat{\theta}_d = .044$	Day	Night	$\hat{\theta}_d = .731$	Day	Night	$\hat{\theta}_d = .225$
98	67	$\hat{\theta}_n = .0356$	1613	1378	$\hat{\theta}_n = .7325$	497	436	$\hat{\theta}_n = .2317$

Table 2.1

With the following formula to produce:

Formula	Grand Boulevard
$y = \frac{\hat{\theta}_d - \hat{\theta}_n}{\sqrt{\frac{\hat{\theta}_d(1-\hat{\theta}_d)}{n_d} + \frac{\hat{\theta}_n(1-\hat{\theta}_n)}{n_n}}}$	$y = \frac{.731 - .7325}{\sqrt{\frac{.731(.269)}{2208} + \frac{.7325(.2675)}{1881}}}$
Armour Square	Douglas
$y = \frac{.225 - .02317}{\sqrt{\frac{.225(.775)}{2208} + \frac{.02317(.7682)}{1881}}}$	$y = \frac{.044 - .0356}{\sqrt{\frac{.044(.956)}{2208} + \frac{.0356(.9644)}{1881}}}$

Table 2.2

And reached the following conclusions:

Neighborhood	Grand Boulevard	Armour Square	Douglas
Result	-.1079	-.5085	.06
Conclusion	Cannot Reject H_o	Cannot Reject H_o	Cannot Reject H_o

Table 2.3

Below is a heatmap of the time and location data:

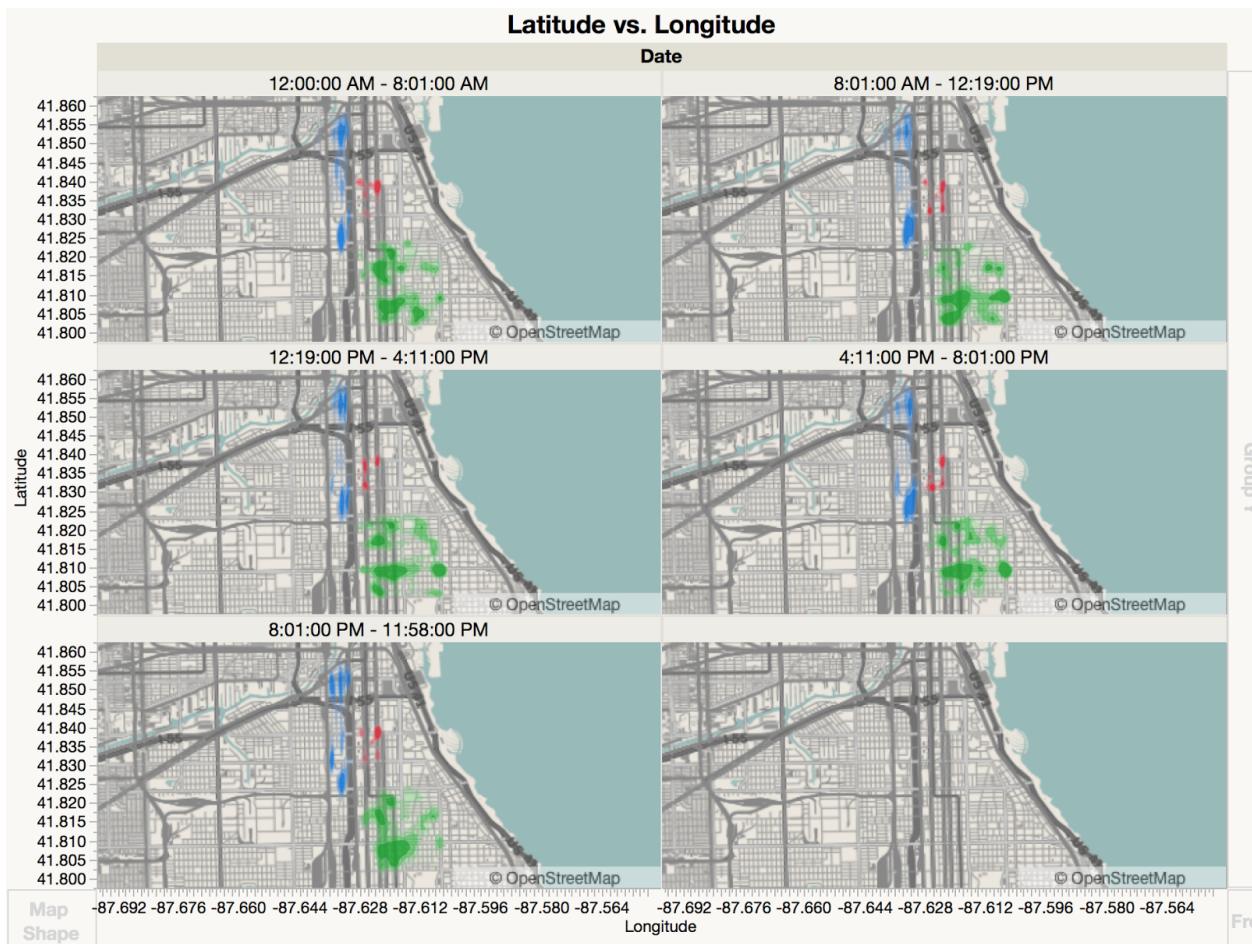


Figure 2.1

From the result of table 2.3, we can not reject the hypotheses that the crime rate during the day in all three neighborhoods, Grand Boulevard, Armour Square, and Douglas, equals the crime rate at night.

For our final comparison, we decided to look at crime in the neighborhoods as compared to one another during the day and at night.

Our hypotheses were:

Day	Night	Day	Night
$H_o : \theta_{gb,d} = \theta_{d,d}$	$H_o : \theta_{gb,n} = \theta_{d,n}$	$H_o : \theta_{gb,d} = \theta_{as,d}$	$H_o : \theta_{gb,n} = \theta_{as,n}$
$H_a : \theta_{gb,d} > \theta_{d,d}$	$H_a : \theta_{gb,n} > \theta_{d,n}$	$H_a : \theta_{gb,d} > \theta_{as,d}$	$H_a : \theta_{gb,n} > \theta_{as,n}$

Table 3.2

And we used the following data:

Grand Boulevard	Douglas	Armour Square
$\hat{\theta}_{gb,d} = .731$	$\hat{\theta}_{gb,n} = .7325$	$\hat{\theta}_{d,d} = .044$

Table 3.2

With the formulae:

gb and d (day)	gb and d (populated)
$\frac{\hat{\theta}_{gb,d} - \hat{\theta}_{d,d}}{\sqrt{\frac{\hat{\theta}_{gb,d}(1-\hat{\theta}_{gb,d}) + \hat{\theta}_{d,d}(1-\hat{\theta}_{d,d})}{n_d}}}$	$\frac{.731 - .044}{\sqrt{\frac{.731(.269) + .044(.956)}{2208}}}$
gb and d (night)	gb and d (populated)
$\frac{\hat{\theta}_{gb,n} - \hat{\theta}_{d,n}}{\sqrt{\frac{\hat{\theta}_{gb,n}(1-\hat{\theta}_{gb,n}) + \hat{\theta}_{d,n}(1-\hat{\theta}_{d,n})}{n_n}}}$	$\frac{.7325 - .0356}{\sqrt{\frac{.7325(.2675) + .0356(.9544)}{1881}}}$

gb and as (day)	gb and as (populated)
$\frac{\hat{\theta}_{gb,d} - \hat{\theta}_{as,d}}{\sqrt{\frac{\hat{\theta}_{gb,d}(1-\hat{\theta}_{gb,d}) + \hat{\theta}_{as,d}(1-\hat{\theta}_{as,d})}{n_d}}}$	$\frac{.731 - .225}{\sqrt{\frac{.731(.269) + .225(.775)}{2208}}}$
gb and as (night)	gb and as (populated)
$\frac{\hat{\theta}_{gb,n} - \hat{\theta}_{as,n}}{\sqrt{\frac{\hat{\theta}_{gb,n}(1-\hat{\theta}_{gb,n}) + \hat{\theta}_{as,n}(1-\hat{\theta}_{as,n})}{n_n}}}$	$\frac{.7325 - .2317}{\sqrt{\frac{.7325(.2675) + .2317(.7683)}{1881}}}$

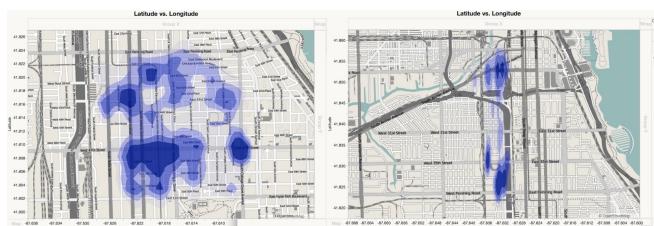
Table 3.4

And reached the following conclusions:

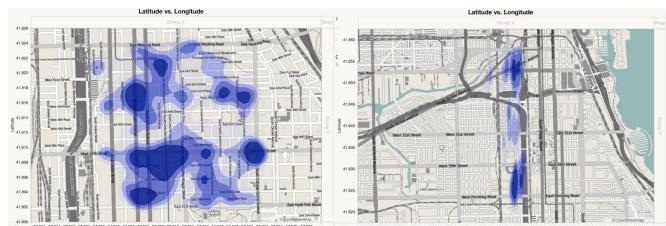
Comparison	Grand Boulevard and Douglas		Grand Boulevard and Armour Sq	
Time/Value	day = 66.073	night = 62.98	day = 39.035	night = 35.52
Conclusion	Reject H_o	Reject H_o	Reject H_o	Reject H_o

Table 3.5

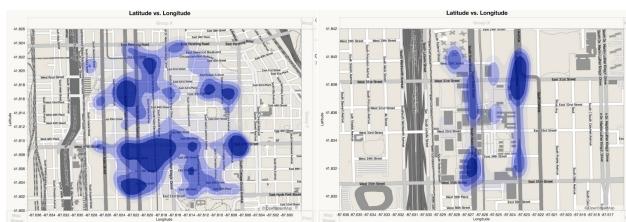
The following are heat maps of the various data sets:



Grand Boulevard and Douglas in the day



Grand Boulevard and Douglas at night



Grand Boulevard and Armour Square in the day | Grand Boulevard and Armour Square at night

Figure 3.1

For our final analysis, we compared the crime rates during both the day and night in Grand Boulevard to the same time periods in the surrounding neighborhoods. From the results of table 3.5, we have concluded that the crime rate in Grand Boulevard during either the day or night is not equal to the crime rates in Armour Square and Douglas.

From our analysis, we may conclude that:

- The overall crime rate in the Grand Boulevard neighborhood is not equal to the crime rates in Armour Square and Douglas.
- The crime rate in Grand Boulevard, Armour Square, and Douglas does not differ between night and day.
- The crime rate in Grand Boulevard during the day does not equal the crime rate in Armour Square and Douglas during the same time period. The crime rates are not equal at night either.

If we were to continue with this analysis, we would like to expand our comparisons to other neighborhoods in the city of Chicago. It might also be useful to identify specific intersections or landmarks in the analysis so that we may draw conclusions on the relative safety of different neighborhoods in Chicago.

Citations

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"City of Chicago | Data Portal." *Chicago*. City of Chicago, n.d.
Web. 05 Dec. 2016.