

# A Data Scientist Perspective On Philadelphia Crime 2006-2016

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## Background

The open data Philly initiative has crime data from Jan 1, 2006 to Nov 11, 2016. There are over 2 million crimes events in the file. The types of crime entries vary from disorderly conduct to criminal homicide. Each entry has location, street address with longitude and latitude coordinates, dispatch date and time, district number, Dc-key, UCR-General and Text-General-Code. Text-General-Code is a factor list of 33 types of crimes and has corresponding Dc-key. These two fields describe the type of crime committed.

Each crime type was calculated by the number of reported instances. Each type of crime was grouped into 4 segments: Part I, Violent and Property Crimes; Part II; and Quality of Life. Part I crimes (felony and misdemeanor) make up the Index Crimes tracked by the FBI and include Violent Crimes such as Homicide, Rape, Aggravated Assault and Robbery. Part I crimes also include the Property Crimes of Theft, Burglary, and Arson. All other misdemeanor crimes are filed under Part II crimes and include Other Assaults, Receiving Stolen Property, Embezzlement, Fraud, Weapons Violations, Forgery/Counterfeiting, Drug Law Violations, Offenses against Family, DUI, and Vandalism. Quality of Life Crimes are less severe summary offenses that affect standards of living in communities, such as Drunkenness, Prostitution, Gambling Violations, Disorderly Conduct, and other minor offenses. All Other Offenses have been grouped with Quality of Life and may include Traffic and Parking Tickets, Truancy and Curfew violations, and police investigations such as pedestrian stops and vehicle investigations.

Table 1 describes the crimes in philadelphia with crime segments and the frequency between Jan 1, 2006 and Nov 12, 2016. It is unfortunet that ~20% of the data is characterized as “all other offenses” and we are not able to precisely say what types of crimes are happening. These are likely quality of life crimes and we can at least separate them from the more violent crimes.

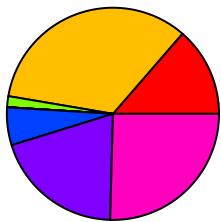
Var1	Var2	Freq
All Other Offenses	Quality_of_Life	428656
Other Assaults	PartII	269569
Thefts	Property	250410
Vandalism/Criminal Mischief	PartII	195288
Theft from Vehicle	Property	166846
Narcotic / Drug Law Violations	PartII	134453
Fraud	PartII	110482
Burglary Residential	Property	92477
Aggravated Assault No Firearm	Violent_crime	67259
DRIVING UNDER THE INFLUENCE		52392
Robbery No Firearm	Violent_crime	50730
Motor Vehicle Theft	Property	45858
Disorderly Conduct	Quality_of_Life	39805
Robbery Firearm	Violent_crime	39530
Aggravated Assault Firearm	Violent_crime	27214
Burglary Non-Residential	Property	22802
Weapon Violations	PartII	18417
Other Sex Offenses (Not Commercialized)	Quality_of_Life	14977
Prostitution and Commercialized Vice	Quality_of_Life	12543
Rape	Violent_crime	11487
Vagrancy/Loitering	Quality_of_Life	6777
Arson	Property	5518
Liquor Law Violations	Quality_of_Life	5397
Forgery and Counterfeiting	PartII	4770

Var1	Var2	Freq
Embezzlement	PartII	4652
Public Drunkenness	Quality_of_Life	4555
Homicide - Criminal	Violent_crime	3341
Offenses Against Family and Children	PartII	1762
Gambling Violations	Quality_of_Life	914
Receiving Stolen Property	PartII	767
	Quality_of_Life	319
Homicide - Justifiable	Violent_crime	42
Homicide - Gross Negligence	Violent_crime	12

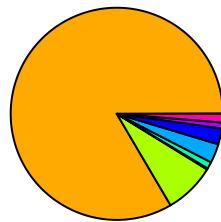
## Results

For the decade spanning 2006-2016, Part II crimes make up 36.3101753% of all crime committed from Jan 2006 to Nov 2016, Property is 26.7514444% of all crime, 23.545913% represent quality of life crimes and the last 9.1452115% represent violent crimes. The crime most committed was "All other Offenses" and is 19.6385531% of total crime. Homicide- Gross Negligence had 12 instances or 0.0005% of all crime. The following pie charts goes into more detail of the 4 segments of crime and what types of crime.

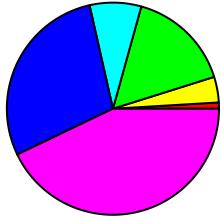
**Violent Crimes**



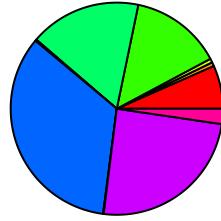
**Quality of life Crimes**



**property Crimes**



**partII Crimes**



## Crime With Respect To Time

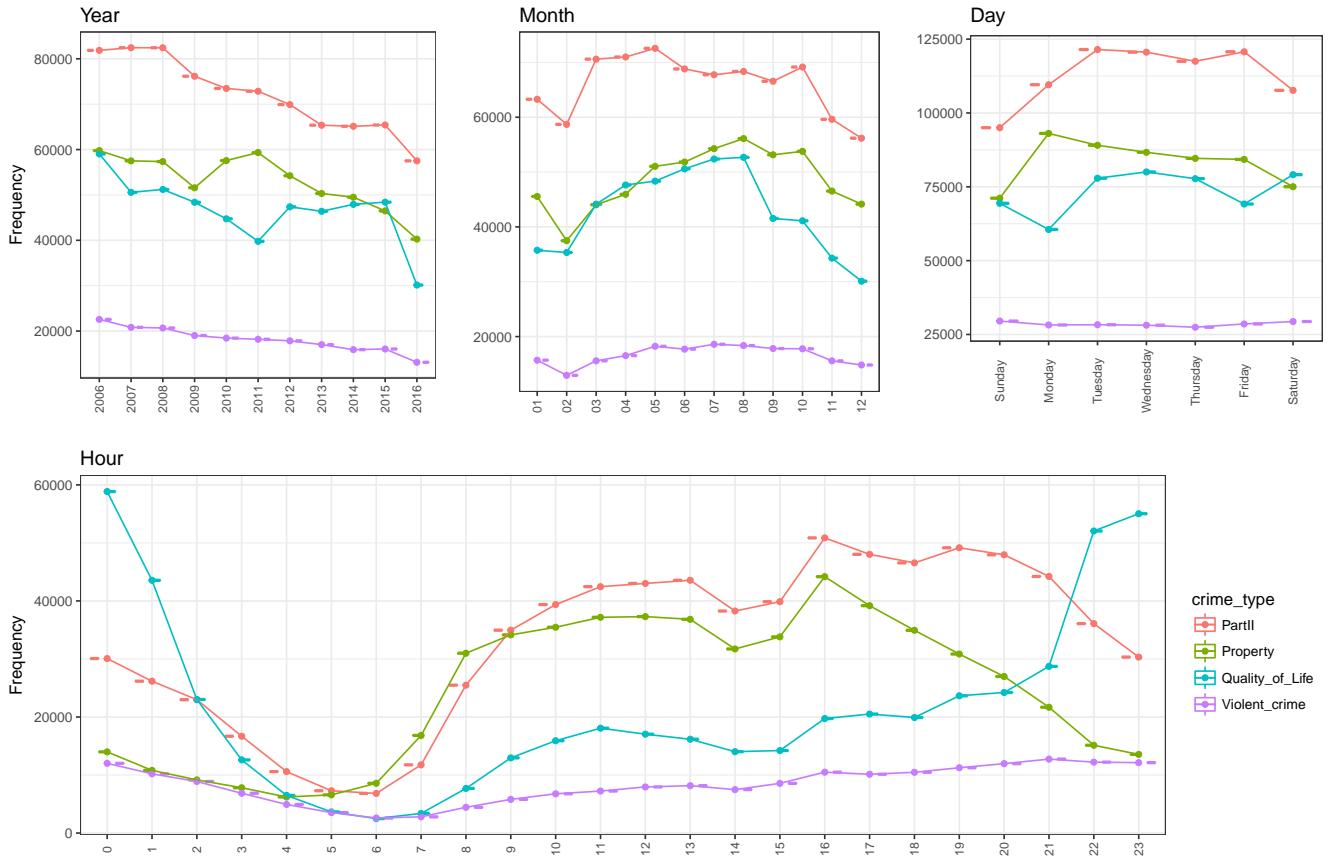
Aggregating time with crime segments reveals broad trends of crimes. In 2006, Philadelphia had 234,755 criminal events and 183,300 in 2015. This ten years span saw a decline in crime rate of 22% in Philadelphia. Even though, all crime segments have declined from 2006 to 2015, not all crime segments have declined year after year. Violent crimes do show a year over year decrease, with 22,198 in 2006 to 15,768 in 2015, a 28.9665736% reduction. Part 2 crimes show the same trend ranging from 54,991 and 41,652 in 2015 or 24.2566966% reduction.

Property crimes also reduced from 59,772 in 2006 to 40,260 in 2016 32.6440474% reduction. However, there was an

increase in property crime from 2009 to 2011, 51,580 and 59,335 incidence respectfully, this produced a 15.0348972% increase in a short amount of time. Quality of life also has a blip. In 2006 there were 59,038 reports and dips down to 39,744 in 2011 (a decrease of 32.6806464%), but its back up to 48,413 in 2015, an increase of 21.8120974% from the 2011 low, but a decrease of 17.9968834% from its 2006 high. This increase could be due to many reasons. Quality of life crimes might be increasing due to increase enforcement prioritization by District Captains.

Other noteworthy trends show the summer months have more crimes committed. The months of February, November and December have least amount of crime. During the weekdays, part II has the highest reporting with a peak on Tuesday and decreases towards the weekend and into Monday. Monday is the peak for Property crimes, but like part II, it decreases moving on into the week and weekend. Quality of life on the other hand, has the least amount of incidence on Monday, and has the most on Saturdays.

Analysis over the 24 hour shows that quality of life is reported most in the evening. Some of these will be curfews, drunkenness etc. Property crimes happen most when no one is home during school and work hours. The least amount of crime occurs between 4am and 6am.



## Geographical Look at Crime

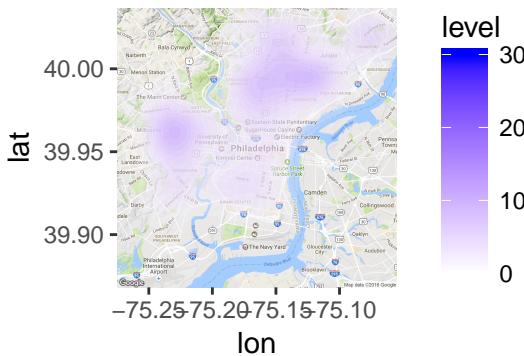
Incorporating a third variable, location, crimes can be mapped with three criteria, place, time and type of crime. From the maps it is noticeable that crime clusters to different regions of the city. These are geographical hotspots for crime. Clustering also is influenced by the time of year and type of crime.

The first set of maps is the city of Philadelphia for violent and quality of life crimes committed in August of 2016. There are overlaps to peaks of crime between the two types of crimes. Quality is more concentrated through out the city, while violent has some concentration, but is otherwise spread out in sections.

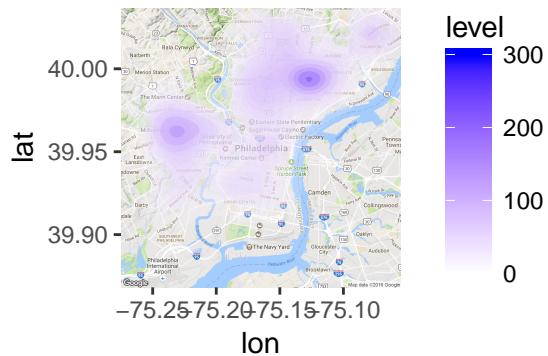
Violent crimes has had a year over year decline, while quality of life initially went down and than increased, but not to 2006. To see if there was a location change in crime, plots were created to see how they changed over the years.

In Sept 2010, SugarHouse Casino was open south of Fishtown. There was concerned crime would increase. From these graphs, the area right outside of the Casino does not show increase in crime, but the region Northern Kensington showed increase in crime activity since opening in Sept 2010.

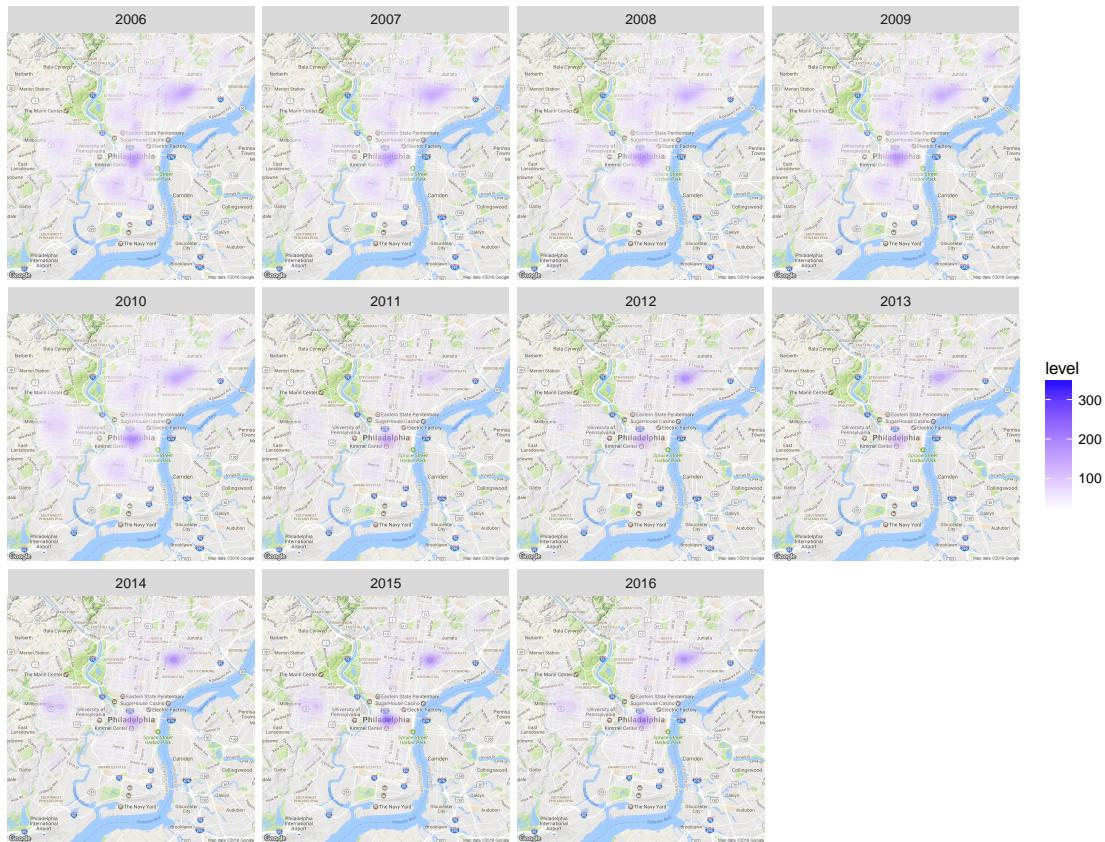
Aug Violent 2016



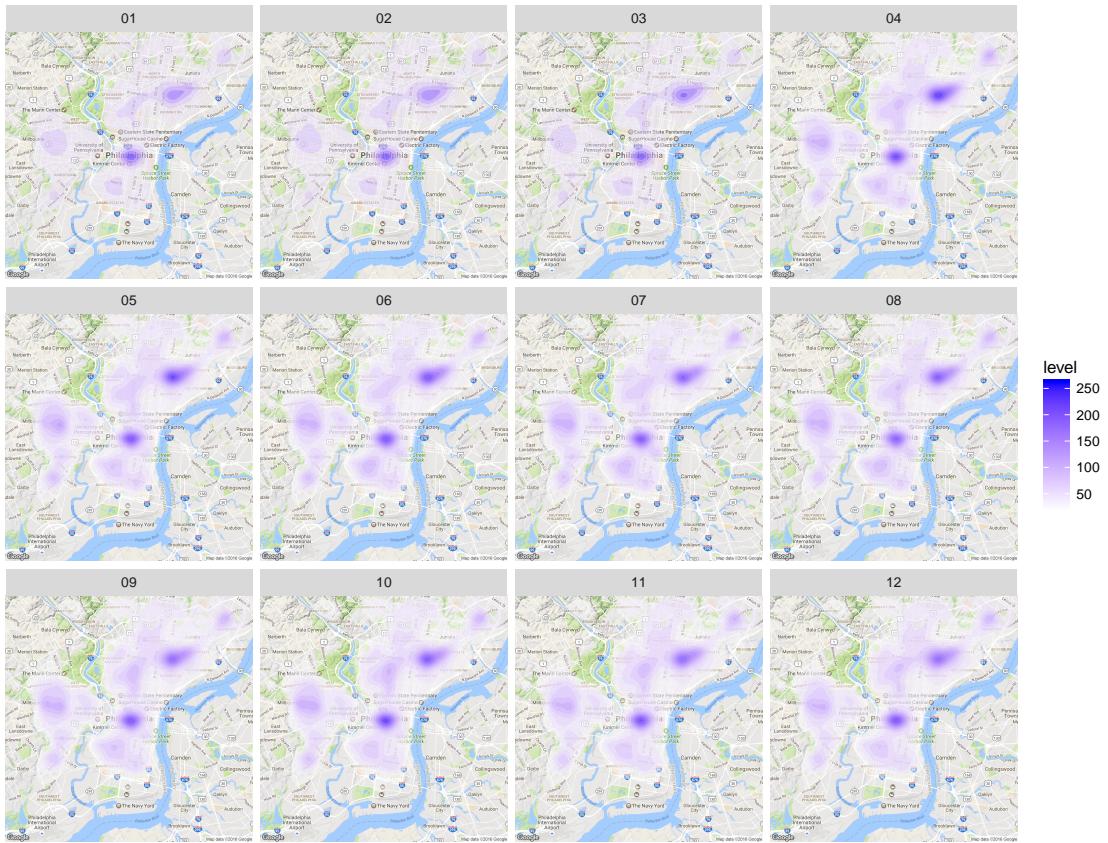
Quality Aug 2016



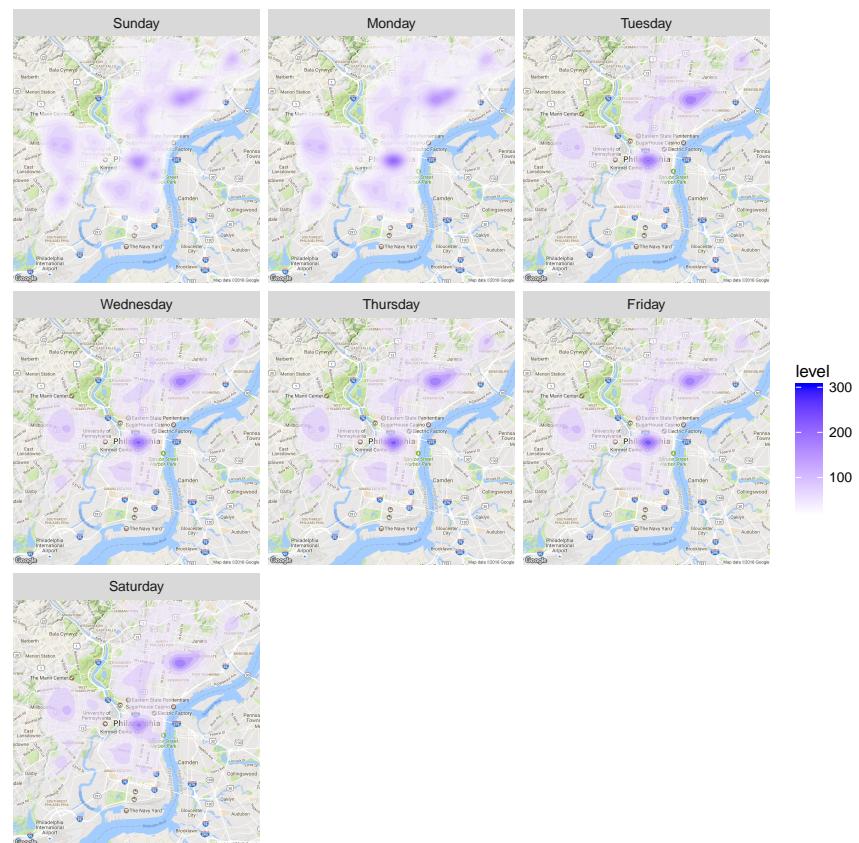
All Crime For Every Year



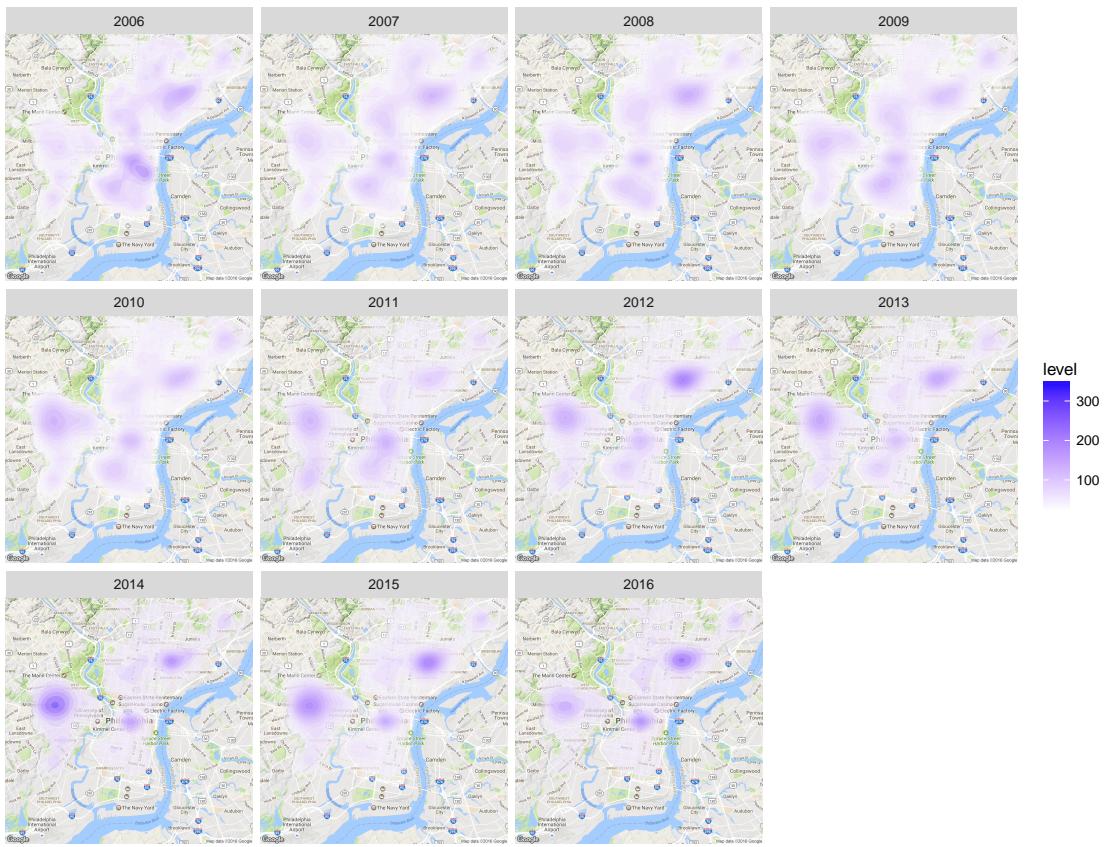
All Crime For Every Month



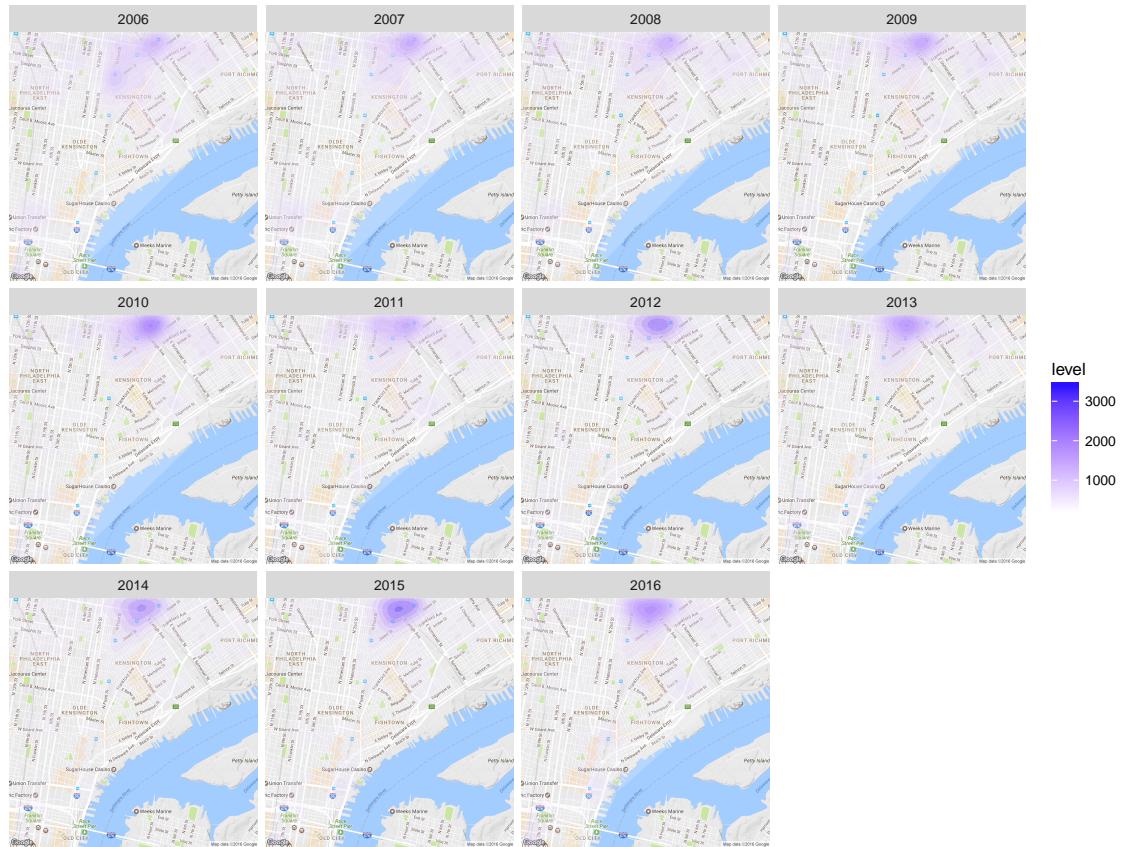
All Crime For Every Day



Quality Crimes in Aug 2006:2016



All Crimes 2006:2016



### **Notes about Arrest Data**

The data for the study was downloaded from Kaggle. A website active in predictive modeling competitions.

Entries are not convictions, but reports generated from police officers, radio call personal and office support officers. If crimes are not reported, they will not be in this analysis. If crimes are falsely reported they will also be included. Homicides produce indisputable evidence, fluctuations will not be based on priorities from Captains. Quality of life crimes, on the other hand, can go unnoticed and unreported. This can create fluctuations in the data.

Another area where the data is not precise is in the areas without addresses such as the Devil's pool. This area in Fairmont park does not have a street address and it is a known place for incidents, medical and criminal happen. Devil's pool does not have an address, so the closest address is used (Philly Magazine, July 26, 2015).

### **Conclusion**

From 2006 to 2016 crime in Philadelphia has decreased. There are more quality of life reports, but violent and other offenses are down. The least amount of crime occurs in Feb with the most in Aug. Depending on the day, depends on the type of crime. The same goes for hour, with the least amount of crime occurring in the early morning between 4-7am.