

# Vancouver Crimespotting

CPSC 547 Project Proposal, 2015W1

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## 1 INTRODUCTION

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Residents in a city are generally concerned with the crime incidents occurring in the city neighbourhoods, and, as a Vancouverite (resident of Vancouver) myself for 10 years, I would say that we are no exceptions. While we may gather crime incident information from news reports of sources such as CBC and the Vancouver Sun, the City of Vancouver actually makes crime incident data openly available through the Vancouver Open Data Catalogue (VODC) [1] and the Vancouver Police Department (VPD) website [2]. VPD also releases yearly reports summarizing crime statistics [3], and incident maps called “Crime Maps” that are refreshed weekly regarding property crime incidents [4].

While any concerned Vancouverite may access these data for additional information, they are currently presented in the forms that are less insightful to interpret. The crime data are generally in the forms of incident counts over certain periods of time, which are pure numbers in text. Although the official yearly reports provide visual representations of yearly crime rate changes, they generally pertain to the city as a whole, and the more specific info pertaining to individual neighbourhoods are no longer visible. The Crime Maps only reflect incident counts over one week of interest, and the previous information is not immediately visible for comparison. This project aims to collect the data and visualize them to better understanding, analysis, and comparison of crime incident statistics in the neighbourhoods of Vancouver.

### 1.1 DOMAIN AND DATA

The domain of interest is the crime incident statistics released by the city government of Vancouver through the 2 primary data sources: VPD and VODC. VPD releases data starting in the year of 2002, and the latest data are generally released up to the previous month of the accessed date. At the time of this writing, monthly statistics are available from January, 2002 to September, 2015. VODC releases property incident data starting from April, 2003, and the latest released data are updated to March, 2015. Both of these data are of the interest of this project.

The raw data from VPD are of 2 types, both in the Table form: (1) Incident counts of different crime categories (Table attributes) occurring in 24 neighbourhoods (Table items) of the city of Vancouver over the month of interest; (2) Incident counts of different crime categories (Table items) of the whole city over the month of interest. The crime categories in (1) are: Sex Offences, Assaults, Robbery, Breaking and Entering (B&E), Theft of MV, Theft from Auto, Theft, Arson, Mischief, and Offensive Weapons. The dataset in (2) includes additional crime types not included in (1), such as Culpable Homicide, Attempted Murder, or Prostitution.

The raw property incident data from VODC takes the form of an incident record, essentially a Table item, that includes the type of crime, the date of the incident, and the hundred block address as the Table attributes. The crime types included are: B&E, Mischief (over, and under \$5000), Theft from Auto (over, and under \$5000), and Theft of Auto (over, and under \$5000). The hundred block addresses are addresses accurate to the hundredth digit. An example is 4XX W 12TH AVE, which is a derived address of the Vancouver City Hall.

## 1.2 TASKS

The project intends to provide visualizations that faithfully reflect the data made publicly available to anyone who is interested in data. Even though the data can be seriously analyzed to study crime patterns in the city of Vancouver, the focus is to provide a more visually understandable overall representation of the data for general consumption, with the following tasks in consideration:

- A. Discover crime incident frequency over a period of time
  - 1. Explore the neighbourhoods as the whole city
  - 2. Lookup specific neighbourhoods
  - 3. Lookup specific crime types
- B. Discover crime incident statistic changes over time
  - 1. Explore the neighbourhoods as the whole city
  - 2. Lookup specific neighbourhoods
  - 3. Lookup specific crime types
- C. Compare crime incident statistics over a period of time
  - 1. A neighbourhood against another, across different crime types
  - 2. A crime type against another, across different neighbourhoods
- D. Discover property crime incidents
  - 1. Explore property crime incidents in the city
  - 2. Browse property crime incidents in specific areas of the city

These tasks are listed in the order of importance, which is determined by the purpose of this visualization project. Providing an overview of the crime data is the main goal, which is reflected in tasks A and B. Task C drills down to direct comparisons of specific neighbourhoods or crime types based on information available from A and B, so its importance is secondary. The property crime incident data are highly localized on the map, and are of essentially different, albeit related, datasets; therefore, task D is deemed the least important. While it is the intention of this project support all tasks, the implementations will likely occur in the order of the task list (A → B → C → D).

## 2 PROPOSED INFOVIS SOLUTION

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### 2.1 INFOVIS DESIGNS

There are several views in the project's visualization solution: (a) Geographical view; (b) Comparison View; and (c) Property Incident View. These views are separate and can be accessed with different tabs in the interface.

#### 2.1.1 Geographical View

Since the neighbourhoods in the city of Vancouver are partitioned geographically, an overall geographical view is a sensible choice to relate the crime statistics to the corresponding region. The geographical view is a visual map of all the neighbourhoods in the city (24 total). Each region will be colour coded to reflect the crime count, with more saturation indicating a higher count. The default color is red, though the colour scheme can be changed. The count values represented are generated based on the conditions specified: (a) Certain periods of time; (b) Certain crime types.

There are settings widgets allowing the users to adjust these conditions to see the changes of counts. A FROM-TO list selection allows the user to adjust the periods of time, which allows the user to see crime

counts of the neighbourhoods over different periods of time (Task A1 – Discover and Explore crime incident frequency as the whole city).

In addition, crime types are listed as checkboxes, so the user can check/uncheck to select/filter the crime types to display. Selecting all reflect the crime count totals. Hovering the cursor over a specific neighbourhood provides a pop-up linked view of the crime counts of the neighbourhood. This mechanism supports both the search tasks A2 and A3 (Discover and Lookup crime incident frequencies of specific neighbourhoods and specific crime types).

The user can click on the neighbourhood to access a more detailed neighbourhood sub-view in the pop-up. It contains the line-chart of monthly crime counts (total), and also the bar-chart of counts of different crime types in the neighbourhood. The changes over the period of time will be labeled in percentages. This sub-view supports Task B2 – Discover and Lookup crime incident statistics for a specific neighbourhood over time.

Each crime type checkbox has its text as a link to a more detailed crime type sub-view in the pop-up. Similar to the neighbourhood sub-view, it contains the line-chart of monthly crime counts of the specified crime, and also the bar-chart of counts of occurrences in different neighbourhoods. The changes over the period of time will be labelled in percentages. This sub-view supports Task B3 – Discover and Lookup crime incident statistics for a specific crime type over time.

There are overall statistical data for the whole city below the geographical map. This includes a line-chart of the monthly crime counts, which can also be toggled to display the bar-charts of counts of different crime. This info supports Task B1 – Discover and Explore crime incident statistics over time.

### **2.1.2 Comparison View**

The comparison view allows 2 neighbourhoods or 2 crime types to be selected for direct comparisons. The information displayed is contained in the neighbourhood sub-views or the crime type sub-views accessible from the Geographical View. This view supports Task C, which allows the user to compare a neighbourhood against another (Task C1), or a crime type against another (Task C2).

### **2.1.3 Property Incident View**

The VODC datasets of property crime incident records contain highly localized geographical information. Therefore, the Property Incident View, while similar to the Geographical View, allows much more localized browsing and zooming. Each incident will be labelled on the map as a mark, with different colour coding indicating the crime types. The user may zoom in/out to see more specific incident locality of the area in sight. This view supports Task D1 and D2 – Explore or Browse property crime incidents in the city/area.

## **2.2 PROPOSED IMPLEMENTATION**

The interface will be implemented with D3.js as its front end, with HTML/CSS templating. AngularJS has been considered as a framework of implementation due to the varying customized views involved. The dataset size, at this point, does not seem to require a database backend. This means the browser and the JavaScript engine of the client will handle the data derivation and manipulation on the fly. A database may need to be utilized if the performance is an issue.

The system will be built from scratch.

## 2.3 PERSONAL EXPERTISE

On a general knowledge level, my expertise in this area only comes from being a Vancouverite for 10 years, and following the local news and official reports as a general citizen. My interest and concern is genuine and general. I do not have prior knowledge of criminology or crime patterns in the city.

On a technical level, I have experiences in traditional programming practices, such as C/C++ and Java. I also have experiences with HTML and CSS when doing basic maintenances of websites. However, my experience with JavaScript programming/scripting is fairly limited.

## 3 SCENARIO OF USE

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Joe has been living in the neighbourhood of Kerrisdale for over 15 years. He is generally concerned with the crime rate of the city of Vancouver and also his own neighbourhood. Using Vancouver Crimespotting, he first navigates the Geographical View (3.1.1), and select the FROM to be 2015 August and TO to be 2015 September. He is interested in the property incident data, so he checks the checkbox next to Breaking and Entering, Mischief, Theft from Auto, and Theft of Auto. The color coding changes on the map, and he sees that the Kerrisdale has similar colours comparing to the surrounding neighbourhoods. Hovering over the Kerrisdale region, he sees that the crime count is 19. Hovering over all surrounding regions revealed that Arbutus-Ridge has 26, Dunbar has 28, Shaughnessy has 24, and Oakridge has 23, and Point Grey has 22. Kitsilano is visually redder, so he hovers over it to see it has 54 incidents. Stanley Park is visibly faint so he hovers over it to see that it only has 1.

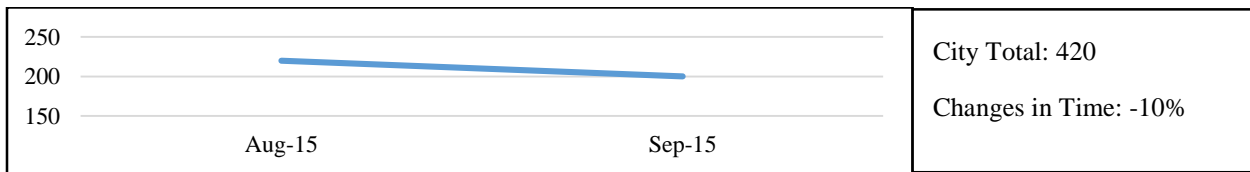
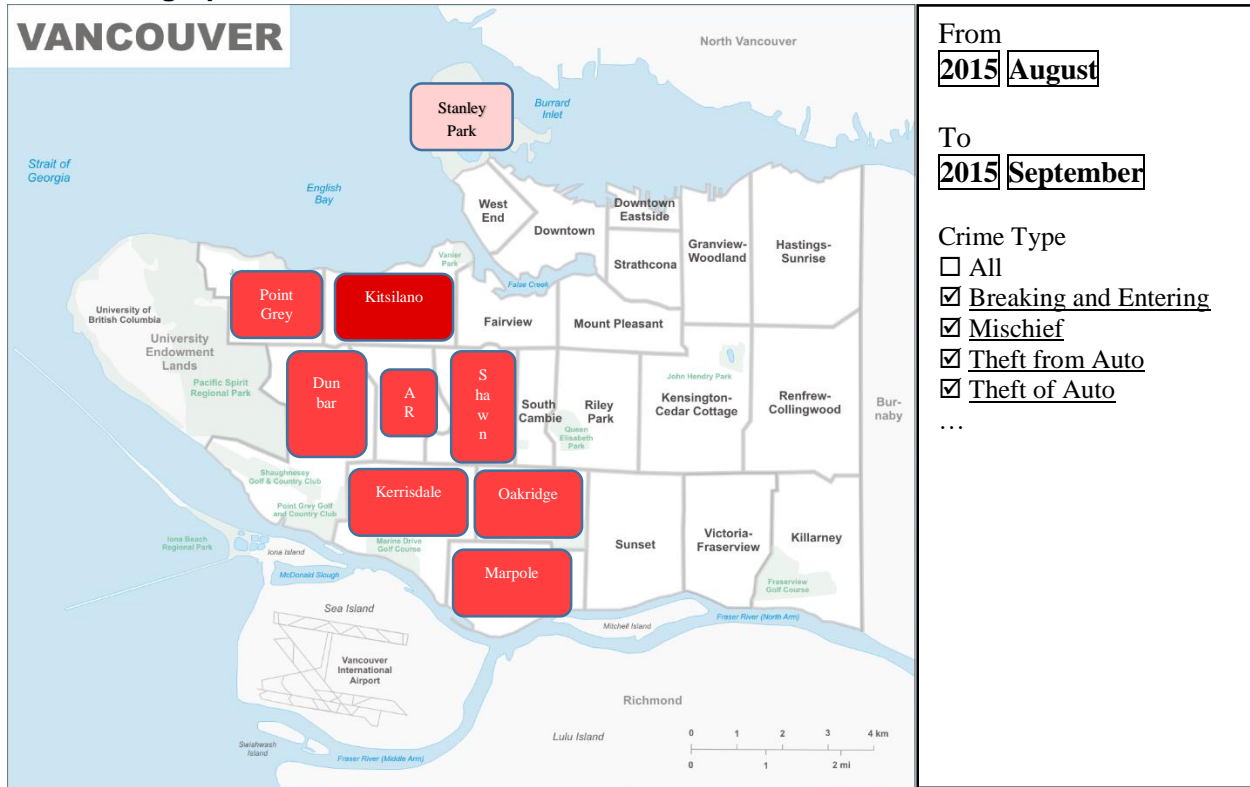
From the same view, he clicks on the Kerrisdale neighbourhood to reveal a Neighbourhood subview (3.1.2). In that view, he sees that the crime rate actually drops in September. The bar chart displayed reveals that Breaking and Entering is a more prominent incident in this area. He wishes to investigate this further, so he clicks on the Breaking and Entering crime type in the Geographical View. The Crime type subview pops up (3.1.3) which provides him statistics regarding B&E. It is dropping in frequency overall, and Kerrisdale is on the less frequent end of the spectrum.

He switches over to the Comparison View (3.1.4) and compares Kerrisdale with Kitsilano, one of the areas with higher B&E incident rates. He specified the time period to be again 2015 August to 2015 September, and chooses only B&E. The displayed charts revealed that B&E rates are dropping in both neighbourhoods, and Kerrisdale has generally lower number of incidents comparing to Kitsilano.

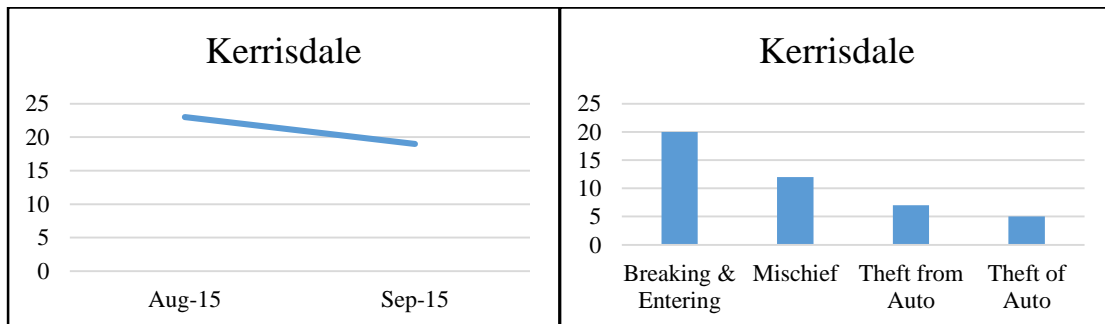
Joe then looks at the Property Incident view (3.1.5) and selects only Breaking and Entering to see actual incidents marked on the map. He zooms in to check local areas near where to his residence is and finds no incident in the period he specified. This gives him a slight relief that his neighbourhood is relatively safer comparing to some others he has explored.

### 3.1 ILLUSTRATIONS OF INTERFACE (MOCK-UP)

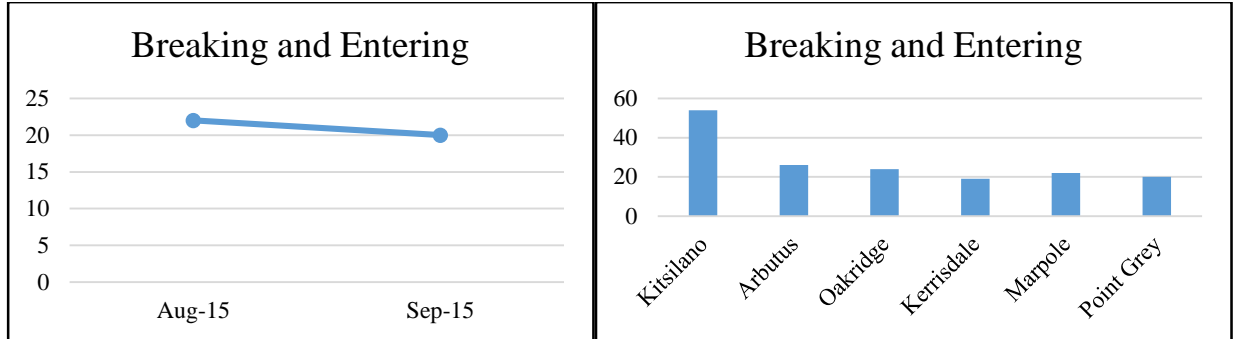
#### 3.1.1 Geographical View



#### 3.1.2 Neighbourhood Sub-View



### 3.1.3 Crime Type Sub-View

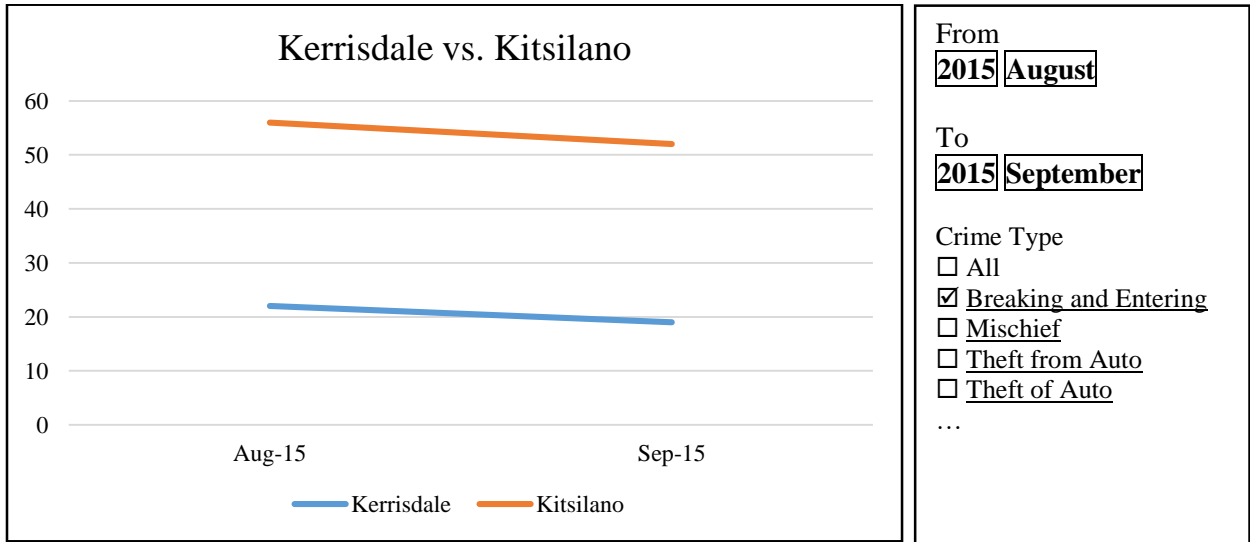


### 3.1.4 Comparison View

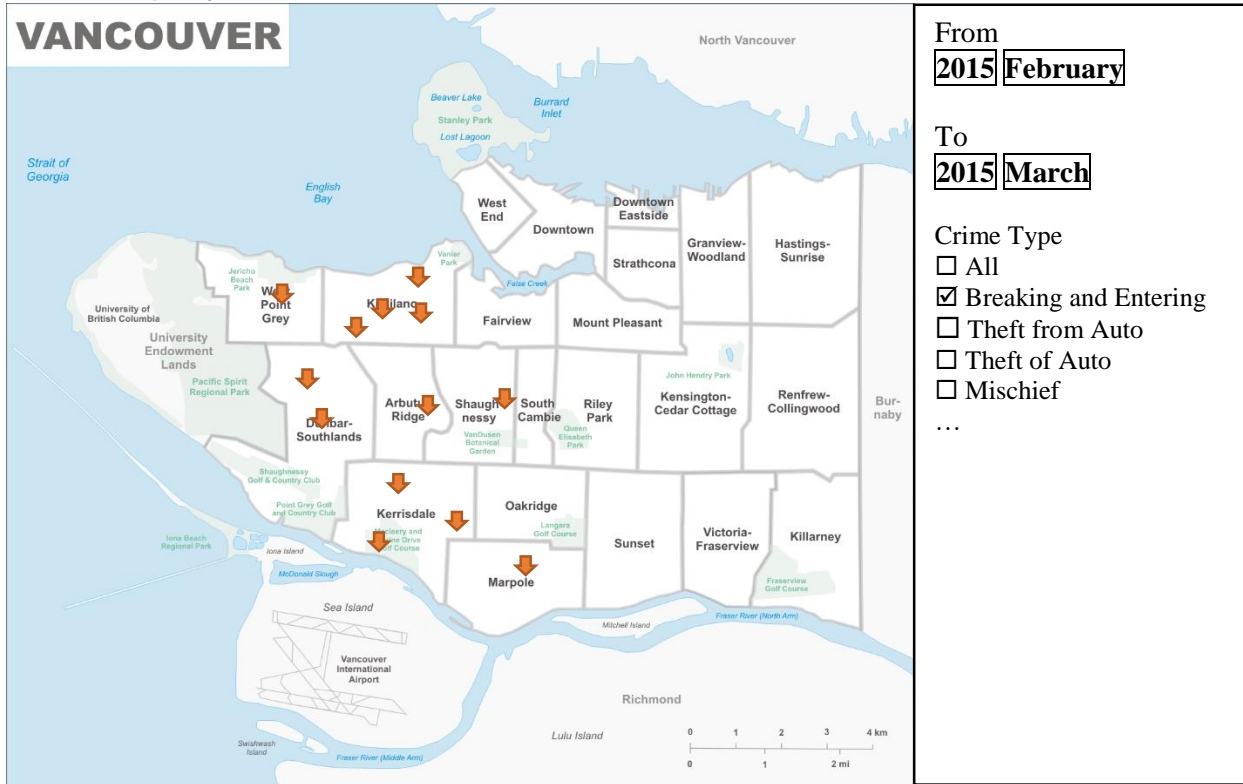
#### Neighbourhood Comparison

Neighbourhood 1:

Neighbourhood 2:



### 3.1.5 Property Incident View



## 4 MILESTONES AND SCHEDULE

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- November 9 – *Project proposal*. Collect datasets and perform preliminary cleanup.
- November 16 – Data cleanup. Geocode property incidents. Implement Geographical view and basic regional colour coding from data.
- November 23 – *Project status update*. Implement settings widgets to allow user selection and filtering of data. Look at neighbourhood and crime type sub-views.
- November 30 – Implement neighbourhoods and crime type sub-views. Implement the Comparison View.
- December 7 – Polish Geographical View and Comparison View. Implement layout of Property Incident View and map incidents.
- December 14 – Implement the Property Incident View.
- December 15 – *Project presentation*. Wrap up the project report.
- December 18 – *Project report submission*.

## 5 PREVIOUS WORK

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As briefly mentioned in the introduction, the city of Vancouver releases official reports summarizing the crime data. They include year-to-year comparisons of crime rates in the city of Vancouver, the changes are presented with line charts or bar charts. These generally reflect the crime totals instead of breakdowns.

The Crime Map released by VPD marks incidents on a geographical map, similar to the Property Incident Map. However, it does not allow different time periods to be specified, and is in the format of PDF, so browsing and zooming is not properly supported.

Crime rate visualizations in other cities are available for design reference, such as Crimespotting projects by Stamen design [5]. The title of this project is a reference, as well as some design choices of the visual representation of crime statistics.

## 6 REFERENCES

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1. Crime Data, Vancouver Open Data Catalogue, <http://data.vancouver.ca/datacatalogue/crime-data-details.htm>, last accessed: 2015-11-09.
2. Statistics Reports by Neighbourhood, Vancouver Police Department, <http://vancouver.ca/police/organization/planning-research-audit/neighbourhood-statistics.html>, last accessed: 2015-11-09.
3. Publications, Vancouver Police Department, <http://vancouver.ca/police/about/publications/index.html>, last accessed: 2015-11-09.
4. Crime Maps, Vancouver Police Department, <http://vancouver.ca/police/CrimeMaps/index.htm>, last accessed: 2015-11-09.
5. Crimespotting, Stamen Design, <http://stamen.com/projects/crimespotting>, last accessed, 2015-11-09.