[n] J. E. Eck, S. Chainey, J. G. Cameron, M. Leitner and R. E. Wilson, "Mapping Crime: Understanding Hot Spots," National Institute of Justice, Washington, D.C., 2005.

Eck: There exists different classifications of hot spots, which are subject to their respective causes, and merit their own responses from civil authorities. Eck applies more than one criminology theory to explain the causes of hot spots and suggests that the classification type of the hot spot will affect the visual and geometric representation when mapped. Eck also indicates that what is visualized must be "consistent with the type of hot spot and possible police action." If visualization becomes too large, there is risk of underrepresentation for definite hot spots. If too surgical, actions become overly intensive in a particular area.

Chainey: Although many techniques exist that examine crime data and how it is visualized, methods that test crime clustering are most appropriate. Chainey suggests that the quartic kernel density estimation method is the most suitable process for "understanding spatial patterns of crime hot spots." Chainey also mentions that accurate representation is the result of iterative refinement which summates to the final product.

Themes: criminological theories (routine activity theory, offender search theory, disorganization theory), methods for visual depiction, kernel density estimation

[n] K. Martin and M. Ralphs, "Using kernel methods to visualise crime data," Statistical Journal of the IAOS, vol. 30, no. 3, pp. 177-183, 2014.

Using a data sample from the Greater London metropolitan area, Martin and Ralphs reinforce the use of kernel density estimation and incremental data smoothing to best visualize crime data. It is also suggested that this method allows analysts "to compare the crime both over time and within an area; this provides advantages when looking for patterns which may be less apparent in point data." Furthermore, Martin and Ralphs mention that products of kernel density estimation and data smoothing can be used feasibly as overlays in conjunction with geographical representations.

Themes: methods for visual depiction, kernel density estimation

[n] J. Fitterer, T. A. Nelson and F. Nathoo, "Predictive crime mapping," Police Practice and Research, vol. 16, no. 2, pp. 121-135, 2015.

Fitterer et al. propagate predictive crime mapping systems in conjunction with the intelligence-led policing model. Their research consists of using data gathered on breaking and entering offenses by the Vancouver Police Department. Fitterer et al. attest that their model was successfully able to forecast breaking and entering offenses for commercial and residential targets, especially with the incorporation of ranging

factors such as short time periods and lesser distances from previously perpetrated breaking and entering offenses. Dynamically updating spatial platforms can further feed intelligence-led policing models and assist in properly directing civil authorities and their resources.

Themes: time (short) and radius (small) based patterns, intelligence-led policing model

[n] L. W. Kennedy, J. M. Caplan and E. Piza, "Risk Clusters, Hotspots, and Spatial Intelligence: Risk Terrain Modeling as an Algorithm for Police Resource Allocation Strategies," Journal of Quantitative Criminology, vol. 27, no. 3, pp. 339-362, 2011.

Kennedy et al. offers risk terrain modeling as an enhancement to spatial crime analysis and to further augment policing intervention techniques to areas in which crime is most likely to occur. This method attempts to negate tactics that would target demographics and social groups, which can sometimes be highlighted by traditional crime clustering visualization methods, and instead focuses on “sound understanding of geographic attributes and qualities of space that connect crime outcomes.” Tangible environmental factors (variables) are required to determine risk; moreover, risk must be subject to running assessments that compensate for resulting reduction of hot spots, as well as the formation of new ones based on tangible environmental factors.

Themes: risk terrain modeling, risk assessment, problem-oriented policing model

[n] J. M. Caplan, L. W. Kennedy and J. D. Barnum, "Risk Terrain Modeling for Spatial Risk Assessment," Cityscape: A Journal of Policy Development and Research, vol. 17, no. 1, pp. 7-16, 2015.

Caplan et al. form risk terrain modeling as a method that opts for geographically-based references being centric to determining the occurrence of crime. Geographically-based references are determined through an amalgamation of location variables that assist in making a judgement on where crime will emerge. Caplan et al. focus on the use of a Rutgers University licensed software which is used to automate the process of developing risk terrain modeling layers. The technical aspects of this system are irrelevant to this study, but the stated framework an on how to use the process of risk terrain modeling and its results are both equally appropriate. Caplan et al. reinforces the conclusion drawn from Kennedy et al. using variables derived from burglary statistics in the City of Chicago. Caplan et al. also propose a parallel relative to Eck’s thoughts: “offenders know they take risks and that these risks increase in certain locations, and police are often deployed to certain geographies to combat crime and manage other real or perceived public safety and security threats.”

Themes: risk terrain modeling, RTMDx

[n] G. Drawve, "A Metric Comparison of Predictive Hot Spot Techniques and RTM," Justice Quarterly, vol. 33, no. 3, pp. 369-397, 2016.

Drawve examines multiple methods for determining hot spots and uses predictive accuracy index (PAI) and recapture rate index (RRI) to determine their effectiveness. PAI was used to assess the accuracy of tested methods in forecasting future offenses. RRI measured precision of a method over a period of time. Drawve noted that no method tested excelled in both variables. Coinciding with studies performed by Chainey, as well as Martin and Ralphs, Drawve echoes that kernel density estimation scored the highest in PAI, but the second lowest in RRI. Risk terrain modeling scored the highest in RRI and second in PAI. Drawve suggests that these methods should be further confirmed with testing against other types of crimes, especially since robbery was only variable used in this study.

Themes: predictive accuracy index, recapture rate index, kernel density estimation, risk terrain modeling

[n] J. M. Caplan, L. W. Kennedy and J. Miller, "Risk terrain modeling: Brokering criminological theory and GIS methods for crime forecasting," Justice Quarterly, vol. 28, no. 2, pp. 360-381, 2011.

Caplan et al. applied risk terrain modeling in order to predict shootings over two six-month time periods and compare the model's effectiveness against crime clustering methods. Risk terrain modeling is concluded to be more accurate in forecasting the occurrence of shootings. Due to the focus of risk terrain modeling on geographical factors that propagate crime-conducive conditions, Caplan et al. strongly state that "the risk of crime in places that share criminogenic attributes is higher than other places as these locations attract offenders and are conducive to allowing certain events occur." Furthermore, they further propose that "individuals at greater risk to committing crime will congregate to riskier locations."

Themes: risk terrain modeling

[n] L. Tompson and M. Townsley, "(Looking) Back to the Future: using space-time patterns to better predict the location of street crime," International Journal of Police Science & Management, vol. 12, no. 1, pp. 23-40, 2010.

Tompson and Townsley induce that the time constraints of police department shift work can be an eligible factor of depicting accurate hot spot development and forecasting. Tompson and Townsley corroborate with Kennedy et al. and Caplan et al. by stating that crime "crime concentrates relative to spatial characteristics, reflecting the existence and attractiveness of crime opportunities in locations where offenders and victims interact." Tompson and Townsley conclude that temporal data has an effect on hot spot mapping

since activity in crime-conducive locations are more predictable during the overnight shifts and tend to be more surgical—routine activity theory is posed as a plausible explanation. Commitment of police resources can either be adversely or favorably affected depending the injection of temporal data.

Themes: predictive accuracy index, introducing temporal data, criminological theories (routine activity theory)

[n] J. H. Ratcliffe, T. Taniguchi, E. R. Groff and J. D. Wood, "THE PHILADELPHIA FOOT PATROL EXPERIMENT: A RANDOMIZED CONTROLLED TRIAL OF POLICE PATROL EFFECTIVENESS IN VIOLENT CRIME HOTSPOTS∗," Criminology, vol. 49, no. 3, pp. 795-831, 2011.

The experiment conducted by Ratcliffe et al. tested the effects of tactics that may fit under the purviews of the problem-oriented policing model and community policing model, primarily strong presence of foot patrols in designated hot spots. Drawing correlation to Eck, overly surgical actions seem to have created overly intensive actions in many areas. What resulted from the experiment was crime displacement of over forty percent of estimated violent crimes, further leading to a large number of crimes that were not prevented and instead were actioned in other locations. Correlation can be drawn to the usefulness of risk terrain modeling to predict crime-conducive geographical conditions.

Themes: problem-oriented policing model, community policing model

[n] T. Hart and P. Zandbergen, "Kernel density estimation and hotspot mapping: Examining the influence of interpolation method, grid cell size, and bandwidth on crime forecasting," Policing: An International Journal of Police Strategies & Management, vol. 37, no. 2, pp. 305-323, 2014.

Hart and Zandbergen test the effects on the predictive accuracy index (PAI) that interpolation method (i.e. kernel function), grid cell size and bandwidth (i.e. search radius) have on kernel density estimation. Hart and Zandbergen determine that interpolation method has a substantial effect on PAI, grid cell size has negligible effect, and bandwidth poses some effect. What was determined in this study was that kernel density estimation yielded the best results in creating hot spot mapping in reference to crimes against persons and the least favorable results dealing with crimes against property. Hart's and Zandbergen's recommend use of kernel density estimation utilizes quartic or triangular distribution for interpolation, "the cell size of the grid overlay to approximately one-third the length of the average blockface of the study area," and that bandwidths that are set small.

Themes: kernel density estimation, predictive accuracy index, interpolation

[n] S. Chainey, L. Tompson and S. Uhlig, "The Utility of Hotspot Mapping for Predicting Spatial Patterns of Crime," Security Journal, vol. 21, no. 1-2, pp. 4-28, 2008.

Chainey et al. address multiple different methods for mapping hot spots while using four different crime data type sets which include “burglary, street crime, theft from vehicles and theft of vehicles.” As addressed by Drawve, Chainey et al. used predictive accuracy index (PAI) to test the effectiveness of each method—meaning “the hit rate against areas where crimes are predicted to occur with respect to the size of the study area.” Chainey et al. conclude that kernel density estimation is the most reliable technique per scores yielding by the PAI.

Themes: kernel density estimation, predictive accuracy index