

SHOULD WE POLICE DISORDER? A LOCAL LEVEL EXAMINATION OF THE SPATIAL
AND TEMPORAL ASPECTS OF THE BROKEN WINDOWS THEORY

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DEDICATION

I would like to dedicate this dissertation to my deceased grandmother Shihui Shen and my uncle Wei Hao, who always had high hopes for me and fully supported me. I miss them so much. I will remember them forever.

In addition, I also dedicate this study to my mother Ming Hao, my husband Weining Che, and my friend Dr. David Webb. They all brought love and lights to my life. Without their help and support during my hard time, this dissertation would have been impossible to complete. Thank you and I love you.

ABSTRACT

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In 1982, Wilson and Kelling introduced the Broken Windows theory (BWT) arguing that policing neighborhood disorder would reduce serious crime while enhancing the quality of life in neighborhoods. However, the questions and critiques of this theory continue today. On the one hand, empirical research testing on this theory has produced mixed or inconsistent results, while on the other, policing disorder activities created more tasks for the police. In order to place these critiques in their proper context, this study utilizes large-scale operational data—two years (2010-2011) of call for police service data from the Houston Police Department (HPD). A Geographical Weighted Regression (GWR) model is employed to examine the spatial and temporal relationships between itemized disorder issues, and reported violent and property crimes. The results of global models show that the residents' reported disorder issues in the neighborhood are significantly related to violent and property crimes with limited temporal effects. However, the GWR model indicates significant spatial effects on reported minor offenses and the crime links, and those effects vary for individual minor offenses. Since the relationships between minor offenses and neighborhood crime vary, three models should be applied to categorize social disorder policing: pro-active, supervision, and liaison.

KEY WORDS: Broken Windows, Disorder, Crime, Disorder Policing, Geographic Weighted Regression

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CHAPTER I

Introduction

When Sir Robert Peel created the first modern police force in London, order maintenance was the main focus of police response in this newly articulated social role (Lentz & Chairs, 2007). Since then, it seems that no other policing theory in the United States (U.S.) has emphasized and influenced the police role of order maintenance more than the Broken Windows theory (Herbert, 2001; Xu, Fiedler & Flaming, 2005). The Broken Windows theory was seen as “the Bible of Policing”—one of the major theoretical bases of community policing, problem-oriented policing as well as the zero-tolerance policing (Harcourt, 1998).

The mechanics of the Broken Windows theory can be simplified as follows (Lily, Cullen & Ball, 2010): Disorders→fear of crime→low informal control→invasion of predatory crimes→high crime rate. Wilson and Kelling (1982) explained this mechanism as:

At the community level, disorder and crime are usually inextricably linked, in a kind of developmental sequence. One unrepaired broken window is a signal that no one cares, and so breaking more windows costs nothing...We suggested that: “untended” behavior also leads to the breakdown of community controls...At this point, it is not inevitable that serious crime will flourish or violent attacks on strangers will occur...Such an area is vulnerable to criminal invasion. (p. 2)

The development of professional policing in the U.S. can be projected as a balance between the police roles of crime control and order maintenance (Kelling & Wycoff, 2002). The focus on crime fighting in the 1960s with its high crime rate was

accompanied by a breakdown between police and public. It was not until the 1980s had the Broken Windows theory reminded police practitioners of the value of going back to traditional police roles and paying attention to the links between order-maintenance and crime-prevention, so obvious to earlier generations (Wilson and Kelling, 1982, p.4). Since then, the impact of the Broken Windows theory on the police role in neighborhood crime prevention has never been fully appreciated (Braga et al., 2011; Gau & Patt, 2008; Haney, 2007; Howell, 2009).

On the other hand, when it was born as a criminological thesis, the mechanisms the Broken Windows theory have come under attack by both well-known scholars and critics. Among the criticisms, the lack of empirical evidence is one of the major criticisms of the Broken Windows theory (Weisburd et al. 2015; Welsh, Braga & Bruinsma, 2015). Using empirical proof, decades of effort by many criminologists suggested that in neighborhoods with many perceptive disorders, the residents would suffer from high levels of fear of crime and an increase in the perception of risk (Hale, 1996; LaGrange, Ferrara & Supancic, 1992; Perkins & Taylor, 1996), and that the police intervention on disorder would significantly reduce crime and victimization (Brotton & Kelling, 2006; Cerda, et al. 2009; Kelling, 2000). Conversely, no persuasive evidence can prove the direct relationship between disorder and crime. Moreover, the inextricable links have never been fully empirically explained and described (Gau et al., 2008).

Similarly, despite the exceptional success of the community policing movement sweeping the U.S., many residents and policing practitioners still comment on its theoretical origin—the Broken Windows theory from a very negative perspective (Collins, 2007; Herbert, 2001; Hinkle & Weisburd, 2008; Howell, 2009; Weisburd, et al.,

2015). For example, Walker (1984) believed using the Broken Windows theory as the benchmark, community policing, which addresses the proactive style of policing, is retrogressive, because “the good old days were not all that good” and new issues exist (p.78). Racial profiling, the problem of privacy, the heavy burdens on the line police officer, the high rates of public complaints about police actions, and so forth, are attributed to the negativity of the Broken Windows policing (Harcourt, 1998). Some opponents even claimed either the Broken Windows theory “has at the least flattened out and may be in decline” (Taylor, 2006, p.1625) or the Broken Windows policing does not work (Justin Peters, 2014).

The primary research purpose of this study starts with this awkward situation. Recently, the development of new empirical research methodologies and techniques provide opportunities to explore the answers to the challenging topics in both criminological and policing studies (Bernasco & Elffers, 2010). It is time to explore the effective measurement of disorder from new perspectives and to fill the empirical voids either supporting or rejecting the Broken Windows theory. At the same time, the development of policing practice in the U.S. also demands to revisit the Broken Windows theory in order to be able to direct the policing practices precisely and properly with insufficient police resources.

From the theoretical and empirical review highlighted in the present study, two significant research topics appear not to have been rigorously considered. Lacking is the analysis of the disorder and crime linkage at the micro level by considering time, space, specific demographics, and the difference of particular disorder effects at the

neighborhood level. Disorder issues at the neighborhood level should be differentially ascertained according to the micro level circumstances of specific neighborhoods.

To contribute to our knowledge base, this study conducted an empirical study based on three hypotheses:

1. Violent crime and each of itemized disorders addressed by the present study have varied associations that are also differently influenced by neighborhood social constraints.
2. Property crime and each of itemized disorders addressed by the present study has varied associations that are also differently influenced by neighborhood social constraints.
3. Locally, the crime-disorder associations are localized and influenced by the neighborhoods' geographic differentiation.

To examine these three hypotheses above, three new research perspectives were introduced into the present study. The first perspective is “measuring and assessing ‘Broken Windows’ using large-scale administrative records [big data]” as suggested by O’Brien and his colleagues (O’Brien, Sampson & Winship, 2015, p.102). In the most of previous studies, disorder and incivility are used interchangeably. Existing research does distinguish between social disorder and physical disorder. Using either survey (Harcourt & Ludwig, 2006; Perkins et al., 1990) or on-site observations, or both, (Perkins et al., 1996; Hinkle et al., 2008; Sampson & Raudenbush, 2004) two groups of disorder measurements are constructed. For social disorder, the traditional measurement was generated by the inquiry on residents’ perception of neighborhood disorder. For physical disorder, the popular measurement (except for surveys) was on-site observation. On-site

observation is costly but more reliable (O'Brien et al., 2015, p.104). Generally, measurements of disorder were either residents' perceptions of disturbances, etc or neighborhood characteristics from observations within specific and limited time ranges. Hence, previous measurements suffered from issues of small sample sizes, time limitations and a paucity of longitudinal indicators (Sampson et al., 2002; Taylor, 2001). These issues will be addressed and summarized in Chapter II.

Recently, employment of "big data"—administrative data, is a growing trend in empirical studies of criminology (Haining, 2003; Hovde Lyngstad & Skardhamar, 2011; O'Brien & Sampson, 2015; O'Brien et al., 2015; Williams, Burnap & Sloan, 2017). According to O'Brien et al. (2015), large administrative databases provide "a rich, low-cost resource for measuring the characteristics of neighborhoods" (p.103). Even though using "big data" still suffers from "clear methodological and substantive challenges" (p.103), O'Brien et al. (2015) have suggested this type of data are well suited to the techniques that are required by the econometric study of neighborhoods. Especially, the administrative data can "act as a guide to both what is missing or included in such data sets, as well as how a researcher might address such issues" (p.103).

Following the direction of "big data," the present study is aiming to use a large sample of police calls for service data to test the Broken Windows theory. Except for the practical advantages of administrative data that were introduced above, the present study uses this data based on two considerations. First, as one of the largest public organizations, police agency data would be a significant law enforcement contribution to social studies in general in the information technology era. It is worthy in its own right to explore the methodology of using big data from police. Second, the Broken Windows

theory is well accepted as a policing thesis. As Greenberg (2014) argued, using calls for service data would more accurately indicate the theoretical concept of the Broken Windows theory and how to reinforce the efficiency of policing on crime prevention.

The second perspective is identifying, categorizing and measuring disorder in a new dimension. This point of view comes from rethinking of an old question that has not yet been fully answered—“what are the disorders that should be addressed by the police?” For the Broken Windows theory studies, much has been written in the attempt to define incivility and disorder. In their early book, “Fixing Broken Windows,” Kelling and Cole (1996) defined disorder in BWT as:

In its broadest social sense, the disorder is incivility, boorish and threatening behavior that disturbs life, especially urban life. By disorder we refer specifically to aggressive panhandling, street prostitution, drunkenness and public drinking, menacing behavior, harassment, obstruction of streets and public spaces, vandalism and graffiti, public urination and defecation, unlicensed vending and peddling, unsolicited window washing of cars (“squeegeeing”), and other such acts (P.15).

Based on their definition (1996), the disorderly behaviors that are associated with the Broken Windows theory should have three key features: 1) “Less extreme is disorderly behavior that, while not as severe as the crimes noted above, nonetheless can threaten social order by creating fear and criminogenic conditions;” 2) “While many of these behaviors are designated as criminal, they are usually classified as misdemeanors or petty offenses under state laws and city ordinances, most often punishable only by fines

or community service;” and 3) “disorderly behaviors are more ambiguous and less straightforward” (p.15).

As noted previously, there have been numerous interpretations of neighborhood disorder within the criminological context. Kubrin (2008) noted that “definitions of disorder used by researchers and officials studying and practicing broken windows policing are not necessarily consistent with residents' perceptions in their own communities” (p.206). The present study measured the indicators of the disorder by using the measurement of the residents’ initiated disorder issues, which are typically enforced by the police. The residents’ initiated disorders can be defined as neighborhood disorder issues, which influences the quality of life in a neighborhood, hence where there exists a need for police activity. This kind of disorder is recorded and can be collected by the volume of calls for service to the police department. The definition of residents’ initiated disorder includes all three characteristics addressed by Kelling et al. (1998). These reported disorders are not as severe as the subsequent crimes, nevertheless, the residents feel frightened by them and perceive them to be the cause of crime.

The advantages of using residents’ initiated disorders to test Broken Windows theory are explicit. First, the application of large-scale residents’ initiated calls for service data allows us to measure the disorder issues in the neighborhoods as a diverse concept, other than a homogenous concept, which can provide the direct implications to the police practices. Due to the limitation of data collection, previous research on the Broken Windows theory had to measure the disorders within two dimensions—social disorder and physical disorder, as mentioned previously. However, in the real world of neighborhood and policing, the disorder has a variety of indicators, which are highly

related to the context of individual community. For the police department, their policing tactics can't be generated based on the general concepts of social disorder and physical disorder but must focus on each specific disorder, such as noisy, litter, prostitution, gambling, graffiti, etc. The residents' initiated disorders can't only provide the information about what kinds of disorder issues are mattered in each community, but also this large-scale dataset can technically bring the researchers opportunity to disaggregate the disorder issues into more categories. Based on measuring disorder as a diverse concept, we can further explore the effects of the disorder by the type and examine the local level association between each itemized disorder and crime. Therefore, the reduction policy can be implied, focusing on an itemized disorder that should be addressed by the police.

Second, compared to previous commonly used survey data, the residents initiated disorders are generally reflecting the actual problems in a neighborhood to be considered a real threat the neighborhood. Survey data cannot distinguish between residents' perception and their behaviors in reality (Yang, 2010; Hinkle & Yang, 2014). For example, in surveys, residents may indicate that littering is a big issue to them, however, in fact, the residents' responses are different based on the variance in the amount of litter. This difference undoubtedly would influence the test of the Broken Windows theory, since, in reality, even though some littering is attributed to contributing to the fear of crime, actual littering may be ignored by some residents in different neighborhoods, even though they rated it as serious when questioned about it in the survey. The residents' initiated disorders could fill the missing data gap since only when the residents feel annoyed, even fearful, they call for police help. Compared to the concept of social

disorder/incivilities or physical disorders/incivilities used by the previous empirical studies, resident-initiated disorders reflects not only the residents' perceptions of the disorder but also their fears in reality (otherwise they would not call for help). From this point of view, the variable of disorder measured by the residents' initiated calls to the police can be assumed to be a better measurement to test the Broken Windows theory.

Also, regarding disorder measurement from on-site observation, quantification generated by residents' initiated disorder also has some advantages. On-site observation can only identify disorders that happened at the time and specific place where observations occur, without clarifying whether or not those physical issues would cause the same psychological pressure on the various residents in different neighborhoods at different periods. Residents' initiated disorder problems provide a record of the occurrence of disorders over an extended period (such as every minute, every hour, every day, every month, every year) and differentiate among other neighborhoods during the same period. In a word, using call-for-service data to measure disorder can "recognize and account for the subjective meanings imbued on concepts by criminologists, residents of communities, and the police officers that patrol disorder and disorderly conduct in those very communities" (Kubrin, 2008, p.207). Here the residents play the role as a rosters but what they recorded on the police information system are the data set advantaged by larger sample size, real-time and location, less time limitation to a longitudinal indicators, and less perceived inability of local actors compared with the those trained rosters working for the on-site observation in previous study.

The third perspective is to test the crime and disorder linkage using micro level spatial statistics. The relationship between disorder and crime can be explored from

spatial and temporal perspectives (Wilson & Kelling, 1982). However, research has shown that the Ordinary Least Squares (OLS) regression model or the Hierarchical Linear Model (HLM) fail to fully consider the variances between neighborhoods or to identify the different impact of the individual disorder by neighborhood (Bernasco et al., 2010). These shortfalls limit the previous studies' policy implications. When applying spatial and temporal analysis to model disorder trajectories of geographical entities at the neighborhood level, the gap between research and practice on the Broken Windows theory can be much more accurately identified.

“Geographic Criminology has always been at the cutting edge of major methodological and empirical progress” (Bernasco et al., 2010, p.700). The use of administrative data provides us the opportunity to use a method that can examine the Broken Windows theory mechanisms in a significant number of diverse neighborhoods spread over different periods of time. In the present study, Geographical Weighted Regression (GWR) model was applied to deal with the non-stationary issue by adding the variance of time and neighborhood characteristics into regression. The GWR model has been commonly used in spatial modeling recently, although applying the GWR model to empirical studies of disorder issues hasn't been a prevalent method in predictive policing (Clear et al., 2011). From this point of view, the application of spatial analysis promises a significant contribution to policing practice. Based on the spatial analysis of the disorder and crime nexus and their interactions at the local level, police administrators can more precisely target specific disorders in specific neighborhoods and respond to the practical question proposed by Wilson and Kelling, “how to allocate the meager police force resources” (Wilson and Kelling, 1982, p.5). Therefore, the target of this study is to

prove that disorder in neighborhoods should be precisely categorized, providing a foundation for balanced tactics in both a reactive and proactive mode.

Based on those three perspectives, using call-for-service data collected from HPD, the present study examines the temporal and spatial aspects of crime and disorder associations. The relationships are first examined by the statistical analysis of binary correlations and OLS regression models. After that, the present study will further explore the local and individual level spatial relationships by using the GWR model, including neighborhood demographic effects. Finally, based on the spatial and temporal regression results, three practical theses are discussed and proposed: 1) The significance of spatial analysis to the neighborhood and contextual criminological research; 2) The importance of the police role in order maintenance; and 3) The feasibility and importance of conducting precise and predictive policing based on disorder.

The research topics in the current study that were summarized above are further developed in subsequent chapters:

Chapter I—the first chapter addresses the purpose of the study, its potential significance, and implications of the study, as well as the general structure of this dissertation.

Chapter II—the second chapter is a historical, theoretical and methodological review of the Broken Windows theory and related studies from the 1960s to the present time. The first part reviews studies before the Broken Windows theory that provided the intellectual origins and support of the Broken Windows theory. The second part is the review of the main theses of the Broken Windows theory and their later theoretical development, mostly elaborated by George Kelling. From this section of the review, the

main theses and arguments made by Wilson and Kelling, and other experts of the Broken Windows theory are discussed. Specific attention was given to the definition of the disorder, the spatial and temporal concepts of disorder, and the significance of the linkage between crime and disorder.

Finally, the review examines the empirical studies from the 1990s to the present time. Three research gaps were identified, which were: 1) The lack of universal measurements of disorder; 2) The absence of empirical proofs of the Broken Windows theory, and 3) The lack of an informed contribution to the police community. Additionally, two trends were projected by the review: 1) That the measurement of disorder can be developed from a range of techniques, from surveys to observed data to “big data”—administrative data; and 2) The local level spatial analysis by referring to as “thinking locally” (Arnio & Baumer, 2012).

Chapter III—the third chapter presents the methodologies of the current study. It has four parts: 1) The introduction of the research area—Houston, Texas; 2) The process of data collection; 3) The list and explanation of measurements used in the current study, and 4) The brief illustration of the statistical and spatial models used in the present study and their analytical logic.

Chapter IV—the fourth chapter provides the results of model regressions. After describing the statistical characteristics of the variables, the results of binary correlation between crimes and disorders, the OLS regression on the effects of the disorder to the crimes, as well as the spatial relationships that are indicated by the GWR are all fully interpreted in this chapter.

Chapter V—the fifth chapter includes discussion based on the statistical results given by the present study. The policy implications are also identified by exploring the significance of policing disorder in a precise and predictive way and how to reinforce proactive policing through the enhancement of the effectiveness of policing disorder. The methodological and statistical limitations of the present study are discussed.

CHAPTER II

Literature Review

Review of Theoretical Origins of Broken Windows Theory

Minor things are not always too minor to be ignored. Even James Q. Wilson and George L. Kelling may never have imagined that their Broken Windows thesis, metaphorically introduced from a triviality of everyday life—shabby neighborhood windows—could have challenged, if not overturned, America's policing model over the past 30 years. The origins of the Broken Windows theory can be traced back to the 1980s when the rapid development of the American economy and the expansion of urbanization accelerated the collapse of the traditional social system, and the high crime rate at the time created many challenges for the criminal justice system (Lynch, 2002). The *New York Times*, a daily newspaper, introduced the New York Police Department report, which claimed that 1980 was “the worst year of crime in New York City history, or at least over the previous 49 years that records had been kept.”¹ In this period of rapid transition and high crime, police organizations as the gatekeepers of the criminal justice system in the US became one of the leading public agencies to counter these social challenges based not only on their actual responsibilities but also on perceptions and expectations of the American public (Bradly and Webb, 1998).

Where should American policing go to fulfill those responsibilities and expectations? In “Broken Windows,” an article published in *the Atlantic Monthly* in 1982, a new theoretical paradigm for criminological and policing studies was introduced,

¹ New York Time, February 1981, retrieve from: <http://www.nytimes.com/1981/02/25/nyregion/1980-called-worst-year-of-crime-in-city-history.html>

which attracted the attention from both academia and practitioners in criminal justice. Although the primary intention of the two authors, Wilson and Kelling (1982), was to assess and demonstrate the performance of police foot patrols observed in Newark, the philosophical and criminological concepts embodied in this article—controlling the crime rates through policing the neighborhood disorder, have been accepted as the basis for the policing reform throughout the United States since 1990s. Immediately, as the title of the article articulates, the criminological theory was generally recognized as the Broken Windows theory, and the policing philosophy addressed by became known as the Broken Windows Policing (Collins, 2007; Harcourt & Ludwig, 2006; Howell, 2010; Weisburd, Hinkle, Braga, & Wooditch, 2015).

The research merits that Wilson and Kelling (1982) achieved in this article were based on their continuously studies in American society and police practice. James Q. Wilson, who received his Ph.D. from the Department of Political Science at the University of Chicago in 1959 and died in 2012, is “the most influential political scientist in America since the White House was home to President Woodrow Wilson.”² James Q. Wilson devoted his life to political studies of the understanding of urban politics, policing and politics, policing and crime, and political organizations (Vollmer & Wilson, 1969; Wilson & Banfield, 1963; Wilson & Boland, 1978; Wilson & Kelling, 1982; Wilson, 1986; Wilson and Herrnstein, 1998).

As a scholar of politics, policing and criminology, Wilson had a wide range of knowledge that provided him with a broad view of crime and society. Before the Broken Windows was published, his early work hinted at what would become the Broken

² President George W. Bush stated when awarding J.Q. Wilson the Presidential Medal of Freedom in 2003. <http://contemporarythinkers.org/jq-wilson/>

Windows Theory. In the book, *City Politics*, Wilson et al. (1963) had already focused on the city ecosystem and its impact on citizens' behaviors and police practice. Later, Wilson (1968) was interested in exploring the significance of police patrol and policing disorders, which were evident in his book *Varieties in Policing*. In particular, Wilson (1968) stated in this book, the environmental differentiation is one of the significant perspectives that have to be considered by community-related studies and practice. For example, when discussing how to examine the effectiveness of police patrol, he argued, "patrolmen in various cities differ in performing their functions, and finally to inquire whether—or under what circumstances—such differences as they exist are based on explicit community decisions" (p. 4).

Before the Broken Windows theory came into the public eyes, George L. Kelling had developed the primary concepts of proactive policing, which was deeply influenced by the Anglo-Saxon style of modern policing, and significantly different from the mainstream policing styles of the 1970s. Kelling came to academic and national attention in the early 1970s. In 1972, he began his law enforcement career at the Police Foundation, and in subsequent years, he conducted several large-scale experiments in policing—notably, the Kansas City Preventive Patrol Experiment and the Newark Foot Patrol Experiment (Kelling & Pate, 197; Kelling, Pate, Ferrara, Utne & Brown, 1981). The accomplishment of these two experiments validated him as one of the earliest scientific methodologists to test the effectiveness of police patrolling, and his team was recognized as the early pioneers of American policing renovation (Dixon, 1998). Although the results of his experiments were not exciting to police practitioners, those experiments provided Kelling a broader understanding of policing with two issues: (a)

why police patrolling is essential, (Kelling et al., 1974) and (b) why the police role of order maintenance is necessary (Kelling et al., 1981). Kelling (1978) observed that neighborhood security should be separated into two categories: (a) the crime rate and (b) the level of fear of crime. From Kelling's (1978) point of view, the police force should respond to not only crimes but also those issues that would deeply influence the public's fear of crime. Based on the findings from the two police experiments Kelling (1978) believed that simply focusing on the traditional preventive patrol was a mistake, a "floor effect", and the result was that other "important proactive (police) activities" related to the public's fear of crime and quality of life, had been abandoned by the traditional myth of police forces (Kelling, 1978, p. 175). Compared with the preventive patrol, which was "remarkably unproductive," self-initiated, proactive (intervention) activities carried out by police would result in decreased apprehensions (p. 176). Kelling (1978) asserted that "in the future, police must abandon strategies which prevent extensive contact with citizens. They must direct their attention to improving the quality of police-citizen interaction and to developing approaches to policing that reduce citizen fear" (p. 173). Kelling's early arguments on proactive style policing were no doubt "at odds" with President Johnson's 1967 Crime Control Commission report that described mainstream policing by crime control (Kelling and Bratton, 1998) and also shed the lights on the later study in the Broken Windows theory.

Germinated from Wilson and Kelling's research achievements on the effectiveness of police patrolling and critical research on traditional police roles in the United States, the Broken Windows theory was also enriched by other ideological origins. The prevalence of the Chicago School in the early 20th century served as the initial and broad

premise for the Broken Windows theory. Specifically, the social disorganization theory brings the Broken Windows theory research-enhanced rationalization. It was Shaw and McKay (1942) who started to develop environmental criminology into a micro-level analysis by focusing on each neighborhood (Lily et al., 2010). Based on their observations and empirical studies, Shaw and McKay (1942) suggested that the nature of neighborhoods rather than the character of the person within the neighborhood determines a person's involvement in the crime. Even though Shaw and McKay (1942) did not include neighborhood incivilities into their perspectives on crime's causes within the neighborhood, the environmental studies and notions of neighborhood-level research framework created by Shaw and McKay (1942), have been primary resources to the theoretical context of the Broken Windows Theory.

Unlike Chicago School scholars, others scholars explored why and how some areas are more likely to attract criminals, which was also seminal in the development of the Broken Windows theory (Taylor, Gottfredson, & Brower, 1981). The main subjects in the research of "crime areas" include: (a) neighborhood incivilities/disorders, (b) human ecology, (c) resident's fear of crime, and (d) informal control (Baumer, 1978;). In Schmid (1960)'s study on "urban crime area", using data collected from Seattle, he examined the ecological distribution of crime in American Urban city and suggested certain areas tended to attract (more) offenders. Schmid (1960) addressed several characteristics that can result in a place of crime including "low social cohesion, weak family life, low social-economic status, physical deterioration, high rate of population mobility, and personal demoralization as reflected by attempted and completed suicide, drunkenness, and narcotic violations" (p. 678). Additionally, Schmid (1960) explained in

his study that the spatial variance of crime occurrences existed due to the effects of “offenses known to police” and “arrests” (p.678). In hence, Schmid (1960) highly suggested the consideration of “the relative constancy and uniformity of crime patterns from one place to another and over a period of time” in place-based criminology. Later, the Broken Windows theory advanced this assumption by exploring that four elements in the neighborhood were significant in attracting more offenders in different neighborhoods: (a) more incivilities, (b) residents’ fear of crime, (c) the lack of informal controls and (d) police intervention. (Wilson and Kelling, 1982).

Meanwhile, the ecological and spatial perspectives on crime were also developed during this time globally, which evinces similarities to the Broken Windows Theory. Since 1945, one of the main research focuses of criminology was on “the spatial patterning of both offenses and offenders...” (Georges-Aleyie & Harries, 1980, p. 29) Based on his study of Luke Street in Liverpool, Gill (1977) described problematic housing estates as “delinquency areas.” According to Gill (1977), “sub-standard housing” and “other deficiencies of the built environment” were, in fact, the core elements of the generation of crimes. When explaining the causal elements of crime concentration on Luke Street, Gill (1997) stated that compared to the success of police intervention, environmental factors such as “local planning and housing department policies” were at the root of the concentration of disorderly and criminal behaviors in some “delinquency areas.” However, compared with the Broken Windows theory, Gill’s argument suffered from an extreme emphasis on the influence of space, location, and territory, and failed to explore the combined effects among other social, psychological and structural elements (Georges-Aleyie & Harries, 1980, p. 37).

Similar to Gill (1977) arguments, Baldwin et al. (1976) pointed out three main elements that led to the creation of “crime areas”—problem estates, including “high rates of population turnover (in the “bad area”); “the paucity of social and recreational facilities”; and “[un]employment and poor education” (Georges-Aleyie & Harries, 1980, p. 38). Focusing on the so-called “materialist” perspective, the studies stated above further indicated that the formal control as a method to maintain order when informal control was absent. They believed the inefficiency of environmental management or the “gatekeeper” (for example, the variations in the “dumping” policy operated by housing managers) would be significantly related to creating prevalent “crime areas” (Georges-Aleyie & Harries, 1980, p. 39). Georges-Abeyie and Harries (1980) suggested those “crime areas” can be resolved by the approaches either “to disperse problem families and achieve a more social mix” or “to upgrade the environment and improve social provision through the policy decision makers and management” (p. 41).

In addition, the early studies on victimization are also played an important role in the development of the Broken Windows theory. Hunter (1978)’ research is one of the early studies that shed light on how the community ecosystem in urban areas affects the residents’ victimization and coined the term “symbols (or sign) of incivilities” as one of the causal effects leading to the increase of neighborhood’s fear of crime (Taylor, 2001).³ Hunter (1978) argued that as an ecosystem, the community interacts with the people living in it, as one of the result, people’s behavior, including criminal behavior, is influenced by the community’s dynamic changes (p. 923). In the Broken Windows theory, Wilson and Kelling (1982) applied a similar concept to further explain the

³ Note: “In the first view, taken by local leaders, the incivilities are the disorder; in the second view, taken by researchers, the incivilities are signs of something deeper—a broader disorder.” (Taylor, 2001, p.7)

residents' isolation from the community and how this isolation increases the level of serious crimes. This theoretical linkage between the Broken Windows theory and Hunter' studies on residents' fear of crime once again underscores the theoretical foundation of the Broken Window Theory.

Overall, before the publication of the Broken Windows theory, criminologists had accepted ecological criminology as the premise for explaining the cause of criminal behaviors. The impact of incivilities on residents' fear of crime also gained in importance, as it was consistently examined and reported. The geographical perspective had begun to be used in the analysis of criminal behavior and how ecological factors impacted it. To that end, the Broken Windows theory has been established not only by the precedent studies of Wilson and Kelling (1982) but also based on absorbing the development in related research fields, which made it possess a strong theoretical origin.

Certainly, the historical context cannot in itself provide sufficient evidence to respond to all the academic naysayers related to the Broken Window Theory. Reviewing the article of Broken Windows (1982) and the following up studies committed by Kelling and his colleagues, indicate that in Wilson and Kelling's opinions, the disorder-crime linkage is a concept that should consider by referring to three dimensions: the diversity of disorder effects, the local neighborhood differentiation, and the regional variance. Nevertheless, these narrative seem to be more or less ignored by the latter empirical studies and law enforcement practice. The present study states that the exploration of the temporal and spatial concepts within the Broken Windows Theory can't only open a new open window for examining the disorder and crime linkage, but also provides the theoretical base for the present study.

Review of the Broken Windows Theory and its development

Wilson and Kelling's study (1982) advanced neighborhood related criminology basically in two dimensions. The first dimension was the observations on associations between disorder and crime in the individual neighborhood (Skogan, 1990; Taylor, 2001; Xu, Fiedler, and Flaming, 2005). The second dimension was to combine the neighborhood criminology factors and the policing strategy or tactics into the neighborhood crime prevention (Kelling and Bratton, 1998; Kelling et al., 1998). Reviewing these two theoretical advancements established by the Broken Windows theory provides more theoretical evidence that a local level perspective should be included in the examination of disorder and crime linkages.

The most important argument that Wilson and Kelling (1982) made in the Broken Windows theory, of course, concerns the linkage between disorder and crime in neighborhoods. Wilson and Kelling (1982) did not empirically explain how minor offenses are linked to serious crimes. Instead, they generalized this relationship by using the term "inextricably linked, in a kind of developmental sequence." The Merriam-Webster's Dictionary (2012) defines "inextricably" as "(a) forming a maze or tangle from which it is impossible to get free, or (b) incapable of being disentangled or untied" (p. 421). From this point of view, the disorder-crime linkage, in fact, can be theoretically assumed in two ways: (a) the relationship between crime and disorder exists but cannot be simplified; (b) contextual effects could exist to condition the relationship between disorder and crime. In their study of the police patrol in Newark, Wilson and Kelling (1982) observed that the "impossible to get free" and "incapable of being united" linkages between disorder and crime resulted from two conditions of a "bad

neighborhood”: locally, there exists the condition that can make disorders and crimes disentangled or untied present, which included but not limited to the neighborhood context, residents' fear of crime, informal control. The second condition was the time sequences during which disorder caused fear of crime, in turn, led to the lack of informal control and eventually to an increase in the crime rate.

The existence of two aforementioned conditions implies the potential spatial and temporal variance of disorder and crime associations across the neighborhood. Actually, before the Broken Windows theory, Kelling and his other colleagues had already addressed that the temporal and spatial variation of neighborhoods should be given enough attention by both neighborhood crime study and police practice. For example, through the Newark Foot Patrol Experiment, Kelling and his colleagues (1981) reported that residents' fear of crime in public spaces, had two sources. Some were “primarily frightened by crime,” especially the prospect of a sudden, violent attack by a stranger, but another source of fear was “the fear of being bothered by disorderly people” (Wilson & Kelling, 1982, p. 1). Apparently, these two sources of fear of causes do not necessarily create the same level of fear of crime in residents, because individual perceptions and responses to disorderly people (e.g., panhandlers, drunks, addicts, rowdy teenagers, prostitutes, loiterers, and the mentally disturbed”) vary. In their study, Wilson and Kelling (1982) illustrated that variables include age, gender, education, or neighborhood demographics all could influence residents' perceptions and behaviors and then influenced the level of disorder and crime associations in different neighborhoods (p. 1). For example, a neighborhood with a higher level of an elder person may be more likely to observe the disorder and crime association since compared with youths, the

elderly feel more fear of crime and are more likely to be isolated from their neighborhood. Wilson and Kelling (1982) also addressed the importance of “thinking locally” in understanding the disorder and crime association based on their observation in two research locations. They recognized that “because of the nature of community life in the Bronx--its anonymity, the frequency with which cars are abandoned and things are stolen or broken, the experience of ‘no one caring’—vandalism begins much more quickly than it does in staid Palo Alto” (p. 3).

The spatial and temporal aspects can also be traced from the second contribution produced by the Broken Windows theory--the police tactics on the disorder. Wilson and Kelling (1982) prospect that the future disorder policing (or the Broken Windows policing) would be an index of policing tactics focusing on controlling the neighborhood crimes through proactively cutting the inextricable linkage between minor offenses and serious crime in each American neighborhood. Based on their observation and experiments in Newark, Wilson and Kelling (1982) pointed out that the disorder policing can be completed by two approaches. First, of course, effectively fighting serious crimes relied on, policing the minor neighborhood offenses (Hinkle & Weisburd, 2008). The underlying logic was that when the minor offenses were subjects to police attention in each neighborhood, the residents’ fear of crime would be decreased and they will be more disposed to open their doors and more actively participate in community life. As a result, the informal controls within the neighborhood would be reinforced, which, in turn, would contribute to crime prevention and crime control (Kelling, & Wycoff, 2002; Kelling, & Tilley, 2005.). Secondly, however, Wilson and Kelling (1982) believed that the core of the police role in order maintenance was not simply focusing on the disorder

by police, but “to reinforce the informal control mechanisms of the community itself” (p. 4). Wilson and Kelling (1982) argued that reinforcing informal controls was not only the public’s most common request but also the proposition to the policing intervention. This type of reinforcement is also the social responsibility of police officers, which has been indispensable to the social legitimacy of police forces since their formal inauguration.

Therefore, Wilson and Kelling (1982) emphasized actually the second approach since they argued that the final target of policing disorder was to reinforce residents’ informal controls, through which social disorder—minor offenses—can be solved by the conscientious participation of residents and eventually prevent serious crime from occurring. Wilson and Kelling (1982) addressed the importance of policing disorder at a higher level than was the typical practice: (1) the meaning of residents’ informal control was a form of social crime prevention, and policing disorder should be a practical way to enhance it (Kelling & Core, 1996) and, (2) the significance of creating a close relationship between the police and residents as well as stressing the importance of informal community controls, by which they provide the theoretical basis for community policing (Kelling, 1997). These two advancements produced by the Broken Windows theory stress the relationship among disorder-crime linkage, disorder policing and neighborhood environments, implying that policing disorder should not be simple and independent, but be diversified in the tactic level by considering the social context of each neighborhood.

In order to complete the theory of this newborn policing strategy, Wilson and Kelling (1982) continued to respond to two issues that needed to demonstrate: the legal issue of policing legitimacy; the practice issue of how to operate the policing style.

Regarding the first issue, the legitimacy of policing disorder, in Wilson and Kelling (1982)' opinion, policing disorder was a social request, and it was a stimulation for informal control. Wilson and Kelling (1982) argued: “(police) charges exist not because society wants judges to punish vagrants or drunks but because it wants an officer to have the legal tool to remove undesirable persons from a neighborhood when informal efforts to preserve order in the streets have failed” (p. 6). The Broken Windows theory addressed that the residents had expectation levels of police work that included both solving crimes and increasing the feeling of security (Kelling & Core, 1996). These two expectations cannot, of course, be fulfilled through the sole process of solving crimes. Wilson and Kelling (1982) insisted that simply depending on crime fighting would not reduce the fear of crime but rather increase it, and the police would feel “helpless” (p. 6). Therefore, in order to minimize fear in public places and strengthen the informal social-control mechanisms of natural communities, Wilson and Kelling (1982) strongly suggested that “the police should respond to the disorders, like vandalism, graffiti, and other minor offenses according to the law” (p.7). They even believed that crime prevention and the reduction of residents' fear of crime supported the legitimacy of policing disorder, which were more important than due process or fair treatment (p. 7).

The explanation of legitimacy in poling disorder addressed the necessity of the police intervention on the disorder in neighborhoods. Wilson and Kelling (1982) realized at the same time that the police intervention on the disorder and crime should also have to be “conditioned” variedly in each neighborhood, since the disorder and crime association may vary across the urban city of America. Following up, when answering the practical question that “how should a wise police chief deploy his meager forces (in disorder

policing)", Wilson and Kelling (1982) explicitly highlighted that policing disorder must precisely dispatch the police force and implement the tactics by demonstrating the "difference" of neighborhoods (p.5). Clearly based on a local level observation, Wilson and Kelling (1982) recognized that the residents' expectation and satisfaction levels related to the police work were varied across different neighborhoods. In hence, exploring these "differences" would be an opportunity to overcome the challenge of policing efficiency (p. 7). Wilson and Kelling (1982) posited, the police department should firstly allocate personnel based on an evaluation of exactly how many disorders need to be dealt with in different neighborhoods, as they stated that "the key is to identify neighborhoods at the tipping point--where public order is deteriorating but not irreclaimable, where the streets are frequently used but by apprehensive people, where a window is likely to be broken at any time, and must quickly be fixed if all are not to be shattered" (p. 7-8).

Moreover, the police department should stress the police and citizens' bonds and cooperation in order to balance the use of the police force and citizens' self-policing in dealing with neighborhood disorder and preventing future crimes (Wilson & Kelling, 1982). Wilson and Kelling (1982) particularly emphasized that police officers did not need to respond to all disorder issues in neighborhoods because some good neighborhoods had fewer disorder problems and police responses were still a substitute for residents' informal control (p. 7). But, relying on citizens' informal controls should be balanced by the police presence. Although the citizen self-guard could work in many ways, "the police are plainly the key to order maintenance" due to police officers'

professional actions and the feeling of commitment and responsibility, etc. (Wilson & Kelling, 1982, p. 6).

From the explanations of what was the disorder policing, to the legitimacy of disorder policing and the allocation in police force in policing disorder, review of the Broken Windows theory disclosed the fact that, when they illustrated their perspectives about policing disorder, Wilson and Kelling (1982) had pinpointed the research and practice related to the Broken Windows theory must consider the specific conditions of each neighborhood, other than using one approach fits all. Academically, Collins (2007) empirically recalled to what Wilson and Kelling's arguments based on his empirical examination and addressed that: "Disorder leads to crime, but that results varied significantly with the type of crime, the type of disorder, and the method of measuring disorder" (p. 425).

Many empirical studies following up the Broken Windows theory, however, provided negative attitude to the Broken Windows theory when testing out the inconsistency results of disorder and crime linkage in different American neighborhoods (Geller, 2007; Gau & Pratt, 2008; Keuschnigg & Wolbring, 2015; Perkins, Wandersman, Rich, & Taylor, 1993; Sampson and Randenbush, 1999, 2004). By ignoring the local level analysis and neighborhood contextual effects addressed by Wilson and Kelling (1982), scholars believed that the Broken Window theory can be seen as scientific only if the disorder and crime association can be observed as consistent as they predicted in every color of each neighborhood. Even worse, the police department simplified the Broken Windows policing practice and implemented it as the "Zero-tolerance" policing, which led to some serious social and racial issues (Herbert, 2001; Harcourt, et al., 2006;

Hinkle & Wisburd, 2008; Cerda, 2009; Kelling, 2015). Those facts from both academic and practice made the Broken Windows theory became the target of public criticism soon after.

Facing the replications, questions, and scrutiny of the theory, Wilson and Kelling (1982) did not stop at their initial assertion. They continued to verify this theory in major US cities (Braga, Flynn, Kelling, & Cole, 2011), among which clarifying and addressing the time and space aspects of the Broken Windows theory were illuminate efforts. When the Broken Windows theory was proposed to the public as a criminological and policing thesis, the first challenge that it encountered was “what are disorders,” as well as “do we want police officers to develop a ‘what the hell’ attitude toward disorderly or dangerous behavior, even if it is not technically illegal?” (Kelling, 1987, p. 91). In 1987, Kelling published an article “*Acquiring a Taste for Order: The Community and Police*,” attempting to explain those basic terms related to the broken windows theory. In this article, Kelling (1987) firstly theoretically and conceptually analyzed the disorders. In Kelling (1987)’s opinion, the disorder was a condition of the neighborhood, which may depend on the number of persons or events involved; and the residents’ perception of the disorder may be varied due to the timing of behavior (p. 95). His argument implies that first, the disorder has diverse indicators across different neighborhoods; second, the location should be an important consideration of those tests on the Broken Windows theory. Based on his observation, Kelling (1987) addressed the importance of properly committing the police role of order maintenance by considering the social context of each neighborhood: “It is not a question of whether police have been involved in such activities (policing disorder) or whether they will continue to be, it is instead a question

of whether they are going to acknowledge and manage their operations fully and appropriately to maintain order (in different neighborhoods)” (p. 96)

In 1988, Kelling (1988) published “The Evolving Strategy of Policing”, which highlighted that simply treating strategy as equal to tactics, without considering variations in neighborhood issues and requirements, accounted for most of the failure of community policing implementation. Kelling (1988) introduced the concepts of efficiency and economy into the implementation of disorder policing to explain his assertion. In Kelling’s (1988) opinion, policing disorder could be summarized as a marketing process, which relies on the security requirements of the public because:

they gather information about citizens' wants, diagnose the nature of the problem, devise possible solutions, and then determine which segments of the community they can best serve and which can be best served by other agencies and institutions that provide services, including crime control. (p. 12)

From this concept of police as an industry, Kelling (1988) clarified the importance of the evaluation of neighborhood environment for improving the effectiveness and efficiency of policing disorder. Because the disorder issues and residents’ requirements of order maintenances were varied, Kelling (1988) suggested, similar to a marketing process, it was crucial to precisely evaluating different kinds of disorders and their relations to the varied solutions required by the residents in that particular neighborhood. Kelling (1988) believed the policing tactics in dealing with the neighborhood disorder should also be diversified to satisfy the expectations of their customers—the residents, including foot patrol, problem-solving, information gathering, victim counseling and services (p. 12). However, decades later, Kelling was disappointed

to report that for most police departments, there was still a lack of a particular focus on implementation and evaluation from this marketing perspective (Kelling, 2015).

Since the end of the 1980s, more questions were raised in academic due to the inconsistent results of the empirical tests on the Broken Windows theory. Under this circumstance, Kelling and Stewart (1989) responded to those questions by discussing the potential regional variation of disorder and crime linkage caused by the diverse nature of the neighborhood and the level of informal control. Kelling and Stewart (1989) demonstrated that the neighborhoods that addressed by the Broken Windows theory should be recognized from both temporal and spatial dimensions. Kelling and Stewart (1989) reported that the neighborhood in the Broken Windows theory could be defined as a place "in which people live or work near each other, recognize their recurring proximity, and signal this recognition to each other" (p. 1). The temporal dimension was implicated by the examples that the residents' mobility of neighborhoods varies over time.

Second, the residents' perceptions of the areas varied daily, weekly, monthly and yearly, For example, "Citizens can view a neighborhood as being theirs, in a sense, and a comfortable place in which to be. The same area at another time of day or week (midnight or Saturday) may be perceived as extraordinarily alien and threatening" (Kelling and Stewart, 1989, p. 2). The neighborhood has been popularly accepted as a spatial concept (Shaw and Mackey, 1942; Anselin, 1999; Hipp, 2007). Kelling and Stewart (1989) pointed to that as a geographic and social concept, the neighborhoods were different to each other, which was determined mostly by "the political culture of the city," "the form of city government," "the demographic composition of the given

neighborhood,” and “the extent to which neighbors feel threatened and have been able to mobilize” (p.3). Therefore, it could assume that the variation of neighborhoods should act as a set of significant variables in the linkage of disorder and crime.

Kelling and Stewart (1989) addressed in their article that the informal control indicators also varied among neighborhoods. Two key concepts were significantly related to informal control in neighborhoods (Kelling and Stewart, 1989). The first key concept is “neighborhood competence,” which can be expressed mainly by the accumulation of “commerce” in each neighborhood (Kelling and Stewart, 1989). According to Kelling and Stewart (1989), Commerce, especially small shops, appeared to have a substantial stake in the civil functioning of neighborhoods. Another instrumental variable is “Pluralism,” which can be explained by “the relationship of different groups (often ethnic or racial) between neighborhoods, and the relationship of the various groups within neighborhoods” (Kelling and Stewart, 1989, p. 465). Few empirical studies have touched on these two key concepts related to informal controls, even though Kelling and Stewart (1989) explicitly suggested that since the target of “Fixing Broken Windows” in the neighborhood was to enhance the informal controls, the neighborhood differences originated from the “neighborhood competence” and “Pluralism” should have been evaluated either when testing the linkage of disorder and crime in neighborhoods, or when assessing the effectiveness of implemented policing strategies.

Kelling and Stewart (1989) summarized that the informal control within neighborhoods could be generated or stressed by six forces: (a) “Individual citizens in association with police and criminal justice agencies”; (b) “Individual citizens acting alone”; (c) “Private groups”; (d) “Formal private organizations”; (e) “Commercial firms”;

(f) “Public criminal justice agencies”(p. 470). Kelling and Stewart (1989) argued that since that six kinds of forces were developed differently in the different neighborhood, the informal controls were also varied over time and space, for example:

A person withdrawing from the neighborhood may be detracted from the self-defense of the community rather than contributing to it; A neighborhood anticrime group may detract from community order by increasing the level of racial antagonism between groups; A community agency may increase the degree of citizen fear as a result of the increasing number of homeless persons who frequent the area; A large food chain that develops a neighborhood shopping center that includes a record and video store and a video-game parlor may attract many youths to the facility; Black and Baumgartner raise the interesting point that the relationship between the intensity of police presence in neighborhoods and the amount of citizen self-help in solving problems might be inverse: that is, the more police tend to solve problems, the less likely it is that people will resort to their own devices. Although informal controls are influenced by many elements in each neighborhood, it is clear that “the residents vary in their competence to defend themselves against predators.” (p. 465)

Accordingly, the fact that any changes stated above could influence the informal controls provided more credibility to the predictions that the diversity of disorder and the heterogeneity of social context in each neighborhood should be considered precisely by disorder policing.

Based on their exploration in the variance in neighborhoods, social context and informal control, Kelling and Stewart (1989) addressed that the consideration of the

diversity disorders, as well as social and regional difference, were the premise of neighborhood disorder policing and crime prevention. Kelling and Stewart (1989) pointed out the weakness of community policing at that time and the gravest mistake of community policing was the failure to take into account different demographic circumstances in the study of informal controls; hence, the community policing strategy lacked specific tactics that could be tailored to meet the needs of each community. As a result, the collaborative effects of community policing in a given neighborhood were limited. Therefore, it is crucial to “take the different circumstances into account” when dealing with the disorder issues in the community (Kelling & Stewart, 1989, p. 465).

In Kelling and Stewart’ eyes (1989), the police role in order maintenance should be as “problem identifiers,” “dispute resolvers,” and “managers of relations”. In hence, “police tactics must be tailored to specific neighborhoods because neighborhoods vary like their problems and their capacity for self-help (their ecology of self-defense)” (p. 467). Logically, the next question would be how should we tailor tactics to neighborhoods? Kelling and Stewart suggested (1989) that police, as the professionals, should first clarify how, when, and why they work; their strengths and their vulnerabilities; their members or users whose relationships comprise the institutions; and why they participate or do not. From this perspective, localized examination of the disorder issues and the linkage of disorder and crime is not only necessary but also essential to the target of preventing crime. The stated observations and arguments in Kelling and Stewart’ study (1989) provided a strong theoretical basis for localized studies on crime and disorder intersection in neighborhoods.

In the 1990s, a long-term increase in crime rates in the U.S. suddenly reversed and began to decline in the U.S. In 2000, Kelling published an article entitled “Why Did People Stop Committing Crimes”, in which he examined the efficiency of disorder policing in New York and other cities, and suggested that the Broken Windows theory and its implications for community policing were the sources of the decline in crime rates in the US. The limitation of this article was no doubt obvious, which arose many criticisms; for example, no evidence existed to refute the possibility that the crime rate decline was influenced by other social, economic and political factors which almost attracted most of the attention of academia (Harcourt et al., 2006, Geller, 2007). As a result, other important arguments that he made in this article were, unfortunately, overlooked.

First, Kelling (2000) interpreted the Broken Windows theory by addressing three key points: (a) the classification of disorder is crucial, (b) an explanation of the association between disorder and crime should include discussion of the mechanism from disorder to perception and to behaviors, (c) inherently, efforts to reduce disorder and crime should be implemented based on the consideration of each “precinct” (neighborhood)’s characteristics. As far as Kelling (2000) concerned, the disorder in neighborhoods included two types: disorderly behaviors and disorderly conditions. The classification implied that in the neighborhood, since both perception and behaviors of residents were all varied influenced by the social and environmental factors, the disorder issues should be a diverse concept with different indicators, the effects of which clearly should not be totally the same on crimes. On the other hand, since the effects of each disorder on crime had to experience the transformation from the change of perception to

the change of behavior, instead of a direct path from A to B, it could be assumed that the neighborhoods had to generate even more different outcomes for the association between disorder and crime. However, little research has been designed to exactly follow the theoretical framework and explored the variety of disorder and crime nexus based on the typology of disorders and local level analysis, but keeping trying to explore the consistent effects of disorder on crime within the neighborhood, or across neighborhoods (Yang, 2010). In the third section, when reviewing the previous empirical tests on the Broken Windows theory, this empirical void was further addressed.

The second important notion that provided by Kelling (2000) in this article is his explanation of three key factors for a successful disorder policing, which were all related to focusing on the local environment. Kelling (2000) argued the exploration of disorder and crime association and inherently a successful intervention on it should be based on: “precinct data,” “precinct commanders,” and “precinct problems” (p. 578). Kelling (2000) emphasized that to ensure that the disorder was correct and properly policed (in each neighborhood), empirical evidence collected from each neighborhood should be used to determine “what disorders should be handled by the police and what disorders can be addressed by other social forces, should be clarified” (p. 582). Kelling (2000) concluded that the success of crime control at the New York City subway not only suggested working on minor offenses to limit the occurrence of serious crimes, but also reflected the effectiveness of mid-level managers to reform police departments when providing them “a clear and explicit mandate, measurable objectives, resources to achieve these targets, and the need to be held strictly accountable for accomplishing them” (p. 576)

Review of the major theoretical development of the Broken Windows theory indicates that the association between crime and disorder is actually an intricate relationship caused by the individual neighborhood context. The varied level of effects between disorder and crime in different neighborhood was influenced by three factors: (1) time, (2) the diversity of disorder, and (3) the social context of each neighborhood (including the elements that possibly have the homogeneous effects with the disorder to shape the perceptions and behaviors of the residents and police-residents bond). Since the existence of variance in each neighborhood disorder and crime linkage highly influenced the efficiency of policing disorder and possibly the consistency of empirical tests on the Broken Windows theory, it is worthy to explore the patterns of the itemized disorder and crime linkage in different neighborhoods and determine the variance. Recently, with the rapid development of large-scale spatial data and GIS techniques, spatial analysis has been applied to environmental criminology studies. A number of empirical studies using the spatial data and the local level studies, continuously shed the lights on the Broken Windows theory by comparing it with the traditional global model analysis (Anselin, 1999; Cahill & Mulligan, 2007; Chi & Zhu, 2008; Han & Gorman, 2013; Linning, 2015; Mennis, 2006; Rybarczyk & Kruger, 2015; Zhang & Song, 2014). Below, the existing empirical studies on the Broken Windows theory and the recent development on neighborhood geo-criminology were examined, which reinforced the conclusion above and enlightened the methodologies of the present study.

Review of Empirical Studies on the Broken Windows Theory

The previous research on the Broken Windows theory, in particular, the disorder and crime association, seemed to lack consensus for many decades (Welsh, Brage, &

Bruinsma, 2015; Hinkle & Yang, 2014). The Broken Windows theory did not achieve equal attention from academia compared with their reputation among police practitioners since its developers had failed to provide strong empirical evidence (Gau and Pratt, 2010). Conversely, the enthusiasm for testing the inaccuracy of the Broken Windows theory from a variety of perspectives has never diminished. Based on the research purpose of the present study, I only give a brief summary of limitations of previous global studies on the Broken Windows theory, and then focus more on the technology and methodology of the spatial analysis in current neighborhood research, which provides the main inspiration and empirical context for the present study.

The review of previous empirical studies on the Broken Windows theory indicates that there are inadequacies in their measurements of the disorder (Perkins et al., 1993; Taylor, 2001; O'Brien, Sampson, & Bruinsma, 2015). Originally, Wilson and Kelling (1982) published their paper in a quasi-academic journal and only introduced a qualitative and conceptual study methodology to generate their original idea of "Broken Windows," without empirical evidence (Loader, 2011). Since Wilson and Kelling (1982) did not empirically classify the disorders in their study, the later scholars were interested in examining the definition and measurement of the disorder based on their understanding of this concept (Harcourt, et al., 2006; Perkins, Florin, Rich, Wandersman, & Chavis 1990; Perkins, et al.1992; Perkins, et al.1993; Skogen, 1999; Sampson & Raudenbush, 1999; 2004; Taylor, 2001; Taylor, 2001). Therefore, the definitions and measurements of disorder were inconsistent (Hinkle et al., 2015). The lack of consistency not only reduced the validity and reliability of those empirical studies on the Broken Windows theory but also caused more disputes regarding the thesis (Taylor & Gottfredson, 1986).

Among those disorder measurements, the inquiry of residents' perception to the neighborhoods' "incivilities," was used to be the most popular measurements of disorder to test the Broken Windows theory in the last two decades of the 20th century (Skogan, 1990; LaGrange, Ferraro, & Supaneic, 1992; Harcourt, 1996). In fact, this type of measurement can be traced to the 1960s when scholars began to focus on the "environment—fear" links (Biederman, 1960) and the "environment—victimization" links (Hunter, 1974; Skogan and Maxfield, 1981). Those survey questions were generated based on the common disorder scenarios created by scholars based mostly on their own life experience. For example, Levis and Maxfield (1980) asked respondents whether they thought "groups of teenagers hanging out on the streets, abandoned or burned-out buildings or storefronts, people using illegal drugs, and vandalism (manifested, for example, in graffiti or broken windows) as a big problem, some problem, or almost no problem" (p. 180).

Scholars who attempted to empirically examine this theory chose to adopt the measurements of incivilities from the traditional studies (environment criminology or studies of the fear of crime) (Taylor, 2001). As far as they were concerned, the "small things" addressed by the Broken Windows theory pointed to the incivilities (Levis & Maxfield, 1980; Levis & Salem, 1985; Skogan & Maxfield, 1985; Taylor, 2001). Taylor (1986) named the studies of Hunter (1978) and Wilson and Kelling (1982) as "an incivilities theory concerned with crime, fear, and physical environment" (p. 403). Most scholars at that time were more likely to use the expression of "incivilities" rather than "disorders" to test the Broken Windows theory, their measurements of the incivilities in the neighborhood did not differ much from those studies on environment-fear links

(Perkins et al., 1992). For example, in their study, Box and his colleagues generated “a summary index of 5 questions based on perceived levels of litter, graffiti, teenagers hanging around street corners, noisy parties, and drunks and tramps in the neighborhood” to test the disorder and crime linkage (Box et al. as cited in LaGrange, Ferraro, & Supancic. 1992, p. 314).

Meanwhile, some scholars began to separate the incivilities measurements into social incivilities and physical incivilities in their studies (Perkins et al, 1990; Perkins et al, 1992; Perkins et al, 1993; Sampson et al, 1999). Perkins et al. (1992) opined: “Although conceptualized somewhat differently by different researchers, the disorder perspective links the concept of social and physical incivilities, or symbols of disorder, with crime and fear of crime” (p. 21). Using a survey instrument data collection method, Skogan’s (1990) study successfully explored the direct relationship disorder and crime, by discovering that the residents’ perception of physical incivilities (disorders) was significantly related to the victimization of robbery in the neighborhood. Following this methodological change in measuring disorder, LaGrange et al. (1992) created a social incivility index of four items, including (a) bad neighbors, (b) unsupervised youth, (c) too much noise, and (d) drunkenness in public; and a four-item index of physical incivilities, including: (a) trash and litter, (b) loose dogs, (c) vacant houses, and (d) abandoned cars (p.317). The categorizing of disorder into physical and social disorders was no doubt an important development in the empirical studies of the Broken Windows theory.

Moreover, scholars demonstrated that simply relying on the survey measurement was not a proper approach to fully explore the disorder effects in neighborhoods (Perkins, et al., 1990, 1992, 1993; Sampson & Raudenbush, 1999; Taylor, 2001; Cerda, et al;

O'Brien, et al., 2015). To increase the quality of empirical studies on the Broken Windows theory, some scholars including Douglas D. Perkins and Ralph B. Taylor, introduced the block environmental inventory into their study to supplement the resident's survey responses. Using on-site observation and the block environmental inventory, Perkins et al. (1992) tested that "physical incivilities were independently linked to perceptions of social and crime-related problems" (p. 21). Perkins and Taylor (1996) systematically proposed three ecological methods of measuring community disorder including "resident perceptions reported in surveys"; "on-site observations by trained raters"; and "content analysis of crime and disorder-related newspaper articles aggregated to the neighborhood level" (p. 63). Based on these three methods of data collection, Perkins and Taylor (1996) generated a list of measures of incivilities. Those incivility indicators were significantly associated with fear of crime; however, the associations with disorder and crime were still untested (p. 64).

In all, the measurements of disorder developed from the overall perceptions of residents to disorders in neighborhood (Harcourt, 1998; Skogan, 1990; LaGrange et al., 1992; Perkins, Andersmen, Rich & Taylor, 1993), to separate measurements of residents' perceptions of physical disorder and social disorder by combining the on-site observation to measure the physical disorder (Hinkle, 2008; Perkins & Taylor, 1996; Sampson and Raudenbush, 1999, 2004; Taylor, 2001). The associations between crime and disorder, still lack consistent verification (Harcourt, 2009; Howell, 2009). When summarizing the development of the Broken Windows theory research in that era, Taylor (1995) responded to this predicament by claiming that:

To test Wilson and Kelling's thesis, we need longitudinal studies of individuals within communities, using a significant number of communities. This would permit us to gauge the independent impacts of incivilities to change over time in respect of the fear of crime, the perception of risk, and offender movement patterns. (p.74)

In the 21st century, the measurements of the disorder are still one of the main challenges to the empirical study of the Broken Windows theory(Taylor, 2001).

Although Sampson and his colleagues (2004) strongly refuted the authenticity of the Broken Windows theory, they strove to reexamine and reevaluate the measurements of the disorder and suggested the weakness of traditional measurements on the disorder. They concluded that “what predicts individuals’ perceptions that disorder, defined in the manner of ‘broken windows,’ is a problem” (p. 320). Hence, using the same data collection methodology and measurement in their previous studies, Sampson et al. (2004) revealed that:

Observed disorder predicts perceived disorder, but racial and economic context matter more. As the concentration of minority groups and poverty increases, residents of all races perceive heightened disorder even after they account for an extensive array of personal characteristics and independently observed neighborhood conditions. Seeing disorder appears to be imbued with social meanings that go well beyond what essentialist theories imply, generating self-reinforcing processes that may help account for the perpetuation of urban racial inequality. (p.340)

At the same time, Innes (2004) explored the disorder implication by focusing on the variation of the residents' responses to the signal disorders in the neighborhoods. According to Innes (2004), “people tend to construct their understandings of crime and disorder, and thus their perceptions of criminogenic risk, around certain 'signal' incidents”, and “not all crimes and disorders have equal value regarding how common risk perceptions are assembled” (p. 352). Similarly, Keizer et al. (2008) asserted, “not everyone will tune into the same set of signals, nor will they necessarily interpret a signal in the same way”; in other words, residents' perceptions of disorder, which can vary, significantly influence the level of fear of crime (p. 325). The signals of disorder and crime were important caveats to the traditional measurements of disorder either by the resident's surveyor or the on-site observer. In the previous tests on the linkage of disorder and crime, this mediational issue has been largely ignored. In particular, Hinkle and his colleagues (2015) focused on the validity of using on-site observation to measure the physical disorder, and pointed out that the physical incivility measurement generated by the on-site observation only reflected the substantial situation of the neighborhoods, and the reliability and validity of the study suffered from limitations, such as the time of observing, the skill of the raters, and the small sample size.

In addition to the shortcomings in the measurement of disorder, the second issue for previous empirical research on the Broken Windows theory is lacking consistent evidence of the direct linkages between disorders and crimes. Instead, they suggested the associations were indirect and even conceivably spurious (Sampson & Raudenbush, 1999; Morenoff, Sampson & Raudenbush, 2004; Gault & Silver, 1999; Wilcox, Quisenberry, Cabrera, & Jones, 2004; Jean, 2008). Among them, the study conducted by

Sampson and Raudenbush (1999) is the most influential research that challenged the merit of the Broken Windows theory. Sampson and Raudenbush (1999)'s study were advanced the contemporary studies on the Broken Windows theory in several aspects. In their disorder measurements, Sampson and Raudenbush (1999) applied the method of systematic social observation and dichotomous coding. The first scale was based on 10 items reflecting physical disorders; the second set of items was the social disorder components, which included: "the presence or absence of adults loitering or congregating; drinking alcohol in public; peer group with gang indicators present; adults fighting or arguing in a hostile manner; selling drugs; and prostitutes on the street" (p. 618). To deal with the measurement error, such as "item inconsistency within a face-block," "face-block variation within larger geographic units," and "temporal variation," Sampson and Raudenbush (1999) applied a three-level multivariate regression model (p. 618). It seemed that Sampson and Raudenbush's study (1999) had included most of the contemporary methodological advancements.

However, Sampson and Raudenbush (1999) claimed that no linkage between police-recorded incidents and disorders was identified. Conversely, they argued that disorder was a minor crime and both of them were predicted by the level of collective efficacy in the neighborhood. They explained the effects of collective efficacy as a mediated effect on disorder and crime association in the neighborhoods. Unfortunately, their findings in their study still can't totally neglect the Broken Windows theory, but to some degree verified the Broken Windows theory by addressing the interactions between disorder, collective efficacy, and crime. The Broken Windows theory never excluded the informal control, an indicator of collective efficacy effect from its theoretical framework

(Wilson & Kelling, 1982; Kelling & Coles, 1997; Kelling, & Tilley, 2005). According to Wilson and Kelling (1982), a higher level of disorder will increase fear of crime, and as a result, the residents will close their doors and not interact with or observe their neighbors, and hence, the neighborhood will become a target area for crime since nobody cares. In this causal mechanism, “residents closing the door” and the signal of “nobody cares” are the indicators which imply a decrease of collective efficacy or informal control. More interestingly, later, two scholars at Pennsylvania State University even pointed out that the effects of collective efficacy to the disorder and crime linkage suggested by Sampson and Raudenbush's study in 1999, couldn't be statistically defined as a mediating effect at all (Gault and Silver, 1999). Sampson and Raudenbush's study (1999), as an example, reflects that a fair amount of previous empirical studies that claimed to neglect the Broken Windows theory actually are related to “the debate continues regarding measurement concerns, causal orders, and individual versus ecological influence level of fear” (Sausa & Kelling, 2006, p.80).

When scholars pursue the consistency effects of disorder and crime linkage, little research has addressed an implicit weakness behind their research design. Reviewing of the Broken Windows theory in current study revealed that the disorder and crime associations were varied by the neighborhood social context, which required the policing tactic to adapt to the local environment.(Wilson & Kelling, 1982;). However, all research designs of the previous empirical studies focusing on the Broken Windows theory were solely relying on the global OLS regression models analysis, which was based on assumption that the examined effects would keep consistent across every corner of the neighborhoods. Recently, this assumption has been identified as one of the major

weaknesses of regression models which potentially misled the interpretation of neighborhood crime patterns, since it fails to reflect the existence of regional variance, fully control the spatial auto-correlation across the neighborhoods (Leong & Sung, 2015; Nelson, Bromley, & Thomas, 2001; Martin, 2002; Morenoff, Sampson & Raudenbush, 2001; Malczewski & Poetz, 2005;). As a result, Kubrin (2008) concluded that “the most important step in this process (using the Broken Windows theory) is to reevaluate the central concept of the disorder itself...and sort out the various issues before relevant public policies such as order maintenance policing are implemented” (p.204)

How will those limitations of disorder measurements and model analysis stated above be resolved in the future Broken Windows theory empirical studies? Recently, the development of large-scale administrative data (spatial data), spatial analysis methodologies and ArcGIS software have started to introduce new avenues to the empirical study on the neighborhood crime analysis (Ali, Partridge & Olfert, 2007; Anselin, 1999; Bernasco & Elffers, 2010; Tita & Radil, 2010; Scott & Janikas, 2010). The application of spatial data and analysis can highly contribute to the exploration of spatial heterogeneity of the spatial patterns within the research area (Brunsdon, Fotheringham, & Charlton, 1996). In particular, Kyratso and Yiorgos (2004) argued that spatial models analysis “establish an alternative approach urban spatial phenomena interpretation and a new explanatory basis for the clarification of obscure relations” (p.25) Could the spatial analysis enlight the exploration of inextricable patterns of disorder and crime in neighborhoods addressed by the Broken Windows theory? When reviewing the current trend of using large-scale administrative data to examining the

spatial pattern of crime in environmental criminology studies, the stress of this research methodology is obvious and convincing.

First, the application of large-scale administrative data (the “big data”) expands the subjective measurements of the disorder. The Broken Windows theory addressed how the disorder issues in the neighborhood would influence the perception and behaviors of residents, hence, leading to the increase of crime in every neighborhood (Willson & Kelling, 1982). Therefore, the measurements of disorders in the neighborhood should consider “the subjective meanings imbued on concepts such as ‘disorder’ by criminologists, residents of communities, and the police officers that patrol disorder and disorderly conduct in those very communities” (Kubrin, 2008, p.207). Except for measuring the disorder issues by relying on the trained rater who recorded the physical disorders in the neighborhood, or the survey questions based on the scenarios of disorders, more importantly, the measurement of disorder should integrate the reaction of residents to the disorder in the real-time and real-world occurrences (Gau & Pratt, 2008).

Yang’s study in 2010 acts as an important research development that addresses the use of large-scale administrative data in the Broken Windows theory. The large-scale administrative data collected from 311 and 911 calls in Seattle allow Yang (2010) to measure and categorize the disorder issues into different groups by distinguishing the qualitative concept of each kind of disorder. She (2010) found that qualitatively distinct types of the disorder have different associations with violent crime. Based on her findings, Yang (2010) suggested that for future studies of the Broken Windows theory, the researchers should consider disorder a diverse concept, rather than a homogeneous one, in understanding the development of the violent crime at places. The findings and

suggestions from Yang's (2010) study, delivered at least two significant advancements for disorder research: first, the measurement of disorder needs to take into account that different types of the disorder have different degrees of association with crime. Second, the disorder-crime association will vary with location. Similarly, after reviewing the strengths and weaknesses of the various methodological strategies for testing the Broken Windows theory, Greenberg (2014) argued considering social and geographical differentiation of disorder and crime nexus by using the large-scale administrative data and minimizing the unit of analysis would introduce the next wave of studies on the Broken Windows theory and police disorder pattern. In 2015, Bones and Hope (2015) used the block group as the unit of analysis, measured the physical disorder by "the number of calls for each block group complaining of abandoned vehicles, graffiti, illegal dumping, and streetlight repair" (Bones & Hope, 2015, p. 319).

Measuring disorder by large-scale administrative data got further developed in 2015 when O'Brien and his colleagues (2015) reported their econometric measurement of physical disorders using large-scale administrative data. O'Brien and his colleagues believed that the use of large-scale administrative data has a broad future in econometric science. They highlighted that

as the volume of data on urban areas continues to grow and diversify, such data provide new and distinctive ways to measure neighborhood characteristics, often in ways previously unforeseen. These advances can be appropriated to shed light on some of the most salient themes in urban science, from the structure and function of the social organization to the role of cognition and culture in

generating local patterns, to the nascent examination of relationships between neighborhoods and the higher order social structure of the city (p.135).

In their study, O'Brien et al. (2015) explored an econometric methodology to directly measure the physical disorder by using large-scale citizen-initiated calls for service data and generated independent subcategories of physical disorder. Specifically, they concluded three statistical advantages of measuring itemized physical disorder by citizen initiated disorder calls including (a) "enable a variety of analytical approaches that could prove useful in the extension of research surrounding 'Broken Window' and other theories of neighborhood well-being"; (b) "these measures can also be tracked across time, allowing which, and explored using calls for service data to measure and categorize the physical disorder" and (c) the large scale administrative data "are continuously generated as part of administrative operations, which provide extra convenience since these up-to-date data requires only a download and some data manipulation" (p. 136). Moreover, by assessing the reliability and validity of qualitatively distinct types of itemized disorders, they found that "census tracts can be measured at two-month intervals and census block groups at six-month intervals" (p. 102). The advancements provided by O'Brien and his colleagues (2015) were not doubting profounding and full of central inspiration for the future study. They proposed a couple of research questions for the future such as "do the five subcategories relate differently to a neighborhood's other social and demographic characteristics? If so, do they each reflect a different set of processes occurring within the neighborhood?" (O'Brien et al., 2015, p. 135). Welsh et al. (2015) commented on the meaning of this important study, observing that it "allows the authors to generate various measures of physical disorder, social disorder, and crime

and analyze the relationships among these variables with crisis-time models” (Welsh et al., 2015).

Second, as an application of large-scale administrative data, the promise of spatial analysis allows spatial heterogeneity to be considered based on the spatial model analysis, which can reflect more geo-information in the neighborhood with better model fit than previous global analysis. As stated above, one of the weaknesses of previous global studies on the Broken Windows theory is the lack of consideration of neighborhood differentiation, especially the failure to solve the issue of the spatial unstationary (Stein, Conley, & Davis, 2016). Lacking the consideration of spatial heterogeneity acts as a major threat to the validity of research results generated by global level analysis (Fotheringham, Charlton, & Brunson, 1998; Fotheringham, Brunson & Charlton, 2003). An easy scenario to assume is that for those neighborhoods with different social constraints and different locations (e.g., one is in the downtown area and in a quiet suburb of the city), even though they suffered from the same types of disorder issues at the same level of concentration, the impacts of those disorders on crimes occurring in different neighborhoods could not possibly be the same. Ever since 2000, scholars have addressed the issue of spatial nonstationary that was statistically ignored by global OLS regression analysis in the studies in neighborhood crimes. For example, Morenoff, Sampson, and Raudenbush (2001) argued: “neighborhoods are independent and characterized by a functional relationship between what happens at one point in space and what happens elsewhere.” (p. 532) In order to explore the effects of neighborhood inequality and collective efficacy on the spatial dynamics of urban violence, Morenoff and his colleagues (2001) adopted a hierarchical generalized linear

model with spatial dependence and constructed “spatial lagged” versions of measures of violence. Based on the spatial analysis, Morenoff and his colleagues (2001) revealed that “a neighborhood’s spatial proximity to collective efficacy conditions its homicide rate, independent of its level of collective efficacy.” (p.357) Moreover, when taking all social characteristics such as concentration disadvantage, residential stability, and collective efficacy into account, spatial proximity is the variable that continues to have significant power to predict violent crime (Morenoff, Sampson & Raudenbush, 2001). Morenoff et al.’ (2001) study suggested that the spatial relationship is an important element in analyzing the crime mechanism that can’t be overlooked. When the ArcGIS and crime incident datasets have been commonly used for examining the trajectory of crime, many studies have suggested that crime clusters differently in urban cities by applying the different kinds of spatial analysis stated above. Among them, Groff et al. (2010) examined both temporal and spatial variations of crime patterns across streets (p. 8). Their longitudinal patterns indicated that “temporal crime trajectory pattern membership often varies from street segment to street segment” (p. 23).

Braga and Bond’s (2008) study was a significant breakthrough on testing Broken Windows theory because it considered spatial relationships. To evaluate the crime-control effectiveness of policing disorder, Braga and Bond (2008) used several innovative methodologies in their randomized, controlled experimental study. First, Braga and Bond (2008) geocoded the calendar year 2004 crime and disorder data based on citizens’ calls for service, which allowed them to map the crime and disorder hot spots in the Lowell community. To gather data for the study, Braga and Bond (2008) identified 34 discrete crime and disorder hot spot areas in the Lowell community. Data indicated that “these 34

hot spots only accounted for 2.7 % of the total area of Lowell, but that small area experienced 29.5% of violent crime calls, 25.1% of property crime calls, and 19.8% of disorder calls” (Braga & Bond, 2008, p. 583). These findings provided a new research question relevant to assessing the relationship of important Broken Windows theory variables: why did the locations of crime calls and disorder calls overlap? Does it imply some relationship between crime and disorder?

Using Group-based Trajectory Analysis and Joint Trajectory Analysis, Yang (2010) directly assessed the spatial-temporal relationship between disorder and violence. The findings of her study not only responded to some research questions that haven’t been fully answered in the field of the Broken Windows theory but also provided guidance for future research. Yang (2010) suggested that “disorder, just like crime, concentrates in a few ‘hot spots’” (p.139). She tested the association between physical disorder and violent crime in Seattle, and generated four important advancements for the Broken Windows theory research: (a) “disorder and violent crime are indeed correlated at the census block group level, as expected by different theories;” (2) “disorder (both social and physical disorder), just like crime, concentrates at a small number of places;” (3) “the results also demonstrate an imperfect relationship between disorder and violence;” and (4) “while the lack of disorder problems guarantees places to be violence free, having high levels of disorder predicts having violence problems only about 30% of time” (p.139). Yang’ (2010) findings contributed to future research by providing an empirical foundation for a couple of important research questions that need to be explored within the field of the Broken Windows theory. Yang (2010) suggested that disorder should be measured as a diverse concept in the future studies. Also, she emphasized that to explain

the discrepancy of disorder and crime associations across each neighborhood, it is important to consider the circumstances in which disorder and violence are correlated. Yang (2010) asserted that “protective elements” exist within each neighborhood that would influence the disorder-crime association, and therefore, “future research which focuses on the broken windows ideas also needs to explore potential conditional factors mediating the effects of disorder on crime.” (p. 158)

The aforementioned studies discussed above point to the same issue: a temporal and spatial heterogeneity should be considered and assessed when testing the Broken Windows theory. Recently, the development of spatial data and spatial analysis, especially the application of geographically weighted regression (GWR) model in assessing the spatial heterogeneity of the main theoretical frameworks in environmental criminology, provide a new perspective to the study of the Broken Windows theory (Brunsdon, Aitkin, Fotheringham, & Charlton, 1999; Malczewski, Poetz, & Iannuzzi, 2004; Malczewski, & Poetz, 2005; Chi, & Zhu, 2008; Cahill and Mulligan, 2009; Lee, Kang, & Kim, 2009; Troy, Grove, & O’Neil-Dunne, 2012; Arnio, & Baumer, 2012; Matthews, & Parker, 2013; Erdogan, Yalçin, & Dereli, 2013; Deller, & Deller, 2012; Megler, Banis, & Chang, 2014). Cahill and Mulligan (2009) pointed out that the use of global OLS regression misspecified the pattern of urban violent crime because it assumed the results of this model fit for all locations within the study area. Alternatively, their study suggested that the local model with both spatially varying and fixed parameters produced by the GWR was “the most accurate model of crime.” (p.174) Lee, Kang, and Kim (2009) made similar arguments in their study on spatial and environmental effects on crime victimization. Lee et al. (2009) argued that the local model of analysis based on

GWR was “superior to those from standard spatial econometric models (SAR, SEM, SAC) with respect to model fits and stability of the parameters estimated” (p.1) Based on the mixed GWR approach, their findings suggested spatial dependency and spatial heterogeneity was critical to explore the crime pattern in urban city (Lee et al., 2009).

GWR models and related local analysis have been applied broadly to environmental studies on exploring crime spatial patterns together with the spatial heterogeneity of neighborhood structures' effects on crime. Arnio and Baumer (2012) examined spatial heterogeneity in the effects of traditional demographic indicators and foreclosure on neighborhood robbery and burglary in Chicago using census tracts as the unit of analysis. Arnio and Baumer' (2012) study demonstrated that the GWR model is proficient at addressing the potentially significant local variability in model parameters, which statistically provided a better model than “the typical ‘global’ or ‘one size fits all’ approach that has been applied in most neighborhood studies of demographic context and neighborhood crime rates” (p. 449). Based on the GWR model analysis, they found that the predictive effects of socioeconomic disadvantages, immigrant concentration, foreclosure, and percent black on robbery or burglary are all significantly and spatially varied in Chicago census tracts, which strongly proved the merit of “ ‘thinking locally’ when developing theoretical explanations and empirical models of how demographic context shapes crime rates” (p. 450).

Also, Deller and Deller (2012) examined spatial heterogeneity for social capital in explaining rural larceny and burglary, using GWR and local analysis methodologies. The GWR model in their study indicates significant spatial heterogeneity in the research area. Deller and Deller (2010) argued based on their findings that “relying on global estimates

from classical statistical methods, such as least squares, may lead to erroneous policy recommendations at the local level” (p.225). According to Deller and Deller (2009), “some of the inconsistencies in the ecological empirical criminology literature might be explained by spatial heterogeneity” (p.225).

Following up on the analogical methodologies described above, Han and Gorman (2013) applied the GWR model to their study and discovered “the strong effects of neighborhood characteristics combined with on-sale alcohol availability on violence outcomes” (p. 1). The GWR model explained an additional 7% of the variance of the violent crime rate and significantly suggested the existence of spatially nonstationary among the associations between violent crime and on-sale alcohol outlets (Han and Gorman, 2013). Song and Zhang (2014) used GWR to access the spatial variations of relationships between contextual factors and residential burglary crime in Louisville, KY. Rybarczyk and Kruger (2015) also involved GWR analysis in their study exploring the linkage between public health, social capital, and environmental stress and crime in Flint, Michigan. Compared with the global OLS model, Rybarczyk and Kruger (2015) suggested that GWR was superior to it by explaining 10% more variance in the crime pattern and providing “additional insights into the directionality, magnitude, and spatial variation of localized predictors of crime” (p.17).

The above studies suggested the superiority of analysis at the local level (GWR) over analysis at the global level (e.g. OLS regression) in environmental criminological studies. Then, does the GWR model provide the explanatory power to shed light on the obscure relations between disorder and crime? Although few studies have applied spatial and temporal patterns to explore the disorders and crime trajectory, the answer should be

affirmative. In 2004, Doran and Lees (2004) examined the linkages among disorder, crime and the fear of crime in the Central Business District area at Wollongong, Australia, from the spatial-temporal perspective. Using survey data collected from 234 people who worked in the CBD area, and a designed weighting system based on the level of the various types of disorder, Doran and Lees (2004) suggested that graffiti was one of the prevalent types of disorder that temporally and spatially coincided with the fear of crime based on the distribution of the collective avoidance areas in Central Business District. Since the neighborhoods vary in regarding the residents' social characteristics, Andresen (2015) used police calls for service data to map the spatial relationship of different crimes and illustrated how police interventions on disorder would influence the offense concentration in the specific area. Although the study was limited to a small data set and unit of analysis (community), Andresen (2015) used the local Moran's I to test the existence of spatial heterogeneity and indicated how the nuances of changes would influence the spatial crime patterns in the city of Lower Lonsdale, Canada. According to Andresen's (2015) study, that the precise (nuances) information provided by the spatial analysis for neighborhood crime (disorder) patterns is necessary for a productive police intervention within each neighborhood (Andreson, 2015).

Stein et al. (2016) published their study on exploring the different impact of physical disorder and collective efficacy on crime in an eastern city in the U.S. Both Stein and his colleagues (2016) believed crime opportunities are varied across and within neighborhoods and significantly influenced by neighborhood structures, such as social disorganization, the concentration of disorder, and collective efficacy (Stein et al, 2006; Sampson and Rudenbush, 1999; Wilson and Kelling 1982; Shaw and MacKhey, 1942).

Using the GWR model, Stein et al. (2016) examined the variance of crime opportunity between each small unit of analysis of their study—the “pocket” within two neighborhood in this eastern city, which was suggested to be related to the physical disorder and collective efficacy. One advance of their study is that through the GWR model, they successfully explored where the disorder significantly impacts the crime rate across the small "pockets" within the neighborhood. Stain et al.' (2016) study suggested that both disorder and collective efficacy impact the occurrence of crime; however, those impacts are much more complex than what had been illustrated by previous studies because they displayed a significant spatial heterogeneity within the neighborhood. Similaly, Kyratso and Yiorgos (2004) predicted in their article, for the future neighborhood related studies in criminology, the GWR model would be a key to exploring the complex relations in neighborhood crime patterns and provide us a sufficient and proper explanation for the disorder and crime association and also the legitimacy of disorder policing. Since Stain and his colleagues' study (2016) only focused on two neighborhoods in a city in the U.S., it is necessary to follow up their study as a successful research exploration to test the disorder and crime association relying on the GWR model with a larger and broader sample size.

Welsh et al. (2015) have summarized the developments of empirical studies conducted on the Broken Windows theory over the past 30 years, which provided implications and directions for future studies of the theory. Welsh et al. (2015) asserted that in the past 30 years, the main advancement in the Broken Windows theory empirical studies has been concentrated on “the measurement of disorder, experimentation of community, and problem-solving strategies for policing disorder” (p. 447). Specifically,

Welsh et al. (2015) recognized three trends for future empirical studies to evaluate the Broken Windows theory, including: (a) survey measurements, at an increasing rate, have been replaced by the administrative and police data on disorder; (b) the simple item measurement, at an increasing rate, has been replaced by more complex multidimensional scales; and (c) the unit of analysis changed from macro-level to micro-level analyses in small segments and blocks (Welsh et al., 2015).

Whether or not the crime-disorder linkage—the primary claim of the Broken Windows theory —exists still requires further research. Reviewing the limitations of previous empirical studies of the Broken Windows theory (global level models) and the new trend in environmental criminology, there are some gaps in the spatial and temporal study of the Broken Windows theory. However, the rapid development of spatial technology has provided valuable information and inspiration to develop future studies to examine the theory. The reviewing of spatial and temporal aspects in classical Broken Windows theory, the new measurements with calls for service data, the new development in geo-criminology, and theoretical predictions from Welsh et al. (2015), all enhanced the present study to generate its main research purpose. The arguments I made are that disorder is a diverse concept in the neighborhoods, the nature and strength of the relationship between disorder and crime, hence, are varied with respect to the temporal and spatial dimension, and as a result, the association between disorder and crime should be examined by local level analysis that considers spatial and temporal differentiation. The development of new research methodologies and techniques in spatial data and analysis provides opportunities to realize the research goals. The use of large-scale administrative data expands the typology of the disorder based on the calls for service

data. Spatial analysis, for example, the GWR model, makes the neighborhood criminology studies enter into the time of local analysis, with which the social, spatial heterogeneities can be assessed.

CHAPTER III

Methodologies

Research area/location—Houston

The research location of the present study is in Houston, Texas. Several reasons make Houston a treasured research area for the current study.

Houston, located on the upper Gulf coastal plain, 50 miles from the Gulf of Mexico, is the fourth-most populous city in the United States. In 2014, Houston was populated by 2.239 million people, within an area of 667 square miles (1,730 km²) (Oguz et al., 2007). According to Podagrosi et al. (2011), Houston is a city “characterized as a dispersed metropolis” at 1642 km², which is equal to the entire area of the cities of New York, Washington, Boston, San Francisco, Seattle, Minneapolis and Miami together (Podagrosi and Bruce Pigozzi, 2011, p.1914).

Houston is also a multicultural city with demographics that made it invaluable for social science research. Resulting from localizing many academic institutions and strong industries, as well as being a major port city, Houston’s multicultural tradition has over 90 languages being spoken in the city. Since Houston implemented a comparatively flexible immigrants policy (An estimated 400,000 illegal aliens reside in the Houston area), it has also enjoyed being among the youngest populations in the nation. According to the 2010 U.S. Census, the population in Houston was mostly made up of 51% White; 25% Blacks or African Americans; 6% Asians; 0.7% Native Americans. Moreover, individuals from some other races made up 15.2% of the city's population. Houston is also identified as a city with diversified demographics. The median income for a household in the city was \$37,000, and for a family was \$40,000. Males had a median

income of \$32,000 versus \$27,000 for females. The per capita income was \$20,000.

Proximately, about 19% of the population and 16% of families were below the poverty line. Of the total population, 26% of those were under the age of 18 and 14% of those 65 and older were living below the poverty line⁴.

Houston has a functional and geographical neighborhoods management and regulation system providing a fundamental basis for the ecological and crime studies. Many residents of Houston are proud of their suburban landscape, where “residents generally live in separate, often gated, communities. Enclaves of people who share socio-economic status and ethnic backgrounds live in relative isolation from other demographic groups” (Klineberg, 1999, p.1; Podagrosi et al. 2011). The eight Super-Neighborhoods play a major role in Houston’s political and social life. For the neighborhood quality of life, except for relying on the HPD to maintain order, the Department of Neighborhoods also actively conducts programs to improve the neighborhood quality of life through other pilot programs, such as "Houston Hope," or "Neighborhood Mow-Down program." Because the neighborhoods and Super-neighborhoods have been highly involved in the social activities with independent responsibility, Houston is an ideal research location for social and economic studies that focus on neighborhood issues.

Finally, Houston has enjoyed stability in social, economic, and political development since the last century but the crime rate is high in the US, which, once again provides an ideal social context for cross-sectional and longitudinal criminological studies. Some scholars in the 1990’s refuted BWT effects on the crime rates’ decline by arguing that the macro level of elements like social, economic and political environment

⁴ The information introduced in current paragraph was depicted mostly from the website below:
https://en.wikipedia.org/wiki/Houston#cite_ref-180

should not be ignored when studying the crime trend (Kelling et al., 2004). For this reason, a perfect research location would be a place where has a comparatively stable social and economic environment during the investigation period. Since last century, Houston has started to be recognized worldwide for its energy, medical, aerospace industry. Because of these advantages, Houston has been enjoying a trend of overall economy growth since 1980's to the early 21st century with the annual rate of 2.47% and an average increase of almost 45,000 new jobs per year. (Hanna and Smith, 2006, p.95) In 2006, the Houston metropolitan area ranked third in the U.S. within the category of "Best Places for Business and Careers" by Forbes magazine. Jankowski stated that "more than 100 foreign-owned companies relocated, expanded or started new businesses in Houston" between 2008 and 2010. In 2012, the city was ranked number one for paycheck worth by Forbes, and in late May 2013, Houston was identified as America's top city for employment creation.

Data

In the present study, the FBI Part I crime incidental data was collected from Houston Police Department. The FBI uniform index of property and violent crimes were included at the incidental level. The violent crime incidents includes the incidents of murder, rape, robbery, and aggravated assault. The offenses of burglary, larceny-theft and motor vehicle theft were combined to reflect the incidents of property crime. From 2010 to 2011, a total of 261,917 incidents were recorded and incorporated in the present study. Among them, violent crime had 67,816 cases. Also 194,101 property crime cases were included into the current analysis.

The calls for service data were all collected from Houston Police Department, which were all calls initiated by the residents in the neighborhoods within the research location, meanwhile confirmed and recorded by the response of the line officers. Based on the previous empirical literature, seven disorder issues that residences commonly reported to the HPD were selected in the present study: calls regarding a disturbance, calls regarding narcotics, calls regarding a home invasion, calls regarding prostitution, calls regarding gambling, calls regarding a mischief, calls regarding suspicious person/event. These seven kinds of reported disorders issues comprise 95% and up of all calls for service related to neighborhood disorders. According to the review of empirical studies, it showed that those disorders issues all had been used by one or more previous studies as the indicators of either physical disorder or social disorders. For example, Sampson and Raudenbush(1999) defined social disorder as the behavior usually involving strangers and considered threatening, such as “verbal harassment on the street, open solicitation for prostitution, public intoxication, and rowdy groups of young males in public” (p.604). Overall, 516,550 disorder calls for police service were abstracted from HPD records in the present study.

The demographic data were collected from 2010 US Census tracts statistics. Census tracts were used as the unit of analysis in order to describe and explain variations in levels of crime and disorder with relation to the demographic and functional characteristics of the neighborhoods in which they occur. Those demographic data with geo-information of census were collected from 2010 U.S census data. In order to picture the social characteristics of Houston neighborhoods and stress the linkages of present study to social disorganization theory and studies on collective efficacy, eight kinds of

demographic data that have been commonly used by neighborhood social studies were collected on census tracts in research location, which include: the poverty rates, the unemployment rate, the percentage of female households, the percentage of Black, House occupied, the percentage of moving in the current place more than 5 years, the percentage of Foreign-born residents, as well as the percentage of Hispanic residents.

In the present study, following up the research design of the recent studies in neighborhood research, the census tracts were used as the unit of analysis to test the Broken Windows theory from a local and micro level spatial perspective (Anselin, 1999; Hipp, 2010; Hipp, Faris & Boessen, 2012). Using Arc-GIS software, through the geocoding and spatial join process, the related crime data, calls for service data, as well as the demographic data with spatial information were aggregated into 665 Houston census tracts. Then, according to the geographical characteristics of Houston and the research purpose, those census tracts with the population more than 600 and crime incidents are more than 10 were selected into the final overall data set. The total sample included 489 census tracts. Those census tracts spread over the most populous areas of Houston territory including most of Harris County, and parts of Fort Bend and Montgomery (Figure 1). So based on the geographical coverage and differentiation of the final dataset, the selective bias of present study is very limited. Using these formal tools and spatial analysis, the current study describes and explains variations in levels of crime and disorder with relation to the demographic and functional characteristics of the neighborhoods in which they occur.

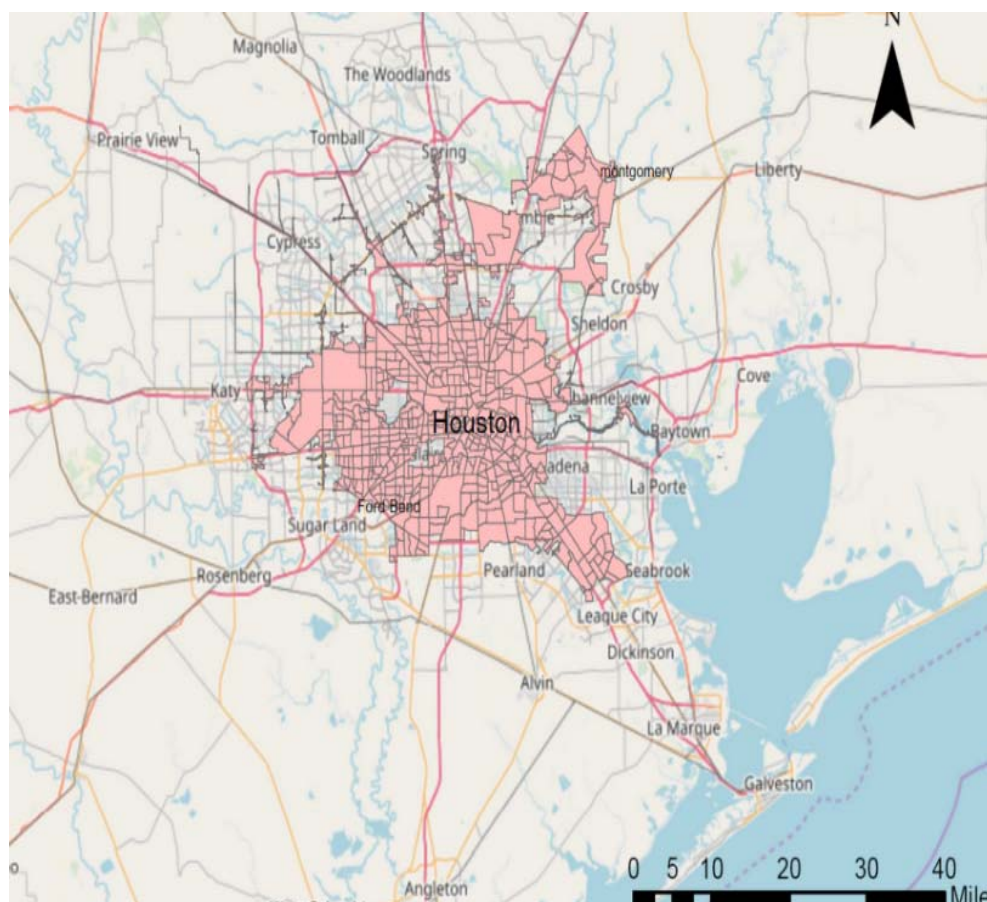


Figure 1. The research location in Houston (n=489, in pink).

Measurements

The dependent variables in the present study have two dimensions. The first dimension is the violent crime rate and property crime rate in 2010, which are measured by the crime counts per census tract and population from 2010. These two dependent variables were used to analyze the spatial heterogeneity and temporal linkage of disorder-crime associations. Second, to explore the temporal associations between crime and disorder, I created four time progressions from 1/2010 to 12/2011, based on 3, 6, 9, 12 months intervals and then calculated the violent crime rate and property crime rate during each time progression individually. For example, the violent crime rate in progression 3 months are measured by the crime rates per census tract and population from April 2010 to March 2011. As a result, another 8 dependent variables were created including violent crime rate in progression 3 months, violent crime rate in progression 6 months, violent crime rate in progression 9 months, violent crime rate in progression 12 months, likewise property crime rate in progression 3 months, property crime rate in progression 6 months, property crime rate in progression 9 months, and property crime rate in progression 12 months. This research strategy provided a total of 24 analyzed months for the temporal analysis on disorder and crime nexus.

The independent variables of the present study were seven itemized disorder rates in 2010. Similar to the measurements of dependent variable, each itemized disorder variable was measured by individual disorder rate per census tract and population. The independent variable included 1) disturbance rates in 2010; 2) nuisance rates in 2010; 3) home invasion rates in 2010; 4) prostitution rates in 2010; 5) mischief rates in 2010; 6)

suspicious events rates in 2010; and 7) gambling rates in 2010 . The definition of each itemized disorder is listed in Table 1.

Table 1

The Measurements of Disorder Predictors

Predictor	Measurement
Disturbance	Calls regarding a threat to public/family peace, health, safety and welfare
Nuisance	Calls regarding loud noise, littering/dumping
Home Invasion	Calls regarding home invasion/in progress/just occur/report
Prostitution	Calls regarding prostitution/narcotics
Mischief	Calls regarding mischief/progress/occur/report
Gambling	Calls regarding gambling
Suspicious Event/People	Calls regarding suspicious/Person/Event

The last group of variables are three social components including concentrated disadvantages, immigrant concentration and residential stability, which have been commonly used in neighborhood crime research. These three social structural components were abstracted from the demographic dataset in the present study through a principle components analysis with an oblique factor rotation in the tract level, which set the linkage of the present study to the social disorganization theories (Sampson, Raudenbush & Earls, 1997, Sampson and Raudenbush 1999). According to table 2, concentration disadvantages, which were commonly applied as the social explainer for neighborhood crime, was produced by high loading of the poverty rate ($b=.767$), unemployment rate ($b=.836$), female-headed household rate ($b=.891$), unmarried families rate ($b=.638$), and percentage of Black ($b=.787$). Immigrant concentration was dominated by the foreign-born rate ($b=.868$) and the percentage of Hispanic residents

($b=.930$). Last, residential stability, which has been suggested a significant association with neighborhood crime, was combined by the highly loading of by house ownership rate ($b=.912$) and the rate of household moving in more than 5 years ($b=.940$). This model of principle components analysis totally allowed the combined elements explained 39% variance of concentrated disadvantages, 27% variance of immigrant concentration, and 18% variance of residential stability, which suggests an acceptable model fit. The clear emergence of three dimensions of social structural components addressed the consistency of the present study with much of research in neighborhood crime analysis.

Table 2

Principle-Components Analysis on Social Structure Components: Concentrated Disadvantages, Immigrants Concentration, and Residential Stability (Data are from 2010 census)

Variable	Factor loading
<i>Concentration disadvantage</i>	
Poverty rate	.767
Unemployment rate	.836
Female households rate	.891
Unmarried rate	.638
Percentage of Black	.787
<i>Immigrant concentration</i>	
Foreign born rate	.868
Percentage of Hispanic	.930
<i>Residential stability</i>	
House ownership rate	.912
Move in>5years	.940

Note. The sample size was 489 participants.

Analysis

The present study was built up based on three main statistical models including the traditional binary correlation coefficient, Ordinary linear regression model (OLS), as well as the Geographically Weighted Regression (GWR) model, to test three hypotheses in present study.

For the first and second hypotheses, firstly, a set of bivariate analysis were conducted between all the variables applied in the present study: each itemized disorder rate in 2010, violent crime rate/ property crime rate in 2010 and during four-time progression, as well as three social components through SPSS. This multi-correlation model was conducted to primarily explore the temporal patterns of each itemized disorder and violent crime/property crime and meanwhile verify the multicollinearity issue. The bivariate results indicated whether or not all variables in the present study were significantly correlated with the levels one might expect from the Broken Windows theory.

After checking the distributions of each variable, I transformed the dependent variables by logging to adjust for the significant skew, and a small constant was added to transform zero values. Plots of leverage values were used to identify outlying extreme values, through which another 25 census tracts were deleted in present study to avoid the influence of outliers. After these step, the total sample of present study is reduced to 464 census tracts in Houston. Then, a set of hierarchical style of multivariate OLS regressions with two models were applied by SPSS to identify the itemized disorder rates' associations with logged violent crime rates and logged property crime rates separately. Model 1 tested the impacts of each itemized disorders as the predictors on either logged

violent crime rate 2010 and across 4 time progressions, or logged property crime rate 2010 and across 4 time progressions as the dependent variables. The linkages of crime and itemized disorders were indicated by the coefficients and the P value generated by the SPSS software. Model 2 further estimated those predictive effects after adding three social components. This step examined the disorder-crime association by considering the social differentiations, which directly responded to the second hypothesis of present study. To test the model fit, the variance inflation factors (VIF) were obtained for each of the explanatory variables to assess multicollinearity. Residual plots and partial regression plots were also checked for non-random pattern and model specification (Rybarczyk, Maguffee, and Kruger, 2015).

To verify the consistency of the global analysis estimates by OLS and further explore the spatial patterns of disorder and crime associations, a set of spatial analysis were conducted by using Arc-GIS software after completing the OLS regression by SPSS. After identifying the existence of spatial non-stationary effects among the estimates of global OLS models by classic spatial autocorrelation index, Moran's I (Anselin et al., 2000), a Geographic Weighted Regression (GWR) model is used to explore the spatial patterns of disorder and crime nexus across the research area of Houston.

Traditionally, the OLS regression model is well accepted to examine the interactions between the environment predictors and crime indicators in the neighborhood related crime studies. However, the problem of using OLS model is that it assumes those research elements in the neighborhoods remain unvaried. Since neighborhoods at the micro level are usually differential to each other (Wilson and Kelling, 1982), the

assumption of OLS model is empirically invalid, especially when adding the spatial data into the model (Erdogan et al., 2012). Recently, GWR has been a popular model, which uses the local regression techniques to solve the OLS limitation of non-stationary space (Ferreira et al., 2012). Several studies have suggested GWR can present more accurate results of the spatial data analysis than OLS, since it allows the measurement of relationships among variables that differ from location to location (Charlton et al., 2009; Páez et al. 2011; Tu et al., 2008; Wheeler et al., 2009) .

According to Bernasco and his colleague (2010), “Geographically Weighted Regression (GWR) analysis is a local level modeling technique for spatial exploratory analysis. It estimates (ordinary least squares, logistic or Poisson) regression equations in which the parameters are allowed to vary across space (and it tests whether they do). It permits the effect of predictors to be varied between different micro level spaces like blocks, census tracts, or even every data point within the study area. Moreover, GWR models can also be mixed models combining coefficients of both global and local levels of variables” (p.710).

The GWR (ordinary least squares) equation in the present study follows the standard GWR version of the OLS regression model given by Charlton and Fotheringham (2009, p.5):

$$Y_i(u) = \beta_{0i}(u) + \beta_{1i}(u) x_{1i} + \beta_{2i}(u) x_{2i} + \dots + \beta_{mi}(u) x_{mi}$$

Charlton and Fotheringham (2009) explained that “the notation $\beta_{0i}(u)$ indicates that the parameter describes a relationship between location u and is peculiar to that location. The weighting functions were calculated as well to estimate the coefficients of the equation at the point I , and they are spatially weighted to the effect that observations

near I weight more heavily in the estimation of β_i than distant observations” (p.6). Hence, the parameter estimation of GWR is highly depended on “distance” so that locations closest to the estimation point have more influence on the estimate (Erdogan et al., 2013).

In the GWR context, these spatial weights were calculated using the “Gaussian weighting function,” which is the most popular calculation method (Cahill et al., 2007, p.181). According to Charlton and Fotheringham (2009), Gaussian kernels are calculated by the below formula in the present study:

$$W_i(u) = e^{-0.5(d_i(u)/h)^2}$$

Where $w_i(u)$ is the geographical weight of the i th observation in the dataset about the location u , $d_i(u)$ is some measure of the distance between the i th observation and the location u , and h is a quantity known as the bandwidth (p.6). The value of bandwidth reflects the weighting scheme: a small bandwidth results in very rapid distance decay, while large value results in a smoother weighting scheme (Erdogan et al., 2013). Through this calculation, every point in the dataset will receive a weight between 0.0 and 1.0 based on the different distance it is to the query. Since each observation/points would be in numerous varied weight functions, the results are unique to that place (Fotheringham et al. 2002).

The selection of the bandwidth (kernel width) is crucial to model calibration. According to Cahill et al. (2007), if the bandwidth is too large, all weight functions would be the same as 1.0, then the spatial variation will be low, and the model at each point will tend toward the global model. If the bandwidth is too small, the weight functions would be all close to 0.0, then the number of data points used I estimation may become too low and result in instability in the parameter estimates. In the present study, following the

guideline of Charlton and Fotheringham (2009), the optimal bandwidth is determined through an iterative process to minimize the Akaike information criterion (AIC_C).

The GWR output of the present study was submitted by the estimated coefficients maps, the raster surfaces of coefficients, and t-statistics maps for each parameter at each data point (Rybarczyk, Maguffee, and Kruger, 2015). The resulting maps display spatial variations in the relationship between two variables. Moreover, the corrected Akaike Information Criterion was applied to test the model goodness of fit (Hurvich et al., 1998). According to Charlton and Fotheringham (2009), the AIC_C provides a measure of the information distance between the model that has actually been fitted and the unknown “true” model. The GWR model analyses were conducted by using the Arc-GIS10.5 software.

CHAPTER IV

Results

This chapter presents the main research results of the current study in three parts. The first part summarizes the descriptive statistics of the main variables, which includes explained variables, predictor variables, and three social components. The second part discusses the results of correlation, regression models (Global models), by which the first and second hypotheses of the present study are partially replied. According to the Broken Windows theory, there are temporal and statistical associations between neighborhood incivilities and future predatory crime (Wilson & Kelling, 1982). In this part, the bilateral results of correlations were discussed at first to primarily identify the existence of this theoretical association. Then, multivariate regression analyses further suggest the temporal and statistical effects of each itemized disorder on the violent/property crime rate and the effects of social constraints on these associations. At last, the visualized results of GWR model analysis are discussed, which addresses the spatial heterogeneity patterns of the crime and disorder associations influenced by the place and neighborhood social components. The application of GWR model analysis not only sufficiently verified the third hypothesis of the present study but also provided further suggestions to the first two hypotheses. Compared with the multivariate regression models (global models), GWR model yields better model fit and spatial accuracy by considering both the neighborhood geographical and social structure.

Overview of the Data

Descriptive statistics on dependent variables—crime incidents and independent variables—seven itemized disorders and social components are displayed in Table 2. A

common feature of the descriptive statistics in Table 2 is that neighborhoods vary significantly along the dimensions of crime, incivility, and social structures. Among 489 census tracts within research area in Houston, the total number of violent crime incidents on each census tracts in 2010 ranged from zero to 211. Property crime incidents in 2010 extend from the minimum value of 10 to the maximum value of 1,951 on each census tracts in the research area of Houston. During four time progressions, the distributions of the total counts of violent crime incidents and property crime incidents across 489 research tracts were also very unbalanced. From April 2010 to March 2011(the first-time progression), the total counts of violent crime incidents in each census tracts ranged from the minimum value of 0 to the maximum value of 216. The total counts of property crime incidents in each census tracts ranged from the minimum value of 11 to the maximum value of 1,680. From July 2010 to June 2011(the second-time progression), the total counts of violent crime incidents in each census tracts ranged from the minimum value of 0 to the maximum value of 210. The total counts of property crime incidents in each census tracts ranged from the minimum value of 13 to the maximum value of 1,629. From October 2010 to September 2011(the third-time progression), the total counts of violent crime incidents in each census tracts ranged from the minimum value of 0 to the maximum value of 227. The total counts of property crime incidents in each census tracts ranged from the minimum value of 14 to the maximum value of 1,536. Lastly, in the year of 2011(the fourth-time progression), the total counts of violent crime incidents in each census tracts ranged from the minimum value of 0 to the maximum value of 210. The total counts of property crime incidents in each census tracts ranged from the minimum value of 13 to the maximum value of 1,459.

Meanwhile, the distribution of seven itemized disorders in the present study shows the same trend of regional variance. In 2010, the total occurrences of disturbances in each research tract ranged from 2 to 1,248. The total occurrences of a nuisance in each research tract ranged from 1 to 967. The total occurrences of a home invasion in each research tract ranged from 0 to 18. The total occurrences of prostitution in each research tract ranged from 1 to 1,320. The total occurrences of gambling in each research tract ranged from 0 to 485. The total occurrences of mischief in each research tract ranged from 0 to 210. And the total occurrences of suspicious events in each research tract ranged from 2 to 399. The occurrences of each disorder are also significantly varied across the Houston tracts in that some disorders had more records compared to others. Among seven disorders in the present study, the most commonly reported disorder issues were disturbance and nuisance with the total occurrences of 126,669 and 126,599 individually in 2010 within 489 census tracts in Houston. Comparatively, home invasions and gambling were two issues that less likely to be reported. In 2010, the total records of home invasions and gambling were 1,386 and 19,341, which were significantly less than the observations of other five disorder issues.

A very limited temporal variation in the violent crime counts and property crime counts emerged within 24 analysis months. As Table 3 displays, the descriptive statistics indicate that from 2010 to 2011, both violent and property crimes occurrences within the research area in Houston decreased slightly. The total counts of violent crime in 2010 were 20,749. Then across four-time progressions, the total counts of violent crime reduced separately to 20,268 (2%)⁵; 19,777 (2%); 19,616 (0.8%); 19,332 (1.4%).

⁵ The percentage of reduction compared with the total counts in 2010 is showed in the parenthesis.

Although the total counts of property crime indicated some fluctuations between 2010 and the four time progression, the variation was very still very little. In 2010, the total occurrences of property crime in research area was 109,515, which was then reduced to 105,968 (3%) during the first-time progression and to 104,136 (1.7%) during the second-time progression. The total counts of property crime started to increase since the third-time progression (104,872, 0.7%) and continued to the fourth-time progression (105,318, 0.4%), which, however, was still less than the total occurrences in 2010. According to the discussion above, from 2010 to 2011, either violent crimes or property crimes didn't indicate significant changes in Houston. These findings seemed disappointed for tracking the temporal crime patterns.

Lastly, the theory relevant demographics that invited by the present study also showed varied distribution across the census tracts in Houston. The poverty rate ranged from zero to .70 across census tracks (Mean=.18, Standard Deviation= .13). The unemployment rate ranged from zero to .32 (Mean=.08, Standard Deviation= .05). The number of female-headed households increased from zero to .97 (Mean =.25, Standard Deviation=.27). The unmarried rate ranged from .15 to 1 across census tracts (Mean=.57, Standard Deviation=.13). Both house ownership rate and moving at more than five years rate ranged from zero to 1 with the mean values of .49, and .54; standard deviation of .25, and .18, individually. The foreign-born rates, the percentage of Black, and percentage of Hispanic ranged from zero to .68 (Mean=.27; Standard Deviation=.15), zero to .97 (Mean=.25; Standard Deviation=.27), and .10 to .98 (Mean=.40; Standard Deviation=.27), respectively.

Table 3

Descriptive Statistics for Violent Crime, and Property Crime incidents in 2010 and Total incidents in Four Time Progressions as Dependent Variables; Residents-Initialed Disorder Issues in 2010 from Police Calls for Service Data as Independent Variables and the Selective Neighborhood social constructors from 2010 U.S. Census Data.

Variable	Mean	SD	Min	Max	Sum
<i>Dependent variable</i>					
Violentcrime2010	42.43	33.06	0	211	20,749
Progression1	41.45	32.37	0	216	20,268
Progression2	40.44	31.55	0	210	19,777
Progression3	40.11	31.58	0	227	19,616
Progression4	39.53	31.58	0	210	19,332
Propertycrime2010	223.96	180.14	10	1,951	109,515
Progression1	216.70	172.23	11	1,680	105,968
Progression2	212.96	169.75	13	1,629	104,136
Progression3	214.46	170.12	14	1,536	104,872
Progression4	215.37	169.29	13	1,459	105,318
<i>Independent variable</i>					
Disturbance	259.04	196.63	2	1,248	126,669
Nuisance	258.89	170.86	1	967	126,599
Home invasion	2.83	2.64	0	18	1,386
Prostitution	71.94	74.70	1	1,320	35,179
Gambling	39.55	42.494	0	485	19,341
Mischief	44.65	28.15	0	210	21,836
Suspicious events/persons	96.29	56.24	2	399	47,086

(continued)

Variable	Mean	SD	Min	Max	Sum
<i>Social constrains index</i>					
Poverty rates	.18	.13	.00	.70	
Unemployment rates	.08	.05	.00	.32	
FHF rates	.25	.27	.00	.97	
Unmarried rates	.57	.13	.15	1.00	
House occupied rates	.49	.25	.00	1.00	
MIMT5 rates	.54	.18	.00	1.00	
Foreign-born rates	.27	.15	.00	.68	
Percentage of Black	.25	.27	.00	.97	
Percentage of Hispanic	.40	.27	.10	.98	

Note. The sample size was 489 participants.

Progression 1 ranges from 04/2010 to 03/2011.

Progression 2 ranges from 07/2010 to 06/2011.

Progression 3 ranges from 10/2010 to 09/2011.

Progression 4 ranges from 01/2011 to 12/2011.

FHF rates=Female headed families; MIMT5= Move in more than 5 years

Results of bivariate correlations and multivariate regressions analyses

Preliminary examinations were conducted in SPSS analytical environment with the present data set, which revealed some problematic outliers for some observations. Following Harris et al. (2010) and Arnio and Baumer's (2012) studies, the outlier cases were removed, which reduced the overall sample size from 489 tracts to 464 tracts. Unfortunately, the preliminary examination also showed high correlation coefficients in the present data set as some of the previous research assumed (Sampson and Raudenbush, 1999; Gau and Pratt, 2010). Disturbance, home invasion, and suspicious events/people correlated highly with each other, which implied that the multicollinearity was a possible issue. To avoid this problem, three independent variables, i.e., disturbance, home invasion, and suspicious events/people, were removed from the analyses, since they all

had high correlation coefficients compared with other predictors (Johnson & DiNardo, 1972).

The correlation coefficients between the dependent variables, the remained predictors, and social components were displayed in Table 4-6. Table 4 showed that the correlation coefficient between prostitution and mischief was still comparatively high, with the value of .706. In the multivariate regression model, the VIF parameters were also applied to further investigate the multicollinearity issue. The results will be discussed later.

In Table 5, all the predictors were highly correlated with the violent crime rate in 2010 and across four time progressions, indicating that the violent crime, disorders, and social constraints in Houston area are strongly correlated within 24 months. For the property crime, the correlation coefficients in Table 6 indicated that except for the predictor of residential stability that lost its predictive effect on property crime rate from Oct. 2010 to Sep. 2010, other predictors correlated highly with the property crime rate in 2010 and across the four-time progressions. On the other hand, the bivariate results failed to find distinct temporal variance among the correlations between itemized disorders and crimes. I used the multivariate regression to further explore the temporal pattern of disorder and crime associations in the present data set.

Meanwhile, consistent with the previous studies (Fajnzylber et al., 2002; Taylor, 2001; Warner & Pierce, 1993), each itemized disorder also presented varied correlation estimates for the violent crime and the property crime (See Table 5 and Table 6). Nuisance had a higher correlation with the violent crime rate in 2010 ($r=.615$) than with the property crime rate in 2010 ($r=.519$). Prostitution and gambling correlated more

strongly with property crime rate in 2010 ($r=.585$, $r=.365$) than with violent crime rate in 2010 ($r=.414$, $r=.176$). These trends were consistent across the four time progression.

Mischief was the only disorder in the present study that had similar correlations with both the violent crime ($r=.697$) and the property crime ($r=.683$) in 2010 and across the four time progression.

In sum, the bivariate correlation results suggest the existence of associations between dependent variables and predictors using in the present study. Although I deleted the highly correlated predictors in the present study, I still had to further address the issues of the multicollinearity. In the following step, the multivariate regression analysis was conducted to further explore the associations between itemized disorder and violent/property crime, considering the effects of social constraints on those associations. Meanwhile, the VIF test was also applied to ensure that the multicollinearity was not violated.

Table 4

Bivariate Correlations between Itemized Disorders and Social Components

variable	X1	X2	X3	X4	X5	X6	X7
Nuisance (x1)	1	.564**	.608**	.366**	.315**	.197**	-.201**
Prostitution (x2)		1	.684**	.706**	.086**	-.110**	-.249**
Gambling (x3)			1	.484**	.399**	-.066**	-.301**
Mischief (x4)				1	.071**	-.111**	-.153**
Condi (x5)					1	0.00**	0.00**
Ress (x6)						1	0.00**
Immcon (x7)							1

Note. **=correlations were statistically significant at the .01 level.

The sample size was 464 participants.

Seven itemized disorder rates were calculated by disorder counts per population/tract.

Condi=concentrated disadvantages; Ress=Residential Stability; Immcon=Immigrant concentration

Table 5

*Bivariate Correlations between Violent Crime, Itemized Disorders and Social**Components*

variable	VCrime2010	VCrimepro1	VCrimepro2	VCrimepro3	VCrimepro4
Nuisance	.615**	.613**	.601**	.602**	.589**
Prostitution	.414**	.414**	.403**	.410**	.395**
Gambling	.176**	.178**	.161**	.164**	.148**
Mischief	.697**	.695**	.696**	.692**	.682**
Condi	.143**	.149**	.160**	.161**	.154**
Ress	-.342**	-.345**	-.357**	-.356**	-.353**
Immcon	-.109*	-.119**	-.120**	-.122**	-.123**

Note. **=correlations were statistically significant at the .01 level; *=correlations were statistically significant at the .1 level.

The sample size was 464 participants.

Four itemized disorder rates were calculated by disorder counts per population/tract.

Violent crime rates were calculated by counts per population/tract and logged.

Condi=concentrated disadvantages; Ress=Residential Stability; Immcon=Immigrant concentration

Table 6

*Bivariate Correlations between Property Crime, Itemized Disorders and Social**Components*

variable	PCrime2010	PCrimepro1	PCrimepro2	PCrimepro3	PCrimepro4
Nuisance	.519**	.516**	.522**	.520**	.509**
Prostitution	.585**	.578**	.581**	.577**	.574**
Gambling	.365**	.364**	.366**	.368**	.373**
Mischief	.683**	.684**	.690**	.685**	.680**
Condi	.646**	.654**	.648**	.651**	.647**
Ress	.117**	.107*	.096*	.086	.095*
Immcon	-.224**	-.224**	-.224**	-.222**	-.227**

Note. **=correlations were statistically significant at the .01 level; *=correlations were statistically significant at the .1 level.

The sample size was 464 participants.

Four itemized disorder rates were calculated by disorder counts per population/tract.

Property crime rate was calculated by counts per population/tract and logged.

Condi=concentrated disadvantages; Ress=Residential Stability; Immcon=Immigrant concentration

Results of Multivariate Regression

The OLS regression has been the most widely used model to examine neighborhood crime (Arnio & Baumer, 2012). Before running the OLS regression, based on the distributions, the dependent variables were all transformed from crime counts to crime rates per population and tract, and further analyzed the log of the dependent variables as outcomes to ensure their approximate normal distribution (Sampson and Raudenbush, 1999; Moreoff, et al. 2004). To keep the consistency between the dependent variable and independent variable, each independent variable was also transformed into disorder rates per population and tract.

Table 7 and Table 8 display the estimated parameters and standard errors, for the multivariate regressions on violent crime rates and property crime rates in 2010 and across four time progressions. The collinearity statistics for each predictor are small enough to suggest that multicollinearity is not an issue for the overall models. As displayed in Table 7 and Table 8, in model 1 (testing the sole association between itemized disorder rates and violent crime rates), except for prostitution rates in 2010, nuisance rate ($B=.025$; $p<.01$), gambling rate ($B=.301$; $p<.01$) and mischief rate ($B=.085$; $p<.01$), were all the significant predictors of the logged violent crime rate in 2010 and across the four time progressions. This finding supports the hypothesis of the present study and implies that the neighborhoods with higher levels of a nuisance, gambling, and mischief are more likely to suffer from the higher level of violent crime, as supported by the Broken Windows Theory (Wilson & Kelling, 1982). Second, although the prostitution rate in 2010 was not significantly related to the logged violent crime rate in 2010 and within the three-month, six-month, nine-month progression, it became

significant at twelve-month progressions ($B = -.028$, $p < .05$). The changes in the effects may imply the potential temporal pattern in prostitution's effects on violent crime; however, the negative associations between prostitution and violent crime, whether significant or not, were still not in the expected direction, violating the main assumption of Broken Windows Theory (Wilson & Kelling, 1982).

When adding social structure components to the models, both concentrated disadvantages ($B = .138$; $p < .01$) and immigrants concentration ($B = .047$; $p < .01$) were significantly positively associated with the logged violent crime rate in 2010 as well as during the four time progressions. In contrast, residential stability ($B = -.017$; $p < .01$) showed a significantly negative relationship with the logged violent crime rate in 2010 and across the four time progressions, as supported by the social disorganization theory (Cahill & Mulligan, 2007; Shaw & Mackey, 1960). Meanwhile, adding those three social constraints into the model affected the disorder-violent crime associations differently in the present study. Nuisance ($B = .010$; $p < .01$), gambling ($B = .060$; $p < .01$), and mischief ($B = .165$; $p < .01$) were significant predictors of violent crime rate in 2010 and also during the four time progressions, suggesting that they were strong explanatory variable of violent crime rates and were not moderated by social constraints.

Conversely, prostitution emerged as a significant predictor of logged violent crime rates in 2010 ($B = .057$, $p < .01$) and during the three-month progression ($B = .047$, $p < .01$), indicating that social structural characters strongly enhance the association of prostitution with the violent crimes in research location. These findings suggest that violent crimes are more likely to occur in disadvantaged or immigrants concentrated neighborhoods with a dense residential mobility and a higher level of prostitution issue

would more likely lead to the increase of the violent crime rate in those kinds of areas. However, the findings of model 2 also indicate that during the six-month ($B=.030$, $p<.05$), nine-month ($B=.030$, $p<.5$), and twelve-month progressions ($B=.027$, $P<.5$), the moderate effects of social constraints on prostitution-violent crime association start to recede.

The empirical findings stated above support the proposed hypotheses of the present study, and indicate that nuisance, prostitution, gambling, and mischief have different associations with violent crime and that the neighborhood social differentiations also affect to those associations differently. Three social components failed to influence the associations of logged violent crime rate with nuisance, gambling, and mischief rates. Conversely, they exerted strong moderating effects on the prostitution and violent crime association, which remained constant over the three months progression. Lastly, the prostitution displayed the negative association with violent crime, which is, in fact, inconsistent with the previous studies (Brown, 1987; Goldstein, 1979; Wilson & Kelling, 1982).

Table 7

Coefficients from Multivariate Regression Analysis Predicting Temporal Associations between Violent Crime Incident Rates (2010-2011), Itemized Disorder Rates by Type from Calls for Service Data 2010 and Neighborhood Social Components from 2010 Census in Houston

Variable	VCrime2010	VCrimepro1	VCrimepro2	VCrimepro3	VCrimepro4
<i>Model1</i>					
Nuisance	.025** (.004)	.025** (.004)	.025** (.004)	.025** (.004)	.026** (.004)
Prostitution	-.003 (.014)	-.012 (.014)	-.025 (.014)	-.024 (.013)	-.028* (.014)
Gambling	.301** (.025)	.083** (.016)	.093** (.016)	.096** (.016)	.085** (.016)
Mischief	.085** (.017)	.306** (.025)	.308** (.024)	.294** (.024)	.294** (.025)
Constant	-.307** (.038)	-.302** (.038)	-.300** (.037)	-.289** (.037)	-.270** (.038)
R ²	.620	.617	.619	.617	.591
<i>Model2</i>					
Nuisance	.010** (.004)	.011** (.004)	.012** (.004)	.013** (.004)	.014** (.004)
Prostitution	.057** (.013)	.047** (.012)	.030* (.012)	.030* (.012)	.027* (.013)
Gambling	.060** (.014)	.057** .014	.069** (.014)	.070** (.014)	.059** (.014)
Mischief	.165** (.024)	.168** .024	.173** (.024)	.156** (.023)	.153** (.024)
Concentrated disadvantages	.138** (.010)	.138** .010	.131** (.010)	.134** (.010)	.135** (.010)
Immigrants concentration	.047** (.009)	.042** .009	.035** (.009)	.030** (.009)	.032** (.009)
Residential Stability	-.017 (.009)	-.017* .009	-.020* (.009)	-.020* (.008)	-.023** (.009)

(continued)

Variable	VCrime2010	VCrimepro1	VCrimepro2	VCrimepro3	VCrimepro4
Constant	-.032 (.040)	-.026 .039	-.031 (.039)	-.012 (.039)	.011 (.040)
R ²⁶	.740	.738	.729	.732	.710

Note. *= $p < .05$; **= $p < .01$;

The sample size was 464 participants.

VCrimepro1 are total crime rates from 4/2010 to 3/2011;

VCrimepro2 are total crime rates from 7/2010 to 6/2011;

VCrimepro3 are total crime rates from 10/2010 to 9/2011;

VCrimepro4 are total crime rates from 1/2011 to 12/2011;

Violent Crime rates in 2010 and across 4 progressions are transformed by logging incident rates per 100 which are multiplied by 100.

Each kind of Incivility rates are created by sum all counts in 2010 on each census tract and then divide the total population that census tract.

Standard Errors are reported in Parentheses

The associations between property crime rates and individual disorder rates (see Table 8) were also very interesting, indicating some distinct difference compared with violent patterns explored above. In model 1, three itemized disorders, including prostitution ($B=.164$; $p<.01$), gambling ($B=.105$; $p<.01$), and mischief ($B=.225$; $p<.01$) in 2010, all had significant predictive effects on the logged property crime rates in 2010 and kept consistent across four time progressions, as supported by the Broken Windows Theory (Wilson & Kelling, 1982). On the other hand, nuisance rate in 2010 was insignificantly associated with logged property rates in 2010 and across the four time progressions in the present study, which was contrary to the main conclusion of the Broken Windows Theory (Wilson & Kelling, 1982) but consistent with some other studies (Geller, 2012; Herbert, 1993; Sampson et al., 2004). Additionally, similar to the outcomes of violent crime model, the temporal variations were not apparent in 2010 or

⁶ The values of R² generated by the multivariate regression models are a little bit high. Although the VIF values are all within the acceptable level (see in Appendix), all crime and call for service data were collected from the same resource may act as the limitation to results in this phenomenon. In chapter V, this issue has been further discussed as one of the limitation of present study.

four time progressions, since the associations were either consistently significant or non-significant across five time ranges.

When adding those social structure components to the models (see Table 8, model 2), the predictive effects of each itemized disorder also changed clearly. On the one hand, concentrated disadvantages ($B = -.080$, $p < .01$), the concentration of immigrants ($B = -.043$, $p < .01$), and residential stability ($B = -.075$, $p < .01$) were all significantly negative related to the logged property crime rates in 2010 and across four time progressions. These findings are consistent with some of the previous studies on social disorganization theory (Sampson & Grove, 1989; Sampson & Raudenbush, 1997, 1999; Shaw & Mackay, 1942).

On the other hand, adding social constraints into the model influenced the association of the property crime with itemized disorders differently compared to Model 1. In model 2, prostitution rate ($B = .109$; $p < .01$), gambling rate ($B = .132$; $p < .01$), and mischief rate ($B = .260$; $p < .01$) in 2010 were still significantly positive predictors of the property crime rate in 2010, and these associations remained significant across the four time progressions. These findings suggest that prostitution, gambling, and mischief have very strong predictive power in explaining the variance of property crime, which can't be moderated by the social constraints. Nevertheless, the nuisance rate in 2010 kept as the insignificant predictor of the logged property crime in model 2, which means that the social constraints could n't influence the predictive power of nuisance on the property crime. These findings didn't support the hypothesis that the social constraints moderate the associations of itemized disorders and property crime differently (Lees and Doran, 2005; Sampson and Raudenbush, 1999; Yang, 2009).

Table 8

Coefficients from Multivariate Regression Analysis Predicting Temporal Associations between Property Crime Incident Rates (2010-2011), Itemized Disorder Rates by Type from Calls for Service Data 2010 and Neighborhood Social Components from 2010 Census in Houston

Variable	PCrime2010	PCrimepro1	PCrimepro2	PCrimepro3	PCrimepro4
<i>Model1</i>					
Nuisance	.000 (.007)	.000 (.007)	.000 (.007)	-2.239E-005 (.007)	-.003 (.007)
Prostitution	.164** (.024)	.158** (.024)	.157** (.024)	.156** (.024)	.155** (.024)
Gambling	.105** (.028)	.109** (.028)	.108** (.028)	.115** (.028)	.114** (.028)
Mischief	.225** (.042)	.230** (.042)	.236** (.042)	.229** (.042)	.226** (.042)
Constant	.624** (.065)	.594** (.065)	.568** (.065)	.580** (.065)	.621** (.065)
R ²	.441	.441	.446	.441	.426
<i>Model2</i>					
Nuisance	.013 (.007)	.014 (.007)	.014 (.007)	.014 (.007)	.010 (.007)
Prostitution	.109** (.024)	.102** (.024)	.103** (.024)	.103** (.024)	.102** (.024)
Gambling	.132** (.028)	.134** (.028)	.132** (.027)	.138** (.028)	.138** (.028)
Mischief	.260** (.047)	.259** (.047)	.254** (.046)	.245** (.047)	.244** (.047)
Concentrated disadvantages	-.080*** (.020)	-.077** (.020)	-.069** (.020)	-.068** (.020)	-.068** (.020)
Immigrants concentration	-.043* (.017)	-.049* (.017)	-.050* (.017)	-.050** (.017)	-.047** (.017)

(continued)

Variable	PCrime2010	PCrimepro1	PCrimepro2	PCrimepro3	PCrimepro4
Residential Stability	-.075** (.017)	-.076** (.017)	-.082** (.017)	-.083** (.017)	-.082** (.017)
Constant	.562 (.078)	.543 (.077)	.539 (.077)	.555 (.078)	.593 (.078)
R ²	.497	.490	.496	.489	.475

Note. *= $p < .05$; **= $p < .01$;

The sample size was 464 participants.

PCrimepro1 are total property crime rates from 4/2010 to 3/2011;

PCrimepro2 are total property crime rates from 7/2010 to 6/2011;

PCrimepro3 are total property crime rates from 10/2010 to 9/2011;

PCrimepro4 are total property crime rates from 1/2011 to 12/2011;

Property Crime rates in 2010 and across 4 progressions are transformed by logging incident rates per 100 which are multiplied by 100.

Each kind of Incivility rates are created by sum all counts in 2010 on each census tract and then divide the total population that census tract.

Standard Errors are reported in Parentheses

Summary

Following the traditional methodologies of multivariate regressions (Sampson & Raudenbush 1997, 1999), the present study tested the Broken Windows Theory framework by addressing the associations of four itemized disorders (nuisance, prostitution, gambling, and mischief) with both property and violent crimes from 2010 to 2011. On the one hand, adjusted R² of the multivariate models indicated that overall, the predictors in the present study explained about 70% of the variance in logged violent crime rates and nearly 50% of the variance in logged property crime rates, suggesting the statistical promising of the OLS models. Additionally, the VIF values of each predictor indicated that the correlation between predictors suggested that multicollinearity had not been an issue in the multivariate regression models. On the other hand, supporting the hypotheses I and II, the multivariate regression results showed that nuisance, gambling, and mischief were all significant and consistent predictors (across 24 months) of logged violent crime rate, whereas, prostitution, gambling, and mischief showed significantly predictive effects on logged property crime rate across the five time ranges. Meanwhile,

the three neighborhood components can affect only the association between prostitution and the violent crime from 2010 to 2011. However, it seems that no conclusion can be made in support of the Broken Windows theory based on some of the paradoxical facts. First, the results actually provide bilateral evidence to the Broken Windows Theory that some disorders are significantly associated with a crime while others are not. Second, the results provide limited support to the previous studies of social disorganization theory, since the three social components did not have any effects on various associations between disorders and crime explored by the present study except for prostitution and violent crime nexus. Moreover, prostitution (Violent crime) and nuisance (Property crime) were revealed as negative predictors of either the violent crime or the property crime in model 1. These findings are also inconsistent with the results of previous studies (Brown, 1987; Goldstein, 1979; Wilson & Kelling, 1982). In fact, the weakness of OLS regression in analyzing the spatial data is that it often yields unusual and controversial results when testing the neighborhood crime patterns, which has been a hot research topic recently, attracting increasing attention (Arnio & Baumer, 2012; Cahill & Mulligan, 2007; Han & Gorman, 2013; Stein et al., 2016). As addressed in the previous chapter, for the spatial data, the spatial auto-correlation between each observation could threaten the reliability of the estimates generated by the OLS models (Bernasco & Elffers, 2010). For example, in a related study, Arnio and Baumer (2012) have proposed that the non-stationary assumption of global OLS model would bias the global empirical estimates due to the existence of spatial variation. According to their study (2012), adding the spatial weights into the OLS model would not generate the property model to deal with this issue. The authors (2012) suggested that GWR model responded better to the spatial

autocorrelation of crime across Chicago census tracts. To investigate the accuracy of the outcomes generated by the multivariate regression and further explore the theoretical indications of the Broken Windows theory across Houston census tracts in the research location, I therefore conducted the multivariate regression(global) and GWR(local) with the same parameters and the dataset in 2010, using ArcGIS10.5 software and compared the two model estimates between global and local level analysis⁷. The results of model diagnostics and the spatial heterogeneity of the Broken Windows Theory elements tested by the present study are discussed in the rest of this chapter.

The diagnostics of global models of violent crime and property crime

To verify the assumption of the present study that the spatial heterogeneity should be considered by the examinations of disorder and crime linkages, the multivariate regressions (global models) and GWR analysis with the same parameters were conducted in ArcGIS consecutively using 2010 dataset. Based on the outcomes of two models, the global OLS and GWR models were compared firstly by using the Moran's I test to address the issue of spatial auto-correlation. Then AICc, and Adjust R² values were used to examine the advantages of local level analysis for theoretical frameworks of the Broken Windows theory. The optimal bandwidth (i.e., local sample size) required by the local level analysis in ArcGIS was provided by the Akaike Information Criteria (AICc) optimization method for both of logged violent crime and logged property crime in 2010. The bandwidth generated through this method has been suggested to contribute to the minimization of the AICc value and identifying the local variation (Han & Gorman,

⁷ The local level analysis in present study focus on examining the associations between itemized disorder and both violent crime rate and property crime rate in 2010.

2013). Table 9 shows the main outcomes of the diagnosis of global OLS models and GWR models. Not surprisingly, the OLS models for the violent crime and the property crime in the present study demonstrated statistical significance of spatial autocorrelations, suggesting the issue of the spatial cluster and reflecting poorly the localized analysis. The outcomes of Moran's I test for OLS models (for violent crime model: Moran's $I=.145$, $p<.000$; for property crime model: Moran's $I=.152$, $p<.000$) suggested that there were significant spatial clusters in the residuals of OLS models for the logged violent crime rate and the logged property crime rate. Therefore, a spatial modeling analysis was necessary to explore the spatial pattern of itemized disorder, social constraints, and crime. The outcomes of Moran's I test for the GWR models (also displayed in table 9) verified this finding by yielding no significant spatial clusters existed for violent crime model (Moran's $I=-0.017$, $p>.05$) and property crime model (Moran's $I=.02$, $p>.05$). Then, a further comparison between global OLS model and GWR model was produced based on the outputs shown in Table 9. The first parameter that was used to compare the model fit of the global OLS model and GWR model was AIC_C . According to Table 9, the AIC_C values of the GWR models for both violent crime and property crime were all smaller than those of the global OLS models, which suggests that GWR models provide better estimation of the violent crime and property crime patterns using current predictors compared to the global OLS models (Fotheringham et al., 2002). Additionally, the adjusted R^2 of GWR models for violent crime and property crime all highly increased. For the violent crime, the adjusted R^2 increased from .736 to .800, which means that the predictors in the GWR model can explain about 8% more variance of the logged violent crime rate in 2010 across the research location in Houston.

For the property crime, the adjusted R^2 increased from .490 to .633, indicating that the GWR model can explain 14.3% of the variance in logged violent crime rate in 2010 in the same area. Similar to the previous research conducted in Flint, Chicago, Portland, and some northern cities in the U.S., the overall model improvement provided by GWR estimates suggests that the disorder and crime linkages in the Houston census tracts are not just simple linear relationships but include more complex effects than those revealed by the OLS model (Arnio et al., 2012; Cahill and Mulligan, 2007; Ryarczyk et al., 2011; Stein et al., 2016). The indication of spatial heterogeneity captured by GWR models may provide an alternative approach to urban crime phenomena interpretation and an explanatory basis for the clarification of "intricate" relationships (Kyratso and Yiorgos, 2004; Wilson and Kelling, 1982).

Table 9

OLS and GWR Model Diagnostics Output

	Violent Crime		Property Crime	
	OLS	GWR	OLS	GWR
AIC	-312.16	-366.246	308.544	205.213
Adjusted R ²	.736	.800	.490	.633
Moran's I	.145***	-0.017	.152***	0.02

Note. The sample size was 464 participants. AIC= Akaike Information Criterion. GWR=geographically weighted regression. OLS=ordinary least squares regression.

GWR Models for Violent Crime and Property Crime

The analyses and interpretation of GWR model outcomes were based on three main theoretical frameworks in neighborhood research, including the Broken Windows Theory (Wilson & Kelling, 1982), social disorganization theory (Shaw & MacKay, 1942), and environmental criminology on Crime opportunity (Geller, 2007; St. Jean, 2007). Previous empirical studies in environmental criminology have suggested that neighborhood is an ecosystem in which other neighborhood unmeasured effects (i.e. crime opportunities) influence the neighborhood crime effect models, i.e., the Broken Windows Theory (Hipp, 2007; Sampson & Raudenbush, 1997, 1999; Yang, 2009). Thus, accessing the regional variation in the associations between crime and disorder across the research area cannot only “identify regions with stronger or weaker association”, but also “identify the local drivers of the strength of the local association” (Wheeler & Waller, 2009, p.4). Following the theoretical arguments focusing on the integration of neighborhood crime empirical models, in the present study, I interpreted the results of GWR model and explored the spatial patterns of disorder-crime associations by

considering the people living in those neighborhoods (i.e., social constraints) and the environment (i.e., geography and crime opportunity).

Moreover, in this study, 88 super neighborhoods in Houston⁸ were also applied in order to reflect the spatial heterogeneity, since the desired census tracts clustered within the boundary of super neighborhoods. Using Arc-GIS software, the research location in the present study was overlaid with the map boundaries for all of Houston super neighborhoods. Hence, the locations specific to the significance of spatial variance addressed by the present study were discussed based on the geographical information of super neighborhoods in Houston.

The median coefficients of all census tracts and the coefficients of the tract-specific distribution (showed by the minimum and maximum values in parentheses) for the logged violent crime rate and logged property crime rate in 2010 were displayed in Table 10, which provided an overview of the estimated outcomes of GWR models on violent crime rate and property crime rates in 2010 across 464 census tracts in Houston. According to Table 10, all predictors generated both positive coefficients and negative estimated coefficients for both logged violent crime rate and logged property crime rate in 2010. It implies that the crime effects caused by the predictors are more complex than those suggested by the OLS models stated above. To further explore the spatial pattern

⁸ According to the office of the city of Houston, super neighborhood is a geographically designated area where residents, civic organizations, institutions, and businesses work together to identify, plan, and set priorities to address the needs and concerns of their community. The boundaries of each super neighborhood rely on major physical features (bayous, freeways, etc.) to group together contiguous communities that share common physical characteristics, identity, or infrastructure. The super neighborhood elects a council comprised of area residents and stakeholders that serves as a forum to discuss issues and identify and implement priority projects for the area.

of disorder-crime associations in the research area in Houston, the outcomes of spatial heterogeneity effects on the associations between four itemized disorders and crime were discussed below based on the spatial patterns of estimated coefficients, raster surfaces, and calculated t-values generated by the GWR model.

Table 10

Estimate Coefficients of Geographically Weighted Regression for 2010 Violent Crime Rate and Property Crime Rate across the Tracts in Houston

	Violent Crime Rate	Property Crime Rate
Nuisance	.010 (-.005, .043)	-.001 (-.032, .0378)
Prostitution	.056 (-.129, .168)	.121 (-.016, .281)
Gambling	.067 (-.026, .157)	.153 (-.076, .416)
Mischief	.154 (.009, .351)	.356 (-.134, .585)
Concentrated disadvantages	.106 (.002, .179)	-.106 (-.314, .127)
Immigrant concentration	.054 (-.049, .127)	-.035 (-.190, .084)
Residential stability	-.004 (-.086, .128)	-.026 (-.212, .118)

Note. The sample size was 464 participants. Estimates shown are the median value of coefficients with the minimum and maximum values of coefficients in parentheses.

Nuisance. The spatial patterns of coefficients, coefficients raster surface, and calculated t-values for the logged violent and property crime rates estimated by the nuisance rates in 2010 are displayed individually in Figure 3-8. A significant spatial heterogeneity was visualized across the 464 census tracts of the Houston Area. The

spatial regression coefficients for violent crime and property crime in each census tract suggested distinct discrepancies (See Table 10). As Table 10 demonstrates, the regional coefficients for logged violent crime rates in 2010 on census tract ranged from the minimum value of $-.005$ to the maximum value of $.043$, with the median value of $-.010$, meanwhile, estimated coefficients for logged property crime rates in 2010 ranged from $-.032$ to $.378$ (Median= $.010$). Overall, for estimation on logged violent crime rates in 2010, the positive coefficients were observed across 429 census tracts (92%), whereas in 35 census tracts (8%), the negative coefficients were explored. Regarding estimation on the logged property crime rates 2010, 258 census tracts demonstrated positive coefficients, comprising 55% of the total research area with the remainder of the census tracts (206, 45%) presenting negative coefficients.

In the present study, the estimated coefficients in each census tract were visualized by raster surface data as the outcomes of a GWR model. The higher coefficient values in census tracts are designated in red, which denotes a strong predictive impact on logged violent/property crime rate in 2010 across those census tracts, whereas the census tracts with lower coefficient values were illustrated in blue, demonstrating the weak predictive impact in those areas. Figure3 and Figure 6 individually, showed the outcomes of GWR models for the associations between nuisance rate and the logged violent crime rate as well as the logged property crime rate across 464 tracts in Houston. The high values of estimate coefficients on two explained variables in the present study are clustered in six areas of Houston (figure3, figure6, in red). Among them, the highest coefficients generated by nuisance for logged violent crime rate were concentrated in four independent suburban areas including (1) Kingwood and Lake Houston (North), to

IAH/Airport, (2) Eldridge/ West Oaks , Westchase, Alife, and Westwood, (3) South Main and Central Southwest super neighborhoods, and (4) Meadowbrook/Allendale, Edgebrook, and South Belt/Allington (n=117, showed in red in Figure4), according to the geographical information provided by the overlaid boundaries of super neighborhoods. In terms of property crime, the highest positive coefficients were found in two separate areas in Houston (n=34, shown in Figure 6, in red): Langwood, Central Northwest, Spring Branch East; Lazybrook-Timbergrove; Kingwood and northern Lake Houston.

Does neighborhood nuisance cause more violent crimes? The calculated T-values of estimate coefficients were applied in the present study as a supplement to explore further the spatial nature of the associations between nuisance and violent crime/property crime by referring to the significance thresholds (i.e. when $t > 1.96$, $p < .05$) (Mennis, 2006; Zhang and Song, 2014; Rybarczyk and Kruger, 2015). According to the T-value map (Figure 4) for violent crime, the nuisance and logged violent crime rates in 2010 have very strong positive associations within the four dependent areas listed above (n=110, 24%, shown in red). This finding suggests that the association between nuisance and violent crime can be explored in Houston but with significant regional variances. In those four areas stated above (Kingwood Area and Lake Houston Area (North), the IAH/Airport area, the adjacent of area of Eldridge/ West Oaks , Westchase area, Alife and Westwood, the areas of South Main and Central Southwest super neighborhoods, as well as the areas of Meadowbrook/Allendale, Edgebrook area, and South Belt/Allington), higher levels of nuisance were more likely to lead to higher level of violent crime rate, which is in accordance with the Broken Windows Theory theoretical framework (Wilson & Kelling, 1982).

The next question examined by the present study was whether or not social constraints generate spatial impacts on nuisance and violent crime associations. The comparison between the estimated coefficients of nuisance (Figure 3) and the coefficients distributions of concentration disadvantages (Figure26), immigrant concentration (Figure27), and residential stability (Figure28), showed that unlike the outcomes of a global multivariate regression model, the three components indicated three kinds of effects on the nuisance and violent crime associations in different research tracts in Houston, including the “non-effect”(Sampson & Raudenbush, 1999), “compound effect” (Sampson & Raudenbush, 1999), and “buffer effect” (Yang, 2010).

First, the nuisance and violent crime associations can be very strong without significantly moderated by social disadvantage, immigrant concentration, and residential stability. In the area around the supper neighborhoods of South Main and Central Southwest, the nuisance issue was observed to have a strong impact on the local logged violent crime rate (see figure3), however, three social components fail to strongly impact the local violent crime rate (see figure 26, 27, 28). This finding supports the Broken Windows theory by suggesting that in this area, nuisance acts as the major predictor to explain the variance of violent crime rate without moderating by the social components.

Second, the social components were observed to have compound effect with nuisance in estimating local violent crime rate in some place of Houston, which supports the previous study on social disorganization theory (Sampson and Raudenbush, 1999). When looking at the rest three desired areas for nuisance and violent crime association, the strong impacts of three social components can also be observed in that area (see figure 26-28, the blue area of residential stability raster indicates the strong negative

impact). This finding suggests that the increase of violent crime rate in the Kingwood Area, Lake Houston Area (North)), IAH/Airport area and the adjacent of area among Eldridge/ West Oaks, Westchase area, Alife, and Westwood were caused by both nuisance and social contextual factors in those areas and potentially the social components enhanced the nuisance and violent crime association.

Thirdly, for those areas where the nuisance-violent crime association was not salient (figure3), the predictive relationship of the nuisance to violent crime may be more or less buffered by the neighborhood social components or other situational crime effects, as previous studies have suggested (Sampson and Raudenbush, 1999; Yang, 2010). A typical area was the central-east area of Houston from Eastex-Jensen to South Park. In these areas, the nuisance issues indicated a weak association with logged violent crime rates, however, according to Figure26-28, the highest coefficients of the three social components were all clustered in those areas. Contrary to Broken Windows theory (Wilson & Kelling, 1982), this finding is supported by empirical models of social disadvantage theory (Shaw & Mackay, 1942; Sampson, Randenbush and Earl, 1997), suggesting that in Esatex-Jensen and South Park, the increase in local violent crime rates are more likely to be caused by the social issues of people living there or other unmeasured effects, and less likely to result from nuisance issues.

In addition, Figures 2-4 showed an important spatial pattern of nuisance — violent crime linkage that the strong linkages of two factors were more likely to concentrate on the outskirts of Houston. This finding is supported by previous studies, which suggested that a suburban area with the more spatial disorder is more likely to experience higher crime rates due to lower levels of place attachment and social cohesion

(Brown et al., 2004). Therefore, it implies that suburban areas of Houston come under increased policing.

Spatial clusters were also revealed from the association between nuisance and logged property crime rates in 2010 across Houston tracts. According to Figure 6, a strong positive association between nuisance and property crime rates can be explored in the area of Kingwood Area and Lake Houston, and a small area in Central Northwest and Lazybrook/Timbergrove. It means that in these two areas, the levels of nuisance rates would cause more property crime to occur.

When looking at the neighborhood environmental context of these two areas, the strong associations between nuisance and property crime were observed to be conditioned by specific social characteristics (Hipp 2007). According to social disorganization theory, social disadvantages, residential stability, and immigrant concentration are three significant factors to predict the neighborhood crime (Sampson and Groves, 1989). In the present study, except for the strong association between nuisance and property crime, the strong positive impact estimated by concentrated disadvantages (Figure 29, in red), and immigrant concentration (Figure 30, in red) together with a strong negative impact on residential stability (Figure 31, in blue), were also revealed in the area of Kingwood Area and Lake Houston. The overlap between those effects suggests that in the neighborhoods with high levels of poverty, unemployment, and (or) immigrants and (or) residential instability, higher levels of nuisance would be an important signal of lack of “guardian” elements, which would result in more property crime (Brown et al., 2004). Contrary to the areas of Kingwood and Lake Houston, the Central Northwest and Lazybrook/Timbergrove neighborhoods

were located in the affluent area of Houston (Figure29, in blue) with fewer immigrants (Figure30, in blue), which would provide more “attractiveness” to property crime. So, in this area, the association between nuisance and property crime may also be enhanced by the strong effect of social constraints. Commonly, the affluent area should have more “guardian” elements supported by the household security or police intervention. Therefore, the emerge of higher levels of nuisance issues observed in this area would be an even stronger signal of less protection which makes the criminals more likely to commit property crime in that area (Cromwell, et al, 1991; Groff, & La Vigne, 2001; Wilson and Kelling, 1982).

These findings observed in above areas (Kingwood Area, Lake of Houston, the Central Northwest and Lazybrook/Timbergrove neighborhoods), support the hypotheses of the present study that property crime could be caused by the compound effects of nuisance and social components. It implies that the positive association between nuisance and property crime as addressed by the Broken Windows theory, is more likely to happen in disadvantaged neighborhoods with less level of residential stability but higher levels of immigrant concentration or the affluent areas where have more “attractiveness” for the property crime, which requires a specific crime-reduction strategy to deal with the nuisance issues (Rybarczyk, et al., 2015).

In sum, the present study supports the Broken Windows theory that the strong impact of neighborhood nuisance to either violent crime can be observed in five areas of Houston with significant regional variations. The strong association between neighborhood nuisance and property crime can also be observed in two areas of Houston, however, those effects are kinds of compound effects that moderately enhanced by the

neighborhood social components. For the rest of research area in Houston, the significant spatial heterogeneity suggested the neighborhood social components, or opportunity effects, or other unmeasured effects would buffer a disorder's effect on violent/property crimes (Hipp, 2007; Doran and Lee, 2005; Sampson and Raudenbush, 1999; Yang, et al, 2010), since the nuisance and crime association is not salient. These findings would open a new page for future studies to explore the independent effects and the heterogeneity effects (based on the interactions between those factors) of neighborhood factors to property and violent crime patterns at the neighborhood level.

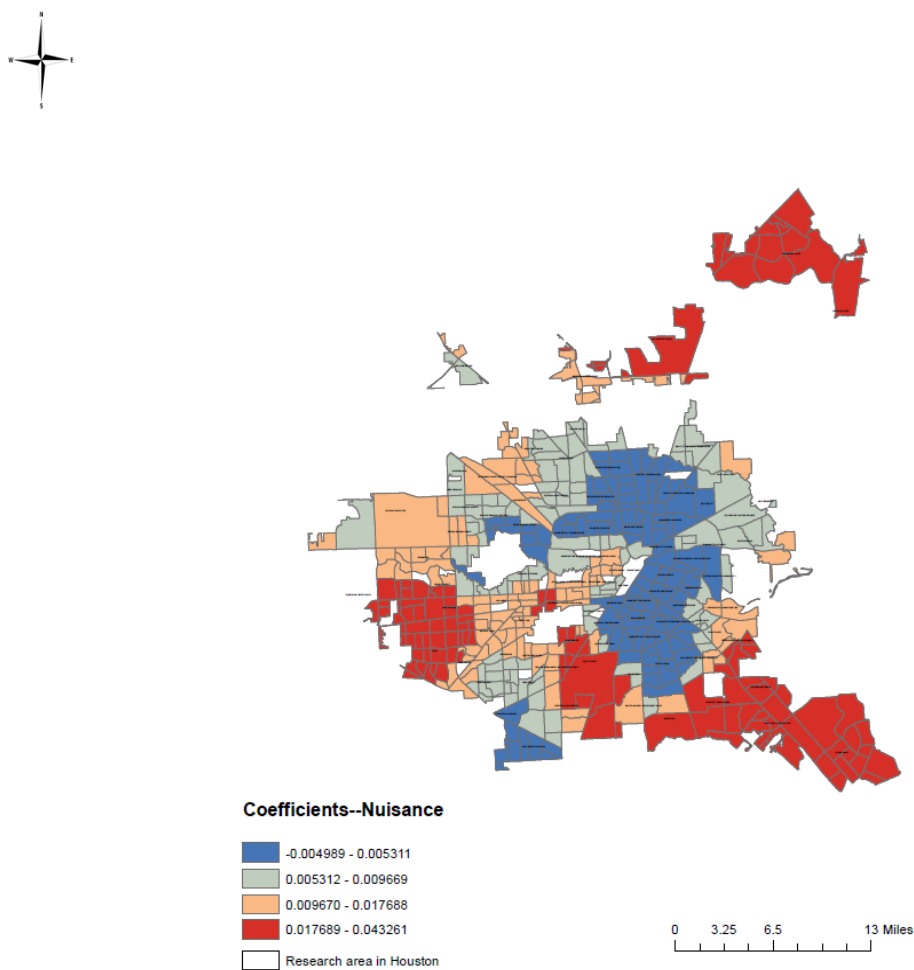


Figure 2. Coefficients for Nuisance Estimates on Violent Crime Rate 2010

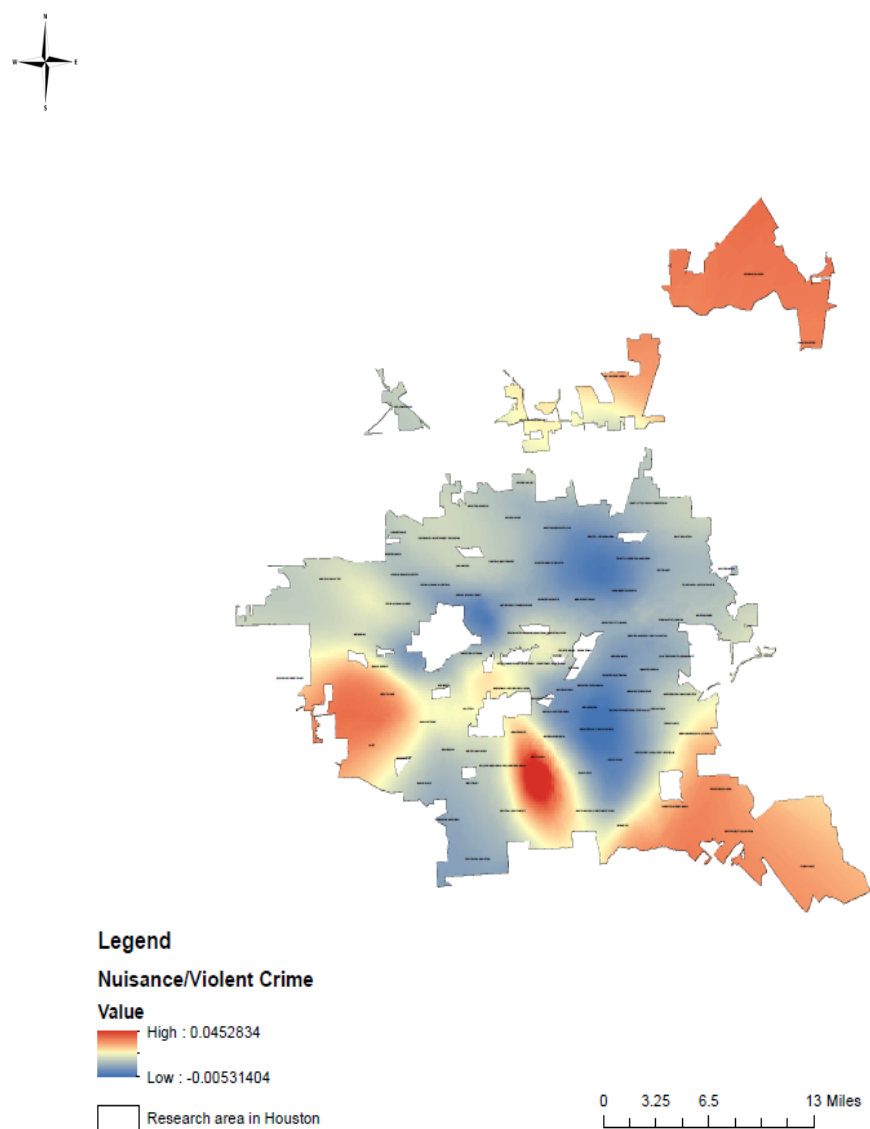


Figure 3. Nuisance Estimates Raster for Violent Crime Rate 2010

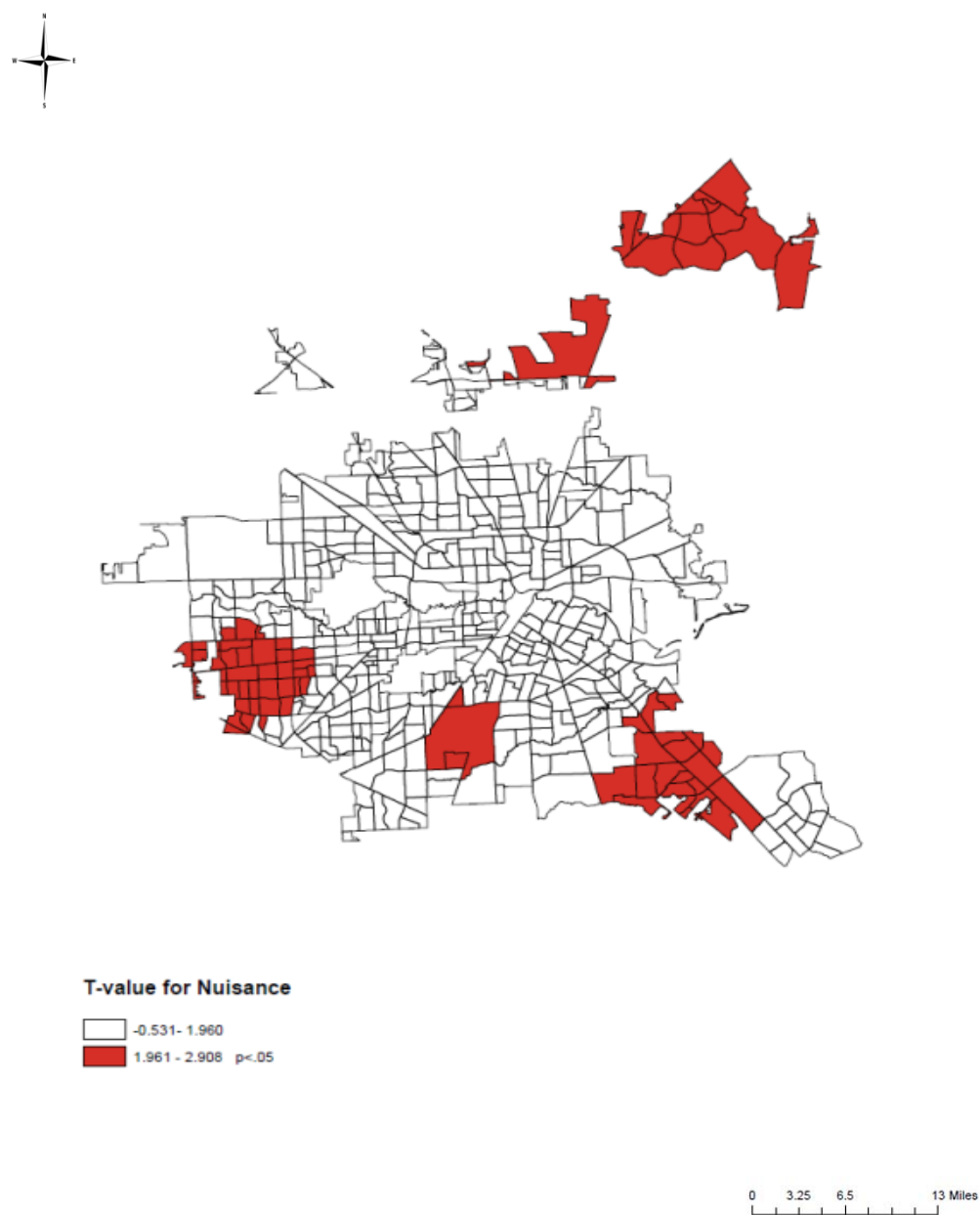


Figure 4. Calculated T Values for Nuisance Estimates on Violent Crime Rate 2010

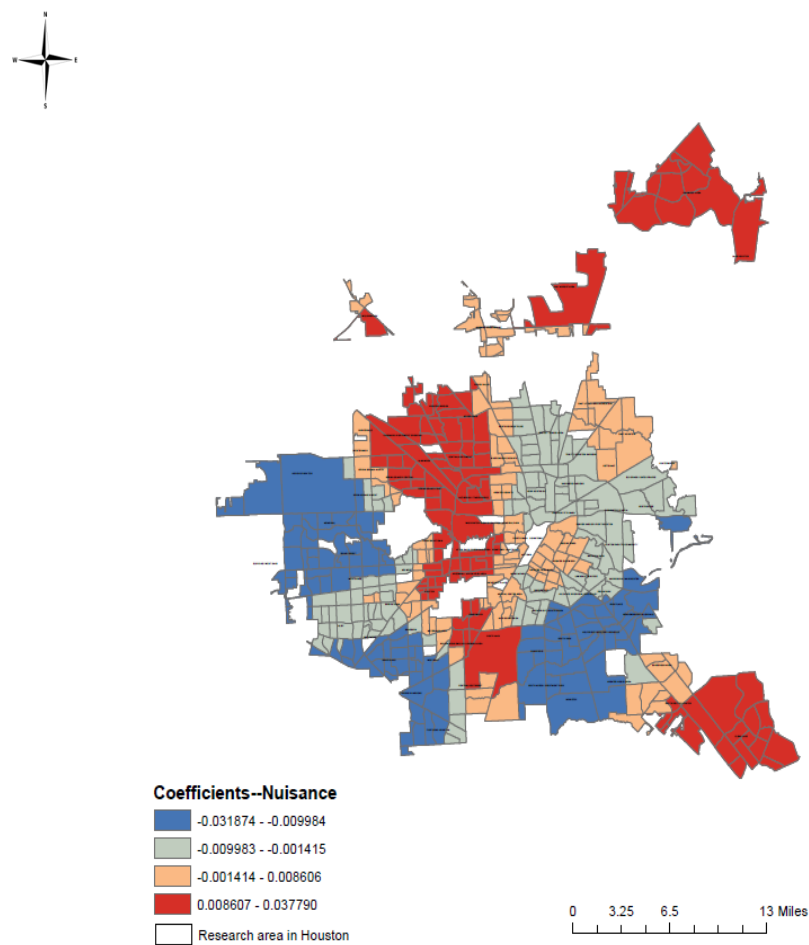


Figure 5. Coefficients for Nuisance Estimates on Property Crime Rate 2010

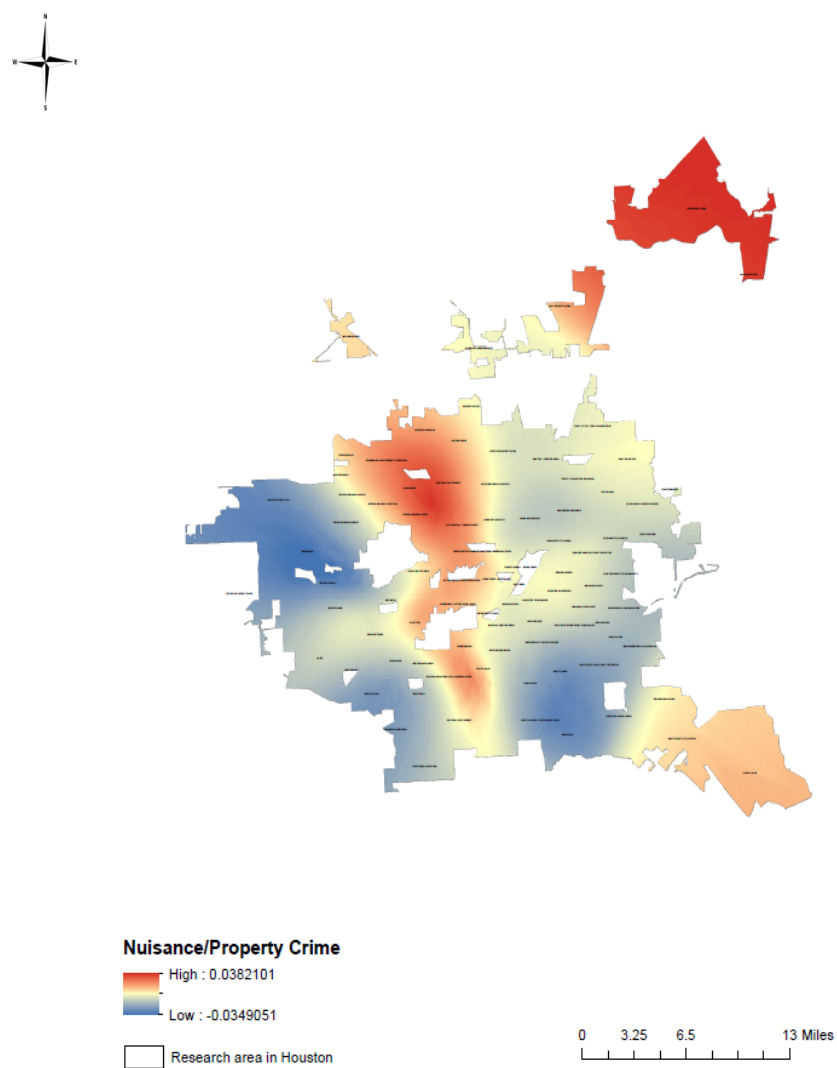


Figure 6. Nuisance Estimates Raster for Property Crime Rate 2010

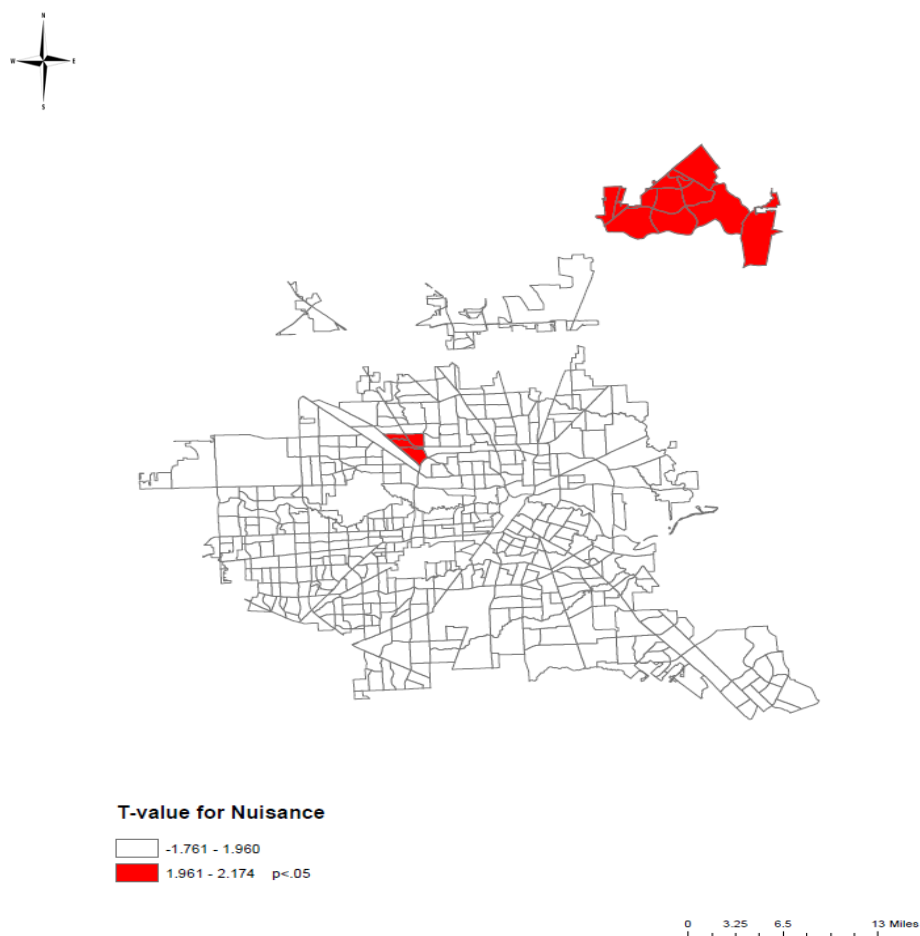


Figure 7. Calculated T Values for Nuisance Estimates on Property Crime Rate 2010

Prostitution. Prostitution is a minor deviance which is commonly addressed as a social disorder issue (Evans et al, 2002). According to Table 10, for the violent crime, the regional coefficients estimated by prostitution through the GWR model ranged from a minimum of -.129 to a maximum of .168, with the median value of .056. For the property crime, the estimate coefficients ranged -.016 to .281, with the median value of .121. In terms of the regional variation, the strong and positive coefficients for the logged violent crime rate were mainly clustered at the outskirt areas of southwest and north of Houston (Figure 8, in red), including the super neighborhoods of Willowbrook, Greater Greenspoint, East Little York, and the adjacent area from Greater Fondren Southwest to the Central Southwest in Houston (n=33). Conversely, the smallest and negative coefficients were more likely to be observed in the west of Houston, such as Westchase, and Mid-West of Houston (n=15, Figure 8, in blue). For property crime, the estimate coefficients (ranging from -.016 to .281) were also distributed with significant spatial variance (see Figure 11). The strongest positive predictors were clustering at the supper neighborhoods of Houston from the Lake Houston, Willowbrook, Alief, to the Minnetex, Great Hobby area, Edgebrook, which were distributed in a half circle (Figure 11, in red). And a small portion of negative predictors was found in six census tracts located within the Lazy Brook and Memorial Park super neighborhoods (Figure 11, in blue), comprising only 1% of the research area. As one of the commonly encountered disorders in neighborhoods, the association between prostitution and crime has been mentioned by Kelling and his colleagues in previous studies (Wilson & Kelling, 1982; Matthews, 1992; Kelling & Cole, 1997). The global multivariate regression analysis in the current study suggested that violent crime and prostitution associations existed only

when social constraints were added into the multivariate model (See Table 7), which demonstrated the existence of moderate effects of social constraints to this association. The local analysis in GWR model verified this moderate effect to some degree by mapping out the spatial heterogeneity of their associations. In figure 9, the strong association between prostitution and violent crime can be explored in 115 census tracts (24%) clustering in three main areas: 1) the north area of Houston from the super neighborhood of IAH/Airport area to the super neighborhood of Willowbrook; (2) the central east of Houston from Hidden Vally to Downtown to Sunnyside Golfcrest; and (3) the north west of Houston from Alief to Fort Bend. This finding suggests that in these three areas in Houston, neighborhood prostitution issues are observed to be more likely to cause the higher levels of violent crime, which implies a more focused police tactic on prostitution issues in that neighborhood in order to prevent crime. When referring to the social components effects on violent crime in those three areas in Figure 26 (concentrated disadvantages), Figure 27 (immigrant concentration), Figure 28 (residential stability), the overlap areas indicated the compound effects provided by prostitution, and social constraints to the violent crime in Houston, which was supported by Sampson and Raudenbush (1999), and other studies (Markowitz, 2001; Hipp, 2007). For example, compared with the raster coefficients of concentrate disadvantages shown in Figure 26, the areas of Willowbrook and the central east of Houston were observed to be the places where the highest coefficients of social disadvantages on violent crime were clustered (Figure 26, in red). Whereas, the IAH/Airport area and the area from Alief to Fort Bend were located where demonstrated the small and negative coefficients of social disadvantages (Figure 26, in blue). These findings suggest that a higher level of

prostitution is more likely to lead to the increase in the violent crime rate in either the most disadvantaged neighborhoods or the most affluent neighborhoods. Hence, police interventions on prostitution should be focused on the neighborhoods with these social characteristics.

However, in the rest areas, the present study failed to support the Broken Windows theory, since prostitution lost its association with violent crime, which conversely supports many studies opposite to the Broken Windows theory. The existence of areas where prostitution didn't strongly associate with the violent crime, suggests that there must be some opportunity factors or other unmeasured effects existing that buffer the association between prostitution and violent crime (Louderback, & Sen Roy, 2017). This finding also verified Yang's (2010) assumption that in some neighborhoods, some opportunity or environmental factors may provide buffers to social disorder's effects on violent crime. The spatial pattern of prostitution and violent crime explored by the present study, still, reveals the significant regional variance to enrich the assumptions of the Broken Windows theory (Wilson & Kelling, 1982).

When it comes to property crime analysis, both Figure 11 and Figure 12 showed that the significant associations between prostitution rate and the logged property crime rate distributed across research area in Houston, just like the annularity. The significant positive associations between prostitution and property crime were observed and concentrated across the outskirts of Houston including (1) the north area of Houston from Willowbrook, Greater Greenspoint, IAH/Airport area to Lake Houston; (2) the east area of Houston from the East Little York to Great Hobby Area; and (3) the south-west of Houston from Westwood to Fondren Gardens and from Gulfton to Meyearland. As

mentioned before, the social characteristics of neighborhoods have been suggested to have significant impacts on crime (Rybarczyk and Kruger, 2015). The present study also suggests the compound effects caused by prostitution and neighborhoods' social disadvantages on property crime. The coefficients raster of concentrated disadvantages (Figure 29) showed that those super neighborhoods (including IAH/Airport area, the East Little York to Great Hobby Area, Greater Fondren Southwest, Fondren Gardens, Gulfton and Meyearland) with strong prostitution and property crime associations were all within the areas where the smallest coefficients of social disadvantages were clustered (Figure 29, in blue). This implies that prostitution is more likely to cause the property crime in the affluent neighborhoods. However, this implication still is not the whole picture. One may ask why the Willowbrook and Alief super neighborhoods also indicated strong associations between prostitution and property crime, whereas, either strongly negative or positive effects of concentrated disadvantages were observed in those two areas (see Figure 29). One possible answer is that the residential instability of that area may enhance the predictive effect of the prostitution on property crime since Sampson and Raudenbush have suggested the higher level of residential mobility would decrease the level of neighborhood collective efficacy, then result in the increase of the crime (Sampson and Raudenbush, 1999). When looking at the residential stability coefficient raster (Figure 31), those two super neighborhoods were all within the areas of low coefficient values for residential stability (in blue). This finding implies, in neighborhoods with higher levels of residential instability, the "guardians" for the property crime would decrease, and hence, higher levels of prostitution would be more likely to cause more property crime.

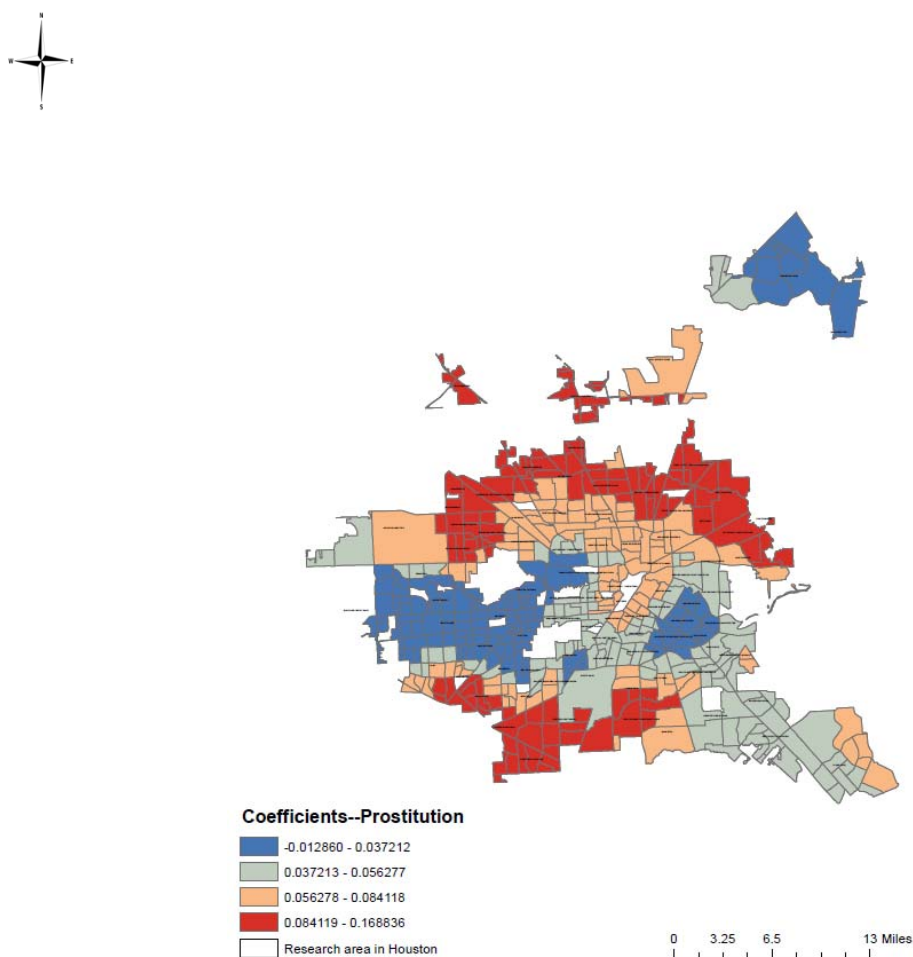


Figure 8. Coefficients for Prostitution Estimates On Violent Crime Rates 2010

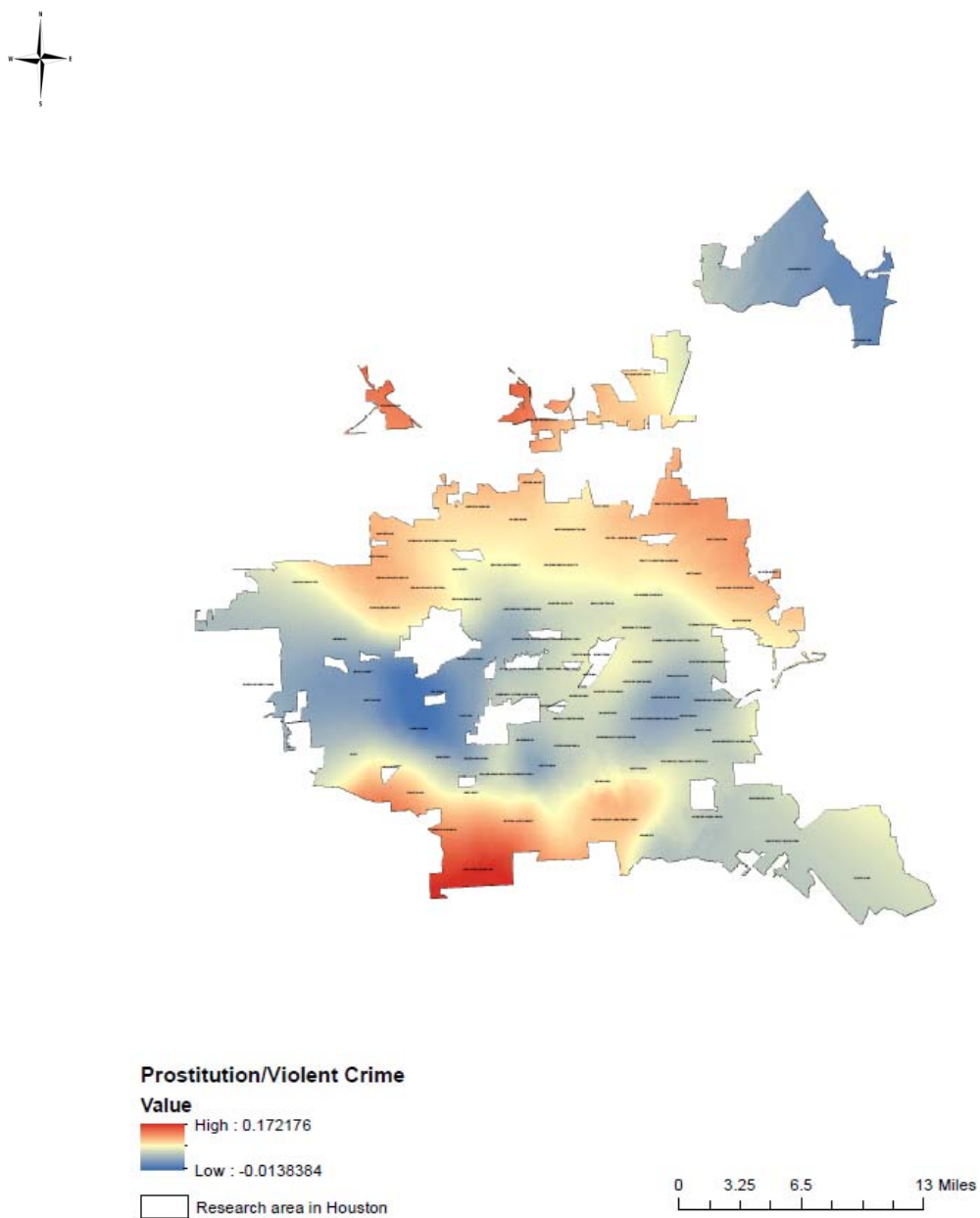


Figure 9. Prostitution Estimates Raster for Violent Crime Rate 2010

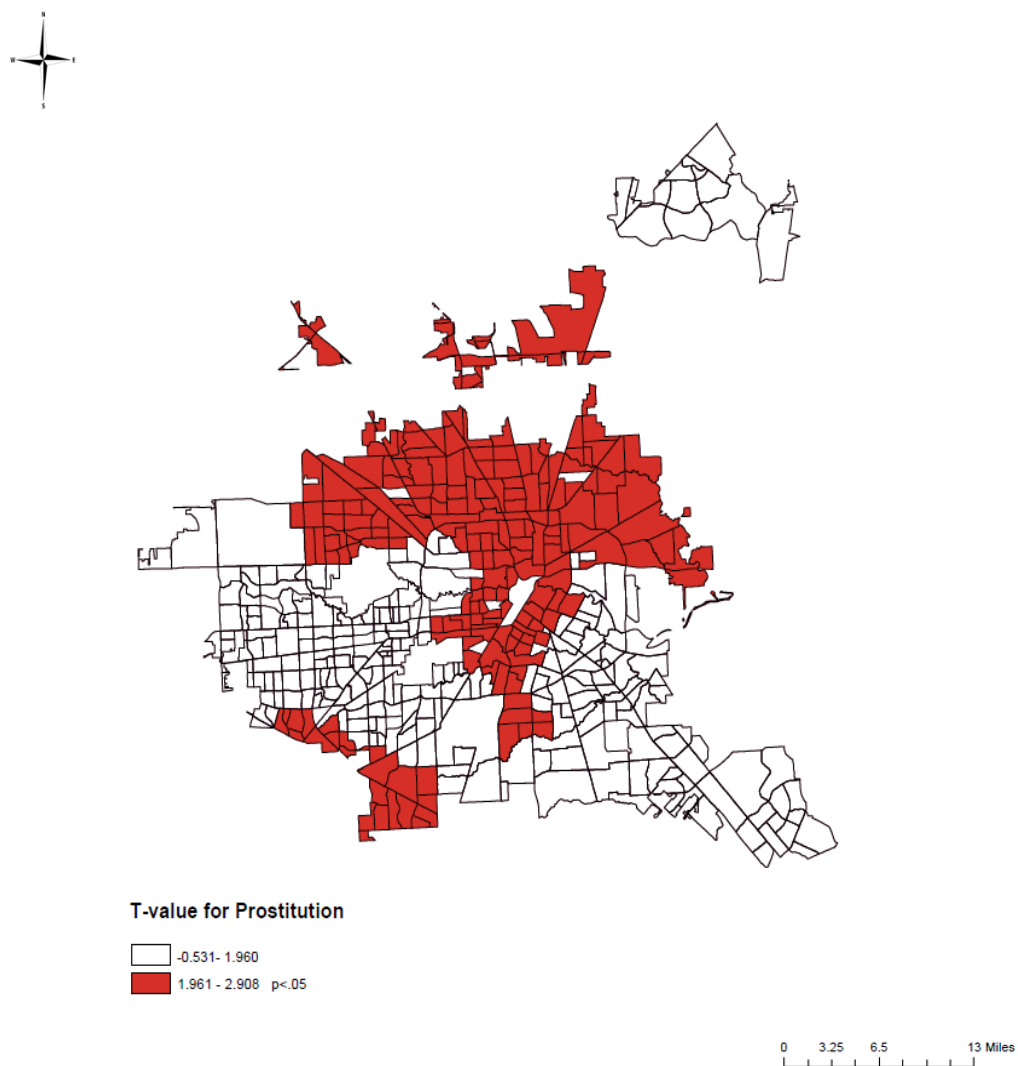


Figure 10. Calculated T Values for Prostitution Estimates on Violent Crime Rate 2010

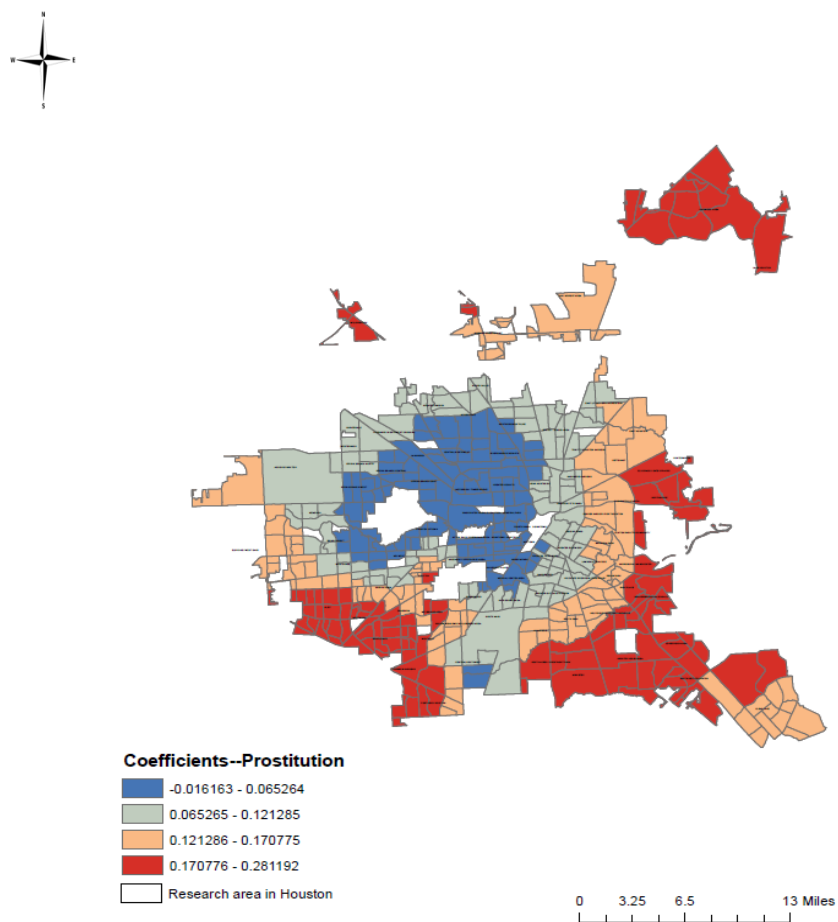


Figure 11. Coefficients for Prostitution Estimates On Property Crime Rates 2010

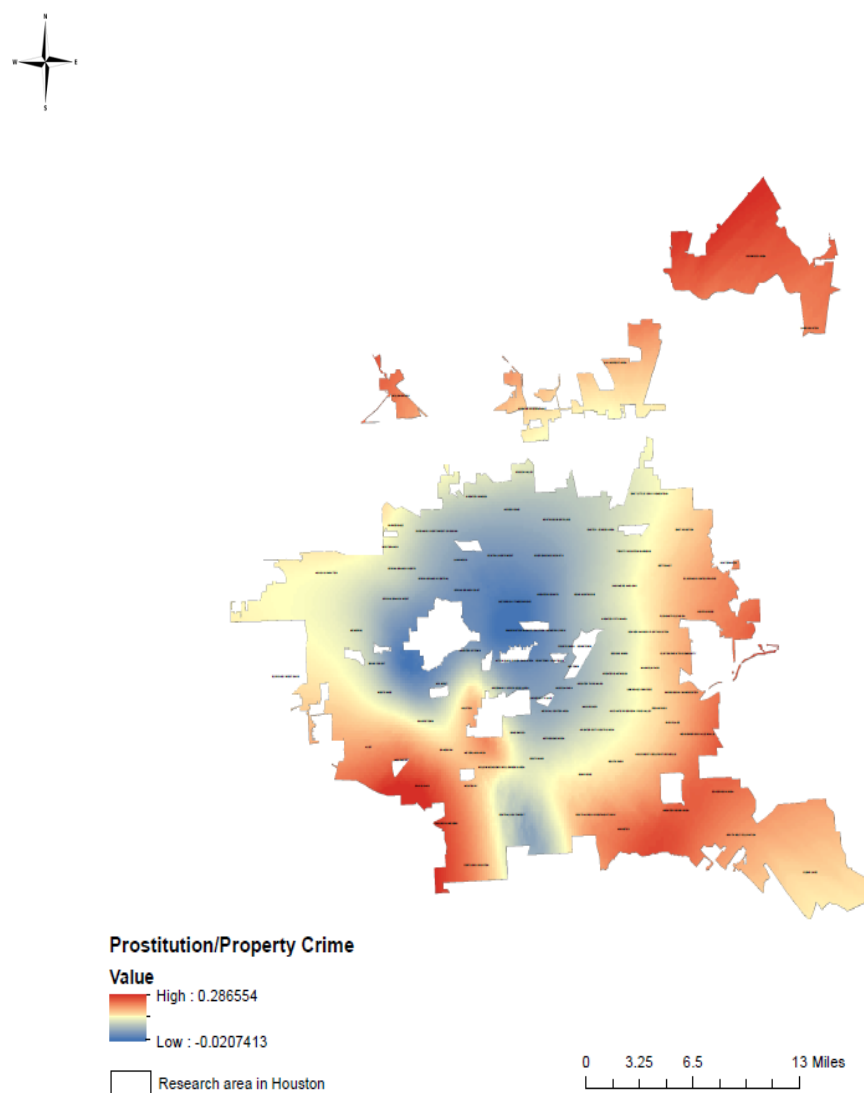


Figure 12. Prostitution Estimates Raster for Property Crime Rate 2010

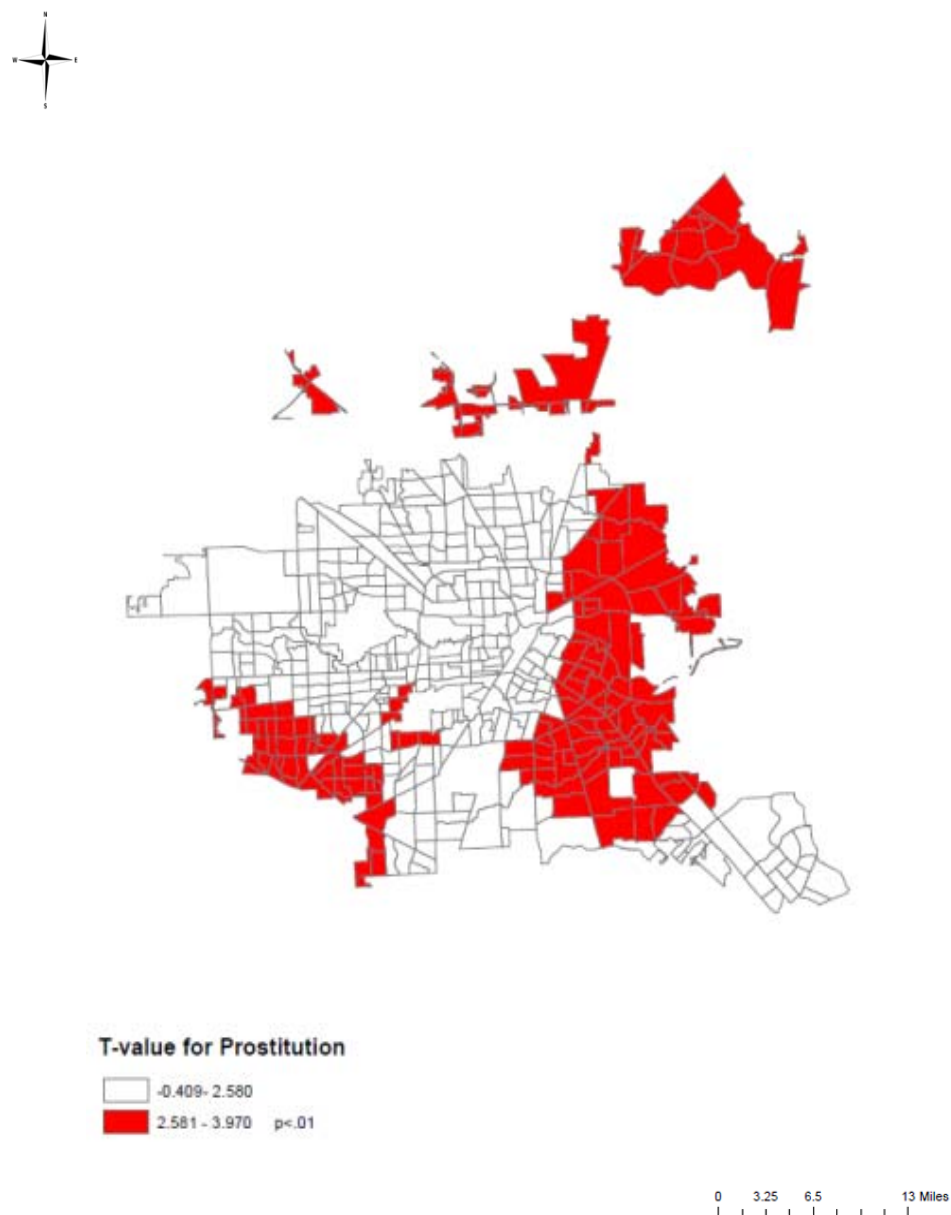


Figure 13. Calculated T Values for Prostitution Estimates on Property Crime Rate 2010

Mischief. In the present study, the GWR model of local analysis explored the significant regional variation of mischief estimates on both property crime and violent crime in Houston. As shown in Table 10, the estimated coefficients of mischief for violent crime rates in each census tract were all positive values but indicated a regional variance, ranging from .009 to .351 and the median value of the coefficients is .154. Similarly, the estimated coefficients for property crime rates were also distributed within a wide range from -.134 to .585, with the median value of .356. According to the raster surfaces shown in Figure 15 (for the logged violent crime rate in 2010) and Figure 18 (for the logged property crime rate in 2010), the largest coefficients for the former one (n=96) were clustered in east Houston from Spring Branch East to Greater Fifth Ward to Sunnyside (See figure 15, in red), whereas the highest value of coefficients for the latter one (n=85) were concentrated in central west Houston including Spring Branch West, Spring Branch areas, Mid-West, Greater Uptown, Greenway, Lawndale, and Braeswood Place (See Figure 18, in red). The spatial analysis of the present study suggests that mischief and violent crime were strongly associated ($p < .05$) across 386 census tracts (83%) and are concentrated in west Houston (Figure 16, in red), whereas, in the remainder of research tracts in Houston, the strong association between these variables can't be tested (see Figure 16, in blue). The spatial heterogeneity addressed here suggests that the increase of violent crime can be explained by the higher level of mischief in 83% of research areas within Houston, from which an increase in mischief policing would be the desired outcome. When comparing with the raster surfaces of three social components (see Figure 26, 27, 28), the compound effects among mischief, concentrated disadvantages, and residential stability can also be observed to positively influence the

local violent crime rate. In the areas of east Houston from Spring Branch East to Greater Fifth Ward to Sunnyside, mischief, concentrated disadvantages and residential stability all indicated the strong impacts on local violent crime rate in 2010, suggesting that the increase of mischief rate in the area with higher level of concentrated disadvantages and residential stability, were more likely to lead to the higher level of violent crime to occur. Hence, a focusing policing style on mischief is necessary for this kind of neighborhoods. Similarly, the significant association between mischief and property crime can only be explored in the central north to east of Houston (see Figure 18, in red). In particular, when examining the impacts of social components in those areas on property crime (see Figure 29, 30, 31), it showed that the mischief was a very strong predictor of local property crime rate in this area without being mediated by the social components, since strong influence of the three components were failed to investigate in this area in Houston. This finding supports the Broken Windows theory and suggests that a precise and focused disorder policing model on mischief issues should be addressed in those robust areas in Houston. Although the present study can only provide limited evidence to support the Broken Windows theory framework, without fully denying arguments that the association between mischief and crime result from their similar nature as crimes, the above findings still possess practical value for directing and focusing proactive, community policing. As a matter of fact, the existence of those indistinct areas both for violent crime (27% of the total tracts) and property crime (25% of the total tracts) also produce research value for further exploration. For example, in the area of Kingwood and Lake Houston, the increase of local property crime may be more likely to result from the higher level of social disadvantage (see Figure 29), immigrants concentration (see

figure 30) and residential mobility (see Figure 31), other than experiencing the increase of mischief (see Figure 18). The exploration of those buffer effects to the mischief and crime associations in the suburban area of Houston would provide important directions for the police department to balance its disorder policing with other crime prevention tactics in those neighborhoods and establish a geographically-tailored crime prevention strategy.

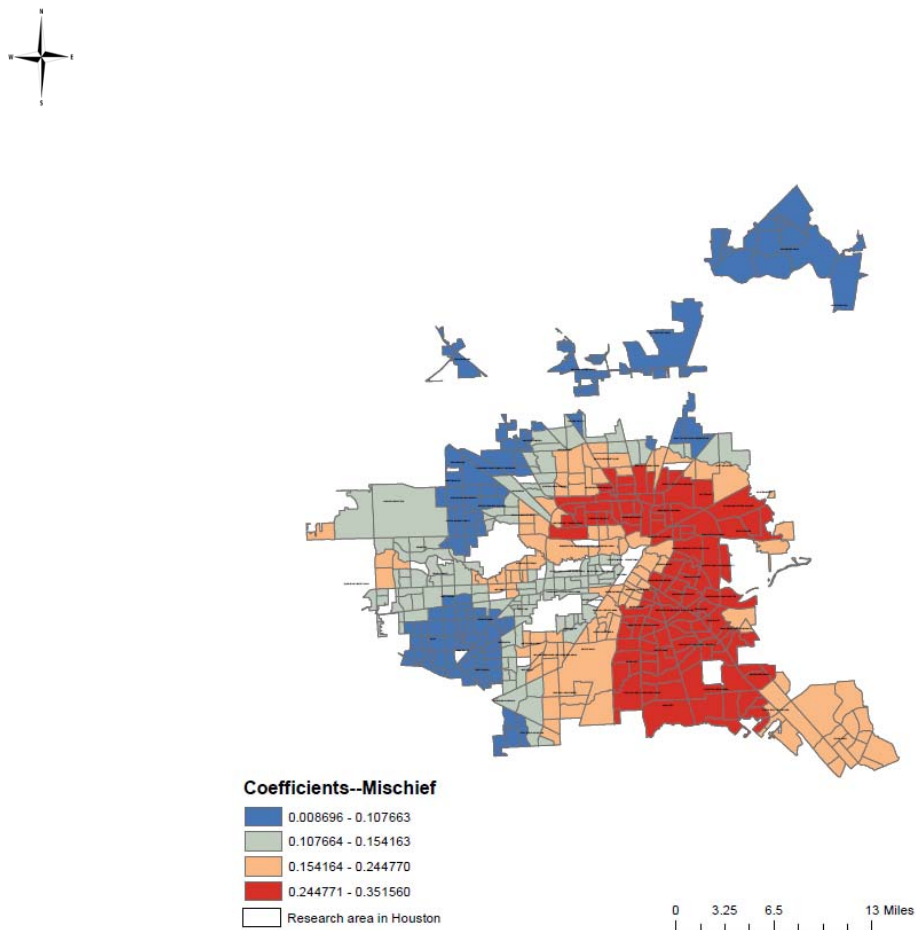


Figure 14. Coefficients for Mischief Estimates On Violent Crime Rates 2010

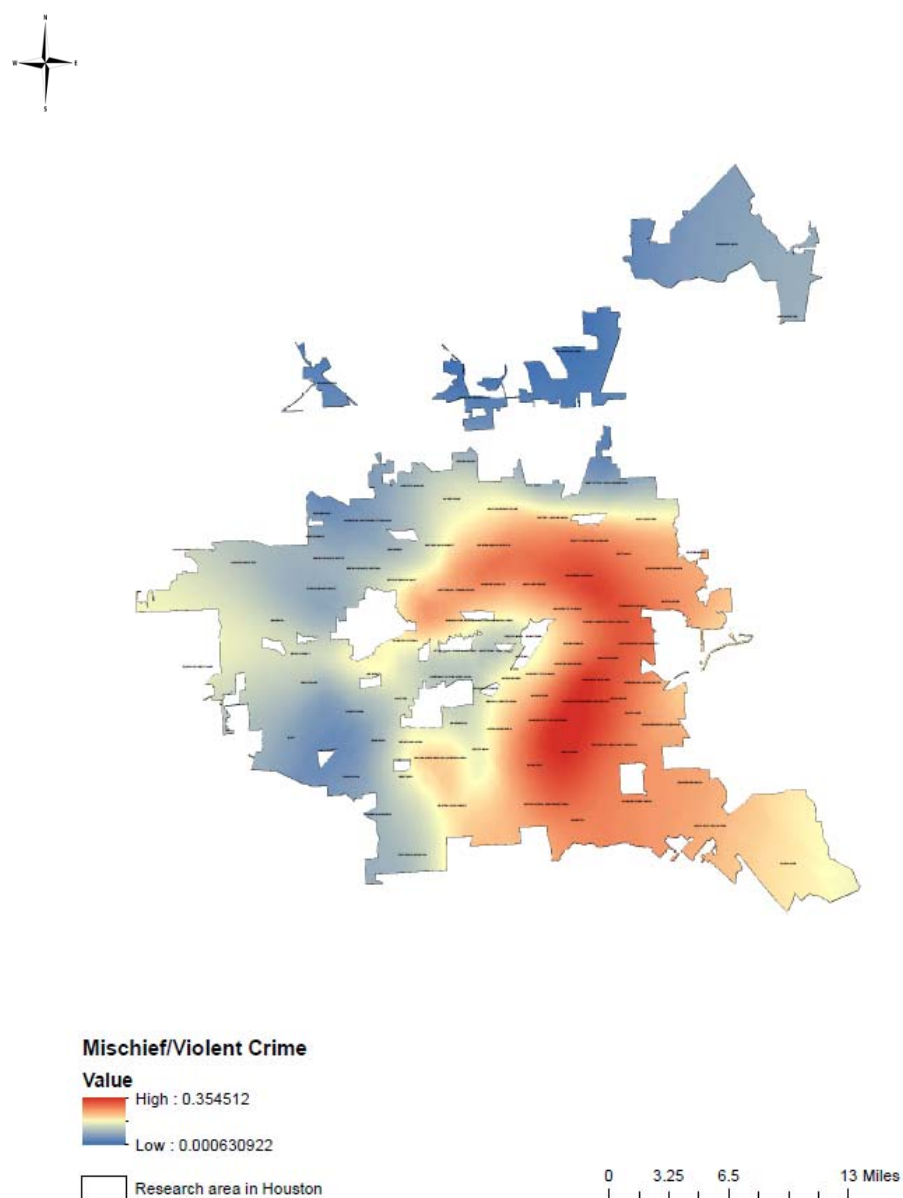


Figure 15. Mischief Estimates Raster for Violent Crime Rate 2010

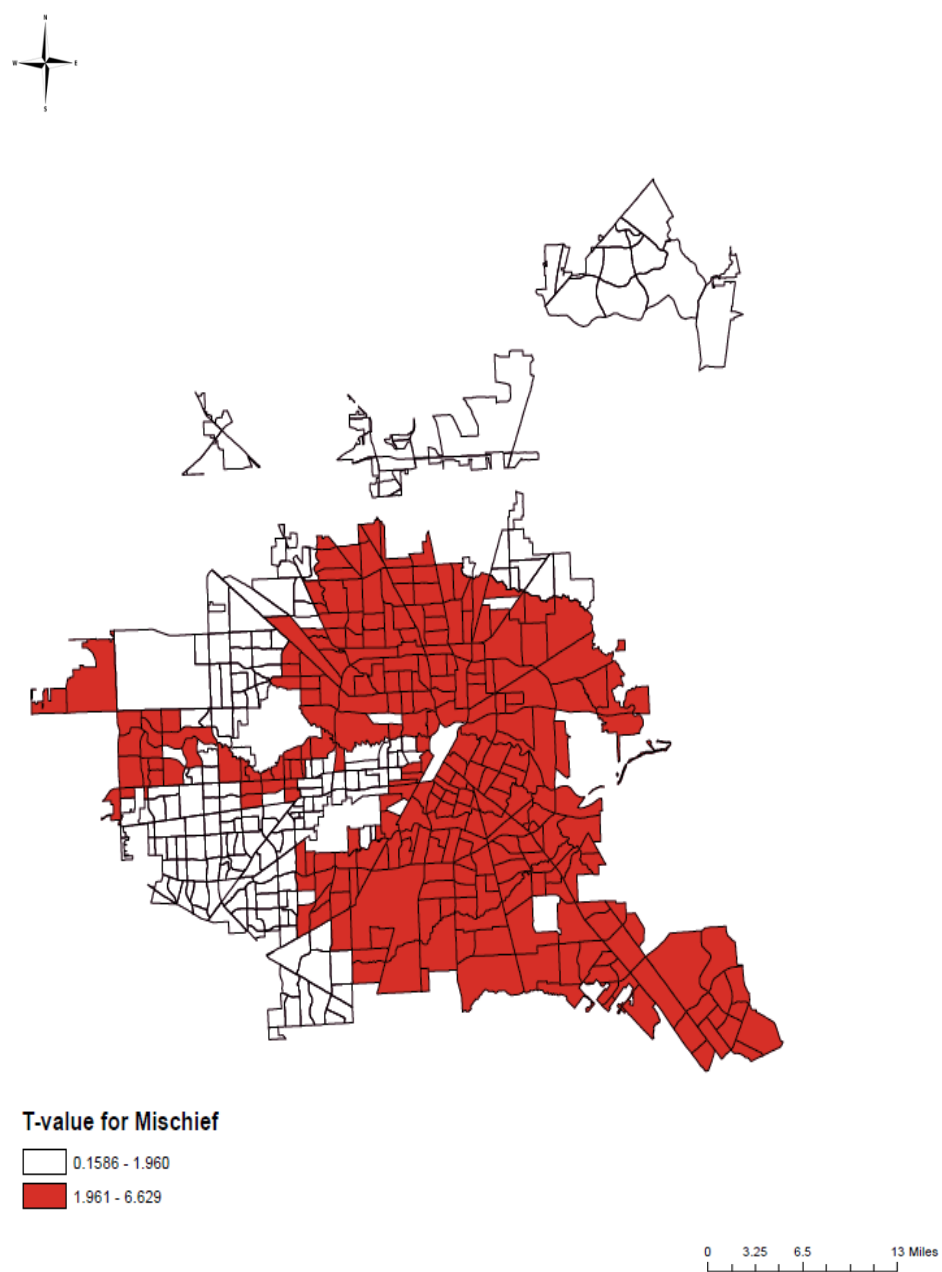


Figure 16. Calculated T Values for Mischief Estimates on Violent Crime Rate 2010

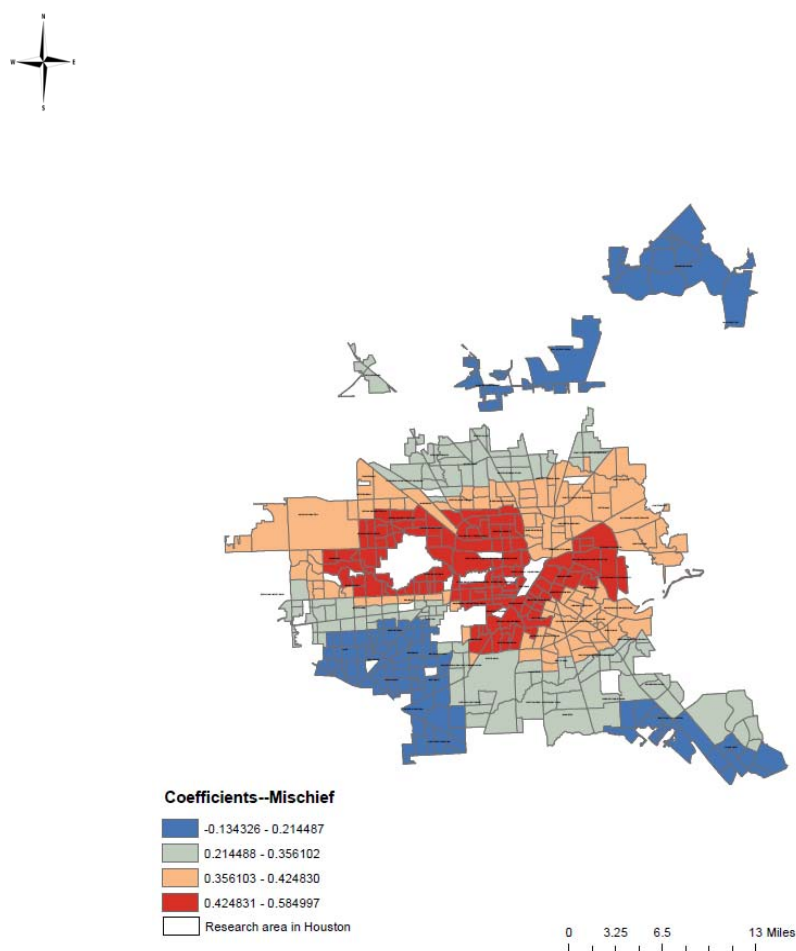


Figure 17. Coefficients for Mischief Estimates On Property Crime Rates 2010

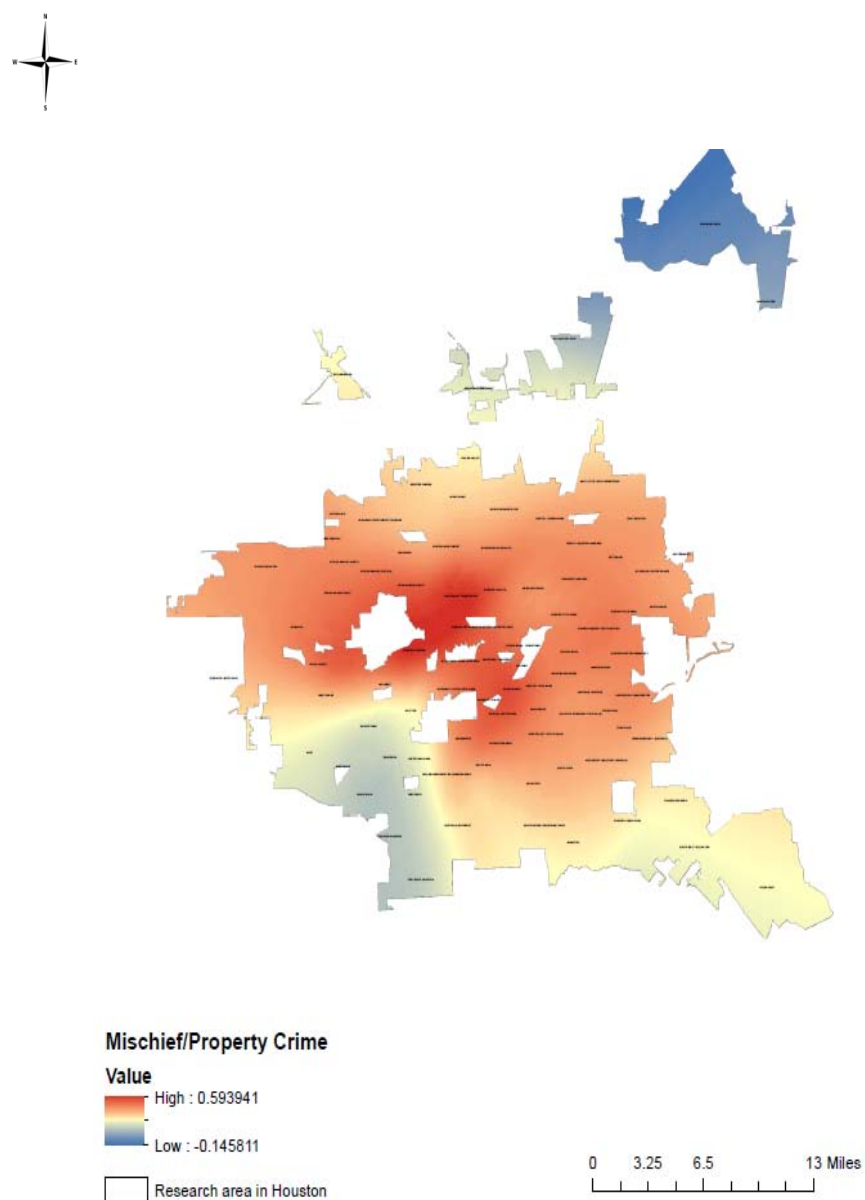


Figure 18. Mischief Estimates Raster for Property Crime Rate 2010

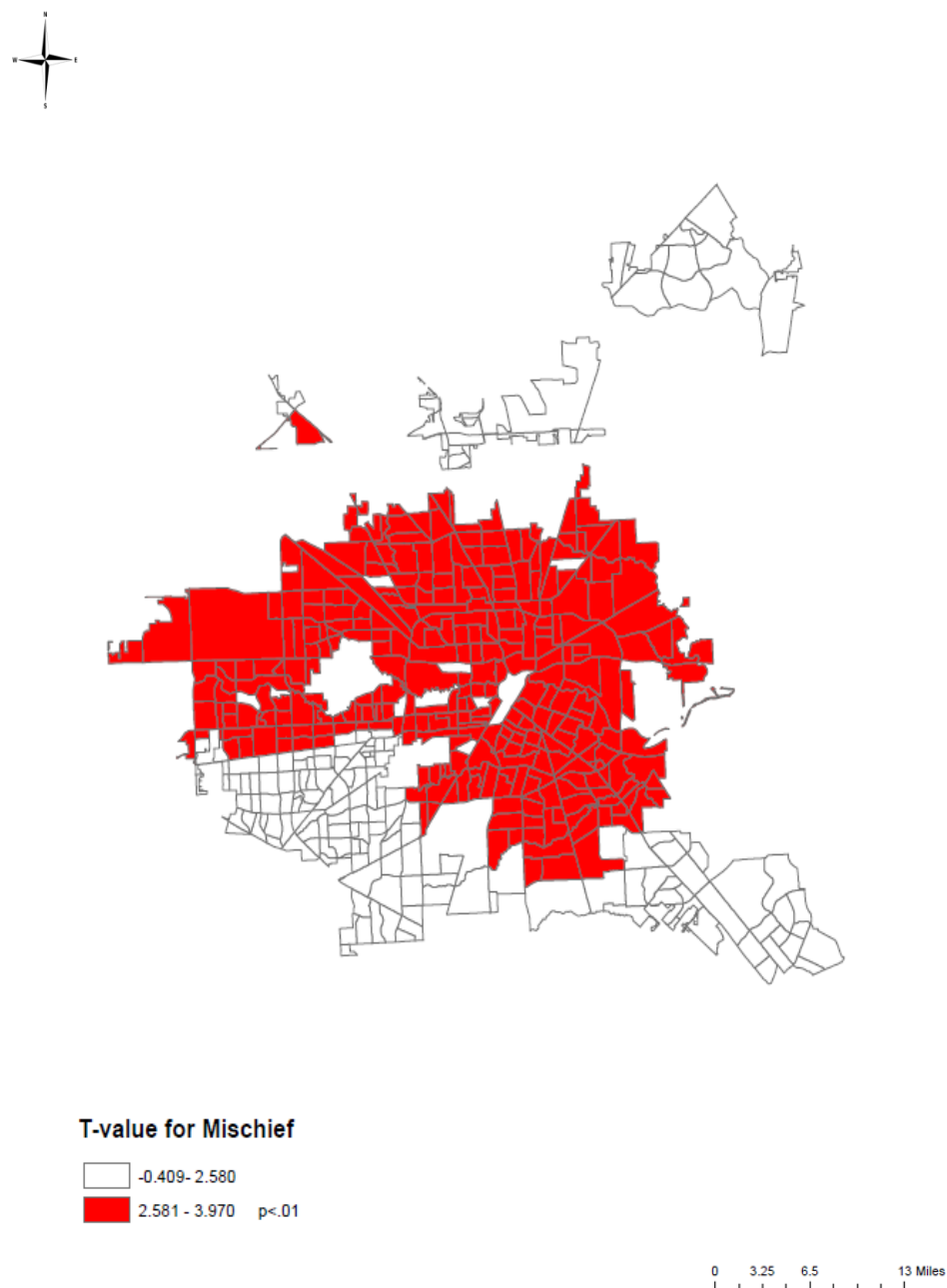


Figure 19. Calculated T Values for Mischief Estimates on Property Crime Rate 2010

Gambling. Similar to nuisance and prostitution, the relationship between gambling and violent crime or property crime also produced both positive and negative coefficients, indicating significant regional variations in the GWR model. As shown in Table 10, the coefficient estimates for violent crime ranged from -.026 to 0.157 and the median value of the coefficients was .067. According to Figure20, the highest values coefficients (n=113) were concentrated in the areas of (1) the Lake Houston, IAH/Airport Area; (2) East Little York/Homestead, Northside, Eastex-Jensen Area and (3) the west central area of Houston (in red, Figure 20), which suggests that gambling has strong impact on the violent crime rate in the west-central part of Houston. In terms of property crime, the GWR model analysis estimated the coefficients ranging from -.076 to .416, with a very unbalanced distribution. The median value of the coefficients was .153. The negative coefficients can only be found in nine census tracts (2%) in the research area and concentrate in middle-west Houston (Figure20, in blue). The remainder of census tracts (n=455, 98%) all indicate positive coefficients (in red). Among those positive coefficients, the cluster of the highest positive predictors (n=48) was found in the areas around the super neighborhoods of Central Southwest, Ford Bend, Westbury Willow Meadows, and Fondren Gardens; and across the Spring Branch West and Spring Branch North (See Figure 20, in red). Specifically, the strong associations between gambling and violent crime were discovered in the center to the west of Houston (see Figure20, n=211), which took up 45% of the total sample area. This finding suggests that in 45% of research areas, gambling acted as one of the explainers for the higher levels of violent crime.

Meanwhile, the spatial heterogeneity was also addressed by the linkage of gambling to property crime across the 464 census tracts (see Figure 23, 24). Although the significant positive association between gambling and property crime had been explored through the global OLS model, those strong impacts can only be found across 292 census tracts from the northeast to central north to west Houston, taking up 63% of the research area (see Figure 23, in red). Overall, the strong impacts of gambling on violent/property crime observed in several areas in research location of Houston, confirmed the main theoretical framework of Broken Windows theory (Wilson & Kelling, 1982). However, due to the significant spatial variance, this finding cannot be generalized as a global evidence for the predictive accuracy of the Broken Windows theory.

When compared with the effects provided by the social components on the local crime patterns in Houston, the present study discerns the existence of a compound effect among gambling, residential stability, and immigrant concentration on local crime. When comparatively analysis Figure 21 and Figure 27, it showed that the significant association between gambling and the violent crime can only be found in those areas where the coefficients of immigrant concentration also had strong impacts on the violent crime. In contrast, the gambling did not indicate strong impacts on the violent crime across remain 253 census tracts where the immigrant concentration did have a strong impact neither (Figure 27, in blue). These comparable situations imply the occurrence violent crime in some areas may result from the compound effects between gambling and immigrant concentration. In the neighborhoods that have more immigrants, higher levels of prostitution may be more likely to lead to the violent crime. The kind of compound

effects can also be explored from property crime patterns in the research location. Figure 24 and Figure 31 told us that in Houston, the neighborhoods where a strong association between gambling and the property crime can be explored were also located in the areas with lower coefficients of residential stability. It implies that in the neighborhoods with higher level residential mobility, prostitution would more likely to lead to the property crime to occur since those neighborhoods are lack of the “guardians” elements to avoid the property crime.

All in all, the proportional difference between significant and insignificant linkage of four kinds of disorders and crime can only partly support two kinds of opinions to the Broken Windows Theory. The existence of those un-robust areas may imply that there are some opportunity effects in neighborhoods that moderate the association between disorder and crime (Harris, 1976; Veysey and Messner, 1999; Groff and La Vigne, 2001). The spatial consideration of the Broken Windows theory, as Wilson and Kelling (1982) argued, suggests that associations between disorder and crime are more intricate than previous studies suggested. There are many kinds of interactions between social factors and disorders which would significantly impact the linkages between disorder and crime.

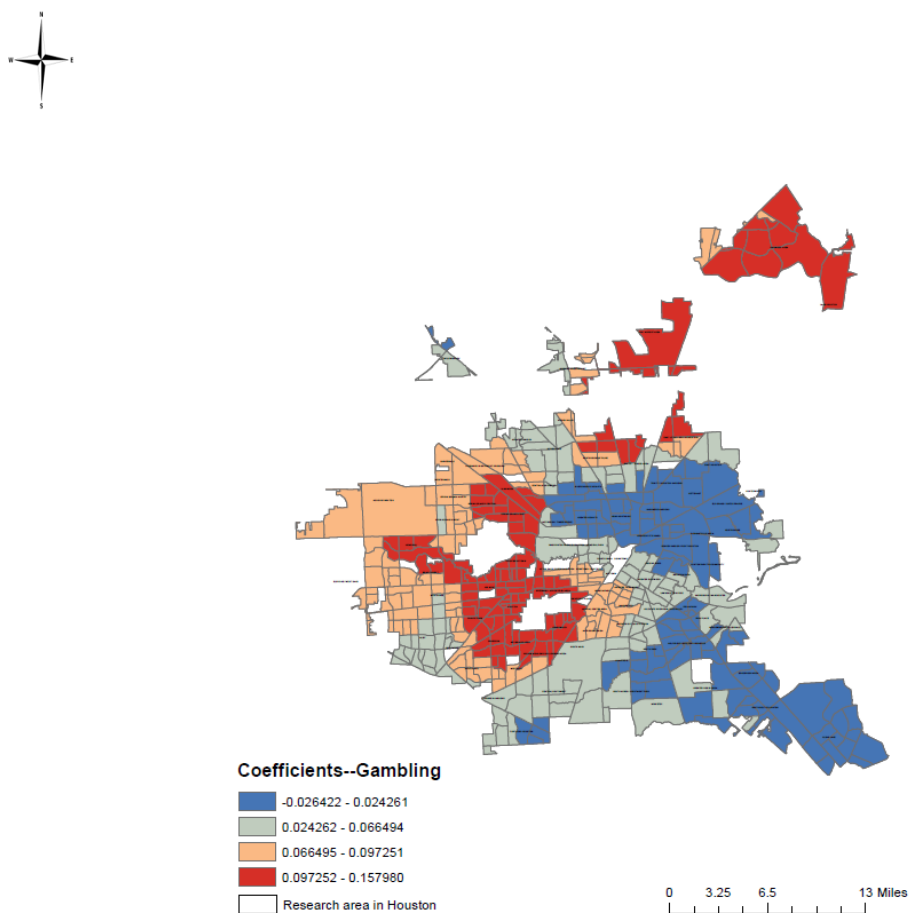


Figure 20. Coefficients for Gambling Estimates on Violent Crime Rates 2010

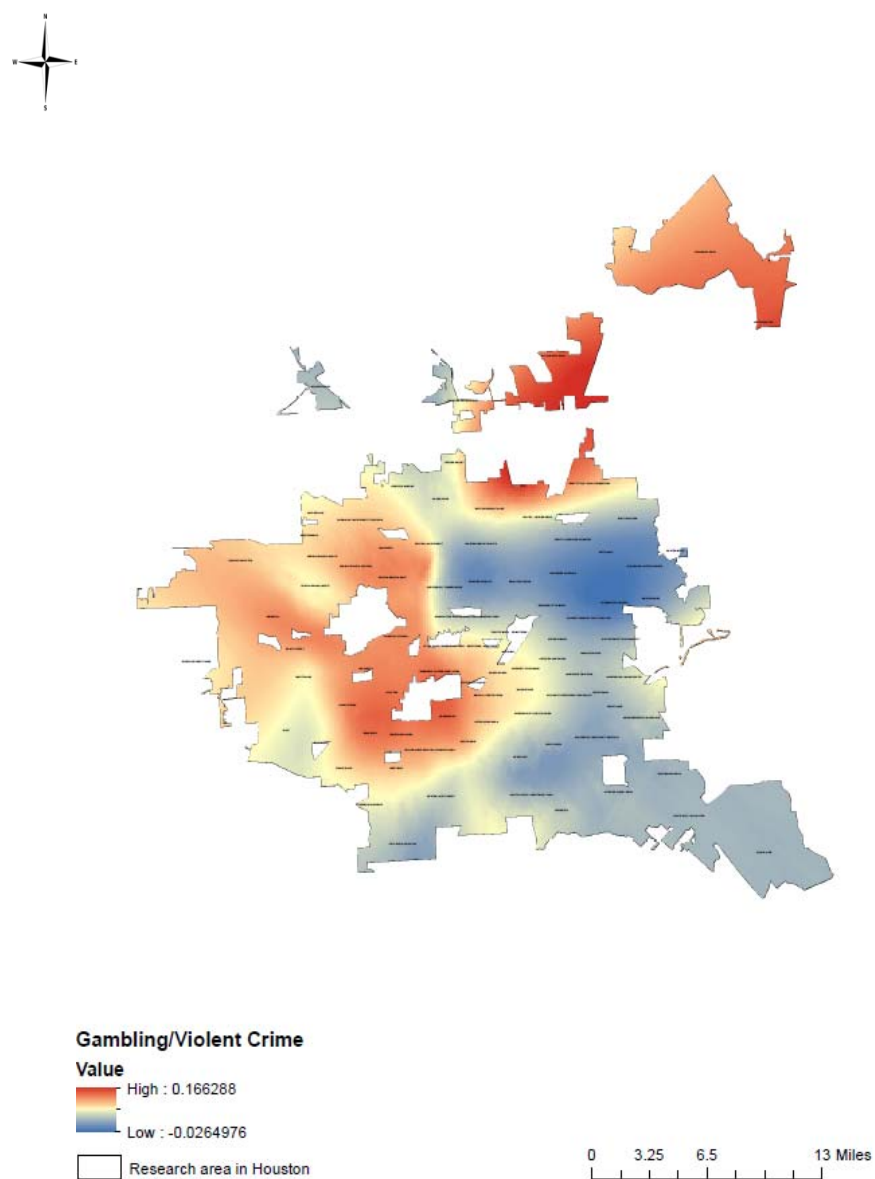


Figure 21. Gambling Estimates Raster for Violent Crime Rate 2010

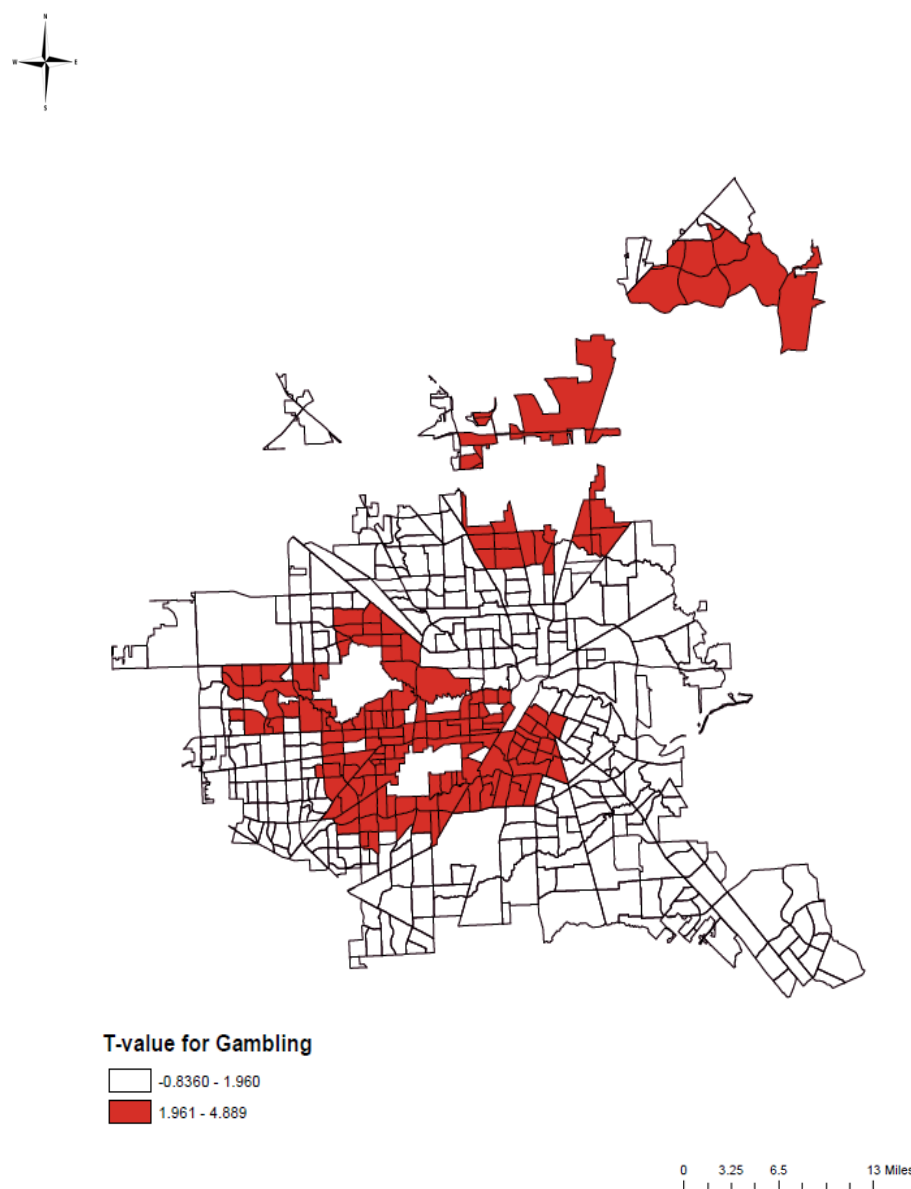


Figure 22. Calculated T Values for Gambling Estimates on Violent Crime Rate 2010

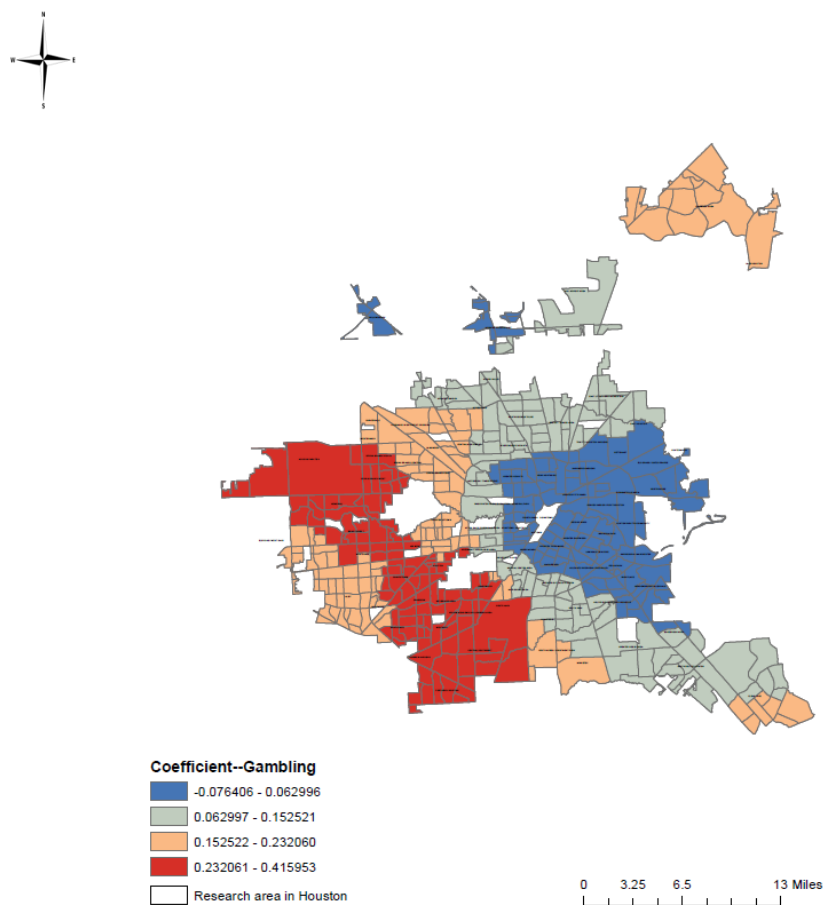


Figure 23. Coefficients for Gambling Estimates on Property Crime Rates 2010

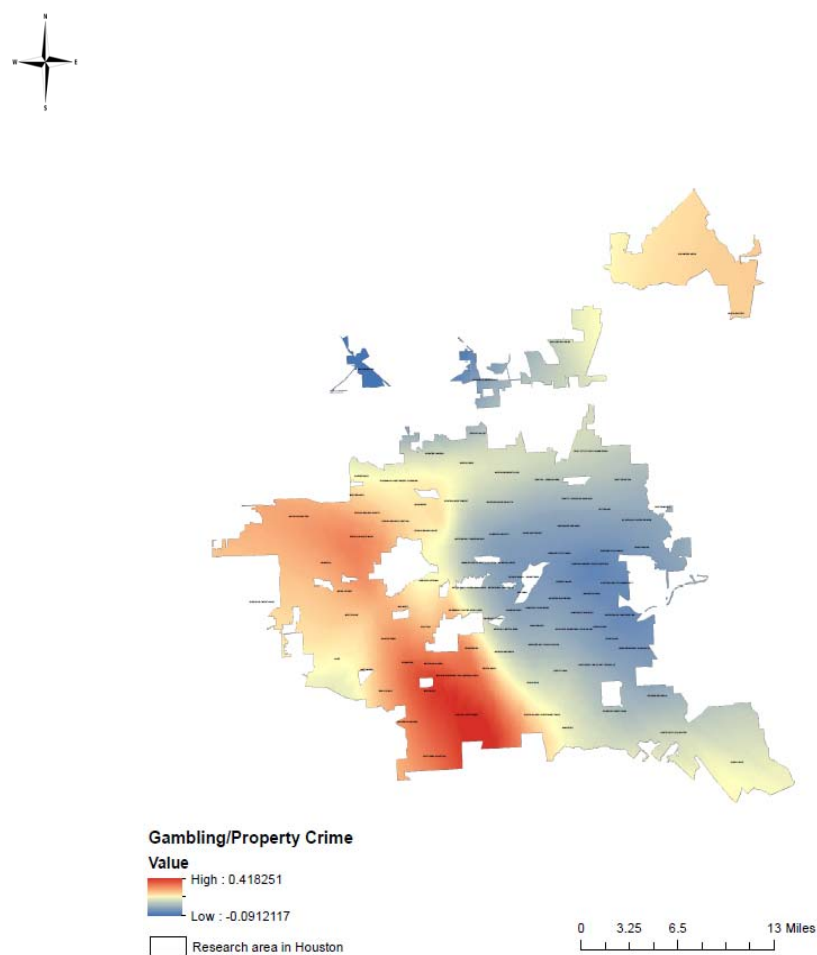


Figure 24. Gambling Estimates Raster for Property Crime Rate 2010

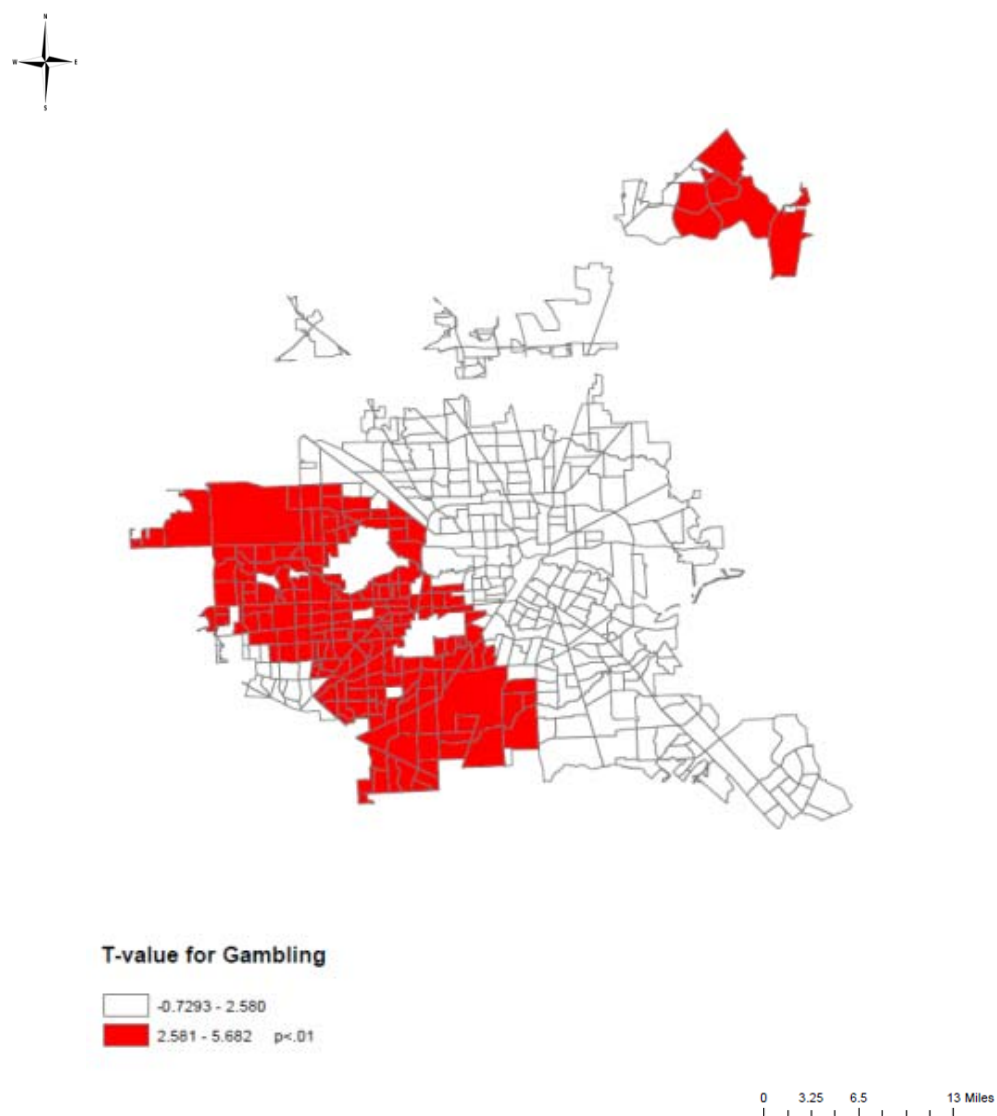


Figure 25. Calculated T Values for Gambling Estimates on Property Crime Rate 2010

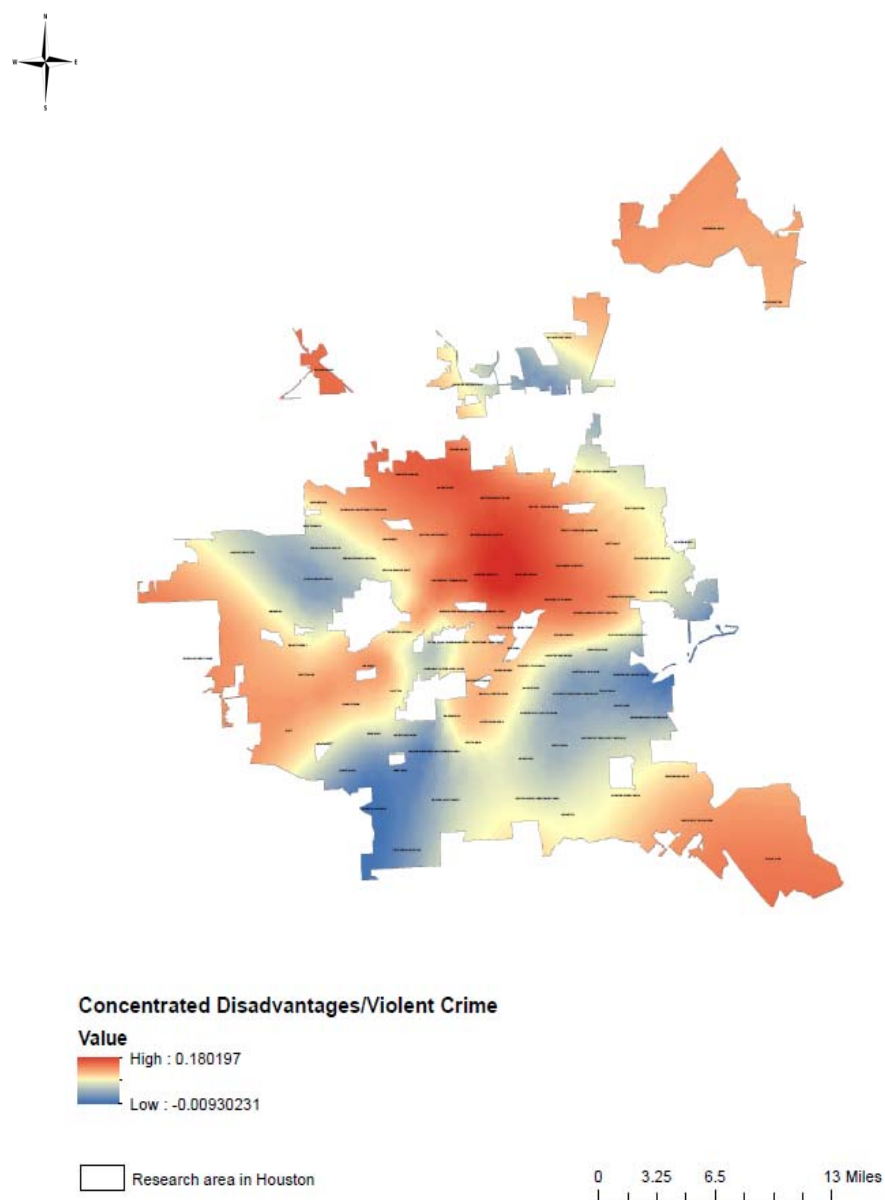


Figure 26. Concentrated Disadvantages Coefficients Raster for Violent Crime Rate 2010

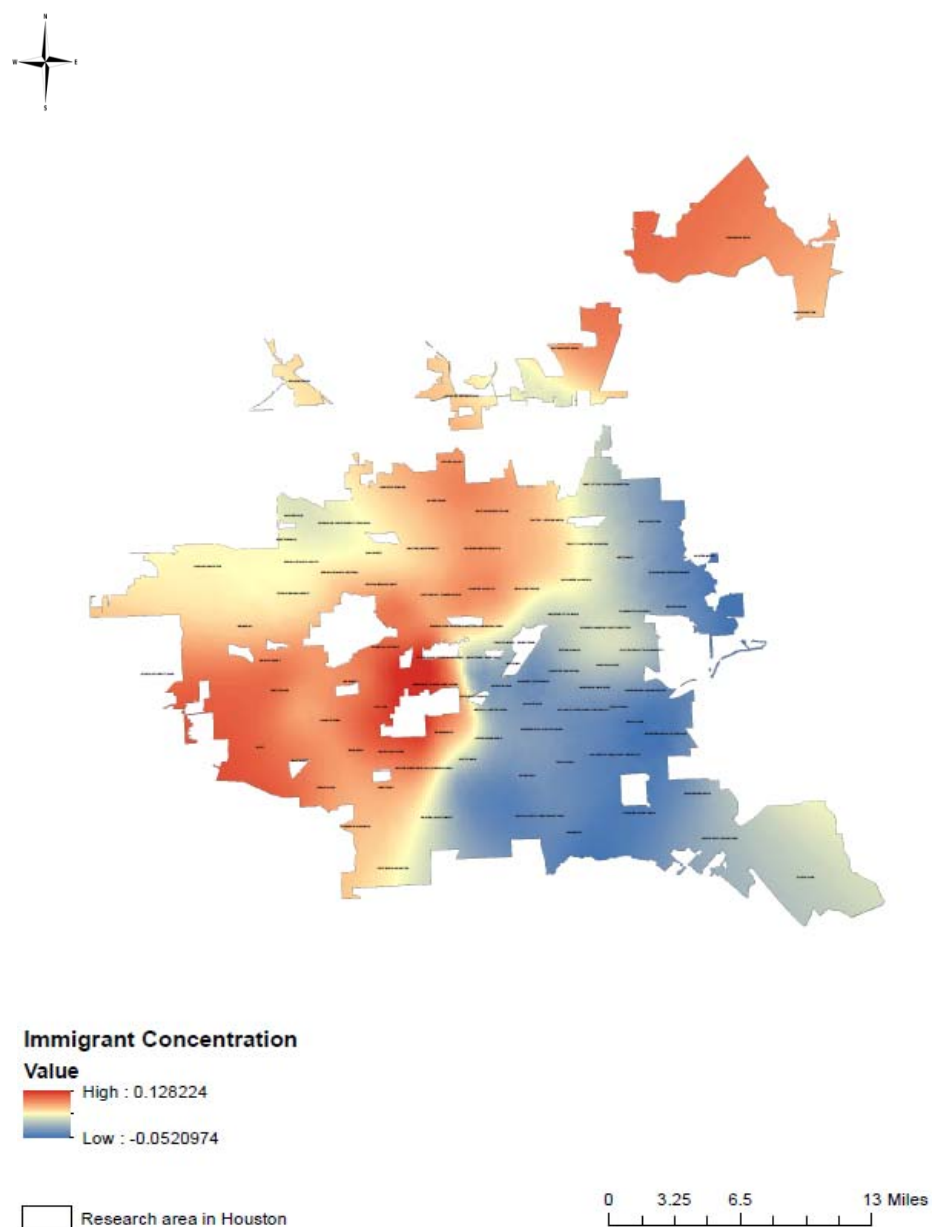


Figure 27. Immigrant Concentration Coefficients Raster for Violent Crime Rate 2010

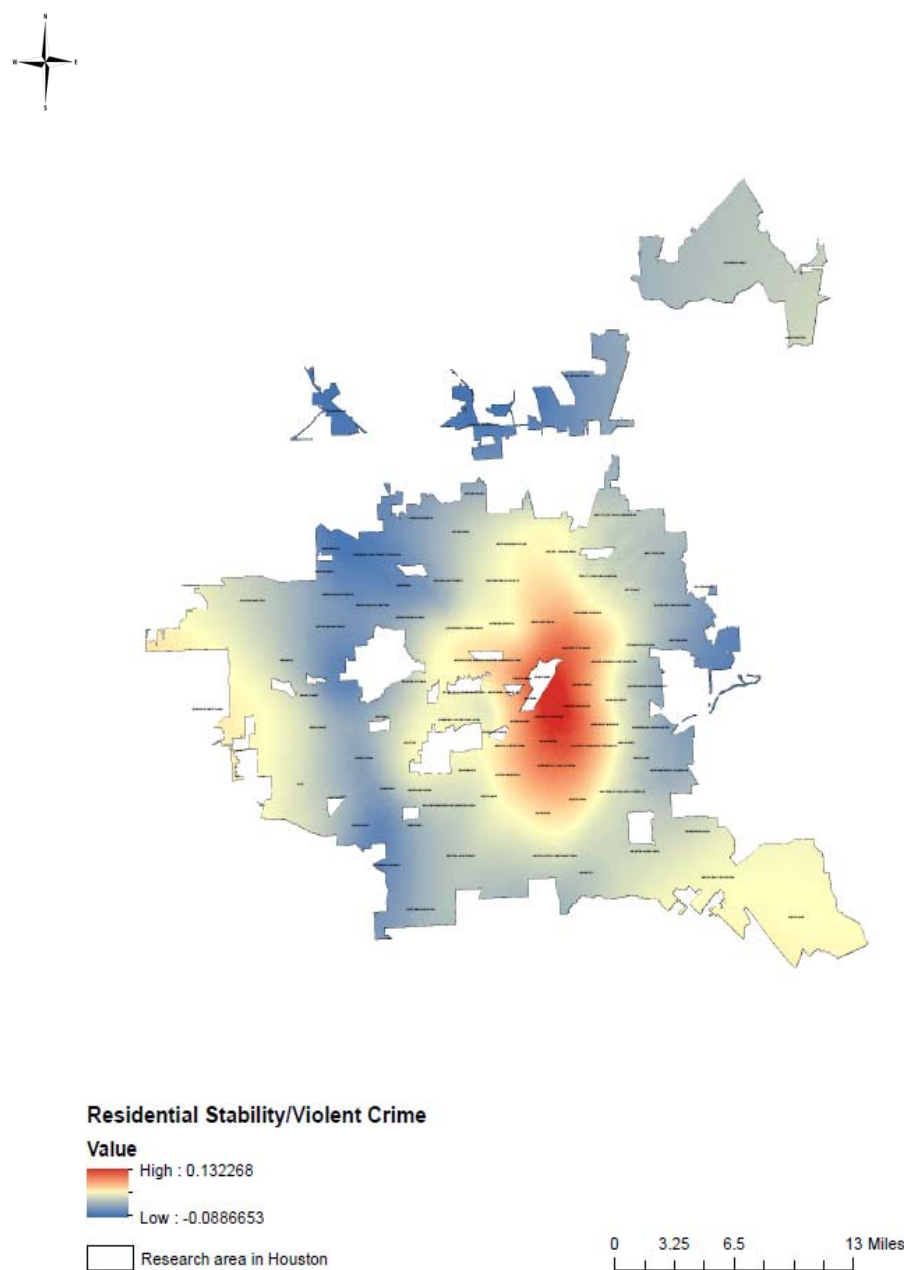


Figure 28. Residential Stability Coefficients Raster for Violent Crime Rate 2010

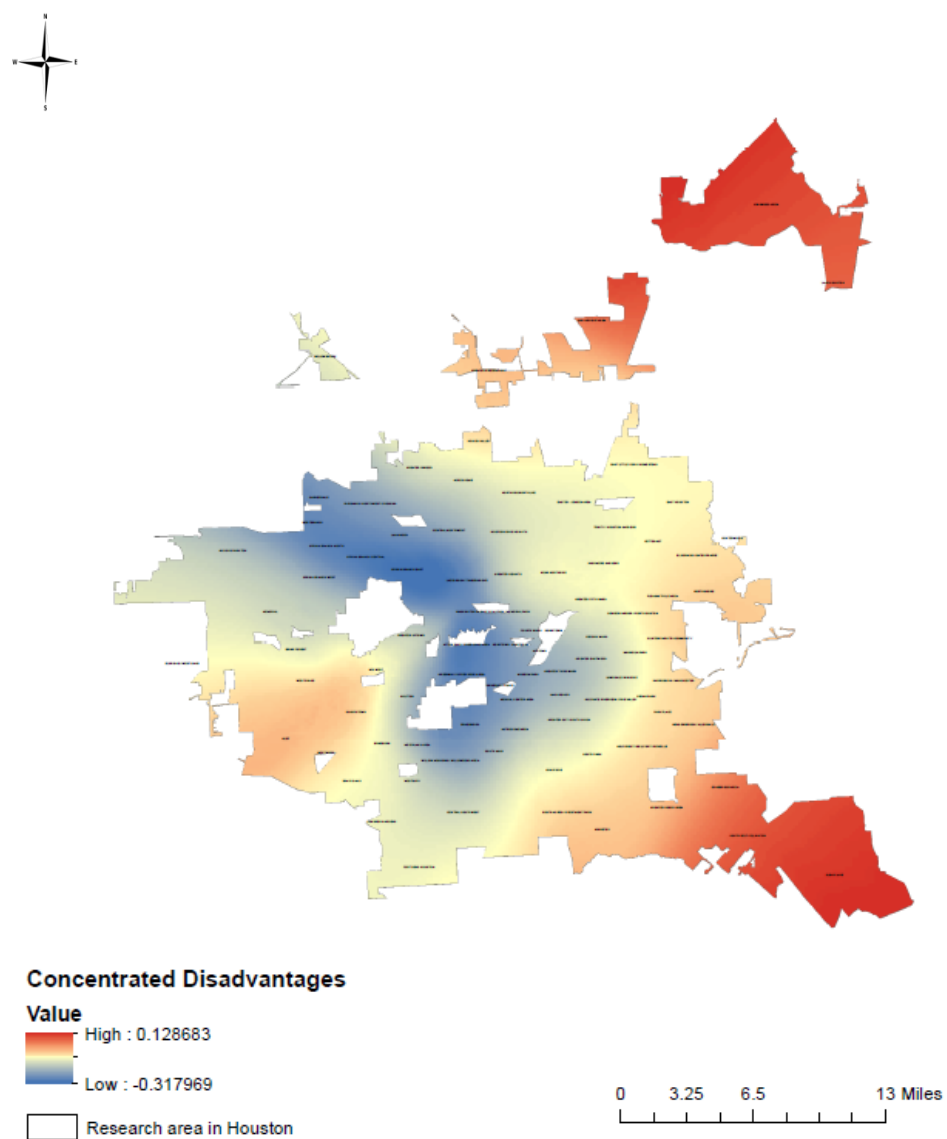


Figure 29. Concentrated Disadvantages Coefficients Raster for Property Crime Rate 2010

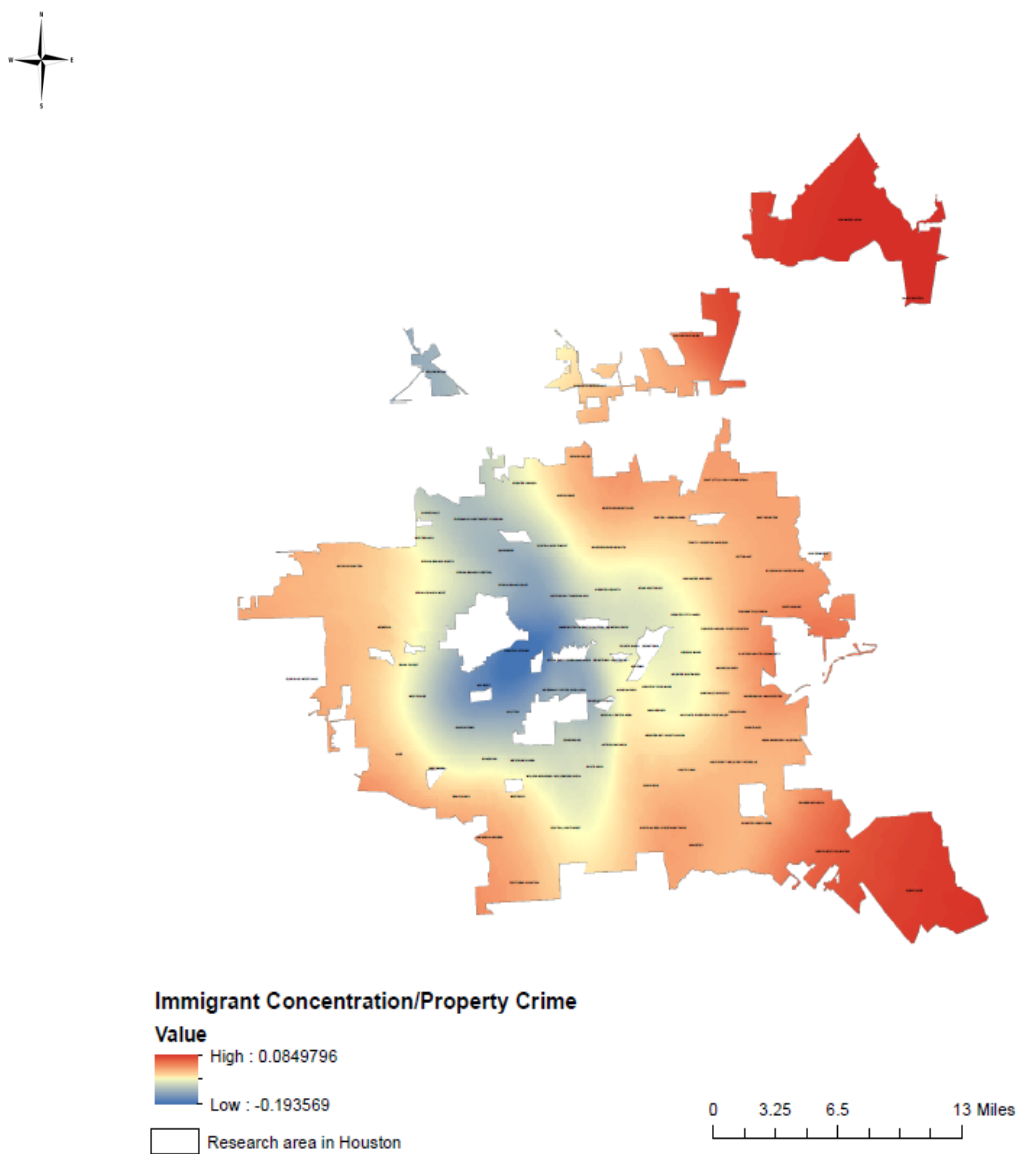


Figure 30. Immigrant Concentration Coefficients Raster for Property Crime Rate 2010

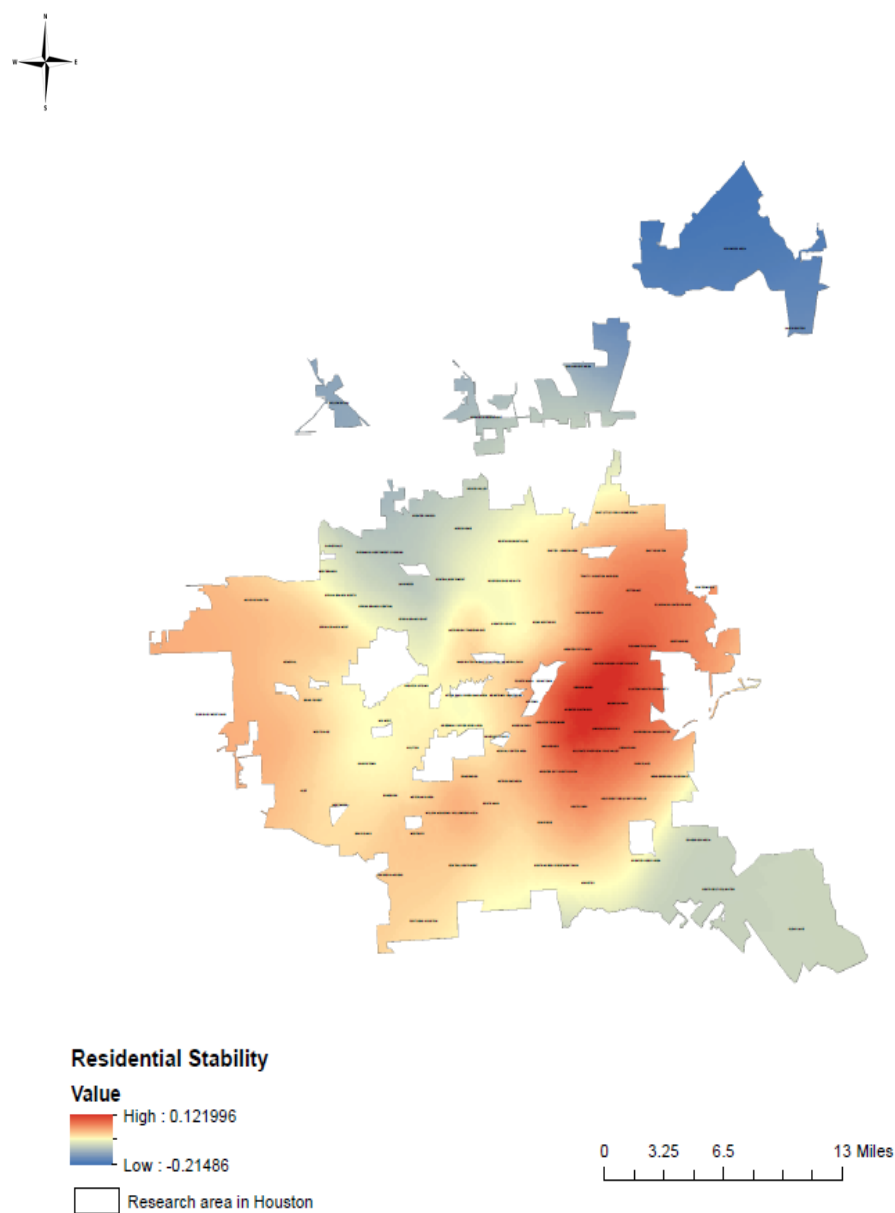


Figure 31. Residential Stability Coefficients Raster for Property Crime Rate 2010

Summary

Does disorder impact crime patterns in neighborhoods? The outcomes, utilizing the Geographic Weighted Model, visually demonstrates that the impact supported by the Broken Windows Theory does exist but also varied significantly across the research area of Houston. In general, the regional variation in the disorder and crime nexus across Houston neighborhoods is determined by three main factors according to the findings of the present study: First, the type of disorder; second, the social context of neighborhoods; and last, their collective efficacy. Of course, the present study also claims that the real situation of the neighborhood ecological environment is more complex than any individual study has predicted, hence, there are unmeasured effects existing that can influence crime patterns and their causal effects. If we consider the Geographic Weighted Regression results, we identify a number of issues. First, disorder and crime nexus are variedly concentrated in the city, which is determined by the type of disorder. We explored four itemized disorder issues-- a nuisance, gambling, prostitution, and mischief. According to the Broken Windows Theory, the nuisance is the physical disorder and the other three disorder issues belong to social disorder (Kelling and Coles, 1990). The raster coefficient surfaces of these four itemized disorders on crime indicate that the physical disorder and social disorders' impacts on the crime present significant spatial heterogeneity. Explicitly, the physical disorder can significantly impact crime in fewer areas in the city than social disorder. Previous research has discussed that social disorder, especially, the minor offenses in the neighborhood have actually the same qualitatively nature of the crime (Gau and Pratt, 2008). The existence of spatial heterogeneity of the social disorder and crime nexus suggest in the present study that

social disorder is independent of crime without the tautological issue. However, based on the comparisons among the concentrations of four itemized disorders and crime in the city, it shows that the severity of a minor offense acts as one of the factors to influence the disorder and crime nexus. The more serious a disorder, the more areas it would influence local crime. In the present study, the nuisance and crime association can only be explored from several small areas in the research location, whereas gambling, prostitution, and mischief can affect much larger areas. This principle can be adopted by evidence-based disorder policing and direct the police department to set priority level responses to the local disorders.

Second, the disorder and crime nexus are concentrated in the city differently and are significantly influenced by the social context of the individual neighborhood. One of the core issues of previous debates on the Broken Windows Theory is whether or not the disorder is an independent predictor of crime, or is a substitute to neighborhood contextual effects (Sampson & Raudenbush, 1999). The spatial heterogeneity of disorder and crime associations explored by the present study presents a more complex picture. The direct association between disorder and crime is discovered in several areas, where the neighborhood social contextual factors do not present strong impacts. For example, in the West Main area, the nuisance is found to strongly impact local violent crime whereas, in the area of Central Northwest and Lazybrook/Timbergrove, the nuisance is revealed to strongly impact the local property crime. Since the social constraints failed to significantly impact local crime, it implies, in the area of West Main area, the increase of nuisance issues would increase the fear of crime of local residents. At the same time, it would inform the criminals of the lack of neighborhood carelessness. Inherently, this

neighborhood would locally experience higher levels of violent crimes (Wilson & Kelling, 1982). Similarly, in the area of Central Northwest and Lazybrook/Timbergrove, the increase of the nuisance issues act as the signal that this area has a lack of informal control and lack of "guardian" elements, otherwise, the residents would likely rely on the neighborhood to deal with the nuisance issues and less likely to call the police for help. As a result, this area would more likely suffer from a higher level of property crime, due to the lack of local attachment and "guardians". On the other hand, for the social disorder such as gambling, prostitution, and mischief, the present study shows that the neighborhood social disadvantages, and immigrant concentrations are more likely to moderate and enhance the impacts of social disorder on crime. Stated differently, gambling, mischief and prostitution are revealed to strongly impact local crime in the research area of Houston that exercises a strong impact of social disadvantage and immigrant concentration. As Social Disorganization Theory suggested, the neighborhood disadvantages characteristics, such as poverty, unemployment rates, and female-led households are more likely to lead to a higher level of minor offences and crimes to occur in those neighborhoods (Shaw & MacKay, 1946; Sampson and Raudenbush, 1999). The findings of the present study also suggests that in Houston, the social disorder issues are more likely to impact crime in those areas where the immigrant concentration acts as one of the strongest predictors of crime. Although, some research has suggested immigrants are the reason why a neighborhood has less crime, the reality of Houston supports the studies that provide the opposite suggestion, which is that immigrants are responsible for more minor offenses and crimes in Houston. Lastly, disorder and crime association can be buffered in some areas of Houston that commonly have a high level of collective

efficacy. Both the Broken Window Theory and collective efficacy address the fact that collective efficacy is the "guardian" factor of the neighborhood to avoid crime (Sampson & Raudenbush, 1999; Wilson & Kelling, 1982). Wilson and Kelling (1982) argued that the disorder and crime nexus can be invented by the increase of informal controls other than totally relying on policing disorder. In the present study, households are discovered to present a higher level residential stability in the east central area of Houston. Whereas, in this area, except for mischief, gambling and prostitution each lost their strong impact on local crime. According to the previous study, residential stability is more likely to strengthen residents' local bonds, hence, the higher level of collective efficacy would be generated in those areas (Sampson and Raudenbush, 1999). Therefore, the present study discovers that in the east of Houston, the higher levels of neighborhood collective efficacy acts as the "guardian" factor to distinguish the association between social disorder and crime.

CHAPTER V

Discussion

Main Findings

The target of the present study is to test the Broken Windows theoretical framework by focusing on the spatial and temporal associations between four kinds of neighborhood disorders (Independent variables) including nuisance, prostitution, mischief, gambling and both violent crime and property crime (Dependent variables), using a large scale of spatial data collected in 665 census tracts in Houston. For a broad exploration of neighborhood crime patterns, three neighborhood social components that are commonly used in neighborhood studies: (a) concentrated disadvantages, (b) immigrant concentration, and (c) residential stability are applied to verify the impact of social characteristics of neighborhoods on crime and disorder associations (Hipp, 2007; Shaw and Mackay 1942; Sampson and Randenbush 1997, 1999).

The temporal variance of crime and disorder associations are examined by comparing the individual coefficients of multivariate OLS regression for the violent crime and property crime within in each time progression (1/2010-12/2010; 7/2010-6/2011; 10/2010-9/2011; 1/2011-12/2011). The results of multivariate regressions respond to the first two hypotheses proposed by the present study (see Chapter I) by revealing that, first, the predictive relationships between each neighborhood disorder issues and crimes are varied. Second, the itemized disorder and crime linkages are also variedly influenced by social structural characteristics. Third, prostitution being the exception, nuisance, gambling, and mischief are revealed to have a consistent relationship

with violent crime and property crime in Houston tracts during the twenty-four analytical months from 2010 to 2011.

Results discussed in Chapter 4 showed that limited temporal indicators are present in the current study because, in the global model, the association between itemized disorder and either property crime or violent crime all stay consistent in 2010 and across four-time progressions whether they are statistically significant or insignificant. Two reasons may explain these results. Routine activity theory has suggested that the individual crime types are occurring in the same places and that these locations remain the sole target sites of offenders no matter what time of year (Cohen & Felson, 1979). Also, the climate is an important variable influencing the temporal pattern of crime. Linning (2015) stated that in Vancouver and Ottawa, Canada, property crimes indicated a significant peak in the summer months when humid continental climates dominated, whereas, without the consideration of climate, “micro-spatial patterns of property crime remain relatively constant throughout the year” (Linning, 2015, p.544). Unlike the two cities stated above, the climate in Houston is characterized as humid subtropical. The temperature in Houston has less change through the year, which leads to very minimal seasonal changes. It can be assumed that the comparatively steady temperature and inexplicit seasonal climate changes would lead to the result that both crime and disorder occurrences did not significantly change during the 24 months across the census tracts in the present study.

Compared with the temporal aspects of their linkages, more contributions have been made in the examination of spatial aspects of crime and disorder nexus in the present study. The diagnostic of spatial auto-correlation and model fit based on Moran’s

I and AIC suggested that the global multivariate regression failed to control the spatial autocorrelation and reflected non-constant response covariate associations across the study area, whereas the GWR model for the same parameters analysis is a superior fit to deal with the weakness of the global model. Therefore, the GWR model is applied in the present study to control the spatial autocorrelation and explore the spatial heterogeneity of the associations between each type of disorder and crime, as well as the linkages of social components to these regional variances using 2010 as the analysis year.

Are the observed associations between disorder and crime constant across Houston or are the associations stronger in particular neighborhoods of the city than in others? The spatial assessments of the associations or linkages among disorder, social components and crime prove that the spatial heterogeneity unavoidably exists in the research area of Houston. The assessing of regional variance of disorder and crime associations in the present study suggests again that geography does matter in interpreting the disorder-crime linkages in neighborhoods (Wilson and Keling, 1982). Based on the GWR model of analysis, the present study illustrates and visualizes the comprehensive associations between crimes and itemized disorders by considering interactions with the social disorganization factors and other unmeasured situational mechanisms in the neighborhoods.

As aforementioned, many researchers have made great and consistent efforts to test the direct effects of disorders on crime. However, the large-scale administrative dataset and modern spatial analysis technologies present us with a picture that is more complex than had previously been assumed. The existence of spatial heterogeneity addressed by the present study, reveals that the local level of analysis is preferable than

the traditional global model of analysis in neighborhood studies. The neighborhood is an intricate and complex eco-system and crime is an activity that is caused by both necessity and opportunity. Hence, the crime predictor that is geographically measured in the neighborhoods is unlikely to be fully explored by following global linear models. Spatial analysis responses to the limitation of global analysis and imply a new avenue to explore the challenged and intricate research topics in the neighborhood studies addressing spatial auto-correlation, regional variance and taking the local characteristics into account.

The current study addresses the premise that since the associations between disorder and crime do exist (no matter causal effects or not) but vary across Houston census tracts, the future study on BWT could make empirical progress by testing each part of its theoretical mechanism and its linkage with other neighborhood-related criminological theories, as some scholars have suggested (Weisburd et al., 2015). From a police study perspective, the results of the present study also encourage us to argue that for disorder policing in neighborhood crime prevention, we cannot rely on a “cure-all” for police tactics, for example, zero-tolerance policing will not solve all neighborhood crime related issues. The local level of analysis, by addressing the spatial and disorder typological differences would combine more values for policy and police practice.

By this dissertation, I attempt to contribute to both substantive and methodological development of neighborhood-level research on BWT. Based on the findings and intent of the present study, three dimensions of future research and practice focuses are recommended including micro-level measurements of disorder; a localized analysis of the spatial heterogeneity of neighborhoods; and a precise understanding of disorder policing tactics by applying three different models.

Research and Policy implications

The disorder could be considered as a diverse concept and examined locally using a large-scale administrative dataset. As discussed in the previous chapter, when Wilson and Kelling published their research on the Broken Windows theory in *Atlanta Quarterly* in 1982, they did not empirically define disorder (Wilson & Kelling, 1982). Other researchers were inclined to measure disorder as a homogeneous concept and explore the global effects of disorder on crime based on their own interpretation. Early in 2001, Taylor (2001) commented on the weakness of previous survey measurements on disorder by admitting that when the attention of empirical studies on the Broken Windows theory developed from individual resident to a community focus, the traditional measurements of incivilities, relying on the survey or on-site assessment, were even more questionable. He (2001) revealed that the problematic aspect of previous measurements was that they lacked the consideration of other groups who use neighborhoods (difference besides residents) and failed to reflect the connection between incivilities and social context. His argument is not difficult to understand. For example, we cannot assume that simply litter and raised voices would cause the same level of fear of crime to the residents or provide the same confidence to offenders to commit a crime in those areas. In particular, simply as a life experience, nuisance, and disturbances could definitely lead to a different level of residents' fear of crime, which inherently results in different levels of the informal control reduction, and then influences differently the concentration of future crime. From the empirical standpoints, simply aggregating the effects of each disorder together can't avoid the threat to the validity and reliability of the disorder measurement, because itemized disorder may have a mutual offset effect upon each other (Skogan, 1999).

The misleading position, of treating the disorder with no differentiation in all neighborhoods for policing practice, is even more widespread and has resulted in many critiques of disorder policing (Kelling, 2015). The lack of empirical classification of disorder or inactivity and simply focusing on the global effects of disorder on crime encourages police departments to generate a limited and uniform response to disorder issues in urban areas. As a result, “during its peak years, the New York Police Department’s (NYPD) stop, question, and frisk (SQF) policy generated extensive controversy” (Rosenfeld and Fornango, 2017, p. 931). In a country that admires the freedom and equality of race and ethnicity, Fixing Broken Windows makes the Broken Windows theory an target of public critics (Collins, 2007; Harcourt, 2009, Hinkle, Herbert, 2001; Howell, 2009).

Through measuring the itemized implications of disorder, the present study indicates that not all kinds of the disorder have the same impacts on crime occurrences in all places of an urban area. And the impacts of each itemized disorder also varied in terms of the crime typology. The findings of the current study from the empirical point of view disclose that to understand how disorder impacts crime patterns in the neighborhood, we should measure the disorder based on diverse concepts rather than homogeneous ones.

Moreover, the outcomes of the present study also demonstrated three advantages of using large-scale administrative data in measuring disorder issues in the neighborhoods, which should be considered for the future empirical study on the Broken Windows theory. First, “big data” can provide fruitful measurements to differentiate the typology of the disorder. In O’Brien et al. study (2015), they generate the geometric

measurement of the physical disorder by using large-scale 311 calls for service data and suggests two main types of physical disorder. In the current study, the police calls for service data also permit an index of localized analysis on seven kinds of disorder issues and their associations with the two main categories of crime.

The second advantage of using a large dataset to measure diverse indicators of the disorder is that this type of dataset can support the longitudinal analysis on hypothetical Broken Windows effects and combine physical and social disorders signals together to explore the residents' perception to the disorderly environment. Lack of longitudinal indicators is the common weakness of both survey-based and onsite assessment-based measurements of the disorder. However, the usage of large-scale administrative data can provide costless years longitudinal data analysis. Even though the present study uses 12-month disorder data, compared with the survey-based data and assessment-based data in the previous analysis, large-scale administrative data have much more coverage of sample size, fewer time limitations, and selective bias.

Third, the geographical and social information that attach to the data allows the BWT study to develop localizing analysis by addressing linkage to other theoretical elements in neighborhood related studies. The application of large-scale administrative data could be a path to explore the comprehensive neighborhood crime causal mechanisms generated by multiple contextual factors including disorder, through which the crime patterns on different factors and on the interactions among those factors can be spatially and statistically illustrated. Even though limited to data collection, the present study abstracts each physical and social disorder incident directly from the calls for service data, those Broken Windows theory predictors generated by the calls for service

data provide strong statistical powers to both OLS and GWR analysis. From this point of view, the current study can be seen as an important trial of using large-scale administrative data to test the Broken Windows theory.

In order to enlarge the knowledge base of applying large-scale administrative data into policing studies, future studies are recommended to focus on the exploration of the theoretical and statistical essence of large-scale administrative data in criminal justice and, the generation of the methodological framework for using the large-scale administrative data in each substitute field. Currently, more researchers have agreed, large-scale administrative data are addressed as “the eyes and ears of the city” (O’Brien et al, 2015). The usage of large-scale administrative data, for example, calls for service data, should be accepted as an important alternative measure, the empirical values of which to the social studies need to be continuously explored and suggested.

The findings of the present study also suggest that disorder is a diverse concept and should be examined by “thinking locally” based on the spatial analysis. The inconsistent empirical results of testing direct models of effectiveness between disorder and crime have always been the main enduring questioning of the BWT. Hinkle (2014) has also argued the requirement of integration examination of the BWT that:

From its earliest roots (Zimbardo, 1969) the broken windows thesis has been a social-psychological theory that has focused on how individuals perceive and react to the presence of disorder in their environment. Clearly, observed levels of disorder play a role in this process, but perceptions are the key influence in this process. If residents are not aware of the presence of a disorder or are not

bothered by it, it likely will not generate fear or otherwise, lead to neighborhood decline as hypothesized. (p.27)

In particular, the application of local level analysis by GWR models and its findings in the present study can provide a contribution to two questions that are commonly addressed by the tests on disorder—crime linkage. The first index of questions is whether there is an effective model of disorder and crime. The present study provides an affirmative answer but also emphasizes that the type of disorder, the type of crime, social and spatial differentiation, could all act as the important roles to “condition” the associations. The present study implies that simply relying on the global measurement of disorder and lacking variation by type may be one of the reasons leading to the lack of robustness of many previous empirical studies on disorder and crime associations.

By answering this question, the present study suggests that for future study, more neighborhood effects addressed in the place-based criminology, i.e. collective efficacy, race, physical arrangements and geographical characteristics should be invited into the neighborhood spatial analysis together with the different disorders. The exploration of those integrated crime causal effects would provide the foundation to create the space-based typology of crime patterns for neighborhoods, cities, or even countries, which would be the valuable directions for the crime prevention and control policy in each kind of area. Generally, the future space-based crime analysis can be assumed to be developed from two spectrums based on the setting of the unit of analysis. The spatial analysis for the integrated effects on crime is focused on the broad territory based on the large-scale dataset and unit of analysis (i.e. neighborhood, city, or country), which would provide

important comparative study resource on crime prevention and control. Concentrating on a small area within the neighborhood, or police district should employ a unit of analysis such as block groups, street segments, or geographic “pocket”.

The second question is whether disorder and crime are the same concepts but in different developmental stages? Legislative differences between disorder and crime make the distinction, but the present study provides strong empirical evidence to separate disorder from crime. If disorder and crime were the same things in essence, then each itemized disorder should have a strong association with either property crime or violent crime and keep consistent in every part of the research area in Houston, as previously assumed (Sampson and Raudenbush, 1999). However, the outcomes of the present study indicate that the different types of the disorder have varied relationships with property and violent crime, either acting as the significant predictor or insignificant predictor of crime indicators. These differentiations among itemized disorders strongly suggest it may be problematic when simply concluding that disorder and crime are the same concepts. The findings of the present study indicate that as the reference bases of crime prevention policy, the disorder is the signal of crime in each specific location other than the crime (Wilson and Kelling, 1982). It is of the great necessity of further distinguish the disorder from crime both academically, legally and practically (Ross & Mirowsky, 1999).

The different impacts caused by the social and spatial differentiation suggested that disorder should be precisely policed and comprehensively collaborated. Over the years, the response to residents’ calls for service has been accepted as the main task of line officers (Hoover, 2013). However, the paradox between effectively responding to disorder calls and the meager resources of police forces is always a challenging issue for

police crime control strategies (Jang, Hoover & Lawton, 2008). Although many police departments have a complete and digital system to dispatch the police response based on the priority scales of disorders (Walker, 2013), methodological advancement is still in demand which will effectively increase the public satisfaction and at the same time decrease the line officers workload. The residents always complain that their calls have not been dealt with thoroughly, whereas line officers are always pressured by endless calls they respond to, which in turn generates tension between the police and public (Lyons, 2008; Sunshine and Tylor, 2003).

How do we deal with this paradox? The spatial heterogeneity of disorder and crime associations explored by the present study imply a precise style of disorder policing balancing “zero-tolerance” and “focused policing”, should be developed for future community policing tactics. The neighborhood is an ecosystem, which generates crime and victimization by the compound effects of different elements such as the social constraints, physical outlets, or the physical/social disorders (Hipp, 2010; Stokols & Hipp, 2013). The findings of the present study further indicate that locally, the disorder is a diverse concept and a different kind of disorder indicates a different association with property crime and violent crime influenced by social and spatial differentiation. In particular, trend and spatial analysis of crime and disorder at the neighborhood level should be addressed as a necessary component of disorder policing. Based on the temporal and spatial pattern of disorder and crime association in different neighborhoods, a police department can focus on disorders that have a significant association with either property crime or violent crime.

For example, as the present study indicates, nuisance is a significant predictor of violent crime in the Lake Houston super neighborhood. Then nuisance should be addressed as a main responsibility of the line officers in that area. From this point of view, emphasizing and adding the localized analysis of disorders into community policing tactics contribute to concentrating the police force on the high-impact issues and improving the proficiency of policing disorder (Clear et al., 2011).

Moreover, the measurements and localized analysis for disorder issues generated by the present study imply that the residents' roles in neighborhood disorder-crime mechanism, as such, enhancing the residents' willingness to cooperate with the police and work on the neighborhood quality of life establishment, should be addressed by future policy development. In general, neighborhood incivilities can be divided into the incivilities that the public care about and those incivilities that they do not. According to the Broken Windows theory, neighborhood disorder can lead to predatory crime based on the premise that disorder should increase the fear of crime (Kelling & Coles, 1997). In other words, if the disorder is not serious enough to make the residents feel frightened, then the disorder-crime association may not exist. Therefore, a disorder that is suggested by the Broken Windows theory should be those that make residents concerned. What are those physical incivilities and social incivilities that the public cares about? The present study finds that incivilities that residents care and report to the police are significantly related to predatory crime. This finding supports the analytical framework of the Broken Windows theory by arguing that those disorders that cause fear to residents can potentially lead to an increase of crime in the neighborhood (Wilson & Kelling, 1982). More importantly, this finding implies that the residents are the natural observers of

crime-related disorders in the neighborhood and therefore, their participation in formal control plays an important role in crime prevention at the neighborhood level. If we think about the difference between people in the subway and those living in a neighborhood, we can't ask for those people who are in hurry to get to school or their office to stop and call the police for the incivilities on the subway, but neighborhoods are different. In the neighborhoods, residents care about security and order and show more willingness to work with a police officer (Wilson & Kelling, 1982; Wo, Hipp & Boessen, 2016).

Currently, both research and practice all indicate that zero-tolerance policing is uneconomic and short of legitimacy (Howell, 2009; 2015). Compared with reactively responding to all the disorders in the neighborhood, all by police, a more efficient disorder policing style could be relying on the engagement of the residents as a supplemental power in crime prevention. Through this cooperation between residents and police, the neighborhood formal and informal controls can be drawn together to work for the neighborhoods' quality of life. From this point of view, future community policing tactics should be designed by focusing on two perspectives. First, the police department should increase the resident's engagement into formal control through proactive policing methods. Second, reactive policing to major neighborhood issues are also necessary where appropriate. In order to bring together these two facets of policing, the present study suggests it should include two parts; first, use the temporal and spatial analysis to precisely target the disorders that should be addressed by the police. Second, target on information exchange, collective efficacy building and accordingly encourage the willingness of citizens to communicate and cooperate with police. Three models of

disorder policing should be considered by future police operational options in the neighborhood order maintenance role.

The first model is disorder focusing model. This model is applied specifically to those disorders that have been suggested by the local analysis to have a significant impact on either violent crime or property crime in the different neighborhoods. These disorders are the responsibilities of police since they are highly correlated to crime. Therefore, the police force should be allocated to the priority of “fixing those broken windows” as suggested by the Broken Windows theory and inherently the Broken Windows policing (Sousa & Kelling, 2004).

The second model is the disorder supervision model. This model focuses on the disorders that have not had a significant impact on crime in the neighborhood but, are reported regularly by the residents. Many kinds of physical disorders have these characteristics. For these types of disorders, the police department can direct the residents to participate in the neighborhood crime prevention strategies and seek help based on the capacity building of neighborhood social capital and informal control. The current community meeting as the components of community policing strategy can play an effective role in this model. At the same time, the police department should supervise the dynamic of temporal and spatial associations between those disorders and specific crime indicators in that neighborhood and prepare for the policing intervention if significant relationships emerge.

The last model is the quality of life establishment model. This model addresses the role of disorder policing in comprehensive community change (CCC) (Clear et al, 2011). According to Clear and his colleagues (2011): “(the comprehensive community

change) are systematic ways to confront the most entrenched problems communities face. They work by establishing a local development corporation that operates under legal authority to build approaches that confront the communities' most pressing problems” (p.23). According to the theory of comprehensive community change, for the complex neighborhood security ecosystem, the social agencies and organizations act as one of the major powers to respond to neighborhood quality of life and justice, to wit “the profound empowerment that occurs when private and public interests combine to create solutions to the problems that make public safety a priority” (p.25). For those neighborhoods that are more likely to face the multiple problems besides those of public safety, including “housing, employment, child care, and health”, the creation of effective partnerships among justice service providers can increase the impact of those services. According to the present study, the disorders and their associations with the crime were highly impacted by the social context of neighborhoods, which indicates that disorder effects are more likely to be tangled or determined by the complex and interconnected social problems and influences in the neighborhoods. Practically, the police role in this process of comprehensive neighborhood change is supplemental and limited, because more social efforts and resources need to be invested in those neighborhoods to enhance the neighborhood quality of life. Under the multiple demands on the quality of life, the police department should pay much attention to generate the balanced model of neighborhood quality life policing style. On the one hand, the ability of reactive policing should be established in terms of the reactive time and power to control the crime occurs in those neighborhoods. On the other hand, the proactive policing style needs to be added as an important supplement, the main focus of which is to deal with the

neighborhood problems by collaborating with the related social and governmental agencies.

Limitation That Needs to Be Focus on Future Research

Until now little research has been launched to examine disorder and crime associations at the local level. Due to the unique role of police order maintenance, the development of police practice indicates the requirement of further exploration on disorder and crime associations. The present study can be seen as an exploratory study in this field as addressed at the beginning of the dissertation, which however can't avoid the research limitations. The major constraints of the present study include the following aspects which also serve as the windows for the future related studies.

1. Bias caused by the data collection and selective variables should be considered when interpreting the findings of the present study. In the present study, the data used to measure both disorder and crime were all collected from the Houston Police Department. Hence, some limitation may result in the present study depending heavily on the collection and application of large-scale administrative data, which echoes a new research hot point-- Big Data. In order to avoid the data collection bias, on the one hand, future studies should provide more evidence of measurement's validity by examining the bias of residents in testing the disorder and crime association. Many studies have suggested that disorder calls for police have a significant relationship with the residents' perception of the disorder. Some may argue the bias does exist since the residents' perception to call the police are varied. Therefore, more effort should be devoted to verifying the validity and reliability of using calls for service data to generate the objective measurement of disorder in the neighborhood. O'Brien et al (2015) make a great contribution to

methodological approaches in measuring the physical disorder by large-scale data. And the present study can be seen as a successful sample of their study. More research is required to invest on the usage of the Big Data as the measurement of disorder since it is the critical and basic issue directly related to the empirical examinations of the Broken Windows theory (Dong & Srivastava, 2013; Keim, QU, & Ma, 2013; Russom, 2011). On the other hand, more administrative data resources provided by the public agencies (e.g., 311 calls) should be included into the future related studies in the Broken Windows theory, to address the discrepancies between disorder and crime datasets and excluding the technical associations between disorder and crime generated by the data collection bias.

Since a local level examination on disorder and crime association by the present study is accomplished in the research area in Houston, the generality of the research findings provided by the present study has to be limited to the city of Houston. In a future study, to contribute to a national or state level adoption of disorder policing strategy, similar research has to be committed in more cities in the U.S. to explore the distribution models of the regional variance of disorder and crime association. Meanwhile, more research needs to be conducted to investigate the interaction between disorder and other neighborhood crime causal effects on crimes. The present study examines the disorder and crime association by considering three commonly used social components in neighborhood criminology. It is evident that there are many other unmeasured neighborhood elements that would directly or indirectly influence the association between disorder and crime. Based on the Broken Windows theory framework, future study should include more neighborhood environmental characters into exploratory

spatial analysis on disorder and crime association. Those theoretical components of neighborhood effects that need to be investigated are included but not limited to collective efficacy, neighborhood institution and outlets, the level of residents fear of crime, more crime opportunity indicators, and so on (Dietz, 2002; Topa & Zenou, 2015).

The last weakness of the measurements in the current study is that the disorder variables weren't standardized as the measure of crime in both GWR and OLS models. To avoid the existence of the potential spillover effects, future study should expand “the spatial normalization process to cover the explanatory variables in order to better understand the spatial aspects and the associated factors of neighborhood crime” (Zhang and Song, 2014, p.101)

2. The unit analysis should be disaggregated into census groups or street block or the higher reliability in the measure's ability to track information across space and time. The definition of unit analysis is critical to spatial studies (Banerjee, Carlin & Gelfand, 2014). The census tract is the most often used unit of analysis in neighborhood criminological studies, as used by the present study (Hipp, 2010; Steenbeek & Weisburd, 2016). For the spatial data analysis (GWR) in the present study, I just examined the disorder and crime association within and between each census tract. However, several geographical issues should also be considered in order to reflect the neighborhood crime patterns.

First, the adjacent units of census tracts should be taken into account (Bernasco and Luykx 2003; Downey 2003, cited by Raise). Second, the distance from surrounding areas to the target neighborhood needs to be taken into account, which is seen as an important implication of geography criminology (Tobler 1970). The unit of analysis is

census tracts which makes it difficult to exclude the business district from the neighborhood. The present study can't exclude the fact that different functional areas would have a different impact on crime. Third, previous research suggested the existence of diffusion effects of crime patterns between neighborhoods (Telep, Weisburd, Gill, Vitter & Teichman, 2014). The specific spatial consideration stated above are possible to be integrated with the use of alternative methods in the local level examination of the BWT mechanism. Hence, the explicitly spatial analysis based on advancements in spatial techniques and availability of spatial data based on the block group, the street block or the police precinct should be added to the empirical study dimension of the BWT.

3. A longitudinal dataset is desired for the future studies. The present study indicates that the disorder and crime associations are very much consistent with the 24-month analysis. According to the descriptive statistics, one of the reasons may be explored by the facts that the crime occurrences in 2010 and across four-time progressions do not appear to fluctuate very much throughout the year. The results of the present study are not inclusive enough to suggest the temporal explanations to the disorder and crime associations. Future studies should consider the longitudinal nature of spatial heterogeneity patterns of crime and disorder associations based on the three-D demission of combining spatial and temporal analysis within the research models to provide more valuable insights into the instability of these crime patterns over time.

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APPENDIX

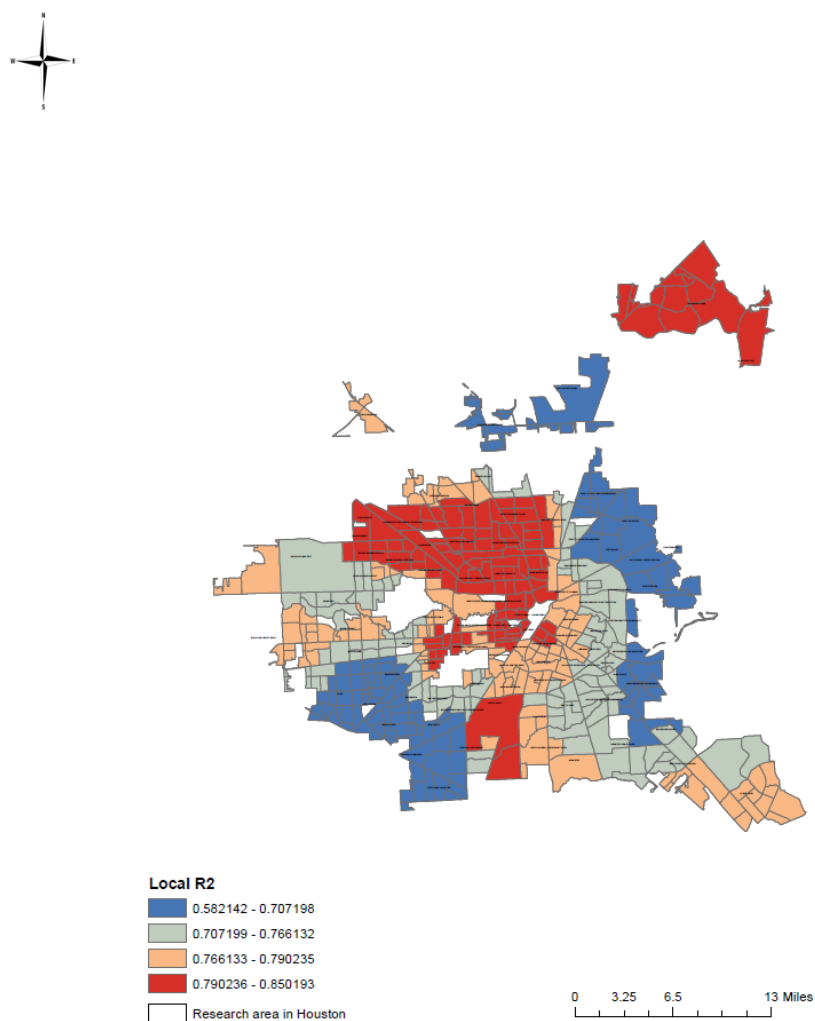


Figure 32. The Local R^2 of Violent Crime Model

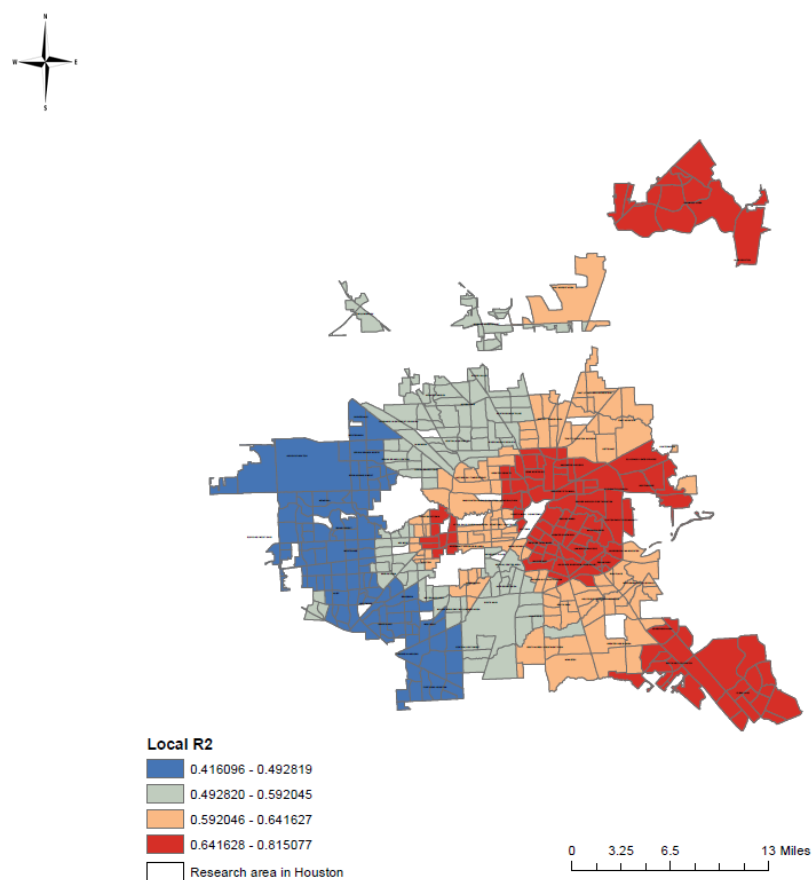


Figure 33. The Local R^2 of Property Crime Model

VITA

Di Jia

College of Criminal Justice and Criminology
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EDUCATION

Ph.D. Criminal Justice and Criminology 2018

Sam Houston State University

College of Criminal Justice and Criminology

Dissertation title: “Should We Police the Disorders?-An Examination of the Spatial and Temporal Aspects of ‘Broken Window’ Theory”

Chair: Dr. Larry Hoover

M.A. Police Administration (International and Comparative Studies)

Chinese People’s Public Security University 2006

College of Criminology

Thesis title: “Crisis Policing with Chinese Characteristics—From a Macro Perspective”

Chair: Dr. Dawei Wang

B.S. Human Resources Management

Hebei University of Economics and Business 2000

College of Labor Economics and Human Resources Management

AREAS OF RESEARCH INTEREST

- Police systems and policing strategies
- Neighborhood crime analysis and prevention
- Comparative studies in criminal justice
- International counter-terrorism strategies and social policies
- Research methods

PUBLICATIONS

PEER-REVIEWED PUBLICATIONS

Cuvelier, S. J., **Jia, D.**, & Jin, C. (2015) Chinese police cadets’ attitudes toward police roles revisited. *Policing: An International Journal of Police Strategies & Management*, 38 (2), 250-264.

Jia, D., Spooner, K., & del Carmen, R. V. (2016). An analysis and categorization of U.S. Supreme Court cases under the exigent circumstances exception to the warrant requirement. *George Mason University Civil Rights Law Journal*, 27(1), 37.

Mitchell, M. M., Spooner, K., **Jia, D.**, & Zhang, Y. (2016). The effect of prison visitation on reentry success: A meta-analysis. *Journal of Criminal Justice*, 47, 74-83.

PUBLICATIONS IN CHINESE

Jia, D and Tan, Q. (2006). American INCOSIT policing training plan. *Journal of China's Special Police*.

Jia, D. (2005). Police civilianization system and its adoption to China (J). *Journal of Jiangxi Police College*.

Wang, D. and **Jia, D.** (2005). Policing crisis with Chinese characteristics. *Journal of Chinese People's Public Security University*.

BOOK CHAPTERS AND POLICY BRIEFS IN CHINESE

Jia, D. (2007). "Police crisis management", chapter in "*European and American police science: world policing revolution*", edited by Wang, Dawei. The Chinese People's Public Security University Press, 533-553.

** Highly-classified publications on renovation and optimization for the Beijing Police Command System (2007 to 2011): One book, two book chapters and nine working papers.

CO-AUTHORED DOCUMENTARIES:

Glory and mission: Chinese policing innovation since Sixteenth CPC National Congress. 2007.
Produced by the Ministry of Public Security of China, ISBN: 9787501441082.

MANUSCRIPTS UNDER REVIEW

Mitchell, M. M., Brinser, K., & **Jia, D.** Hope is around the corner: Determining the effect of neighborhood revitalization on crime through an evaluation of Houston HOPE.

Roth, M. P., & **Jia, D.** From sleeping giant to police state: A comparative study of pre-socialist police systems in China and Russia.

MANUSCRIPTS IN PROGRESS

Jia, D., & Roth, M. P. A comparative study on national counter-terrorism and homeland security strategy frameworks between China and the United States.

Jia, D. Is 'one man's terrorist another man's freedom fighter': A systematic analysis of terrorism definitions and National laws and regulations on the prevention and suppression of international terrorism in member countries of the UN.

Gerber, J., & **Jia, D.** *Community Policing*, *Community Policing*, and *Community Justice: Implementing a seemingly simple concept in the People's Republic of China*.

GRANTS AND SPONSORED RESEARCH

GANT INVOLVEMENT

The MISP training project, supported by the United Nations Fund for Population, the Ministry of Trade of China, and Red Cross Society of China. (\$300,000)

IN PROGRESS

Jia, D. A comparison of the collective efficacy function in China and the United States of America through an analysis of police “calls for service” data.

Jia, D. What accounts for the immigrant community crime rate?: An Examination of the impact of original culture on crime in two Chinese immigrant communities.

ACADEMIC PRESENTATIONS

Jia, D. 2017. *Can Broken Windows theory be more empirical: Revisit it from spatial and temporal perspective.* Paper presented at the annual meeting of American Society of Criminology, Philadelphia, PA.

Jia, D. 2016. *Is ‘one man's terrorist another man's freedom fighter’: A systematic analysis of terrorism definitions and National laws and regulations on the prevention and suppression of international terrorism in member countries of the UN.* Paper presented at the annual meeting of American Society of Criminology, New Orleans, LA.

Jia, D. 2016. *An analysis and categorization of U.S. Supreme Court cases under the exigent circumstances exception to the warrant requirement.* Paper presented at the annual meeting of American Society of Criminology, New Orleans, LA.

Jia, D. 2016. *Comparative study of pre-socialist police systems in China and Russia.* Paper presented at the annual meeting of Academy of Criminal Justice Science, Denver, CO.

Jia, D. 2016. *A comparative study on national counter-terrorism and homeland security strategy frameworks between China and the United States.* Paper presented research exchange at Sam Houston State University.

Jia, D. & Cuvelier, S. 2015. *Chinese cadets’ perceptions to policing roles and practices,* Paper presented at the annual meeting of Academy of Criminal Justice Science, Orlando, FL.

Jia, D. 2014. *Grant proposal: Comparative study on collective efficacy effects in Chinese neighborhoods,* Paper presented at the annual meeting of American Society of Criminology, Atlanta, GA.

INTERNATIONAL CONFERENCE RESEARCH EXCHANGES

- 08/2017 The 28th Annual Meeting in Liverpool, International Police Executive Symposium
- 08/2014 Asian Association of Police Study Annual Conference.
- 07/2013 Asian Association of Police Study Annual Conference.

TEACHING EXPERIENCE

COURSES TAUGHT

CRIJ 3378 05-W Research Methods (Spring 2017)

CRIJ 2367 Police Systems and Practices (Fall 2016)

CRIJ 2367 Police Systems and Practices (Spring 2016)

GUEST LECTURES

Guest Lecturer in Dr. Steven Cuvelier's class of *Intro to Criminology* "White collar crime and cyber-crime"

TEACHING INTERESTS

- Police Systems and Practices
- Criminology; Crime analysis
- Procedural Justice
- Research Methods
- International and Comparative Studies on Criminal Justice Issues
- Homeland Security and Crisis Management

PROFESSIONAL EMPLOYMENT

College of Criminal Justice, Sam Houston State University 2013-2017

Research and teaching Assistant

Work with Dr. Larry Hoover on police studies, probation officer survey and data collection.

Work with Dr. Roth Mitchel on the comparative study of counter-terrorism policy

Work with Dr. Steven Cuvelier on the comparative study of police roles in China and US.

Work with Dr. Raymond Teske as teaching assistant

Work with Dr. Phillip Lyons as research assistant, College Dean

INTERNATIONAL PROFESSIONAL EMPLOYMENT

International Security Defensive College, Beijing, China 2017-present

Senior Academic Consultant on International Training and Exchange Programs (invited)

Command Center of Beijing Municipal Police Department 2007-2011

Second-class Superintendent, Crime Analysis Unit

The Ministry of Public Security of the People's Republic of China 2005-2007

Publicity Bureau

Division of International Cooperation, Counter-terrorism Bureau

Chinese People's Public Security University 2004-2005

Graduate Teaching Fellow: Introduction to Chinese Policing System

HONOR AND AWARDS

- Summer Doctoral Research Fellowship at Sam Houston State University, 2014 (\$3000)
- Second Prize Annual Performance Appraisal Training Center of Red Cross Society of China, 2012
- Merit of Individual Beijing Municipal Public Security Bureau: Spring, 2010
- Excellence Award in the Security Work of the 2008 Olympic Games Beijing Municipal Public Security Bureau: Spring, 2009

PROFESSIONAL CERTIFICATIONS

- Eris Professional Training on Arc-GIS
- An advanced course for quantitative data analysis workshop
- Teaching online with Blackboard certification series created by DELTA
- An advanced course for quantitative data analysis workshop
- Statistical proficiencies: Stata, SPSS, ArcGIS

PROFESSIONAL AFFILIATIONS

- Academy of Criminal Justice Sciences
- American Society of Criminology
- Association of Chinese Criminology and Criminal Justice in the United States
- International Police Executive Symposium (IPES), UK.
- Asian Association of Police Study (AAPS), Asia