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The Utility of Using Virtue Locales to Explain Criminogenic Environments

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Dedication

This work is dedicated to my daughter, Xiomara Nikita Kelish Boehme, who is the center of my world. You have motivated, inspired, and challenged me to be the best person possible. Xiomara, you are the purpose to everything that I do, and the best gift to my life. May you always be happy, your smile continues to light up the world, and your heart filled with love. I love you Xi.

To my parents, Pam and John, who have helped me in ways I cannot explain, thank you for all of your support throughout my life. Your love and guidance throughout have helped make this possible. Your patience and resilience have taught me lessons that only you two could instill upon a child. I love you mom and dad.

To my brother Austin, you have taught me lessons and put me through some tests only an older brother can. Probably of the most importance, I learned my work ethic from you that I have applied throughout all aspects of life. I am forever appreciative of the experiences we have gone through. You have made me a better person. Love you, little (big) Bro.

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Abstract

Place-based criminology has a long history of examining the potential causes and correlates of criminogenic environments. This line of scholarship has been able to establish that crime, levels of social guardianship, and racial/ethnic groups are unevenly distributed throughout space. Routine activity theory and environmental criminology are two prominent explanations of the causes of criminogenic environments. Specifically, the crime generator and crime attractor scholarship (Brantingham & Brantingham, 1995) has found recent success uncovering which certain land uses that may be "risky facilities" (e.g., pawn shops, payday lenders, bars). However, these paradigms have yet to discover which businesses are crime-reducing and an asset to the communities where they are nested. Thus, the focus of this project is to introduce a new theoretical concept called "virtue locales," which are race-specific businesses that reduce crime due to their ability to exert high levels of social guardianship. Moreover, other "virtues" they provide are social capital, social cohesion and connections, social ties, and legitimate opportunities to the community. Utilizing various analytic approaches (descriptive buffer analyses, matching techniques, and count regression modeling), this research project tests whether there are crime-reducing associations of proposed virtue locales (e.g., barbershops and beauty salons) on street segments. Findings show that virtue locales are associated with reductions in crime counts, regardless of time of the day. Theoretical implications, policy implications, and a future research agenda will also be presented.

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Chapter 1: Introduction

Nature of Problem

Crime Dispersion

Criminological research has a long history of demonstrating that "place matters" (Tita & Greenbaum, 2009), as it is well-established that crime is unevenly distributed throughout space and time (see Guerry 1833/2002; Quetelet 1842/2013; Sampson 2012; Shaw & McKay, 1942; Weisburd, 2015). Since the 1930s, macro-level ecological theories have been developed to make sense of the spatial variation of crime, including social disorganization theory (Shaw & McKay, 1942), anomie/strain theory (Chamlin & Cochran, 1994; Messner & Rosenfeld, 1995/2012), resource/economic deprivation theory (Blau & Blau, 1982), routine activity theory (Cohen & Felson, 1979), deterrence theory (Blumstein, Cohen, & Nagin, 1987), social support/social altruism theory (Braithewaite, 1989; Chamlin & Cochran, 1997), and subcultural theories (Fischer, 1975; Huff-Corzine, Corzine, & Moore, 1986).

While some theories may find more support than others (see Pratt & Cullen, 2005), there is still no consensus regarding what causes, or attracts, crime to certain areas. It has been argued that it is much more difficult to fully capture, measure, and understand the factors that lead to crime-prone places than it is to understand what leads to crime-prone individuals (Pyrooz, Fox, & Decker, 2010; Weatherburn, 2001). Said differently, little is truly known regarding what causes patterns of crime to develop across and within

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ecological areas (Brantingham & Brantingham, 1991).[1]   Another consideration for criminologists in explaining the variation of crime across neighborhoods is the uneven distribution of racial demographics across ecological areas (Hipp, 2007). America's neighborhoods are highly segregated by race (Firebaugh & Farrell, 2016; Massey, 1990), wherein research suggests that poverty, weakened family structure, and limited legitimate economic opportunities are seen more predominately in minority neighborhoods (Massey, 1990; Wilson, 1987/2012).[2] Some of these factors may influence people's involvement with crime, as empirical research has shown that Blacks are disproportionately involved in and victimized by crime, specifically in communities with high concentrations of poverty (Sampson, 1987, 1993; Sampson & Wilson, 1995; Shihadeh & Flynn, 1996).[3] Since Blacks have been shown to reside in poorer, disadvantaged living conditions (in comparison to Whites) (see Boggess & Hipp, 2010; Sampson & Wilson, 1995; Wilson, 1987 for a discussion), criminological research should consider racial community context to better understand crime at the neighborhood level (Peeples & Loeber, 1994; Schuck, Rosenbaum, & Hawkins, 2008).[4]

Scholars have suggested that a neighborhood's inability to exert informal social control is strongly associated with high levels of neighborhood crime (Bursik &

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[1] Ecological research struggles in parsing out the structural and cultural influences on crime in an area (Kubrin & Weitzer, 2003a; Sampson & Wilson, 1995).

[2] Also known as the *Underclass* (see: Massey & Denton, 1993; Wilson, 1993)

[3] Poverty and race are found to be highly correlated in many studies (Lee, 2000; Sampson & Wilson, 1995; Wilson et al., 1988; Wu & Fuentes, 1998), disentangling race and class is an issue that permeates in criminology.

[4] Research also demonstrates that minorities living in these areas are more likely to struggle with verbal and cognitive abilities, educational attainment, health outcomes, among others factors (Lloyd & Hertzman 2010; Rankin & Quane, 2002; Sampson, Sharkey, & Raudenbush, 2008; Wodtke, Harding, & Elwert, 2011; Yun & Moreno, 2006).

Grasmick, 1993; Kornhauser, 1978; Sampson & Groves, 1989). Conversely,

neighborhoods whose citizens are able to exert informal social control will have reduced

levels of crime (Sampson, 1986b; Sampson et al., 1997; Silver & Miller, 2004).[5] Informal

social control is said to stem from multiple factors including the family (Bursik, 1999;

Sampson, 1986a), schools (Roncek & Lobosco, 1983), peers (Griffin et al., 1999; Haynie,

Silver, & Teasdale, 2006), civic organizations/participation (Hawdon & Ryan, 2009;

Rosenfeld, Baumer, & Messner, 2001), and local institutions/businesses (Peterson et al.,

2000; Sun, Triplett, & Gainey, 2004).[6] Furthering the understanding of sources of

neighborhood social control is imperative because neighborhood-level crime rates are

shown to be mediated by the neighborhood's ability to exert informal social control (see

Kubrin & Weitzer, 2003b; Sampson et al., 2002; Silver & Miller, 2004). In conjunction

with the uneven distributions of racial communities and informal social control levels, the

impact of local institutions and businesses have also been suggested to impact how crime

is spread throughout space and time.

The Problem

Neighborhood-level research has recently focused on land uses, such as

businesses and local institutions, that influence crime rates, as these land uses affect the

movement and interactions of people within a neighborhood (Stucky & Ottensmann,

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[5] However, Browning, Feinberg, and Dietz (2004) propose that social ties may lend itself
to high levels of collective efficacy; however, social ties may provide a source of social
capital for offenders, diminishing collective efficacy.
[6] There are arguments that there is a paradox to informal social control. For example,
Browning et al. (2004) found that while high levels of social ties within an area may
indicate increased levels of social control, social ties to deviant residents may reduce the
level of social control.

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2009). For example, fringe financial services[7] such as payday lending, pawn shops, and quick cash services have received considerable attention and support as a "crime generator/attractor" (CGA) (Kubrin & Hipp, 2016; Kubrin et al., 2011; Lee, Gainey, & Triplett, 2014; Morse, 2011; Stewart, 2011). Even more, Squires and Kubrin (2005) propose that fringe financial services purposely target racial minority, disenfranchised neighborhoods, while traditional banks simultaneously neglect these communities (also see Cover et al., 2011; Fowler, Cover, & Kleit, 2014; Graves, 2003). While increases in payday lending may be associated with higher crime rates, there are other significant outcomes payday lending influences such as reduced property values (Bowes & Ihlandfeldt, 2001; Gibbons, 2004; Taylor, 1995), which impacts the funding of other important institutions related to social control (e.g., schools, police) (Kubrin et al., 2011). Businesses like payday lenders who target disenfranchised neighborhoods further demonstrates the dynamic neighborhood effects that occur across communities (Aldrich & Reiss, 1976; Macdonald, Stokes, & Bluthenthal, 2010; Sampson et al., 2002).

Payday lenders are a type of land use that may be deemed a "crime attractor," which are known crime areas (e.g., drug markets) that entice large numbers of people who possess high levels of criminal motivation to the area (Brantingham & Brantingham, 1995; Kinney et al., 2011). Further, crime attractors "pull in" criminally motivated people from outside of the neighborhood, thus increasing the number of interactions between potential victims and motivated offenders (Frank et al., 2011; McCord et al., 2007).

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[7] It is noted that there are other "crime attractors" (e.g., alcohol outlets, see: Roncek & Bell, 1981; Roncek & Maier, 1991; Roncek & Pravatiner, 1989; Bernasco & Block, 2011) besides payday lending; however, payday lending is used as an example. Further detail about crime attractors will be provided in later sections.

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Crime generators may not be inherently criminal places like crime attractors; however, they generate crime simply because these locations bring large numbers of motivated offenders and suitable victims together (e.g., sports stadiums) (Song et al., 2017). The establishment of criminally prone businesses/institutions causes a significant problem for neighborhood citizens in exerting social control over the area and the people these businesses attract (Nielsen & Martinez, 2003; Peterson et al., 2000; Sampson and Groves, 1989; Wilson, 1987).[8] Conversely, there is some evidence that sheds light on what factors may prevent, or detract, crime in certain areas (Brantingham & Brantingham, 1998; Jeffery, 1971; Newman, 1972; Sampson et al., 1997), but there is also no consensus regarding what prevents crimes in ecological areas (see Farrington, 1993; Taylor, 1997; Weisburd, 1997).[9] The bulk of land use research examines what businesses/local institutions cause or perpetuate crime rates (Krivo, Peterson, & Kuhl, 2009; Kubrin et al., 2011; Peterson, Krivo, & Harris, 2000). Therefore, to fill some gaps in this literature, the focus of this research will be to propose and test a new theoretical concept called "virtue locales," which are businesses that prevent and deter crime.

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[8] Since research indicates that minority neighborhoods may have more businesses/institutions that are associated with higher levels of crime, as well as lack institutions that may reduce neighborhood crime rates (Krivo, Peterson, & Kuhl, 2009; Kubrin et al., 2011; Peterson et al., 2000; Squires & Kubrin, 2005; Stewart, 2011), further investigation of businesses nested within neighborhoods of various socio-demographic characteristics is necessary.

[9] Macro-level deterrence theories are largely mixed in their findings (Pratt & Cullen, 2005; Pratt et al., 2006). Additionally, there was a shift from offender-centered to place-centered crime reduction strategies in the 1990s (Taylor, 1997; Weisburd, 1997). Also, scholars have varying opinions as to why crime is reduced in an area, such as increasing social control, limiting strain, and minimizing associations with deviant peers (Agnew, 1999; Akers, 2017; Sampson, Raudenbush, Earls, 1997).

Virtue Locales

The concept of "virtue locales" merges ecological theories and collective efficacy to suggest that there are certain businesses that reduce crime rates at the immediate location and nearby areas. As stated, most of the land use research focuses on businesses and institutions that may generate or attract crime (Kubrin et al., 2011; Peterson, Krivo, & Harris, 2000), however, little scholarly attention has been given to businesses that suppress, prevent, and detract crime. "Virtue locales" are businesses[10] that foster or nurture an environment of social cohesion, social connections, social ties, social guardianship, and legitimate opportunities. Moreover, these businesses are social capital to the community, which aids in establishing high levels of collective efficacy. Furthermore, "virtue locales" are race-specific in that these locations fit and mesh with the racial community context at which they are nested. Virtue locales provide a community anchor, in which legitimate opportunities may arise due to neighborhood communication and social connectivity. Finally, virtue locales prevent crime at its immediate environment ("repellant effect"), thus affecting neighborhood crime rates. As people move further from the virtue locales, their protective effects will decay ("distance decay").

One of the few studies to examine the crime-reducing effects of businesses was conducted by Papachristos and colleagues (2011). These scholars found that gentrification (measured by the number of coffee shops) in Black, Hispanic, and White neighborhoods was associated with declining homicide rates; however, increased

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[10] "Virtue locales" can also be other types of land uses and local institutions. However, this dissertation will only examine businesses that may be considered "virtue locales," crime generators, and/or crime attractors.

numbers of coffee shops were associated with increases in robberies in Black neighborhoods (also see Small & McDermott, 2006). These results were mixed, as it may be suggested that coffee shops in minority neighborhoods do not match the cultural fabric of these communities, and thus, has no crime-reducing effect on these communities. Utilizing "virtue locales" in land use and place-based research can provide a more detailed picture of why there are uneven distributions of crime (and low levels of crime) throughout a neighborhood.

Value and Focus of Study

Neighborhood crime has many detrimental effects, including citizens living in continuous fear of crime/victimization and interacting with deviant residents (Covington & Taylor, 1991; Rankin & Quane, 2002; Rountree & Land, 1996), issues related to adolescent behavior and performance in school (Bowen & Bowen, 1999), health issues (Linares, 2004; Wright, 2006), and overall dissatisfaction with the neighborhood (Droettboom et al., 1997; Skogan, 1992). The overarching research question that this study will seek to answer is "do 'virtue locales' prevent or reduce crime at the immediate location and in nearby areas?" While it may be well-documented that impoverished, minority neighborhoods have higher concentrations of crime, not every area of these neighborhoods have high crime rates. Businesses will establish themselves in certain neighborhoods based on racial composition (see Kubrin et al., 2011; Stewart, 2011); therefore, CGAs and "virtue locales" may look entirely different based on the socio-demographics of a neighborhood. Therefore, virtue locales will be examined through a

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racial community context in predominantly (60+%) Black communities in Columbia, South Carolina.[11]

While criminology has tended to focus on what factors lead individuals to commit crimes or what places are criminogenic,[12] limited attention has been given to the factors and characteristics of places that reduces, or "prevents" crime.[13] This study is the first of its kind to test whether virtue locales can prevent crime ("virtue locales"). Understanding this mechanism has important policy implications for legislators, city planners, and police agencies alike. For example, Kubrin et al. (2011) pointed out that states are now restricting the establishment of payday lenders due to their detrimental effects on neighborhoods (e.g., reduced property values). Protecting virtue locales and allowing these businesses to thrive in the community through police patrols, community organization involvement, and legislative support may have tremendous crime reduction and prevention potential.

This project will largely draw from the environmental criminology paradigm. Utilizing an environmental criminology paradigm provides many benefits, as stated best by Brantingham and Brantingham (1991) who observe that:

"The objective of this analysis is to sort out patterns in where, when, and how

crimes occur. From a purely academic standpoint, this form of analysis is

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[11] 60% or more Black was chosen as a conservative estimate to ensure confidence that the study areas are considered "predominately Black."

[12] For example, biological factors (Lombroso, 1878), strain in one's life (Agnew, 1992), learning from deviant peers (Akers, 2017), living in socially disorganized neighborhoods (Shaww & McKay, 1942), and in concentrated poverty (Sampson & Wilson, 1995) have been researched as factors that lead to crime.

[13] It is noted that Hirschi (1969) and Gottfredson and Hirschi (1990) focus on what is it that "prevents" people from committing crime.

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interesting because little, really, turns out to be known about the patterns inherent in the occurrence of most types of crime. From a policy perspective this approach is promising because, once understood, available technologies can be used to modify these patterns and abate some crimes without doing significant damage to basic human rights, while it is not so clear that we have ethically acceptable techniques for changing human motivation" (p.19).

Criminology and criminal justice have generally failed to utilize this theoretical framework in policy, thereby preventing the field from developing novel ideas on how to address criminal (and non-criminal) places. As briefly discussed, virtue locales are proposed to help in producing collective efficacy, social capital, communication and social connectivity, and legitimate opportunities to its citizens. Therefore, protecting these businesses and the virtue they bring to the community is an important policy consideration for police and policymakers.

In the pages that follow, I will lay out my dissertation plan. Chapter 2 presents a discussion of the relevant theoretical literature relating to virtue locales and racial community context. Chapter 3 will present the research questions, discuss the data that will be used, the variables of interest, and the proposed methodology. Chapter 4 will present the analysis, while Chapter 5 will present a discussion of the results, including the study's limitations and the future research agenda. Finally, Chapter 6 presents a brief conclusion.

Chapter 2: Theoretical Foundations & Empirical Literature

Introduction

This literature review presents the historical developments of spatial distributions and patterns of crime within the field of criminology, details the empirical status of these theoretical traditions, demonstrates the compatibility of these traditions, and discusses the gaps in the literature. First, this chapter reviews the historical developments of the social ecology of crime and environmental criminology. This review is followed by a brief discussion of the development of collective efficacy. Second, the empirical status of these traditions is presented, along with the common research themes and findings. Third, a theoretical integration of environmental criminology with collective efficacy is offered. Finally, the "gaps" within this literature are presented, in addition to a discussion of how these gaps can be addressed.

Virtue Locales

The core contribution of this research project is the introduction and development of an original theoretical concept called virtue locales. Before delving into the theoretical literature that inspired the concept of virtue locales, further elaboration of the key aspects related to virtue locales are presented. Virtue locales are businesses that reduce crime due to high levels of social guardianship. Guardianship is established through various sources, including social cohesion, social connections, social ties, and collective efficacy. Moreover, these businesses provide customers and citizens with legitimate opportunities

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due to the location being a form of social capital, as well as providing social connection, and social ties. Virtue locales are race-specific, such that businesses must mesh and fit within the cultural (and community) context in which they are nested. Virtue locales are community anchors, in which citizens gather to discuss various topics such as neighborhood events, concerns within the area, and job opportunities, among other topics. These businesses are valuable to all neighborhoods, but particularly disadvantaged neighborhoods in which these virtuous characteristics may help these struggling communities.

The concept of virtue locales is grounded in the environmental criminology, routine activity, and collective efficacy paradigm variations. In order to fully grasp virtue locales, the reader should fully conceptualize the paradigm variations. Thus, this a thorough discussion of the historical foundations, empirical status, and the gaps in the literature that virtue locales may fill are presented in the following sections.

<center>The Evolution of Place, Space, and Crime</center>

For many decades, the focus of criminology has centered on predicting and explaining individual criminal behavior (Agnew, 1992; Blumstein & Cohen, 1979; Gottfredson & Hirschi, 1990; Sampson & Laub, 1995). However, this task became very difficult due to the unpredictability of individuals and the various influences on their behavior (Bernard, Snipes, Gerould, 2010). As a result, many criminologists turned their attention to explaining the "where" and the "when" of a crime event, which has been deemed the "criminology of place" (Brantingham & Brantingham, 1991; Cohen & Felson, 1979; Sherman, Buerger, & Gartin, 1989; Weisburd, Groff, & Yang, 2012). This perspective uses a social ecology of crime framework, which examines the variation of

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structural characteristics of the physical and social environment on variations of crime throughout collectives (Jeffery, 1978; Kane, 2002).

The historical development of the social ecology of crime paradigm[14] dates to the research of the "moral statisticians" of the 1800s (Beirne, 1987; Friendly, 2007; Miro, 2014). Guerry (1833/2002) and Quetelet (1842/2013) independently utilized science to measure criminal patterns and behavior throughout French provinces. The fathers of "ecological criminology" (Beirne, 1993; Wortley & Mazerolle, 2008; Wortley & Townsley, 2016) demonstrated that there are sociological influences between humans and their environment that affect crime rates. Guerry (1833/2002) found that rates of crime and suicide remained stable over time; however, these rates varied by age, sex, and provinces of France. Quetelet (1842/2013) found that age and gender had influences on spatial variation of crime but added that climate, alcohol consumption, poverty, and education also impacted spatial variations of crime (also see Levin & Lindesmith, 1936; Mayhew, 1863).[15]

In the early 1900s, research conducted by scholars at the Chicago School of Sociology (or, Urban Sociology) helped solidify the emergence of social ecology of crime research (Kubrin & Weitzer, 2003; Zembroski, 2011). At the Chicago school, Park

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[14] This paradigm includes a vast range of theoretical frameworks including the social disorganization/collective efficacy perspective, routine activities, anomie/strain, and environmental criminology, among others.

[15] Durkheim (1893/2013, 1897/1951) focused on the influences of the organization of society on human behavior (Lunden, 1958; Smith, 2008). Durkheim (1897/1951) noticed that rapid social change occurring in France due to the industrial revolution led to the breakdown of social norms, preventing society from regulating individual behavior (Bernard et al., 2010). Durkheim (1897/1951) suggested that this state of "anomie" (or normlessness) contributed to the high rates of suicide in France, thus demonstrating that factors occurring outside of individuals (social change, lack of regulation) impact their behavior.

and Burgess (1924) developed "human ecology," which they likened to plant and animal ecology. They suggested that humans will invade, dominate, and drive out others in a radial fashion as a natural process (also see Park, Burgess, & McKenzie, 1925/1967). Burgess (1928) notes that cities do not grow on their edges, instead the radial process starts at the inner city and moves outward, forming circles (or concentric zones) around the city center. The second concentric zone encompasses the invasion, domination, and succession processes where citizens migrate from the inner city to the outer city (Wortley & Mazerolle, 2008). This zone contains an impoverished population, deteriorated housing, and high rates of immigration (Bernard et al., 2010; Burgess, 1928; Park et al., 1925/1967).

Shaw and McKay (1942) adapted Park and Burgess' (1924) work to build on the concentric zone model by overlapping crime rates within Chicago onto these zones.[16] Within areas of high delinquency, Shaw and McKay (1942) noted high rates of poverty, increased numbers of families on welfare, greater residential mobility, and cultural heterogeneity. Throughout time, the delinquency rates remained stable[17] in these areas even when there was significant residential turnover of many different ethnic groups (Shaw & McKay, 1942).[18] The lack of social organization within these neighborhoods made it difficult to exert informal social control, which was believed to explain

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[16] Clifford Shaw and Henry McKay did not graduate from University of Chicago; however, since their research was inspired by work from other Chicago School scholars, they are grouped with the Chicago School.

[17] Zone two (or the zone of transition) had the highest levels of delinquency rates (Bernard et al., 2010).

[18] Due to these factors occurring within this area, there was difficulty establishing commonly shared values, beliefs, and culture which made the neighborhood vulnerable to a culture of deviance (Blackman, 2014; Taylor, 1996).

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delinquency in these areas (Shaw & McKay, 1942). This work established the social

disorganization paradigm of ecological research (Bernard & Snipes, 1996). The social

disorganization paradigm influenced criminological thought for decades, but this

paradigm fell dormant in the 1960s and 1970s due to the focus on micro-level theories,

longitudinal methodologies, and other data and methodological related criticisms

(Bernard et al., 2010; Townsley, 2009; also see Bottoms, 2007). Regardless, the research

by the Chicago sociologists in the early 1900s laid the foundation for future place-based,

social ecology research.

Environmental Criminology

As previously discussed, criminology has largely focused on the sources of

criminal motivation (or, criminality) of individuals. However, in the 1970s, scholarship

emerged that turned attention away from the factors, experiences, and social forces that

motivate offenders to commit crime, toward research on the criminal event (Wortley &

Townsley, 2016). For example, "environmental criminologists tend to assume that some

people are criminally motivated and begin instead with an analysis of the location of

crimes" (Brantingham & Brantingham, 1991, p.19).[19] With attention turned away from

the criminality of individuals, scholars can focus on specific criminogenic areas to help

explain the uneven distribution of crime. This section outlines the important contributions

made by scholars that aided the development of environmental criminology.

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[19] The environment is viewed as a changing, multifaceted element. Therefore, the environments' effects on human behavior is also consistently evolving (Brantingham & Brantingham, 1978).

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"Environmental criminology" was coined by C. Ray Jeffery in 1971[20] in which he and Oscar Newman (1973)[21] conducted research that cemented environmental criminology's place in social science scholarship. Both scholars examined the effects of modifying the immediate physical environment and urban architecture on criminal behavior (Brantingham & Brantingham, 1991; Wortley & Townsley, 2016). Jeffery (1971) proposed three key factors in reducing crime through environmental design: natural surveillance, natural access control, and natural territorial reinforcement. Natural surveillance involves manipulating the physical environment so that residents can better see the surroundings,[22] access control includes denying access to potential targets (e.g., security personnel, locks), and territoriality is when residents or agents take ownership in their surrounding environment (Cozens, Saville, & Hillier, 2005; Reynald, 2011).

Newman (1973) mirrored Jeffery's (1971) ideas about territoriality and natural surveillance and added "image" and "milieu" as important factors in creating defensible space.[23] The image of the physical environment involves the perception of an area as well-kept, unique, and non-isolated, while "milieu" discusses the importance of the surrounding environment's impact on a community. That is, if a community is near a high crime area, the high crime area may "spillover" into another community (Newman,

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[20] See Jeffery's (1971) *Crime Prevention Through Environmental Design* (CPTED). CPTED today is its own paradigm that includes environmental criminology, rational choice theory, and routine activities.

[21] Jacob's (1961) work is also a founding theory for the CPTED paradigm. However, this study will not draw from Jacob's (1961) research.

[22] Newman (1973) also discusses the importance of natural surveillance.

[23] Wilson and Kelling (1982) built upon Newman's (1973) image and milieu of an area. Wilson and Kelling's (1982) "broken windows" theory also falls under the CPTED paradigm.

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1973).[24] These theoretical arguments laid the foundation for the environmental criminology paradigm, with its emphasis on the location of criminal events and how the environment shapes human behavior (Cullen et al., 2014).

The development of geographical theories of crime (Smith, 1987) also played an integral role in the emergence of the environmental criminology paradigm. Cartographic criminologists analyzed urban ecology through mapping of patterns to explain the interaction of time, space, and criminal behavior (Cozens, 2011; Yarwood, 2001, 2015). Herbert (1976, 1982) conducted one of the foundational geographical theories of crime that helped provide insight into the hegemony of this paradigm. Herbert (1976, 1982) found that there were social and environmental differences (e.g. family, cultural, and neighborhood) in higher delinquency, urban areas. Moreover, research from this paradigm has also examined the effects of policing strategies on crime patterns throughout collectives (Evans, Fyfe, & Herbert 2002; Fyfe, 1991). Even more, the effects of fear of crime on everyday lifestyles (Smith, 1984, 1987), the impact of surveillance in shaping crime patterns (Graham, 1998; Newman, 1973), and critical perspectives, such as political oppression and its effects on the concentration and geometrical patterns of crime in certain areas (Howell, 1998; Mitchell, 1997), have also been examined. This paradigm helped to revitalize the use of mapping to examine crime rates and patterns (Block, 1979) and has merged with environmental criminology (Herbert & Hyde, 1985) to form a prominent ecological approach (Wortley & Townsley, 2016).

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[24] For other significant contributions to the CPTED paradigm, see Colman (1985), Crowe (1991), Perkins and Taylor (1996), Wekerle and Whitman (1995), and Cornish and Clarke (2003).

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More recently, Anderson (2004) presented the complexities of how individuals' routines and travel patterns may lead to social interactions within a city. Anderson (2004) proposes "cosmopolitan canopies," which are "settings that offer a respite from the lingering tensions of urban life and an opportunity for diverse peoples to come together" (p. xiv). These areas typically involve a number of diverse businesses, restaurants, and shopping stores. Anderson (2004) provides an optimistic stance on interactions between a myriad of ethnicities that occur at cosmopolitan canopies, which are shaped by individual's daily routine activities. He believes that over time, positive interactions between progressive and open-minded individuals will eventually change the mentality citizens have towards "other" groups. Race, however, is still a sensitive subject in America, in which negative experiences in the cosmopolitan canopy can quickly erode positively trending race relations. This could lead to a change in the routine activities of Blacks, in which Blacks may no longer frequent the businesses and shops at the cosmopolitan canopy. Anderson (2004) provides insightful racial context to the attitudes, emotions, and feelings that affect individuals' routine activities and movement patterns throughout a city. Finally, this work can be utilized to provide a modern qualitative explanation regarding *how* criminal patterns emerge due to the geography of cities as compared to just identifying *where* concentrates in cities.

Crime Pattern Theory

The theoretical propositions by Jeffery (1971), Newman (1973), and the research by the cartographic criminologists helped lay the foundation for the Brantinghams'

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(1981) crime pattern theory.[25] The Brantingham's performed a series of analyses that aided in their presentation of crime pattern theory (Brantingham & Brantingham, 1975a, 1975b). They suggest that victims and offenders both engage in similar legitimate routine activities; however, as offenders are performing their normal routines, they take notice of criminal opportunities. Accordingly, motivated offenders are more likely to victimize targets that take on similar routine paths as themselves (Brantingham & Brantingham, 1981, 1984, 1993a).[26] "Paths" are routes that people take in their everyday life where offenders may target potential victims (e.g., routes people take to go to work) (Brantingham & Brantingham, 1991). Additionally, paths vary from weekday to weekend and they are largely determined by the location where individuals live, work, go to school, and venture for entertainment and recreation (Kinney et al., 2008). "Edges" are boundaries of the areas where people live and maneuver on an everyday basis (Brantingham & Brantingham, 1991), where crimes like racial attacks and robberies may be more likely to occur since people from different neighborhoods may intersect (Felson & Clarke, 1998). Edges may be physical boundaries such as bodies of water, railroad tracks, or social and conceptual boundaries, such as known boundaries of certain neighborhoods (Song et al., 2017).

The Brantinghams (1993b, 1995) expanded crime pattern theory by discussing the importance of "crime generators," "crime attractors," and "awareness space." Importantly, "awareness space" is developed over time as individuals establish their

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[25] Today, the Brantinghams are most often associated with the inception of environmental criminology due to their book, *Environmental Criminology*.
[26] The Brantingham's present 10 "rules" to crime pattern theory. For a review of these rules, see Wortley and Townsley (2016).

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regular paths and activity "nodes." The boundary of the awareness space is determined by the edges of these paths (Brantingham & Brantingham, 1982, 1993b). Moreover, the "awareness space" and activity spaces evolve as individuals age, change jobs, and develop new friends (Kinney et al., 2008). Offenders commit crimes closer to their and the victim's "nodes," which are places that both offenders and victims spend most of their time (e.g. their homes, school, and/or workplaces) (Brantingham & Brantingham, 1995).

These authors also propose "crime generators" and "crime attractors," which are activity nodes where large numbers of motivated offenders and potential targets congregate. Crime generators are spaces that are easily accessible to the public. Large numbers of people congregate for reasons not related to crime (e.g. sports stadiums, shopping precincts). These crime generators will lead to more opportunistic crimes due to the high numbers of people who are passing through this activity node (Kinney et al., 2008; Bernasco & Block, 2011). Crime attractors are areas that provide specific criminal opportunities and do not necessarily bring large numbers of people together (Bernasco & Block, 2011). On the one hand, these areas are well-known areas for crime occurrences such as bar districts, drug markets, disadvantaged neighborhoods, and parking garages because they exhibit low levels of guardianship to potential targets. Even more, these areas attract individuals possessing high levels of criminal motivation and recidivists who travel to these areas due to their "ecological label" as hotbeds for crime (Brantingham & Brantingham, 1993, 1995). On the other hand, crime detractors (Kinney et al., 2008) are "activity nodes, which lack attractive activities and discourage use by legitimate citizens" (Glasson & Cozens, 2011, p. 32). However, while crime detractors are not enticing areas

for legitimate citizens to congregate, these areas may still be untapped territory that may one day be vulnerable to motivated offenders (Cozens & Love, 2015).[27]

In sum, environmental criminology is a family of theories that provides a multi-faceted ecological paradigm that focuses on the criminal event and the causal mechanisms derived from the immediate environment (Wortley & Townsley, 2016). In addition, this paradigm concentrates on the social and physical environment, routine activities, and humans' rational choice as influencers on criminal offending (Brantingham & Brantingham, 1984, 1991; Eck & Weisburd, 2015; Wilcox, Land, & Hunt, 2003; Wortley & Townsley, 2016). Moreover, environmental criminologists believe that understanding the effects of criminal places on the movement of offenders and victims provides rich policy implications in policing and city planning (Brantingham & Brantingham, 1991). The next section will present the foundations of a theoretical paradigm that has been merged with environmental criminology (Brantingham & Brantingham, 1981/1991), routine activity theory.

<div align="center">Routine Activity Theory</div>

The routine activity perspective was established through the research of Hindelang, Gottfredson, and Garafalo (1978) and Cohen and Felson (1979).[28] Hindelang and colleagues (1978) suggested that differences in victimization risks were dependent on one's vocational (work, school) and leisure activities. Thus, they suggested that younger, male, unmarried, and poor individuals are more likely to be victimized than older,

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[27] This will be an important talking point in the "gaps in the literature" section of this chapter.

[28] While the routine activity paradigm is not the main focus of this research project, a brief discussion is needed as the paradigm has been merged with environmental criminology over the years (Brantingham & Brantingham, 1991).

married, female, and wealthy individuals, since those in the former demographic are more likely to spend time doing public activities outside of the household (Bernard et al., 2010). A year later, Cohen and Felson (1979) (also see Felson and Cohen, 1980) drew upon Hawley's (1950) theory of human ecology, which centered on the assumptions that people have an interdependence with the physical environment, to propose routine activity theory (Felson & Cohen, 1980; Messner & Blau, 1987; Messner & Tardiff, 1985). In their view, routine activity theory focuses on the effects of everyday movements, such as where we go and who we interact with, on the spatial variation of crime rates. Cohen and Felson (1979)[29] added that the socio-structural patterning of routine activities will lead to crime as motivated offenders and suitable targets who lack capable guardians converge in time and space (Bernburg & Thorlindson, 2001; Cohen & Felson, 1979; Kubrin et al., 2011; Marcum, Ricketts, & Higgins, 2010). Simply stated, in areas where all three elements are more likely to intersect, there will be higher crime rates.

When examining the effects of place on criminal opportunities, the routine activity perspective is a relevant theoretical explanation worth considering in explaining the distribution of crime across space and time (Jones & Pridemore, 2019). Like most opportunity theories (Felson & Clarke, 1995, 1998), routine activity theory focuses on *place* and the spatial ecology of individuals that translates criminal motivation into action (Hannon, 2002; Kubrin et al., 2009). When a potential target lacks guardianship, criminal opportunities may arise for a motivated offender. Therefore, the built environment of a

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[29] Cohen, Kluegel, and Land (1981) later presented an opportunity theory positioned to explain predatory victimization as a function of guardianship, exposure, proximity, and target attractiveness.

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place may be significant in creating an environment capable of exerting social control (Anselin et al., 2000). A place may be deemed "criminogenic" based on the social and physical environment's ability to exercise social control (or guardianship), thus affecting the decisions of motivated offenders (Reynald & Elffers, 2009). Moreover, certain land uses may affect an individual's movement patterns as some land uses may attract motivated offenders and suitable targets (e.g., bar districts, see Bernasco & Block, 2011). Finally, the introduction of routine activity theory, has influenced the development of other "opportunity theories" that focus more on the demographic characteristics of victims and the environment within which they are nested (see Felson & Clarke, 1995, 1998; Fisher et al., 1998; Wilcox, Gialopsos, & Land, 2013). Routine activity theory remains one of the prominent ecological theories of crime, as it is well-suited to predict crime (Pratt & Cullen, 2005). Finally, routine activity theory provides a unique criminological perspective because it does not try to explain criminal motivation; rather, it focuses on explaining the criminal event (Madero-Hernandez & Fisher, 2013). Routine activities theory has expanded into other theoretical perspectives (e.g., crime pattern theory) and it has been integrated into other long-standing theoretical traditions such as multi-level opportunity theories and social disorganization theory.

<center>Collective Efficacy</center>

The social disorganization paradigm experienced a revitalization in the 1980s. Lowenkamp, Cullen, and Pratt (2003), in discussing social disorganization theory, stated that "…it has experienced a dramatic revitalization, reemerging from the dustbin of spent criminological paradigms to challenge for the status as a preeminent macro-level theory" (p. 351). The re-emergence of the social disorganization paradigm can be attributed to the

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work of Kornhauser (1978) through her interest in institutional control of crime through community organization, school, and the family.[30] Kornhauser (1978) argued that neighborhoods that are ethnically diverse and whose residents are poor and consistently move, will struggle in establishing social relationships and institutions. Thus, characteristics of social disorganization will lead to increased crime rates as the local community finds difficulty exerting social control and establishing conventional norms, values, and institutions.

Neighborhoods that suffer from concentrated disadvantage, such as poverty, joblessness, and social isolation, are vulnerable to weakened informal social control and diminished legitimate opportunity structures (Bursik & Grasmick, 1993; Fagan & Davies, 2004; Wilson, 1987/2012). The addition of concentrated disadvantage (Wilson, 1987/2012; Massey & Denton, 1993) allowed for informative contextual concepts to be added to social disorganization research. Common methodological measures of concentrated disadvantage such as poverty, family disruption, and joblessness have allowed researchers to better measure structural conditions of neighborhoods that may create social disorganization within a community (Kubrin & Weitzer, 2003a). Sampson

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[30] Bursik and Webb (1982) and Stark (1987) also aided in social disorganization's re-emergence. Bursik and Webb (1982) re-examined Shaw and McKay's (1942) work and found support that regardless of ecological composition, crime rates remained consistent from 1940-1950; however, from 1950 to 1970, they were unable to find support for Shaw and McKay's (1942) original findings, which they attributed to post-World War II population changes. Stark (1987) proposed thirty theoretical propositions to consider for future ecological research which focused around four structural elements of land use[30], dilapidated buildings, residential mobility, and population density. These four elements can lead to increased opportunities for crime, moral cynicism among residents, motivations for crime, and decreased informal surveillance (Bernard et al., 2010; Dobrin, Lee, & Price, 2005; Stark, 1987; Wright & Benson, 2011).

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and Groves (1989) extended social disorganization by finding support for their model[31] which proposed that characteristics of neighborhoods, such as family disruption, low economic status, ethnic heterogeneity, and residential mobility, will create social disorganization within a neighborhood. Finally, Sampson and Groves (1989) found that areas with sparse friendship networks, unsupervised peer groups, and low participation in organizations and institutions had higher crime rates.

Sampson, Raudenbush, and Earls (1997) introduced the neighborhood social process, collective efficacy which has spurred an abundance of additional research (Sampson, 2006; Morenoff, Sampson, & Raudenbush, 2001; Kubrin & Weitzer, 2003). Collective efficacy is defined as the willingness of residents of a neighborhood to mediate in situations of "bad" behavior due to mutual trust, cohesion, and shared norms within that area (Sampson et al., 1997). Sampson et al.'s (1997) proposed model explicitly connects the structural characteristics and social processes with crime in a neighborhood. Moreover, friendship and social ties, as well as involvement in community organizations, contribute to social cohesion, which will then promote effective informal social control to combat crime within a community (Browning, 2002). The introduction of collective efficacy illuminated a valuable neighborhood process that helps to mitigate neighborhood problems, such as concentrated disadvantage, thus reducing crime rates (Bellair, 2000; Bernard et al., 2010; Kirk & Matsuda, 2011; Kubrin & Weitzer, 2003; Markowitz et al., 2001; Sampson, 2006; Steptoe & Feldman, 2001; Wickes et al., 2017).

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[31] The systemic model of social disorganization played a substantial role in the continued revitalization of the social disorganization paradigm (also see: Bursik & Grasmick, 1993).

Pattillo (1998) conducted ethnographic research within Chicago neighborhoods that examined the complexities of neighborhood informal social control. While the systemic social disorganization model (Bursik & Grasmick, 1993) suggests that dense social interactions create an environment suitable to exert social control in a neighborhood, Pattillo (1998) suggests that this proposition may not always be accurate. She suggests that Black middle-class neighborhoods must establish social organization through unique avenues, since Black middle-class neighborhoods are proximately closer to other high poverty areas (as compared to White middle-class neighborhoods). Legitimate and illegitimate citizens of the neighborhood share similar goals (e.g. prevent neighborhood disorder); however, the means of obtaining these goals may be vastly different. Moreover, due to residential stability and home ownership, citizens establish strong institutional ties, perpetuating formal and informal social control. Paradoxically, intertwined within the neighborhood social networks and kinships are gang leaders and criminals; therefore, legitimate and illegitimate citizens must work together (Pattillo, 1998). Unfortunately, the incorporation of gang members and drug dealers in the social networks does not fully eradicate the crime component within the neighborhood. Pattillo (1998) presents research that emphasizes the importance of examining neighborhoods through a racial context as the barriers different neighborhoods face in establishing informal social control may vary by racial composition.

The extensions from the social disorganization paradigm have evolved into research examining the effects of informal social control, concentrated disadvantage, and collective efficacy, allowing the legacy of the Chicago school to have a continuing impact on the explanations of crime (Wilson, 1987/2012; Rock, 2007; Zembroski, 2011;

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Schnell, Braga, & Piza, 2017; Sampson, 2012). These extensions have created a rich foundation for examining the dynamic processes that occur at the community-level. Now that the foundations for three prominent theoretical paradigms has been presented, a discussion of the empirical status of these traditions will be offered. Thus, the next few sections will present the empirical status of the previously presented theoretical paradigms including the environmental criminology, routine activity, and social disorganization paradigms.

Empirical Status

Routine Activity Theory / Opportunity Theory

Since the introduction of lifestyle and routine activity theory, scholars have interpreted, tested, and expanded the theory in a number of important ways (see Madero-Hernandez & Fisher, 2013). Further, the lifestyle and routine activity theories have been reconceptualized and built upon to create other opportunity theory models (Cohen et al., 1981; Sampson & Wooldredge, 1987). These opportunity theories of crime assume that targets who are physically closer to large numbers of motivated offenders are more likely to be victimized; therefore, scholars utilize various operationalizations of *proximity* (e.g., living nearby high crime areas, unemployment rates, perceptions of crime and disorder) when testing opportunity theory (see Burrow & Apel, 2008; Cohen & Cantor, 1980, 1981; Gabor et al., 1987; Fisher, Daigle, & Cullen, 2010; Massey, Krohn, & Bonati, 1989; Meier & Miethe, 1993; Rengert & Wasilchick, 1985; Sampson & Wooldredge, 1987; Tseloni et al., 2004; Wooldredge, Cullen, & Latessa, 1992). Measuring proximity has been difficult for researchers (Madero-Hernandez & Fisher, 2013); however, Miethe and Meier (1990) present one of the only studies to utilize multiple measures of

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proximity that includes measures of living in an inner-city, perceived safety of respondent's neighborhood at night, and the average rate of offending within the neighborhood. Their results were congruent with routine activity theory in that those who lived in close proximity to other citizens residing in high crime areas were more likely to be victimized.

The concept of *exposure,* which is the accessibility of targets located in risky environments (Madero-Hernandez & Fisher, 2013), has often been measured by the activities that people pursue outside of working hours (e.g., nighttime and leisure activity) (Bunch, Clay-Warner, & Lei, 2012; Fisher et al., 1998; Gibson, Fagan, & Antle, 2014; Kennedy & Forde, 1990; Maxfield, 1987; Sampson & Lauritsen, 1990; Sampson & Wooldredge, 1987; Wilcox, Land, & Miethe, 1994; Wilcox, Tillyer, & Fisher, 2009). However, more direct measures such as unoccupied homes, visibility of property, exposure to criminal others at public transit routes, access routes, and vehicle ownership have been used to measure exposure to motivated offenders, which has found to increase victimization rates (Buckley, 1996; et al., 2004; Clarke & Mayhew, 1994; Coupe & Blake, 2006; Estrada & Nilsson, 2008; Newton, Partidge, & Gill, 2014; Piza & Kennedy, 2013; Rountree, & Land, 1996; Tseloni et al., 2004; Tseloni, 2006).

Operationalizations of *target attractiveness* have varied based on the offenses examined, such as personal larceny, robbery, and theft measured as family income, cash carried openly, and ownership of expensive items (Lynch, 1987; Madero-Hernandez & Fisher, 2013; Miethe et al., 1987; Sampson & Wooldredge, 1987). For example, Sampson and Wooldredge (1987) found that households with VCRs were positively associated with higher levels of burglary victimization. While VCRs were highly valued in the

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1980s, more recent highly valued items such as televisions, audio equipment, and jewelry have been utilized to measure target attractiveness (Clarke, 1999; Johns & Hayes, 2003; Nee et al., 2015). Target attractiveness has also been measured as housing value and neighborhood socioeconomic status, and respondent's social class because it is assumed that more affluent neighborhoods have high-value goods that may be attractive to motivated burglars (Miethe & Meier, 1990; Miethe & McDowall, 1993; Zhang et al., 2007). Importantly, the research of Bernasco and Luykx (2003) demonstrate the complexities of this measure as affluent areas have high burglary rates only if the neighborhood is nearby areas where large numbers of burglars reside.

Guardianship is a concept that has developed over time, including physical guardianship and social guardianship (Madero-Hernandez & Fisher, 2013). Common measures of social guardianship include the number of adults in the home, whether neighbors watch over the neighborhood, and parental attachment to youth (Cohen, Kluegel, & Land, 1981; Miethe & McDowall, 1993; Schreck, Stewart, & Fisher, 2006; Zhang, Messner, & Liu, 2007). Moreover, research demonstrates that individual-level informal guardianship, not formal guardianship from government officials, is more effective in preventing crime (Buck, Hakim, & Rengert, 1993; Mustaine & Tewksbury, 1998; Wright & Decker, 1994). Physical guardianship (or target hardening techniques) have been operationalized as door locks, burglar alarms, resident carrying a weapon, and owning a dog (Fisher et al., 1998; Hirschfield, Newton, & Rogerson, 2010; Outlaw et al., 2002; Rountree et al., 1994). Miethe and Meier (1990) found that social guardianship (e.g., household members over 16 years old) was related to reduced victimization rates; however, burglar alarms (physical guardianship) was unassociated with reduced

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victimization risks (also see Miethe & McDowall, 1993). As technology develops, surveillance mechanisms such as photographic, video, and security systems have been operationalized to capture guardianship in recent studies (Reynald, 2016; Surette, 2005; Welsh, Farrington, & Taheri, 2015).

While Cohen and Felson (1979) examined large-scale macro-social units (e.g., variation of crime country-wide), scholars have also examined smaller units of analysis (Kubrin et al., 2009). Opportunity theories can be applied to a myriad of analytical units, which is a key strength of the paradigm. For example, Messner and Blau (1987) found support for opportunity theory by investigating the association between household and non-household activities on city-wide crime rates. They found that increases in non-household activities is positively associated with higher city-wide crime rates, while more household activities (e.g., television viewing) reduced violent and property crime rates (also see Carroll & Jackson, 1983; Messner & Tardiff, 1985; Miethe, Hughes, & McDowall, 1991). Roncek and Maier (1991) studied the association of bars and taverns on crime rates at the block level and found that blocks with more of these businesses had higher crime rates (also see Roncek & Bell, 1981; Roncek & Pravatiner, 1989). Rice and Smith (2002) used a combined model of social disorganization and routine activities to study vehicle thefts at the face-block level.[32] They found that all predictors of routine activities (e.g., vacant parking lots, mean property value) were significant indicators of vehicle theft (also see Smith et al., 2000). As a macro-level predictor, the opportunity theory paradigm has found moderate support. For example, Pratt and Cullen's (2005)

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[32] A face block is defined as "both sides of a street between two intersections" (Rice & Smith, 2002, p. 305; also see: Smith, Frazee, and Davison 2000; Taylor et al. 1995)

meta-analysis of macro-level predictors suggested that routine activity theory has been adequately tested and has found moderate empirical support as a macro-level predictor (also see Kubrin et al., 2009). However, Madero-Hernandez and Fisher (2013) suggest that opportunity theory has only found mixed support due to the inadequate measures utilized in testing the theory.

The research utilizing opportunity theory to explain individual differences in criminal victimization has largely found mixed results as they vary based on the offense(s) examined (Kubrin, Stucky, & Krohn, 2009; Osgood et al., 1996; Madero-Hernandez & Fisher, 2013). In one of the first tests of opportunity theory, Cohen and colleagues (1981) found that individuals who were married, employed, and lived in rural areas were less likely to be victims of property crimes, such as larceny and burglary, as it is assumed they were less exposed to motivated criminals and had higher levels of guardianship (also see Miethe, Stafford, & Long, 1987; Mustaine & Tewksbury, 1998; Reynald, 2009). While Miethe, Stafford, and Long (1987) found that individual routine activities explained property crime in 13 cities, these individual routine activities did not explain violent crime in those same cities (also see Kennedy & Forde, 1990; Massey, Krohn, & Bonati, 1989; Miethe, Hughes, & McDowall, 1991; Miethe & McDowall, 1993). As a result, they argue that opportunity theory may have better predictive strength for property rather than violent crimes. Violent crimes are more impulsive, expressive crimes which defy the premise of opportunity theory that assumes offenders are rational (also see Sampson, 1987). However, Miethe and Meier (1990) found that those who resided in urban and high-crime neighborhoods, possessed an active nightlife, lived alone, and carried cash were more likely to be victims of assault. Other risky lifestyles

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and routines have been associated with violent crime including fighting at school (Burrow & Apel, 2008), adolescents sneaking out of the home (Schreck & Fisher, 2004), alcohol and drug use (Lasley, 1989; Schwartz & Pitts, 1995; Cass 2007), and having deviant peers (Osgood et al., 1996; Bernburg & Thorlindsson, 2001; Haynie & Osgood, 2005).[33]

Multilevel opportunity theories provide an important extension to the opportunity theory paradigm due to its examination of the various contextual effects of areas. Researchers typically examine the contextual effects of the inner-city on street crimes (Sampson & Wooldredge, 1987; Miethe & McDowall, 1993; Lynch & Cantor, 1992). However, research by Fisher and colleagues (1998) (also see Fisher et al., 2010; Fisher & Smith, 2009; Fisher & Wilkes, 2003) have highlighted some of the various sources of contextual effects that create criminogenic environments on college campuses and their surrounding areas. The authors suggest that college students are in close proximity to large numbers of people; thus, they may be exposed to crime due to college nightlife and access to alcohol and drugs. Consequently, they may be vulnerable targets and they may also be exposed to roommates who are motivated offenders (as compared to guardians). Thus, it is possible that the context of being a college student may expose them to not only fellow students who are motivated offenders but other city dwellers in the nearby environment. For example, Fisher et al. (1998) found that students were more likely to be victimized on campus (e.g., theft and sexual assault); however, robbery, assaults, and threats were more likely to occur off-campus (also see Fisher & Wilkes, 2003; Fisher et

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[33] Interestingly, routine activity research has yet to convincingly confirm that gang membership as a deviant lifestyle-routine predicts criminal victimization (see: Spano, Freilich, & Bolland, 2008; Taylor et al. 2008).

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al., 1998; Fisher et al., 2009; Mustaine & Tewksbury, 2002; Sloan & Fisher, 2010; Tewksbury & Mustaine, 2003). This research suggests that college campuses are not "ivory towers" that insulate students from criminal circumstances, but instead may increase their chance of victimization. Further, the contexts of areas are significant considerations that should be made when examining the social ecology of an area that creates various criminal opportunities, as certain contexts may lead to increases in specific crimes.

Overall, the extant research has supported the theoretical propositions of multilevel models by demonstrating that context matters as criminal opportunity arises from the specific context under investigation (Burrow & Apel, 2008; Miethe & Meier, 1990; Meier & Miethe, 1993; Ouimet, 2000; Outlaw, Ruback, & Britt, 2002; Rountree, Land, & Miethe, 1994; Smith, Frazee, & Davison, 2000; Tillyer, 2015; Wilcox et al., 2013). However, some studies have not found support for the micro-level predictors within the opportunity paradigm. Sampson & Wooldredge (1987) tested a multilevel opportunity theory that examines both structural and individual level characteristics. The scholars found minimal support for opportunity theory and instead, they found that structural characteristics of an area were stronger predictors of victimization (also see Rountree & Land, 1996). Findings from multilevel opportunity research has suggested that there are macro and micro-level factors that simultaneously influence criminal victimization.

Crime occurring at middle and high schools has been examined through the opportunity lens (Burrow & Apel, 2008; Cross et al., 2009; Popp & Peguero, 2011). Utilizing a national longitudinal survey from the Department of Education, Peguero

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(2009) demonstrated that 10th-graders who are involved in school-related extracurricular activities were more likely to be victimized; however, students who were involved in school-related sports had lower victimization rates. Other contexts that have been examined utilizing routine activity theory are the work environment (Garbarino et al., 2011; Lynch, 1987; Wooldredge, Cullen, & Latessa, 1992) and crimes that occur on the internet in cyberspace (Bossler & Hold, 2009; Pratt, Holtfreter, & Reisig, 2010; Pyrooz, Decker, & Moule, 2015; Reyns, Henson, & Fisher, 2011).

The opportunity theory paradigm provides benefits to criminologists due to its versatility in application to many social contexts. While routine activity theory has been critiqued for its inability to predict criminal motivation (Kubrin et al., 2009), it offers straight forward policy implications that may be implemented to reduce criminal opportunities. In a similar vein, environmental criminology is a paradigm that has important policy implications due to the focus on the effects of the built environment of metropolitans. Therefore, the next section will present the empirical status of environmental criminology.

<div align="center">Environmental Criminology</div>

Since its introduction in 1981, the environmental criminology paradigm has been connected with routine activities and subjected to rigorous empirical testing (Brantingham & Brantingham, 1991).[34] Brantingham and Brantingham's (1981) crime pattern theory (or target search theory) incorporates elements of routine activity theory, the effects of the urban form (land use), and rationality through the eyes of the offender.

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[34] Environmental criminology is a family of theories including routine activity theory, situational crime prevention, the rational choice perspective, crime pattern theory, and the geometry of crime paradigm (Wortley & Townsley, 2016).

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As evidenced by the paradigm's name, the routines of offenders, targets, and the criminal event are largely shaped by the physical and social *environment*.[35] Since the physical environment is so important to this theoretical tradition, certain land uses throughout the environment have been shown to affect people's regular activities and attract crime to the surrounding area[36] (Bernasco & Block, 2011; Brantingham & Brantingham, 1981; Roncek & Pravatiner, 1989). For example, variations in people's routines may be affected by changes in the built environment such as new roads, transportation modes, and expanded infrastructure that are built throughout a city (Bernasco, 2010; Bernasco & Kooistra, 2010; Wiles & Costello, 2000). An emerging research agenda involves the effects of built businesses nested in the inner-city. For example, Kubrin and Hipp (2016) examined fringe banks (e.g., payday lending, check cashing services) in Los Angeles and found that fringe banks are associated with high crime rates, particularly robbery, at the block-level. Even more, blocks adjacent from payday lenders saw increases in crime rates.

Boessen and Hipp (2015) state, "studies that have tested the effects of various land-use patterns on neighborhood crime rates often have been constrained to testing only the effect of a subset of possible land uses" (p.405). For example, some of the land uses that have received strong support as CGAs are areas with dense bar and alcohol outlets (Bernasco, Block, & Ruiter, 2013; Block & Block, 1995; Bowers, 2014; Groff & Lockwood, 2014; Haberman & Ratcliffe, 2015; Ratcliffe, 2012), bus stops (Bernasco &

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[35] Since the empirical status of routine activities was covered in-depth in the previous section, this section will be relatively shorter as routine activities research is interconnected with environmental criminology.

[36] An in-depth discussion on the effects of land uses will presented later in this chapter.

Block, 2011; Bichler, Smerler, & Enriquez, 2013; Hart & Miethe, 2014; Newton, 2004, 2008; Newton & Bowers, 2007), and hotels (Drawve & Barnum, 2018; Drawve, Thomas, & Walker, 2016; Kinney et al., 2008; LeBeau, 2012; Levine, Wachs, & Shirazi, 1986). Roncek and Maier (1991) examined the effects of bars, taverns, and lounges on block-level crime rates in Cleveland. They found that blocks with a high density of these businesses were associated with higher index crimes. Further, physical characteristics of the surrounding neighborhood (e.g., overcrowding, socioeconomic factors) also increased these crime rates. This research demonstrates that land uses such as bars and taverns, exacerbate crime rates as they affect individuals' routine activities (e.g., attracting people for nightlife purposes).

Since crime pattern theory seeks to understand the spatial patterning of crime, this research has examined crimes along *edges*, which are social or physical barriers of a city. Edges may have higher levels of crime due to territorial conflict between different groups (Brantingham & Brantingham, 1993; Clare, Fernandez, & Morgan, 2009; Peeters & Elffers, 2010; Song et al., 2017). Song and colleagues (2017) found an "edge effect," which is higher crime rates at the boundaries of known neighborhoods and districts, particularly if the edge was nearby a crime generator or crime attractor.[37] Additionally, the authors found that the further you move away from the edge, crime rates decrease. The empirical scholarship also suggests that most cities have crime *generators* and crime

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[37] Crime generators are "particular areas to which large numbers of people are attracted for reasons unrelated to any particular level of criminal motivation they might have or to any particular crime they might end up committing" while crime attractors are "particular places, areas, neighborhoods, districts which create well-known criminal opportunities to which strongly motivated, intending criminal offenders are attracted because of the known opportunities for particular types of crime" (Brantingham & Brantingham, 1995, p.7-8)

attractors, which are *activity nodes* that bring various people together for different purposes, thereby increasing crime rates (Bichler, Swartz, & Orosco, 2010; Brantingham & Brantingham, 1984; 1995; Papachristos, Hureau, & Braga, 2011; Sherman, et al., 1989; Wright & Decker, 1994, 1997).[38]

In order to get to and from places, people travel along *paths*, which are everyday routes taken by both offenders and potential victims (e.g., job, school, home). The research has found that crime commonly occurs along these paths (Brantingham & Brantingham, 1993, 1995). For example, certain crime occurrences are more likely to occur in various paths people take on a daily basis including robberies and vehicle thefts occurring near bus stops, areas with high traffic volumes, and highway exits (Beavon, Brantingham, & Brantingham, 1994; Levine, Wachs, & Shirazi, 1985; Loukaitou-Sideris, 1999; Rengert, Ratcliffe, & Chakravorty, 2005). McCutcheon and colleagues (2016) analyzed county-level data in Georgia to study robberies that occur on highways. The researchers found that increased numbers of highway exits in a county was associated with higher rates of robberies.

Another branch of environmental criminology, rational choice theory (RCT), examines the location of crimes and how the environment shapes what the offender perceives as "good" or "bad" criminal opportunities (Brantingham & Brantingham, 1991).[39] This perspective studies the structural constraints that may prevent offenders from making criminal decisions by increasing their perceived likelihood of being caught

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[38] A more in-depth discussion of crime generators and attractors can be found in later sections.

[39] While this dissertation will not directly focus on the rational choice theory, this paradigm must be briefly discussed as it is a valuable contribution to environmental criminology.

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(Pratt et al., 2006). The initial theoretical ideas of the rational choice perspective were developed by Ron Clarke in the 1970s (see Wortley & Townsley, 2016), and it became more prominent in the mid-1980s when Clarke and Cornish produced a comprehensive rational choice theory (see Clark & Cornish, 1985; Cornish & Clarke, 1986).

Research has found that aggressive policing strategies affect offender's decision-making processes (Clarke, 1992; Mazerolle, Kadleck, & Roehl, 1998; Nagin, Solow, & Lum, 2015; Sampson & Cohen, 1988;).[40] Braga and colleagues (1999) implemented a matched-pairs randomized controlled trial of 24 high crime areas and found that areas implementing the treatment of focused police presence reduced crime and disorder in these areas. Additionally, rational choice theory recognizes that the decision-making process varies by the type of crime being considered by the offender (Cornish & Clark, 1986). While there are arguments regarding the rationality of robbers (see for discussion Gibbons, 1994; Wright & Decker, 1997), scholars have found that robbers and burglars implement a decision-making process when selecting site locations to commit crimes (Burrell, Bull, & Bond, 2012; Hochstetler, 2001; Katz, 1991; Walsh, 2017). For example, houses near a recently burglarized house are subsequently more likely to be later burglarized (Bernasco, 2008; Bowers & Johnson, 2005; Burrell, Bull, & Bond, 2012; Hochstetler, 2001; Johnson & Bowers, 2004; Katz, 1991; Townsley, Homel, & Chaseling, 2003; Walsh, 2017).

The rational choice perspective provides valuable insights into the psychological decision-making process through the lens of the offender (Wortley & Townsley, 2016).

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[40] There is a wealth of research that displays the success of focused deterrence policing strategies (see: Operation Ceasefires implemented across the country) (Boyle et al., 2010; Braga et al., 2001; Tillyer & Kennedy, 2008).

Rational choice theory focuses on the dynamic nature of the choice's offenders make while other theories simply assume the choice of the offender (Clarke & Cornish, 2001). Through this lens, researchers have found that offenders do not always impulsively act, planning their actions in advance (see the crime script, Cornish, 1994). This perspective has a number of important policy implications for crime reduction that focus on making certain locations unattractive to conspiring criminals (Wortley & Townsley, 2016). Now that the empirical status of environmental criminology has been presented, a discussion of the empirical foundation of collective efficacy will be presented. Thus, the next section will briefly discuss the empirical status of collective efficacy before discussing the integration of both environmental criminology and collective efficacy.

<div align="center">Collective Efficacy</div>

Collective efficacy emerged from the systemic social disorganization model (Corcoran et al., 2018) that incorporates both intra-neighborhood and extra-neighborhood factors that may be significant in producing neighborhood informal social control (Bursik & Grasmick, 1993; Kornhauser, 1978; Kubrin & Weitzer, 2003b). Furthermore, the systemic social disorganization model emphasizes the importance of friendship, kinship, social ties, networks, and social capital in exerting informal social control within a neighborhood (Bursik, 1999; Kasarda & Janowitz, 1974; Putnam, 2001; Sampson & Groves, 1989; Warner & Rountree, 1997). These neighborhood mechanisms[41] serve as significant mediators between exogenous neighborhood characteristics (e.g., poverty, residential mobility; see Kubrin & Weitzer, 2003b) and crime.

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[41] These mechanisms demonstrate a neighborhood's ability to exert informal social control.

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Collective efficacy theory has enjoyed substantial support since its introduction as a mediator that reduces crime within neighborhoods (see Sampson, 2006). The introductory research by Sampson et al. (1997) found that high levels of collective efficacy significantly reduced violence throughout Chicago neighborhoods (also see Browning, 2002; Maimon & Browning, 2010). Morenoff, Sampson, and Raudenbush (2001) also found that high levels of collective efficacy reduce violence within neighborhoods, and added that density in social ties independently was not as strong of a mediator as collective efficacy (also see Browning, Dietz, & Feinberg, 2004; Fagan, Wright, & Pinchevsky, 2014; Mazerolle, Wickes, & McBroom, 2010).[42] Even more, collective efficacy has also been found to not only reduce violent crimes but other crimes, such as burglary (see Kubrin & Weitzer, 2003b; Sampson, Morenoff, & Gannon-Rowley, 2002 for discussion). Collective efficacy has also been shown to be effective not only in Chicago, but in other American and international cities (Mazerolle et al., 2010; Wickes, 2010; Wickes et al., 2013).

The empirical scholarship suggests that collective efficacy affects other social problems outside of crime.[43] For example, high levels of collective efficacy are believed to mitigate health problems (Browning & Cagney, 2002; Cohen et al., 2006), children's behavioral and school problems (Goddard, 2001; Hoy, Sweetland, & Smith, 2002; Odgers et al., 2009; Sampson, Morenoff, & Earls, 1999), sexual activity among adolescents (Browning et al., 2008; Kim, 2010), and adolescent alcohol and drug use

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[42] Note, however, that concentrated disadvantage, residential mobility, and immigrant populations contribute to lower levels of collective efficacy (Hipp & Wickes, 2017).
[43] It is important to point out that these "other" social problems may also be correlates or influences into criminal involvement (Maynard, Salas-Wright, & Vaughn, 2015).

(Fagan et al., 2014; Leslie et al., 2015; Maimon & Browning, 2012). In addition, there is a large body of literature that has examined whether high levels of collective efficacy reduce fear of crime and disorder within a neighborhood (Gainey, Alper, & Chappell, 2011; Gibson et al., 2002; Markowitz et al., 2001; Swatt et al., 2013; Weisburd et al., 2011; Xu, Fielder, & Flaming, 2005). In sum, collective efficacy has demonstrated the potential to mitigate a range of social problems (Sampson, 2006), thus benefitting the overall well-being of neighborhood citizens.

The next section will examine how various theoretical paradigms such as routine activities and collective efficacy can be integrated to more fully explain crime at the neighborhood-level. The integration of routine activities and collective efficacy may resolve a number of unanswered questions regarding the interactions of neighborhood, businesses, and crime.

Integration of Complimentary Theoretical Paradigms and Concepts:

Collective Efficacy & Environmental Criminology

There is substantial overlap between environmental criminology and collective efficacy (Braga & Clarke, 2014; Bursik, 1988). The perspectives nested within the environmental criminology paradigm all incorporate the element of guardianship, which aligns closely with theories centered around informal social control (Groff, 2015). For example, guardianship (whether social or physical guardianship) affects the decision-making process in the rational choice perspective (Clark & Cornish, 1985; Groff, 2015). Guardianship can affect offenders' perceptions of whether they will be caught, reported, or confronted during or after crime commission. Crime pattern theory examines the way that crime patterns are shaped through the levels of guardianship that are created by the

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physical environment (e.g., businesses, land uses) (Brantingham & Brantingham, 1991; Cullen, Agnew, & Wilcox, 2014; Eck & Weisburd, 2015). Additionally, the role of capable guardians is an essential element of routine activity theory (Felson & Cohen, 1979). Guardianship involves "possessing qualities that relate to social ties and interpersonal control" (Wilcox, Land, & Hunt, 2003, p. 62) or the ability of people or a community to protect their citizens (Graif et al., 2014; Groff, 2014).[44] Collective efficacy emphasizes the importance of social cohesion and mutual trust between neighbors/citizens that help an area exert social control (Sampson et al., 1997). It can be argued that land uses and businesses may create environments that make it difficult for the surrounding area to exert informal social control, thus lacking the ability to establish social cohesion and mutual trust. On the other hand, land uses may create an environment that endorses social ties, interactions, and social cohesion, thus higher levels of informal social control and reduced crime rates in the surrounding area due to limited criminal opportunities (Anselin et al., 2000; Weisburd et al., 2014; Wo, 2016). Those businesses that foster or nurture environments that create collective efficacy may be called *virtue locales*.[45] Thus, the concept of virtue locales merges three compatible theoretical paradigms (routine activity, environmental criminology, and collective efficacy) to conceptualize businesses that reduce crime in nearby areas due to the guardianship, social capital, and collective efficacy these locations provide.

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[44] Informal social control and guardianship can almost be used interchangeably (Wilcox, Madensen, & Tillyer, 2007).

[45] *Virtue locales* are defined as community context specific businesses that reduces crime in the nearby environment ("crime repellant effect"). These businesses reduce crime due to the high levels of social guardianship, cohesion, ties, interactions, and collective efficacy established at the location.

The Importance of Businesses

Businesses nested within neighborhoods have a significant impact on crime rates in the surrounding area (Brantingham & Brantingham, 1993; Wilcox et al., 2004). For example, businesses that have difficulty establishing guardianship at the immediate location may attract motivated offenders (Brantingham & Brantingham, 1995). On the other hand, "…when crime problems emerge, such businesses may become the informal setting in which residents utilize their social ties to disseminate information and mobilize resources" (Wo, 2016, p.1303). Factors such as the business type, where it is located, and the owners of the business may determine the level of guardianship it possesses (Casten & Payne, 2008; Roncek & Maier, 1991; Rosenthal & Ross, 2010). Thus, businesses are important factors when examining community contexts, especially for scholars interested in crime prevention.

Businesses can promote guardianship throughout the surrounding area in a multitude of ways, including through place management or place managers (Brantingham & Brantingham, 1993). Place managers can be owners and workers, patrons, nearby citizens, and nearby business owners who can provide informal guardianship to the area (Felson, 1995; Kennedy, 2016; Reynald, 2015). Decisions made by the key place manager (the owner), affects what patrons are attracted to their business, the location of the business, and the persona the business accrues over time (Madensen & Eck, 2008). Thus, the decisions made by place managers are consequential to whether social guardianship is exerted and ultimately determine if the business is criminogenic.[46] The

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[46] While "intimate handler" was intended to mean parents whose proximity and knowledge of their child makes them the main tool for informal social control (Felson, 1995), business owners can be considered the "intimate handler" of their business.

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mere presence of business owners, workers, patrons, and bystanders is not enough without these entities taking stock and responsibility in the place/business itself (Felson, 1995).

Without professional and personal responsibility devoted to the business, the place managers/handlers/guardians will have no regard for the business as a criminal target and will not invest in preventative efforts to reduce crime and disorder (Eck & Weisburd, 2015). This concept of professional/personal responsibility in a place can be integrated as a form of informal social control among and within businesses. For example, Felson (1995) presents four levels of place managers (personal, assigned, diffuse, and general), that all have a role in taking responsibility for what occurs at a "place." The owners (personal), employee (assigned), security guards (assigned), and customers/bystanders (general) may "take stock" in the safety of the place and the surrounding environment, thereby fostering an environment rich with informal social control (Felson, 1995; Madensen & Eck, 2013, also see territoriality by Newman, 1973)[47]. Businesses could bridge communications between other owners, employees, and patrons to create a rich environment conducive to developing shared expectations, social ties, and social cohesion within the neighborhood (see Ford & Beveridge, 2004). Essentially, businesses possess the opportunity to establish social capital within areas that have crime-reducing and other virtuous effects on the neighborhood (e.g., job opportunities and social connections) (Oh, Labianca, & Chung, 2006). Virtue locales are businesses in which the owners, patrons, and citizens take stock in the businesses and the

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[47] Territoriality, similar to guardianship and collective efficacy, is defined as "…the sense of attachment and symbolic investment that people can acquire in space… that leads people to wish to guard what is their own" (Rock, 2007, p.21).

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neighborhood. Further, due to the care of the premises and community, high levels of guardianship are established which deters motivated offenders. Due to the overall investment and care for the surrounding areas by invested parties, virtue locales establish a community anchor due to the social capital and collective efficacy established at these locations. All of these qualities of the business are a part of a crime-reducing dynamic of such virtue locales.

<div align="center">Social Wedges, Social Holes, & Social Conduits</div>

A few studies have recently attempted to bridge land use with collective efficacy by discussing the effects of social wedges, social holes, and social conduits (Corcoran et al., 2018) on informal social control capabilities. Social wedges (e.g., rivers, highways), are natural land features that "carve" up neighborhoods while social holes (e.g., parks and industrial estates) are land uses that create no occupancy, both of which create barriers that prevent social interaction, ties, and attachment (Hipp et al., 2014). On the other hand, social conduits (e.g., libraries, community clubs, privately owned restaurants) are places that encourage social interaction and social ties (Corcoran et al., 2018). Some of the scholarship has found that social wedges and holes prevent informal social control from being established within a neighborhood, while increased density of social conduits promotes informal social control due to the concentrations of social interactions and social ties (Corcoran et al., 2018; Hipp et al., 2014; Wickes et al., 2019). Virtue locales may nest within this new research platform in that virtue locales may be a type of business that creates social conduits. Further, virtue locales may extend the concept of social conduits by specifying the type of social ties that are established within social conduits.

The research examining virtue locales may present a more detailed picture of the effects of business and social conduit locations. Virtue locales are businesses that have substantial crime reducing effects as these businesses provide guardianship at the immediate location through a multitude of mechanisms, including target hardening (Clarke, 1983), by demonstrating care for the security around the premises and an investment in the business. Moreover, virtue locales may also be nested in criminogenic environments; however, virtue locales may create a gap in criminal occurrences at its location and the surrounding area. In areas with high-crime levels, these businesses may inject "virtue" to troubled areas, mitigating crime and other social problems the neighborhood experiences. Thus, virtue locales can be near crime generators, crime attractors, and crime neutral areas, but due to these characteristics, motivated offenders are deterred from these locations, because they know the structural security and social guardianship at these businesses creates a higher risk of apprehension. Furthermore, virtue locales bring together customers, neighborhood residents, and employees in building social cohesion and collective efficacy. The addition of virtue locales presents a number of theoretical linkages, including place management and target hardening (Madensen & Eck, 2013), crime patterns and criminology of place theory (Brantingham & Brantingham, 1991, 1995), and collective efficacy (Sampson et al., 1997). These attributes are factors that may join together to affect motivated offenders and potential target's routine activities (Cohen & Felson, 1979). Finally, the introduction of virtue locales provides a bridge between these theories and it paints a clearer picture of spatial distributions of crime.

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This section presented how environmental criminology and collective efficacy are two interconnected theoretical paradigms. However, even within these paradigms, there are still "gaps" in the literature. The next section will present these "gaps" and explain how virtue locales may help to fill the gaps.

Gaps in the Literature

As stated, there is persuasive evidence that certain businesses such as bar districts, alcohol outlets, and hotels are CGAs that lack the ability to exert guardianship in the neighboring area (Bernasco, Block, & Ruiter, 2013; Drawve, Thomas, & Walker, 2016; Kinney et al., 2008; ; LeBeau, 2012; Roncek & Maier, 1991; Roncek & Pravtiner, 1989).[48] While there are considerable amounts of scholarship that focus on what businesses, locations, and areas *attract* or generates crime (LaGrange, 1999; McCord et al., 2007; Sampson & Raudenbush, 2004; St. Jean, 2007; Wilcox et al., 2004), little attention is given to businesses that *prevent* and deter crime from the surrounding area. In other words, there may be businesses that foster environments that are able to exert guardianship at their immediate location and other nearby areas. Unraveling which businesses deter criminally inclined individuals from visiting the surrounding area would make a substantial contribution to the crime prevention literature. Moreover, there are still a number of unanswered questions regarding who or what are the key players/factors in exerting high levels of social guardianship at a business location (Groff, 2015). As such, this research introduces the term virtue locales, which are businesses that establish

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[48] There is also some research that suggests that banks, big box retail, convenience marts, grocery stores, lottery sales stores, and tattoo/piercing parlors may be CGAs (see: Drawve et al., 2016). However, research has yet to convincingly uncover these businesses as CGAs.

high levels of social guardianship within their immediate area, thus deterring criminal behavior. The addition of virtue locales will close the gaps in the literature by providing the other side of the CGA research by examining which businesses do *not* attract crime.

Although Brantingham and Brantingham (1995) emphasize crime attractors and crime generators, they also briefly touch on *crime neutral* areas. Crime neutral areas *do* have crime occurrences, but in low concentrations, since they neither attract nor create easy opportunities for crime. Crime may still be prevalent in crime neutral areas; however, crimes are sporadically and haphazardly distributed throughout the area (Frank et al., 2011). Steenbeck and colleagues (2012) present one of the few empirical analyses of crime neutral places (also see Frank et al., 2011). They suggest that the effects of having large numbers of businesses (and their employees) may serve to create crime neutral areas nested within a neighborhood. They argue that these large numbers of employees in a neighborhood may be more willing and able to exert informal social control. However, they also find that increased businesses and employees in a neighborhood are associated with elevated levels of physical and social disorder. Regardless, the concept of crime neutral places is underdeveloped, and it focuses solely on *how* crime is spatially distributed. Research has yet to explore what kind of businesses create this sporadic concentration of crime. Furthermore, the empirical research has not yet explained the social mechanisms and neighborhood effects that occur in these areas that make spatial distributions sporadic. It is possible that the introduction of virtue locales can offer some critical insights into research involving crime neutral areas. The inclusion of virtue locales may reveal the mechanisms created by businesses to deter crime by signaling to motivated offenders that a specific place is unattractive for crime.

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This "signal" may be a product of the business's history of exerting place management and target hardening (Madensen & Eck, 2013), physical and social guardianship (Cohen & Felson, 1979), and collective efficacy (Sampson et al., 1997) Thus, it is possible that "virtue locales" may explain the sporadic distribution of crime in a crime neutral area.

The scholarship previously discussed regarding social holes, social wedges, and social conduits presents an intriguing avenue to further explore land use. This research is primarily focused on how land uses impedes or creates social interaction and social ties. Where social holes and social wedges (e.g., parks and highways, respectively) may fragment an area and prevent the possibility of social interactions, social conduits (e.g., privately-owned restaurants, libraries, and community centers) may create opportunities for social interactions (Corcoran et al., 2018; Wickes et al, 2018). While social conduits may bring people together and provide opportunities for social interaction, the type of interactions that occur is unspecified, or it is assumed to be positive and virtuous interaction. Said differently, social interaction may not always be positive and productive in creating informal social control. For example, Pattillo (1998) argues that Black middle-class neighborhoods may have high levels of social interactions; however, some off these interactions are with gang members and drug dealers. Thus, simply examining land uses that increases social interactions, but do not address the type of social interactions that occur, does not fully account for the effects of these social conduits. Moreover, Corcoran and colleagues (2018) suggest that community centers encourage social interactions; however, some individuals may be attracted to these locations with criminal intentions, thereby interrupting efforts to exert informal social control in the area. Therefore, the inclusion of virtue locales within this research paradigm may aid in explaining the social

interactions and social ties that occur within social conduits. Moreover, virtue locales may be a beacon, or the reason for establishing social conduits. While social conduit research examines land uses that bring together social interactions, virtue locales provide a more detailed investigation into the type of interactions that occur and the effects businesses have in these areas. This is an important extension of land use research as it combines environmental criminology and the collective efficacy paradigm to better understand crime at the neighborhood-level. However, this scholarship is in its early development and requires further investigation.

When identifying virtue locales, racial and ethnic composition of a neighborhood must be considered. Parker (2015) was one of the first to examine the effect of Black-owned businesses and entrepreneurship on crime rates. She found that Black youth violence dropped in areas with high rates of Black entrepreneurship and Black-owned businesses. Black-owned businesses may provide role models, "old heads," and/or social buffers to youth in areas of concentrated disadvantage, thus reducing crime (see Anderson, 1990; Parker & Reckdenwald, 2008; Wilson, 1987). While Parker (2015) provides some valuable insights when exploring the different effects of neighborhoods by racial composition, there are still limitations. First, this research takes a macro-level approach to crime reductions,[49] whereby failing to specify which areas or which Black-owned businesses reduce crime in surrounding areas. Second, this research fails to specify *where* crime was dropping and its mechanisms near the Black-owned businesses. Third, this research does not specify the crime reducing effects Black-owned businesses may have on other nearby businesses. Finally, Black-owned businesses do not necessarily

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[49] Parker (2015) examined all cities that had 100,000 or more citizens.

mean that the business type "fits" within the cultural fabric of the community in which it is nested. For example, a corporate business owned by a minority owner does not necessarily mean that business type fits within that specific community context. On the other hand, virtue locales are businesses that are organically and culturally nested within the community where they are located. The addition of virtue locales may circumvent these limitations and specify the crime-reducing impacts of different businesses types on neighborhood crime rates. The introduction of virtue locales (e.g., culturally Black businesses) may show which businesses mitigate crime rates within a neighborhood. Moreover, specific locations would be examined to explore what *types* of businesses reduce crime and what types of businesses attract crime. Finally, the use of virtue locales may illuminate the different effects that businesses have within areas, based on race and community context.

Squires and Kubrin (2006) suggest that the uneven development of American cities was created by a history of policy decision-making that segregates cities along racial lines through urban sprawl and concentrated poverty. Therefore, business structures in Black and White neighborhoods look different as certain businesses locate in these neighborhoods to target the populations they serve. As stated by Squires and Kubrin (2006), "the impacts of place and race are not inevitable. If place matters, policy counts as well. The uneven development of metropolitan America is a direct result largely of a range of policy decisions made by public officials and policy-related actions taken in the private and non-profit sectors" (p.48). Ignoring race and community context when examining business land use limits this kind of neighborhood-level research. Business structures (or business types) may vary by racial composition, for example, Black

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neighborhoods may be more likely to have businesses such as barbershops, since "barbershops in the Black community are discursive spaces in which the confluence of Black hair care, for and by Black people, and small talk establish a context for cultural exchange" (Alexander, 2003, p.105). This exchange can create collective efficacy, a care for the surrounding environment, and inevitably affect citizen's (criminal) routine activities.

The addition of virtue locales in the literature offers important extensions of many theoretical paradigms. Further, it also turns attention away from "what *causes* crime" towards "what does *not* cause crime" or rather "what *prevents* crime." Virtue locales closes the gap on research by examining what businesses create a platform for residents, customers, and other citizens to exert informal social control and take responsibility for the surrounding environment. Finally, identifying which businesses prevent crime provides a different piece to the crime prevention puzzle. As Boessen and Hipp (2015) state "the neighborhoods and crime literature has paid limited attention to the importance of land-use characteristics" (p. 405). Virtue locale research provides a distinct opposite viewpoint to the CGA research.

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Chapter 3: Methodology

Introduction

This chapter presents a discussion of the research setting, data, variables, research questions, research design, and methodology that will be used to investigate the effects of the proposed virtue locales on local crime counts. The review of the literature suggests that there are a number of gaps in the scholarship including whether opportunity theory and environmental criminology can be modified to account for differences in the racial composition of neighborhoods. The reconceptualization of these theories will permit a much fuller examination of their core concepts by using various methodologies such as descriptive analyses, observational design, and a quasi-experimental design using matching techniques approach. Additionally, while most prior research has investigated one outcome (typically violent crime counts), the current research will examine both violent and property crime counts. Moreover, this research will examine whether there is an association between barbershops and beauty salons on street segments on crime reductions in predominantly Black areas of the city. The following two research questions drive the focus of this research project:

- Do virtue locales, such as barbershops and beauty salons, nested within predominantly Black communities reduce crime on the street segment?

- Does this relationship between virtue locales and crime vary by time of the day (e.g., daytime or nighttime)?

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Research Design

This study utilizes two different research designs, a quasi-experimental design (matching) and an observational design approach using statistical controls that compare all street segments with a virtue locale to all street segments with businesses, but no virtue locale. The main research design is the quasi-experimental design, using matching techniques. This design is retrospective which allows the researcher to determine which cases were "exposed" to a treatment when selecting which variables are in the case and comparison groups (Mann, 2003; Siskind et al., 2014). This design will allow the research to examine whether crime counts are affected by the influence of a predictor variable of interest (virtue locales on street segments). Street segments containing a virtue locale (barbershop or beauty salon) will be compared to street segments without a virtue locale, matching on relevant factors such as arrests, street length, and socio-demographic variables.[50] During the matching process of the matched design, some street segments that did not meet the matching criteria to the treatment group were removed due to the lack of similarity of socio-demographic, street length, and arrests. After removing these streets, the final sample was n = 108.[51] The street segments with virtue locales can be thought of as the "treatment group" while the street segments with other businesses but no virtue locale can be viewed as the "comparison group."

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[50] That is, street segments that do not have a virtue locale but has a risky facility will be a comparison street under consideration.

[51] Matching was conducted manually by the researcher. Other criminological studies have used hand matching techniques (Braga & Bond, 2008; Schnell et al., 2019). To ensure that matching was executed properly, descriptives, t-tests, and Cohens'd tests comparing the two matched groups were initiated (results can be seen in later sections). The results show that, while the two groups do not perfectly match, they are comparable.

The second research design employed in this study is an observational design using statistical controls, which is intended to serve as a supplement to the quasi-experimental, matched street segment design.[52] This design groups all of the street segments with a virtue locale in one group and all of the street segments with a business but no virtue locale into a different group. Regression analyses were executed, controlling for relevant factors mentioned above (socio-demographic, street length, and arrests) (Rosenbaum, 1987). An important difference between the two research designs is that observational design does not use matching techniques to try to create an "apples-to-apples" comparison of groups (Blackstone, 2002). While the matching design lacks randomization, matching on relevant control variables makes the matching design a stronger design than the observational, statistical control design (Shadish et al., 2002). However, utilizing the statistical controls design will allow for a larger comparison group and increased sample size for statistical models (n = 134).[53]

Research Setting and Data

The data for this research originated in Columbia, South Carolina over a two-year period of time. The research setting of Columbia, South Carolina was chosen due to the researcher's involvement in a Project Safe Neighborhoods (PSN) research grant ("*Ceasefire Columbia*") that involved the Columbia Police Department (CPD), Department of Justice (DOJ), Probation, Pardon, and Parole, various community service

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[52] Throughout the rest of the document, the quasi-experimental, matched design may be referred to as the "Matched Design."
[53] For the rest of this project, this design may be referred to as the "Observational Design."

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providers,[54] and researchers from the University of South Carolina. The city of Columbia provides an important research landscape due to the demographic composition of the metropolitan area. Among other things, there are pockets within the city that contain high concentrations of Black residents (upwards of 80% of residents in certain areas such as the 29203-zip code).[55]

Black citizens consist of 40.6 percent of the Columbia population (American Community Survey, 2019), providing a unique opportunity to examine businesses that may be considered virtue locales in mostly Black neighborhoods. Latinx comprise 5.8 percent of the city's population, making it difficult to determine whether virtue locales truly exist in the Latinx community.[56] Additionally, 22.3 percent of Columbia's citizens live below the poverty line, with 8.4 percent of its citizens unemployed. These numbers are higher than the national average (14.6% below the poverty line and 6.6% of U.S. citizens unemployed). Thus, Columbia offers a research setting that is characterized by its diverse socio-demographic population. Table 3.1 below presents the demographic information of Columbia, South Carolina.

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[54] "SC Works," "Project NAS," and "Serve and Connect" are a few service providers involved in the PSN grant.

[55] Also known as the "North Region" of Columbia, South Carolina. The 29203-area code consists of a large portion of the research setting.

[56] Future research should consider the effects of businesses nested in neighborhoods with high concentrations of other ethnicities, including Asian, Latinx, and Native American neighborhoods.

Table 3.1 Demographics of Columbia, SC

Columbia, SC			United States/Nationwide	
	N	*%*		*%*
Males	67,861	51.3	Males	49.2
Females	64,375	48.7	Females	50.8
Age 15-24	39,494	29.9	Age 15-24	13.6
Black	53,636	40.6	Black	12.3
Latinx	7,626	5.8	Latinx	17.6
White	63,662	48.1	White	61.5
Median Household Income	43,650	-	Median Household Income	57,652
Citizens in Poverty	23,212	22.3	Citizens in Poverty	14.6
Unemployed Citizens	5,414	8.4	Unemployed Citizens	6.6
Bachelor's Degree or Higher	31,814	42.3	Bachelor's Degree or Higher	30.9
Vacant Housing Units	7,244	13.6	Vacant Housing Units	12.2

As part of the research team involved with Project *Ceasefire Columbia*, the

Columbia Police Department (CPD) provided data that included crime data, such as calls

for service, arrests, and crimes known. The crimes known data will be used to measure

the amount of violent crime (murder, non-fatal shootings, armed robbery, and aggravated

assault) and property crime (burglary, theft, and motor vehicle theft) as dependent

variables. Counts of the dependent variables will be utilized to examine the clustering (or

lack of clustering) of these types of crimes near the businesses of interest. The American

Community Survey (ACS), a survey implemented by the United States Census Bureau,

provides measures for socioeconomic status, race/ethnicity make up, and living

conditions. The ACS 2013-2017 summary is used instead of the 2010 decennial Census,

because the ACS is conducted on a yearly basis to provide up-to-date community

information (U.S. Census Bureau, 2018a). Finally, business data was collected from

Infogroup, a company that utilizes business and consumer databases to collect business

locations, their business type, and business ownership structures nationwide. Infogroup

employs over 300 technicians that make 24 million verification calls a year to validate

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business locations, openings, and closings (Infogroup, 2019).[57] The accuracy of the businesses, their type, and geolocation were checked and validated through internet searches, latitude, and longitude verifcation. Missing businesses were manually inserted into the Infogroup dataset to ensure that all businesses of interest in the city were included in the dataset.

Place-based research has focused on three general levels of analysis, the macro-level (community areas), meso-level (neighborhood clusters), and micro-level (street segments and intersections) (Brantingham & Brantingham, 1991; Schnell et al., 2017). Selecting the theoretically appropriate units of analysis is crucial to this research project (Hipp, 2007a; Kubrin & Hipp, 2016; Weisburd, Bruinsma, & Bernasco, 2009). Since virtue locales are nested within neighborhoods, it may make theoretical sense to examine their effects at the block-level. However, the most recent ACS (2013-2017 summary) smallest unit of measurement is the block-group level, thus the ability to examine businesses effects at the block-level is not feasible.[58] Regardless, block-group data derived from the recent ACS will provide accurate racial/ethnic and socioeconomic characteristics of the communities. There are 173 block-groups and 9,490 street segments in the greater Columbia metropolitan area. Moreover, there are 78 block-groups (45.1%)

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[57] I was informed by representatives of Infogroup that they call businesses up to three times a year to verify that businesses are still "in business" while simultaneously updating their databases on a weekly basis. Infogroup representatives guaranteed a 100% coverage rate of businesses of Columbia (J. Jones, personal communication, January, 2019).

[58] It was possible to utilize the 2007-2011 ACS that contains block-level data. However, using data from this time period may present problems since the data collected was too distant from the time period of interest.

that are majority Black residents (50.1% or more) and 54 block-groups that contain 60 percent or more Black residents nested within the block-group.

While the crime generator and attractor scholarship, has often utilized the block-level unit of analysis (see Bernasco & Block, 2011; Kubrin et al., 2011; Kubrin & Hipp, 2016; McCord et al., 2007; Groff & McCord, 2012; Steenbeek et al., 2012; Groff & Lockwood, 2014), other CGA research has utilized street segments as the unit of analysis (Groff & Lockwood, 2014; Groff & McCord, 2011; Groff, Weisburd, & Yang, 2010). Due to the availability of data from CPD and the discrete examination of businesses on the immediate environment and the nearby area, this research project utilizes street segments as the unit of analysis. A street segment is defined as "the two faces on both sides of a street between two intersections" (Weisburd et al., 2004, p.290). This unit of analysis allows the researcher to measure the effects at the immediate location (Groff & McCord, 2011) and investigate the decrementing effects as one moves further from the business location. Since the theoretical concept of virtue locales suggests a crime "repellant effect" at the immediate location and a "distance decaying effect" as one moves further from the business, a micro-level examination of the environment is theoretically relevant. Thus, examining the effects of the virtue locales at the street segment unit of analysis will better help examine the micro-level effects of the theoretical construct. Descriptive statistics show that of the 9,490 street segments, 7,306 (77%) street segments did not have a crime incident from October 31, 2017 to November 1, 2018. This finding aligns with the "law of crime concentration" (Weisburd, 2015) that suggests that even in "bad" neighborhoods, most street segments have little or no crime (also see Curman et al., 2014; Groff et al., 2010; Weisburd, Telep, & Lawton, 2014). Moreover,

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the socio-demographic variables were will be drawn from the 2013-2017 ACS at the block-group level, while the businesses, crimes, and arrests are nested within these block-groups, at the street segment level.

Variables

Dependent Variable

This research will examine both violent and property crime that occurred in Columbia from October 31, 2017 through November 1, 2018. To measure violent crimes, counts of murder, non-fatal shootings, armed robbery, and aggravated assault are used. Counts of property crimes include burglary, theft, and motor vehicle theft. Routine activity theory and opportunity theories were originally conceptualized to explain "predatory" crime, which are crimes in which someone "definitely and intentionally takes or damages the person or property of another" (Glaser, 1971, p.4). Prior research has conceptualized the crimes examined in this research project as "predatory" (see Sherman et al., 1989; Boetig, 2006; Cohen & Felson, 1979).[59] All crimes are geocoded to the location at which they occurred. Table 3.2 shows the total number of crimes on the street segments of interest within both samples.[60]

The influence of time plays an important role in the relevant theories that inspired the concept of virtue locales, including environmental criminology and routine activity theory. Additionally, studies have suggested that certain criminal events vary by time of

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[59] A limited number of studies have utilized routine activity theory to explain non-fatal shootings (see: Anyinam, 2015)

[60] Note that there are more crimes nearby these street segments; however, this table represents the crimes that are nested directly on the street segments of interest. The spatial lag terms are used as a control variable to control for nearby crimes that are not directly nested on the street segments.

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the day, including non-lethal police-citizen encounters (Phillips & Smith, 2000), homicides (Pereria et al., 2016), robberies (Tompson & Bowers, 2013), and burglaries (Coupe & Blake, 2006). Moreover, different types of businesses open and close at various times of the day, possibly affecting the location and type of crime that may occur. That is, businesses may be more likely to be burglarized at night when they are closed (Bichler-Robertson & Potchak, 2002; Conklin & Bittner, 1973; Hakim & Shachmurove, 1996); however, may be more affected by robbery when they are open (Ekblom, 1987; Luckenbill, 1980; Walsh, 2019). Since time has been suggested to be an important factor, it is essential to address if the crime-reducing effects of virtue locales vary by time of the day.

It is a logical assumption that if barbershops and beauty salons are in fact virtue locales, that their crime-reducing effects are felt more during the day, when they are open. However, there is potential that these effects remain, are negated, or these locations turn into crime generators or attractors at night. Therefore, the second research question will address whether the effects of virtue locales vary by time of the day utilizing the phenomenological perception of day (4am-7:59pm) and night (8pm-3:59am) (see Giddens, 1979; Phillips & Smith, 2000).[61] That is, for research question two, the dependent variable will be split into daytime and nighttime crime, and tested separately utilizing different models.[62]

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[61] As stated by Phillips and Smith (2000) these times were used as a cut off to ensure complete darkness/daylight. It also accounts for gender differences in behavior as women may be less likely to go move in public in the dusk due to the potential for victimization, just like at nighttime (see: Kury & Ferdinand, 1998).

[62] Since there are different crime counts during the daytime and nighttime, comparisons between these models cannot be made.

Table 3.2 Number of Crimes on Street Segments

Sample	Number of Crimes on Street Segment
Matching Design Sample	318
Observational Design Sample	406

Proposed Virtue Locales

The key independent variable is the proportion of barbershops and beauty salons[63] on street segments. That is, the proportion of businesses on street segments that are barbershops or beauty salons (in comparison with other businesses on that street segment).[64] These businesses, referred to as "virtue locales" are hypothesized to serve as a social capital (and a safe environment), rich with social connections, social cohesion, and social ties allowing high levels of collective efficacy to develop. Barbershops have been an important cultural institution in American Black communities (Brawner et al., 2013; Harris-Lacewell, 2010; Mills, 2013; Releford, Frencher, & Yancey, 2010) where a vast range of community and nationwide events are discussed (Mills, 2005). Since Blacks have historically faced disadvantage and disenfranchisement in America, barbershops provide these communities with "resilient social networks" as these locations foster friendships, relationships, networks, and provide opportunities to those who frequent these locations (Brawner et al., 2013; Wood & Brunson, 2011). For example, Wood and Brunson (2011) state that:

[barbershops] hold promise for the social and economic survival of communities closer to the central city because the area continues to witness population

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[63] Barbershops are emphasized in the following paragraphs; however, the virtues beauty shops provide to the Black community mirror those of barbershops (Harvey, 2005; Sadler et al., 2007)

[64] Although risky facilities was considered during the matching phase, the proportioning of risky facilities with virtue locales removed the risky facility variable from being incorporated in regression models.

diffusion. The second is that understandings and practices of "community," "neighborhood" and "local" continue to shift and be reconfigured under pressures of urban change… are also key components of neighborhood life and provide an important context for the development and continuation of social networks" (p.229).

Along with increasing social interactions and networks, barbershops have also been suggested to have other positive public health effects such as reducing hypertension levels, as well as other health benefits for Black men (Hess et al., 2007; Releford et al., 2010; Victor et al., 2009, 2011, 2018; also see discussion of beauty salons: Harris-Lacewell, 2010). In sum, based on the various research literature, it is logical to propose that barbershops in Black communities are virtue locales. Beauty salons have been suggested to offer similar benefits for Black women (Haynes & Hernandez, 2008; Lee, 2000; Perry & Waters, 2012).

<div align="center">Control Variables</div>

A number of variables are utilized to match case and comparison street segments in order to reduce the possibility of obtaining spurious effects. *Concentrated disadvantage* is a concept that originated in Moynihan's (1965) work and was popularized by Wilson (1987/2012) (also see Massey & Denton, 1993). Concentrated disadvantage is a term used to conceptualize the struggles of inner-city Black populations that experience poverty, joblessness, family disruption (e.g., single-parent households), and reduced legitimate opportunities (Parker et al., 2005; Parker & Reckdenwald, 2008; Wilson, 1987/2012). Moreover, research has suggested that areas that suffer from concentrated disadvantage are also exposed to higher crime rates (Chamberlain & Hipp, 2015; Pratt &

<div align="center">62</div>

Cullen, 2005; Sampson et al., 2002). *Concentrated disadvantage* is measured utilizing a factor score of three variables including 1) percent below poverty line, 2) per capita income, and 3) median household income.[65] As noted earlier, Columbia is a city that suffers from high levels of poverty; therefore, these measures will capture the socioeconomic status of the areas examined.

Shaw and McKay (1942) found that areas with high levels of *ethnic (or cultural) heterogeneity* were associated with high crime rates in Chicago. Since the introduction of this concept, research has supported the notion that neighborhoods characterized by an environment consisting of a range of conflicting cultures (and ethnicities) regarding the appropriateness of illegal behavior is associated with higher crimes rates (Avison & Loring, 1986; Berg et al., 2012; Hansmann & Quigley, 1982). To control for the potential criminogenic effects of neighborhood *ethnic heterogeneity* (Shaw & McKay, 1942), the Herfindahl index (see Gibbs & Martin, 1962) is used to measure racial/ethnic mixing of an area. The Herfindahl Index is commonly used by economists to measure "the size of firms in relation to an industry and is an indicator of the amount of competition among them" (Trawick & Howsen, 2006, p. 342). "Firms" will be conceptualized as "ethnic groups" and the "industry" will be conceptualized as the population of the area. Thus, Black, Latinx, and White populations will be included in the Herfindahl index to measure *ethnic heterogeneity* (see Chamberlain & Hipp, 2016; Hipp, 2007; Kubrin & Hipp, 2016).[66]

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[65] Using varimax rotation in SPSS, results produced high principle component scores for the measure of concentrated disadvantage (pctpoor - .899, percapitaincome - .861, and medhhinc - .850).

[66] The Herfindahl index formula utilized is as follows: $EH = 1 - (White\%^2 + Black\%^2 + Latino\%^2)$

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The scholarly research suggests that in the aggregate, the *age-crime curve* (Wolfgang, Figlio, & Sellin, 1972) peaks during late adolescence and quickly declines thereafter (Lauritsen, 1998; Blumstein, Cohen, & Farrington, 1988; Hirschi & Gottfredson, 1983); therefore, controlling for percentage of the Columbia, SC population that is between ages 15 and 24 is imperative to best prevent spurious findings (Farrington, 1986; Kubrin, Hipp, & Kim, 2018; LaFree & Bersani, 2004). The *age-crime curve* is controlled for by creating a measure of the percentage of residents ages 15-24 who live in the block-groups of interest. High numbers of residents aged 15-24 may influence neighborhood crime rates that are unrelated to the independent variables of interest. There is a total of 39,494 citizens who are 15-24 in Columbia, which consists of almost 30% of the population.

Shaw and McKay (1942) posited that neighborhoods suffering from residential mobility exacerbated residents' attachment to the neighborhood and community, thereby hindering the neighborhood's ability to exert social control. This lack of informal social control may present difficulty in the neighborhood's ability to regulate behavior, thus making the neighborhood vulnerable to criminal behavior. Research suggests that residential mobility (or residential mobility) is associated with elevated crime rates (Boggess & Hipp, 2010; Sampson & Wilson, 1995; Sampson et al., 1997). Thus, *residential mobility* will consist of three measures drawn from ACS data: 1) the percentage of the population that moved in 2010 or later, 2) percentage of vacant households, and 3) the percentage of renter occupied homes within block-groups.[67] As

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[67] Principle components analysis produced high loading scores (pmoved2010 - .909, prenterocc - .877, pvachouse - .580)

noted earlier, Columbia is a city with elevated poverty levels, and thus one expects to see higher rates of residential mobility (Schafft, 2006). Moreover, the research suggests that these measures properly capture the theoretical constructs of *residential mobility* (Hipp, Tita, & Greenbaum, 2009; Roman & Chaflin, 2008; South & Deane, 1993).

Population density will be operationalized as the number of residents per block-group divided by the block-group's square mileage to capture the concentration of motivated offenders, potential targets, and guardians nested with the block-group (Cohen & Felson, 1979). Research suggests that high numbers of citizens within an area will increase the chances of interactions with motivated offenders due to the close proximity of these individuals (Roncek, Bell, & Francik, 1981; Smith & Jarjoura, 1988; Sampson, 1983). *Street length* is another matching consideration that is considered when matching case street segments to comparison street segments. Generally, longer streets offer more crime opportunities than shorter street segments (Braga et al., 2010, 2011; Schnell et al., 2017, 2019). Thus, matching on potential spurious effects of street length is a necessary consideration.

Other businesses that have been proposed as potentially criminogenic (or "risky facilities") will also be incorporated into the analysis. Businesses such as bars/night clubs (Bernasco & Block, 2011; Roncek & Bell, 1981; Roncek & Maier, 1991; Graham & Homel, 2008), fast food restaurants (Steenbeek et al., 2012; Askey et al., 2018), hotels/motels (LeBeau, 2012; Smith et al., 2000; Drawve et al., 2016), liquor stores (Block & Block, 1995; McCord et al., 2007; McCord & Ratcliffe, 2007), and payday/pawnshops (Kubrin et al., 2011; Kubrin & Hipp, 2016; Stewart, 2011) have been described as crime generators and crime attractors in the literature. Therefore, bars/night

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clubs, hotels/motels, fast food restaurants, liquor stores, and payday loan stores/pawnshops will be incorporated in the analysis to ensure that these potentially criminogenic businesses are considered in the models. Moreover, street segments that contain these businesses, but no virtue locale are included within the comparison group.[68]

In order to control for formal mechanisms that may affect crime occurrences in the city of Columbia, the number of *arrests* on street segments will be considered when matching on important control variables. Arrest data were obtained from the CPD through the researcher's involvement in Ceasefire Columbia and are geocoded to street segments. The scholarly literature has utilized arrests as a measure of the presence of formal social control in communities (Mears et al., 2017; Ousey & Lee, 2008; Shihadeh & Steffensmeier, 1994). Arrests will be utilized to control for various factors that may affect crimes occurring near businesses. For example, certain businesses (e.g., virtue locales) may be more likely than others to call the police, police may be more likely to patrol certain areas, and specific areas may be more criminogenic, thus more arrests. These arrests may affect the crimes known occurrences in the model. Therefore, all arrests that occurred from October 31, 2017 through November 1, 2018 will be used in the analytic models. The measures presented above are commonly utilized by neighborhood-level research as control measures, since the research has suggested that these structural characteristics may have criminogenic effects (Kubrin & Weitzer, 2003a, 2003b, Kubrin et al., 2011; Wilcox et al., 2004). Moreover, in order to attempt to test the effects of selected businesses (independent variables) on violent and property crime, these exogenous variables must be controlled. There are many pockets of Columbia, SC

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[68] Although these businesses may still be on virtue locale street segments.

that suffer from some, or all, of these structural conditions. Thus, these controls are relevant to this research project.

Spatial autocorrelation is the phenomenon that occurs when observations are correlated with each other due to the proximity of each other in space (Townsley, 2009). If spatial autocorrelation is not accounted for, statistical models may be mis-specified, results may be questionable, and the null hypothesis is often rejected when it should not be (Anselin, 1988; Dormann, 2007; Thayn & Simanis, 2013). Moreover, "failure to consider spatial dependence in one's model is far more serious than ignoring spatially autocorrelated error terms because the model is mis-specified and the estimates of the coefficients are incorrect" (Tita & Radil, 2010, p.469). A preliminary test for spatial autocorrelation across block-groups was initiated utilizing a Moran's I test in ArcGis 10.6.1. The results revealed that crimes were clustered, suggesting spatial autocorrelation (see Moran's I output in Appendix, Figure A.1). However, since the analysis of crimes is at the street segment, a closer look into spatial autocorrelation at the micro-level was undertaken. To control for nearby crime, spatial lag terms at the 660-foot and 330-foot buffer were used. An in-depth discussion of the spatial lag terms and spatial autocorrelation can be found in chapter four.

In sum, the proposed virtue locales are barbershops and beauty salons that are nested in areas consisting of populations that are 60% or more Black. Since virtue locales are race-specific, barbershops and beauty salons are entrenched in the Black culture and they may serve as a community anchor providing the area with social cohesion, social connections, and opportunity (Wood & Brunson, 2011). The next sections will present the final samples that are utilized as well as a discussion of count modeling.

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Final Sample: Quasi-Experimental, Matching Sample

Businesses, arrests, crimes, and census variables were all geocoded to the street segment utilizing ArcGis 10.6.1. Street segments that were residential-only were removed in order to examine only the street segments that had one or more businesses. After removing residential-only street segments, the researcher was left with a remaining sample of 134 street segments containing a business in areas that are 60% or more Black. Further, there were thirty street segments contain one or more barbershop or beauty salon, thus the sample size of the "treatment group" is thirty street segments with a virtue locale. After removing the thirty virtue locale streets (and designating them as the "treatment group"), the remaining sample of potential comparison streets is 104. From the 104 comparison streets, the researcher matched virtue locale streets to comparison streets based on the following criteria: concentrated disadvantage, residential mobility, number of arrests on the street segment, population density, ethnic heterogeneity, percent of the population between 15-24, and the street length (in feet).[69] There were enough similar comparison street segments in the remaining 104 sample to have close to three comparison street matches for every treatment street segment.[70] The final sample of all streets in the sample is 108 (30 treatment streets, 78 comparison streets).

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[69] After proportioning the main independent variable, risky facilities no longer was a variable used in regression models. Moreover, the spatial lag term was used a control variable to control for crime nearby the street segments; however, matching did not involve considering the spatial lag term.

[70] That is, of the remaining potential 104 comparison streets, 78 of these streets were selected as the "comparison group." The 26 streets that were removed was due to the lack of similarity in the relevant control factors to the "treatment group."

Final Sample: Observational Design Sample

Since matching was not utilized in this analytic approach, all street segments containing a business were incorporated in the sample. Thus, thirty street segments with a virtue locale ("treatment group") and 104 comparison streets ("comparison group") are used in the model for a final sample size of 134 street segments in areas that are 60% or more Black. Thus, as compared to matching the 104 comparison street segments to the treatment streets based on relevant control groups, all comparison streets are included in this sample.

Count Modeling

While linear regression may capture the number of times an event has occurred, it is safer to use count models. Linear regressions for counts may create inconsistent and biased estimates due to the assumption made by linear models that events are common (Eck, Clarke, & Guerette, 2007; Long, 1997; Long & Freese, 2014). The law of small numbers (or rare events) suggests that certain events occur infrequently even though there are many chances for the opportunities of such events (Cameron & Trivedi, 2013; Whitaker, 1914). The dependent variables of interest are violent and property crimes, which are both rare events. Moreover, research has suggested that crimes are over and under-dispersed in various spatial areas (see discussion of rare event crime reports: Gove, Hughes, & Geerken, 1985). Figure A.8 in the Appendix presents the dispersion of crime outcomes on street segments. This figure shows an abundance of excess zeros. The consideration of excess zeros and overdispersion of crime counts is vital when using count models, as various count models require restrictive assumptions to be met

(Gardner, Mulvey, & Shaw, 1995). The following paragraphs will discuss the different types of count models considered in this research project.

The Poisson model has received the most empirical attention in the literature as it relates to discrete and count outcomes (Greene, 1984; Land, McCall, & Nagin, 1996). The Poisson model assumes that an event will occur a given amount of times, with the parameter that the event will occur more than once. Moreover, the Poisson model assumes conditional variance (or a conditional mean) in which the variance is assumed to be equal to the mean, thus assuming equal dispersion (or "equidispersion"). Thus, if the variance is greater than the conditional mean, then there will be overdispersion, which is common with crime data (Cameron & Trivedi, 2013). It is possible with the outcomes of violent and property crimes that there will be overdispersion in the models, thus violating this assumption. Finally, as the expected occurrence of the dependent variable (or dispersion) increases, the probability of zero counts decreases. With many variables in the model, there are more zeros than predicted (Long & Freese, 2014). Since the Poisson model suggests "equidisperson," the results may be misleading unless the restrictive assumptions are met (Gardner, Mulvey, & Shaw, 1995; Wedel et al., 1993). Finally, the Poisson model's standard errors are biased downward which results in larger z-values and lower p-values (Long & Freese, 2014).

If the data used violates the assumptions of the Poisson model, tests must be conducted to ensure that the model does not accurately fit the data before considering the negative binomial regression model (Berk & MacDonald, 2008). Moreover, tests for *apparent overdispersion* (due to omitted variables, outliers, and nonlinearity) and *real overdispersion* (due to clustering, excess zeros, and temporal autocorrelation) must be

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conducted to understand why the model is overdispersed before considering other models (Hilbe, 2011). The negative binomial regression model may be more compatible with certain datasets as compared to a Poisson model due to the assumption that there are random, unexplained differences in the overdispersion in the regression model (Gardner et al., 1995). The negative binomial model assumes that the error is uncorrelated with the independent variables of interest, thus it is often times used instead of the Poisson model due to the negative binomial model's ability to account for overdispersion (see Lawless, 1987; Engel, 1984; Manton, Woodberry, & Stallard, 1981; Osgood, 2000; Paternoster & Brame, 1997). The negative binomial model introduces a parameter to account for random variation, or a type of random effects model (Cameron & Trivedi, 2013). Criminologists have utilized the negative binomial model for a variety of units of analysis, including individual and neighborhood-level research (Berk & MacDonald, 2008; Paternoster et al., 1997; Sampson & Laub, 1997; Paternoster & Brame, 1997).

Zero-inflated Poisson models are utilized when there are excess zeros in the data, in which the model assumes there is an "always zero" group for which the event cannot happen (Zorn, 1998). Poisson and negative binomial models assume that all observations have a positive probability of an event occurring (Lambert, 1992). Zero-inflated models, on the other hand, "combine two models: one that focuses on the presence or absence of the outcome and a second that models the extent of the outcome when it is nonzero" (Atkins & Gallop, 2007, p.726). Further, Zero-inflated models assume that there are two unobserved groups; the "always zero group" will have an outcome of zero with a probability of one. The "not always zero" group may have a zero but there is a nonzero probability of a positive count (e.g., may experience 0 or +1 events) (Long & Freeze,

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2014). Poisson or negative binomial models, on the other hand, only consider the "not always zero group." Thus, the zero-inflated model must also be considered when choosing the best model for the data.

Due to the nested nature of the data, considerations for a multilevel model must be made to ensure that level one and level two predictors are incorporated. Census level variables (e.g., concentrated disadvantage) are at the block-group (level two), while business, arrests, and crime counts are measured at the street segments (level one). Examining the level one and two influences through multilevel modeling may be necessary to ensure accurate results from the data. The next chapter will present the analytic approach and findings from descriptive and count model regression approaches. Additionally, presents a number of diagnostics that were used including multicollinearity checks, outlier diagnostics, model diagnostics, and considerations for spatial autocorrelation. The use of different approaches to answer the research questions should provide confidence that the research questions are adequately addressed.

Chapter 4: Analysis & Findings

This chapter presents descriptive statistics utilizing spatial buffers, including 100-, 200-, and 330-foot buffers. The second section presents the analyses and findings from the matched design sample testing both research questions utilizing count regression models. The third section reports the analyses and findings from the observational sample utilizing count regression models testing both research questions. Research question number one asks whether virtue locales on street segments reduces crime compared to street segments without virtue locales. The second research question asks whether the association between virtue locales and crime counts changes by time of the day.

Analytic Approach #1: Descriptive Analysis

The first analytic approach provides a descriptive examination of the data in order to provide a baseline for the new theoretical concept presented. Further, it has been argued that descriptive research provides "building blocks" for advances in theoretical criminology (see Nelson & Richardson, 1971). While descriptive research is not experimental, it is empirical (Hough, 2010; Weisburd & Piquero, 2008). Thus, this approach will provide a foundation for the data before moving on to the more advanced analyses.

The descriptive analyses involve spatial buffering around business locations, including 100-, 200-, and 330-foot buffers. Utilizing ArcGis 10.6.1, spatial buffers were placed around barbershops and beauty salons, bars, bus lines, fast food restaurants, gas stations, hotels, liquor stores, pawn shops, payday lenders, restaurants, and schools in areas that

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are 60% or more Black. Other than barbershops and beauty salons, the literature has suggested that the referenced businesses may be "risky facilities" (for a review see Eck, Clarke, & Guerette, 2007). Since street segments are the units of analysis, smaller buffers are used to capture the immediate effects of the businesses on nearby street segments. The concept of virtue locales suggests that these businesses provide a crime "repellant effect" at the immediate location. That is, crimes will be significantly reduced at the nearby location; however, these crime-reducing effects are lessened as one moves further away from the business. Therefore, results from the 100-, 200-, and 330-foot buffers should capture this immediate repellant effect of businesses.[71]

Multiple buffer distances are utilized to examine how the mean and median distances of crimes to the business location varies as one moves further from the businesses. The 100-foot buffer was utilized to examine crimes at the most immediate location. Prior research has utilized 400-foot buffers to examine land use effects at the block-level (Groff & McCord, 2012; Kennedy et al., 2015; Kubrin & Hipp, 2016); therefore, the 200-foot buffer better captures business effects at the street segment level. Moreover, the extant research has examined American street blocks using roughly 660-foot buffers (Braga et al., 2019; Garvin, Cannuscio, & Branas, 2013), thus the 330-foot buffer is utilized to examine the effects of a "half-block" and it is the largest buffer used in this research project. There is no underlying theoretical justification for choosing the appropriate buffer size. Legewie (2019) states "there is no a priori or theoretical way to derive the correct value of the distance parameter… instead, the spatial scale of a

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[71] That is, within the 100-, 200-, and 330-foot buffers, proposed virtue locales should have greater mean and median distances to crime. All three distances are considered distances at the "immediate location."

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potential effect is an empirical question" (p. 6). Accordingly, the mean and median

distances of crimes from these locations, as well as the variation of the mean and median

distances by time of the day (daytime and nighttime), are examined. Further, the average

number of crimes that occur within each buffer and its variation by time of the day will

be examined.

Descriptive Analysis Findings

ArcGis 10.6.1 allows researchers to measure the distance from one point to

another by various units of analysis (e.g., feet, yards, miles, etc.). For the first analysis,

the average distance of crime occurrences from the businesses of interest as well as the

counts of crimes occurring within 100-, 200-, and 330-foot buffers are presented.

Examining multiple buffer sizes to see how results change by extending buffer distances

will help evaluate the effects of virtue locales at the immediate and distant environment.

Moreover, examining the different buffer sizes is important because the proposed concept

of virtue locales suggests that these businesses will reduce crime at the *immediate*

environment (or, a "repellant effect"). Therefore, it is argued that there will be a larger

average distance of crime occurrences at virtue locales than at "risky facilities." Further,

there will be lower counts of crimes within the buffers of virtue locales than at risky

facilities.

Table 4.1. Mean and Median Distance of Crimes from Business (100-foot Buffer)

	Mean (in feet)	Median (in feet)
Barbershops/Beauty Salons	13.02	0
Bars	10.08	0
Bus Line	0	0
Fast Food Restaurants	22.81	37.30
Gas Stations	6.04	0
Hotels	2.55	0
Liquor/Payday Lenders/Pawnshops	.11	0
Restaurants	14.77	0
Schools	0	0

Table 4.1 presents crimes that occur within a 100-foot buffer of the businesses listed. Other than fast food restaurants (22.81) and restaurants[72] (14.77), barbershops and beauty salons had the largest mean distance from crimes (13.02). However, looking at the median, barbershops and beauty salons did not have the largest distance. Instead, fast food restaurants had the largest median distance of crimes within this buffer size. Bus lines (0), schools (0), liquor stores, payday lenders, pawnshops (.11), hotels (2.55), and gas stations (6.04) had smaller average distances to crimes.

Table 4.2. Average Number of Crimes that Occur with 100-Foot Buffer of Business

	# of Crimes	Average # of Crimes
Barbershops/Beauty Salons	14	.39
Bars	4	.80
Bus Line	10	3.33
Fast Food Restaurants	22	2.00
Gas Stations	108	2.84
Hotels	33	3.30
Liquor/Payday Lenders/Pawnshops	9	.69
Restaurants	59	1.74
Schools	15	.44

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[72] "Restaurants" are any restaurant in the area that are not bars or fast food restaurants.

Table 4.2 shows the number of crimes and the average number of crimes that occur within a 100-foot buffer by business type. Barbershops and beauty salons have the lowest average number of crimes that occur within a 100-foot buffer compared to the other businesses. Liquor stores, pawnshops, and payday lenders had the second lowest average number (.44) of crimes within the 100-foot buffer. On the other hand, bus lines (3.33), hotels (3.330), gas stations (2.84), and fast food restaurants (2.00) had high average numbers of crimes within the buffer. Gas stations had the largest number of crimes within their 100-foot buffers; however, this may due to the large number of gas stations in the data (n = 34).

Table 4.3. Mean and Median Distance of Crimes from Business (200-foot Buffer)

	Mean (in feet)	Median (in feet)
Barbershops/Beauty Salons	112.98	148.66
Bars	116.73	167.40
Bus Line	0	0
Fast Food Restaurants	34.69	37.3
Gas Stations	46.69	0
Hotels	19.08	0
Liquor/Payday Lenders/Pawnshops	0	0
Restaurants	52.64	0
Schools	17.42	0

Table 4.3 shows a potential "repellant effect" of the virtue locales compared to other businesses. Of the businesses presented, barbershops and beauty salons have one of the largest average distances (112.98) between the location of the business and crime incidences. Bus lines, liquor stores, payday lenders, and pawn shops all had average distances from crime occurrences of zero (0). The extant literature suggests that these four businesses are "crime attractors" (Bernasco & Block, 2011; Block & Block, 1995; Hart & Miethe, 2014; Kubrin & Hipp, 2016). Schools, fast food restaurants, restaurants, gas stations, and hotels all have lower location-to-crime averages. Surprisingly, bars have

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a slightly greater average in comparison to barbershops and beauty salons, in the view that bars have been characterized as rime generators and attractors (Roncek & Bell, 1981). Thus, you would not expect bars to have a larger average distance compared to proposed virtue locales. Regarding the median distance, barbershops and beauty salons have one of the largest median distances (144.08 feet).

Table 4.4. Average Number of Crimes that Occur within 200-Foot Buffer of Business

	# of Crimes	Average # of Crimes
Barbershops/Beauty Salons	42	1.27
Bars	12	2.40
Bus Line	10	3.33
Fast Food Restaurants	24	2.18
Gas Stations	158	4.16
Hotels	37	3.70
Liquor/Payday Lenders/Pawnshops	18	1.38
Restaurants	81	2.38
Schools	17	.50

Table 4.4 presents the number of crimes and average number of crimes that occurred within each businesses' 200-foot buffer. Other than schools, barbershops and beauty salons have the lowest average number of crimes that occur near its location. Gas stations (4.16), hotels (3.70), bus lines (3.33), bars (2.4), restaurants (2.38), and fast food restaurants (2.18) have the highest average number of crimes that occur within the 200-foot buffer of the business.

Table 4.5. Mean and Median Distance of Crimes from Business (330-foot Buffer)

	Mean (in feet)	Median (in feet)
Barbershops/Beauty Salons	223.40	254.65
Bars	154.06	171.91
Bus Line	0	0
Fast Food Restaurants	106.34	37.3
Gas Stations	110.35	134.93
Hotels	80.16	0
Liquor/Payday Lenders/Pawnshops	188.92	223.53
Restaurants	129.52	126.19
Schools	102.65	0

Table 4.5 presents the mean and median distance (in feet) of crimes from the businesses of interest that occur within a 330-foot buffer. As the buffers were extended from 100-foot buffers, to 200-foot buffers, to 330-foot buffers, barbershops and beauty shops show signs of being potential virtue locales. Within 330-foot buffers, barbershops and beauty salons have the largest mean (223.40) and median (254.65) distance from crimes. The second largest mean distance by business type are liquor stores/payday lenders/pawnshops (188.92), followed by bars (154.06), and restaurants (129.52).

Table 4.6. Average Number of Crimes that Occur within 330-Foot Buffer of Business

	# of Crimes	Average # of Crimes
Barbershops/Beauty Salons	156	4.7
Bars	17	3.4
Bus Line	10	3.3
Fast Food Restaurants	35	3.18
Gas Stations	225	5.9
Hotels	50	5
Liquor/Payday Lenders/Pawnshops	38	2.92
Restaurants	129	3.79
Schools	27	.79

Table 4.6 shows the number of crimes and average number of crimes that occurred within a 330-foot buffer. Here we see the numbers change substantially when increasing the buffer distances from 200-foot to 330-foot buffers. Businesses with the

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most crimes that occurred with the 330-foot buffer of its location were gas stations (225), barbershops and beauty salons (156), and restaurants (129). However, this could be due to the higher numbers of these types of businesses (e.g., 38 gas stations, 34 restaurants, 33 barbershops and beauty salons). These same businesses also had higher average number of crimes that occurred within the buffer during the data collection period. Gas stations (5.9), hotels (5), barbershops and beauty salons (4.7), restaurants (3.79), and bars (3.4) ranked highest in terms of average number of crimes within the 330-foot buffer. Schools show lower numbers of crimes and average crimes compared to the other businesses in the analysis. Schools may be an area that offers high levels of guardianship while the schools are in session due to the large numbers of adults, teachers, and police officers at the location.

Table 4.7. Percentage of Businesses with at least One Crime occurrence within 100-foot Buffer

	%
Barbershop/Beauty Salon (33 locations)	27.27
Bars (5 locations)	40.00
Bus Line (3 locations)	66.66%
Gas Stations (38 locations)	84.21
Fast Food Restaurants (11 locations)	36.36
Hotels (10 locations)	70.00
Liquor Store/Payday/Pawn Shops (13 locations)	46.15
Restaurants (34 locations)	29.41
Schools (34 locations)	29.41

Table 4.7 presents the percentage of businesses that had a crime occur within a 100-foot buffer, by business type. Within a 100-foot buffer, only 27.27 percent of barbershops and beauty salons had a crime occur within a 100-foot radius of the business. This percentage was the lowest of all business types. Restaurants (29.41%) and schools (29.41%), and fast food restaurants (36.36%) had the next lowest percentage. Gas stations

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(84.21%) had the largest percentage of crimes occur within a 100-foot buffer.

Barbershops and beauty salons, compared to other businesses, again appears to show a

"repellant effect" at the location.

Table 4.8. Percentage of Business with at least One Crime occurrence within 200-foot
Buffer

	%
Barbershop/Beauty Salon (33 locations)	57.58
Bars (5 locations)	60.00
Bus Line (3 locations)	66.66
Gas Stations (38 locations)	89.47
Fast Food Restaurants (11 locations)	45.45
Hotels (10 locations)	80.00
Liquor Store/Payday/Pawn Shops (13 locations)	69.23
Restaurants (34 locations)	67.65
Schools (34 locations)	35.29

Table 4.8 presents the percentage of businesses that had at least one crime occur

within a 200-foot buffer. Schools (35.29%), fast food restaurants (45.45%), and

barbershops/salons (57.58%) had the lowest percentage of crimes occur within a 200-foot

radius of the locations. Schools again ranked lowest on the average number of businesses,

thus suggesting there may be high levels of guardianship at these locations. Liquor

stores/payday lenders/pawn shops (69.23%) and gas stations (89.47%) had the largest

percent of crimes occur at their locations.

Table 4.9. Percentage of Businesses with at least One Crime occurrence within 330-foot
Buffer

	%
Barbershop/Beauty Salon (33 locations)	81.82
Bars (5 locations)	80.00
Bus Line (3 locations)	66.66
Gas Stations (38 locations)	94.74
Fast Food Restaurants (11 locations)	63.64
Hotels (10 locations	100.00
Liquor Store/Payday/Pawn Shops (13 locations)	92.31
Restaurants (34 locations)	79.41
Schools (34 locations)	50.00

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Table 4.9 presents the percentage of businesses that had at least one crime occur within a 330-foot buffer. Schools (50.00%), bus lines (66.66%), and restaurants (79.41%) had the lowest percentage that had a crime occur within a 330-foot buffer. Hotels (100%), gas stations (94.74%), and barbershops/beauty salons (81.82%) had the largest percentages by business type.

Table 4.10. Min, Max, Median, and Mean of Crimes that Occur within a 100-Foot Buffer by Business Type

	Min	Max	Median	Mean
Barbershop/Beauty Salon (33 locations)	1	4	1.00	1.56
Bars (5 locations)	1	3	2.00	2.00
Bus Line (3 locations)	5	5	5.00	5.00
Gas Stations (38 locations)	1	9	2.00	3.63
Fast Food Restaurants (11 locations)	1	19	1.00	5.50
Hotels	1	11	3.00	4.71
Liquor Store/Payday/Pawn Shops (13 locations)	1	2	1.50	1.50
Restaurants (34 locations)	1	4	1.00	1.50
Schools (34 locations)	1	4	1.00	1.50

The results in the next few tables only consider businesses that had at least one crime occur within the buffer. Buffers that did not have a crime occur within it are not presented in these tables. Table 4.10 presents the minimum, maximum, median, and mean number of crimes that occur within the buffers that had at least one crime occur. Within 100-foot buffers, the median and mean of barbershops and beauty salons ranks among the lowest compared to other businesses. Schools, restaurants, liquor stores, payday lenders, pawn shops, and barbershops and beauty salons all have a mean around 1.5 crimes per 100-foot buffer that had a crime occur. Fast food restaurants, hotels, and gas stations appear to be criminogenic throughout this chapter, which supports previous literature (see for review: Drawve et al., 2016).

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Table 4.11. Min, Max, Median, and Mean of Crimes that Occur within a 200-Foot Buffer

	Min	Max	Median	Mean
Barbershop/Beauty Salon (33 locations)	1	5	2.00	2.21
Bars (5 locations)	1	5	4.00	4.00
Bus Line (3 locations)	5	5	5.00	5.00
Gas Stations (38 locations)	1	12	4.00	4.65
Fast Food Restaurants (11 locations)	1	19	1.00	4.80
Hotels (10 locations)	1	11	3.00	4.63
Liquor Store/Payday/Pawn Shops (13 locations)	1	3	1.00	1.44
Restaurants (34 locations)	1	8	2.00	3.52
Schools (34 locations)	1	4	1.00	1.42

Table 4.11 presents the same type of results as the previous table, except within a 200-foot buffer. When buffers are expanded to 200-feet, barbershops and beauty salons again have one of the lowest crime averages that occur within buffers (2.21). Liquor stores, payday lenders, and pawn shops (1.44) as well as schools (1.42) have the lowest average number of crimes within the buffers. Liquor stores, payday lenders, pawn shops, and schools having the lowest median and mean number of crimes goas against the extant literature that has suggested these businesses are risky facilities (see Drawve et al., 2016). Bus lines (5.00), fast food restaurants (4.80), gas stations (4.65), and hotels (4.63) have the highest average number of crimes within a 200-foot buffer.

Table 4.12. Min, Max, Median, and Mean of Crimes that Occur within a 330-Foot Buffer

	Min	Max	Median	Mean
Barbershop/Beauty Salon (33 locations)	1	35	3.00	5.78
Bars (5 locations)	1	7	4.50	4.25
Bus Line (3 locations)	5	5	5	5.00
Gas Stations (38 locations)	2	13	6.00	7.42
Fast Food Restaurants (11 locations)	1	19	3.00	5.00
Hotels (10 locations)	1	11	4.00	5.00
Liquor Store/Payday/Pawn Shops (13 locations)	1	6	2.50	3.17
Restaurants (34 locations)	1	10	4.00	4.78
Schools (34 locations)	1	4	1.00	1.59

Table 4.12 presents the minimum, maximum, median, and average number of crimes that occur within 330-foot buffers. Other than gas stations (7.42 mean crimes), barbershops and beauty salons have the second largest mean (5.78). However, looking at the median shows a much lower score (3.00) for barbershops and beauty salons. Gas stations continue to be the most criminogenic business structure based on the analyses in this chapter, while schools continue to show potential as a crime-reducing business.

Table 4.13. Mean and Median Distance of Crimes from Businesses by Daytime and Nighttime (100-foot Buffer)

	Daytime Mean	Daytime Median	Nighttime Mean	Nighttime Median
Barbershops/Beauty Salons	16.57	0	0	0
Bars	0	0	13.43	0
Bus Line	0	0	0	0
Fast Food Restaurants	22.95	37.3	22.59	37.30
Gas Stations	9.50	0	1.21	0
Hotels	3.50	0	0	0
Liquor/Payday Lenders/Pawnshops	16.14	0	0	0
Restaurants	20.45	0	5.88	0
Schools	0	0	0	0

Table 4.13 represents the mean and median distances of crimes that occur within a 100-foot buffer of the businesses that vary by daytime and nighttime. During the daytime, barbershops and beauty salons have the third largest mean distance from crimes (16.57) with restaurants (20.45) and fast food restaurants (22.95) with the largest mean distances from crime. However, examining the daytime median, nighttime mean, and nighttime median, barbershops and beauty salons have lower distances of crimes to the location (0). While some tables have shown schools to be a crime-reducing business, this finding suggests that schools may be a risky facility since both daytime and nighttime crimes occur at the immediate location within the 100-foot buffers.

Table 4.14 Mean and Median Distance of Crimes from Businesses by Daytime and Nighttime (200-foot Buffer)

	Daytime Mean	Daytime Median	Nighttime Mean	Nighttime Median
Barbershops/Beauty Salons	101.30	143.89	130.16	162.42
Bars	127.47	157.00	111.35	167.40
Bus Line	0	0	0	0
Fast Food Restaurants	41.96	37.30	22.59	37.30
Gas Stations	63.35	0	53.21	0
Hotels	19.96	0	16.71	0
Liquor/Payday Lenders/Pawnshops	54.51	24.20	28.93	0
Restaurants	66.83	77.56	25.87	0
Schools	0	0	74.04	70.20

*Units are in feet

Table 4.14 presents the mean and median distance of crimes from each business location by type within a 200-foot buffer, by daytime and nighttime crime. Barbershops and beauty salons continue to show a "repellant effect" as the mean and median distance is one of the largest compared to other businesses, regardless of time of the day. Interestingly, the repellant effect of barbershops and beauty salons is shown be stronger at nighttime, when most barbershops and beauty salons are closed, and guardianship levels may be lower since no one is "watching" over the business. Meanwhile, hotels, liquor stores, payday lenders, pawn shops, schools, and restaurants appear to be criminogenic facilities.

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Table 4.15. Mean and Median Distance of Crimes from Businesses by Daytime and Nighttime (330-foot Buffer)

	Daytime Mean	Daytime Median	Nighttime Mean	Nighttime Median
Barbershops/Beauty Salons	225.67	253.89	231.57	268.68
Bars	192.01	214.41	111.35	167.40
Bus Line	0	0	0	0
Fast Food Restaurants	96.76	37.30	119.12	37.3
Gas Stations	128.70	175.1	79.40	0
Hotels	74.66	0	93.01	0
Liquor/Payday Lenders/Pawnshops	194.02	244.26	180.18	221.72
Restaurants	147.12	175.99	80.50	0
Schools	102.97	0	140.40	101.22

*Units are in feet

Table 4.15 demonstrates the mean and median distances that vary by daytime or nighttime by type of businesses within a 330-foot buffer. Barbershops and beauty salons continue to show a repellant effect during the daytime and night as both the mean and median are the highest compared to other business types. Bus lines, fast food restaurants, and hotels during the daytime appear to be criminogenic. Moreover, restaurants, hotels, bus lines, and gas stations appear to be risky facilities.

Table 4.16. Percentage of Businesses with a Crime Occurrence During the Day within 100, 200, and 330-foot Buffers

100-Foot Buffers	
	%
Barbershops / Beauty Salons	21.21
Bars	20.00
Bus Lines	66.67
Fast Food Restaurants	18.18
Gas Stations	68.42
Hotels	70.00
Liquor Stores/Payday Lenders/Pawn Shops	38.46
Restaurants	23.53
Schools	23.53
200-Foot Buffers	
Barbershops / Beauty Salons	48.48
Bars	40.00
Bus Lines	66.67
Fast Food Restaurants	36.36
Gas Stations	73.68
Hotels	80.00
Liquor Stores/Payday Lenders/Pawn Shops	53.85
Restaurants	58.82
Schools	23.53
330-Foot Buffers	
Barbershops / Beauty Salons	78.79
Bars	60.00
Bus Lines	66.67
Fast Food Restaurants	54.55
Gas Stations	92.11
Hotels	80.00
Liquor Stores/Payday Lenders/Pawn Shops	84.62
Restaurants	73.53
Schools	38.24

Table 4.16 presents the percentage of businesses that had a crime occur at 100-, 200-, and 330-foot buffers during daytime hours. Within 100-foot buffers, fast food restaurants (18.18%), bars (20.00%), barbershops and beauty salons (21.21%), restaurants (23.53%), and schools (23.53%) had the lowest percentage of its businesses affected by a crime. Extending buffers to 200-feet, schools (23.53%), fast food restaurants (36.365), bars (40.00%), and barbershops and beauty salons (48.48%) were

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least affected by crimes. However, extending buffers to 330-feet, schools (38.24%) and

fast food restaurants (54.55%) had the lowest percentage of locations affected by crime.

Note the consistency in schools and bars have the smaller percentages of crimes that

occur within each buffer distance.

Table 4.17. Percentage of Businesses with a Crime Occurrence During Nighttime Hours
within 100, 200, and 330-foot Buffers

100-Foot Buffers	
	%
Barbershops / Beauty Salons	9.09
Bars	40.00
Bus Lines	0.00
Fast Food Restaurants	27.27
Gas Stations	55.26
Hotels	50.00
Liquor Stores/Payday Lenders/Pawn Shops	23.08
Restaurants	5.88
Schools	5.88
200-Foot Buffers	
Barbershops / Beauty Salons	30.30
Bars	60.00
Bus Lines	0.00
Fast Food Restaurants	27.27
Gas Stations	81.58
Hotels	60.00
Liquor Stores/Payday Lenders/Pawn Shops	30.77
Restaurants	38.24
Schools	11.76
330-Foot Buffers	
Barbershops / Beauty Salons	57.58
Bars	60.00
Bus Lines	0.00
Fast Food Restaurants	54.55
Gas Stations	78.95
Hotels	90.00
Liquor Stores/Payday Lenders/Pawn Shops	61.54
Restaurants	55.88
Schools	11.76

Table 4.17 shows the percentage of business that had a crime occur during the nighttime at 100-, 200-, and 330-foot buffers. Bus lines (0.00%), schools (5.88%), restaurants (5.88%), and barbershops and beauty salons (9.09%) are least affected by crime within 100-foot buffers. Within 200-foot buffers, bus lines (0.00%), schools (11.76%), fast food restaurants (27.27%), barbershops and beauty salons (30.30%), and liquor stores, payday lenders, and pawn shops (30.77%) were least affected by crime. Expanding buffers to 330-feet, bus lines (0.00%), schools (11.76%), and fast food restaurants (54.55%) had the lowest percentage of crimes occur within the buffer locations.

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Table 4.18. Min, Max, Median, and Mean Crimes of Buffers that had a Crime
Occurrence during the Daytime

	Min	Max	Median	Mean
100-Foot Buffers				
Barbershops / Beauty Salons	1	2	1.00	1.57
Bars	1	1	1.00	1.00
Bus Lines	5	5	5.00	5.00
Fast Food Restaurants	1	12	6.50	6.50
Gas Stations	1	7	2.00	2.42
Hotels	1	8	2.00	3.43
Liquor Stores/Payday Lenders/Pawn Shops	1	2	1.00	1.20
Restaurants	1	4	1.00	1.63
Schools	1	4	1.00	1.63
200-Foot Buffers				
Barbershops / Beauty Salons	1	4	1.00	1.56
Bars	1	3	2.00	2.00
Bus Lines	5	5	5.00	5.00
Fast Food Restaurants	1	12	1.00	3.75
Gas Stations	1	8	3.00	3.00
Hotels	1	3	1.50	3.38
Liquor Stores/Payday Lenders/Pawn Shops	1	2	1.00	1.14
Restaurants	1	7	2.00	2.75
Schools	1	4	1.00	1.63
330-Foot Buffers				
Barbershops / Beauty Salons	1	20	2.50	4.04
Bars	1	5	3.00	3.00
Bus Lines	5	5	5.00	5.00
Fast Food Restaurants	1	12	1.50	3.33
Gas Stations	1	9	3.50	4.29
Hotels	2	8	4.00	4.38
Liquor Stores/Payday Lenders/Pawn Shops	1	4	2.00	1.64
Restaurants	1	9	3.00	3.80
Schools	1	4	1.00	1.69

Table 4.18 presents the minimum, maximum, median, and mean of crimes that

occurred within a 100-, 200-, and 330-foot buffer in the daytime. Within the 100 and 200-

foot buffers, the proposed virtue locales (barbershops and beauty salons) rank among the

least crime-prone type of businesses when examining the mean and median number of

crimes within the buffer. However, within the 330-foot buffer schools, fast food

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restaurants, liquor stores, payday lenders, pawn shops, and bars all had lower mean and

median numbers than proposed virtue locales.

Table 4.19. Min, Max, Median, and Mean Crimes of Buffers that had at least One Crime
Occurrence during the Nighttime

	Min	Max	Median	Mean
100-Foot Buffers				
Barbershops / Beauty Salons	1	1	1.00	1.00
Bars	1	2	1.50	1.50
Bus Lines	0	0	0.00	0.00
Fast Food Restaurants	1	7	1.00	3.00
Gas Stations	1	6	1.00	2.14
Hotels	1	3	2.00	1.80
Liquor Stores/Payday Lenders/Pawn Shops	1	1	1.00	1.00
Restaurants	1	1	1.00	1.00
Schools	1	1	1.00	1.00
200-Foot Buffers				
Barbershops / Beauty Salons	1	5	1.00	1.70
Bars	2	4	2.00	2.67
Bus Lines	0	0	0.00	0.00
Fast Food Restaurants	1	7	1.00	3.00
Gas Stations	1	8	2.00	2.32
Hotels	1	3	1.50	1.67
Liquor Stores/Payday Lenders/Pawn Shops	1	1	1.00	1.00
Restaurants	1	5	1.00	2.00
Schools	1	1	1.00	1.00
330-Foot Buffers				
Barbershops / Beauty Salons	1	15	1.00	2.68
Bars	2	4	2.00	2.67
Bus Lines	0	0	0.00	0.00
Fast Food Restaurants	1	7	2.00	2.50
Gas Stations	1	6	2.00	2.50
Hotels	1	3	1.00	1.67
Liquor Stores/Payday Lenders/Pawn Shops	1	4	1.00	1.75
Restaurants	1	5	1.00	1.79
Schools	1	2	1.00	1.25

Table 4.19 only examines businesses that had a crime occur within a specific

buffer distance. The table shows the minimum, maximum, median, and mean crimes

within the buffer during nighttime hours. Within 100-foot buffers, liquor stores, payday

lenders, pawn shops, restaurants, schools, and barbershops and beauty salons all had an

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average of one crime occur. Within 200-foot buffers, schools (1.00), liquor stores, payday lenders, and pawn shops (1.00), and barbershops and beauty salons (1.70) had the lowest average number of crimes occur within buffers. Finally, within 330-foot buffers, schools (1.25), hotels (1.67), liquor stores, payday lenders, and pawn shops (1.75), and restaurants (1.79) ranked the lowest.

This section presented the descriptive analyses of crimes that occur with various buffer distances of businesses. Overall, the proposed virtue locales appear to show a crime "repellant effect" in some of the analyses. This section, in part, provides a foundation for virtue locales as theoretical concept. However, without other statistical controls, these descriptive analyses can only provide limited empirical support for this concept. The next sections will present more sophisticated analyses to better understand the effects of virtue locales on street segments. First, a series of diagnostics will be presented from the matched sample.

<center>Analytic Approach #2: Quasi-Experimental, Matched Sample</center>

This section will present results from count regression models on the matched design sample (108 street segments). Before presenting the findings from the models, a substantive discussion regarding diagnostics tests that include multicollinearity checks, outlier diagnostics, and various model fit tests will be presented. As part of the analysis, these tests are crucial to ensuring that the selected model best fits the data under investigation. The first table presents descriptive results of the two groups that were matched. Matching techniques were initiated by examining six variables to match upon: concentrated disadvantage, residential mobility, ethnic heterogeneity, population density, age-crime curve, arrests, and street length.

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Table 4.20. Descriptive Statistics of Key Matched Variables

Street Segments with Risky Facilities (No Virtue Locales)				
	Min	Max	Mean	S.D.
Crimes (DV)	0	19	2.67	3.59
Concentrated Disadvantage	-1.55	2.16	-.14	-.75
Residential Mobility	-1.06	1.24	.28	.58
Arrests	0	28	2.57	4.63
Population Density	281.59	10,773.68	2,736.83	1,753.69
Ethnic Heterogeneity	0	.53	.26	.16
Age-Crime Curve	4.50	78.30	18.98	13.76
Street Length	137.50	2,387.06	555.78	377.80
Street Segments with Virtue Locales				
	Min	Max	Mean	S.D.
Crimes (DV)	0	12	1.57	2.51
Concentrated Disadvantage	-1.42	2.16	-.17	.79
Residential Mobility	-1.06	1.24	.28	.53
Arrests	0	18	2.40	4.48
Population Density	727.96	5,537.50	2,828.61	1,573.02
Ethnic Heterogeneity	.03	.51	.24	.17
Age-Crime Curve	7.60	78.30	21.26	12.77
Street Length (in feet)	75.63	882.16	460.18	180.34

Table 4.20 presents the minimum, maximum, mean, and standard deviation of the variables of interest.[73] Based on this table, the two groups of street segments (treatment and comparison) appear to be similar based on the mean of matched independent variables. To ensure an "apples-to-apples" comparison of case and control groups, independent samples t-test and effect mean size (Cohen's d) were performed. Results show that there is no statistical difference among case and control groups based on both tests. The table presenting these results can be seen below.

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[73] Note that crimes (DV) was not a variable that was during the matching process.

Table 4.21. Difference in Means of Comparison and Control Groups

	t-test	Cohen's d
Concentrated Disadvantage	-.178	.038
Residential mobility	.053	-.011
Po	.254	-.054
Age-Crime Curve	.801	-.168
Ethnic Heterogeneity	-.464	.098
Arrests	-.172	.036
Street Length	-1.333	.281

*t-test scores greater than 1.96 shows statistical difference, Cohen's d scores greater than .20 show significant differences (Schnell et al., 2019).

As presented, there is no statistically significant differences between the two samples based on the t-test and Cohen's d test. Thus, the treatment and comparison groups are similar. Now that we have a relatively equal treatment and comparison group, a discussion regarding spatial autocorrelation is presented.

Spatial Autocorrelation

Spatial analyses should consider the possibility of spatial autocorrelation, a phenomenon that often exists in placed-based criminology research (Collins, Babyak, & Moloney, 2006). Spatial lags have been used in a number of place-based criminological studies, specifically when the unit of analysis is at the street segment level (Braga et al., 2010; Schnell et al., 2017; Taniguchi, Rengert, & McCord, 2009; Weisburd et al., 2018). First, a Moran's I analysis was initiated in ArcGis. Results from the Moran's I test suggested clustering of the dependent variable, thus there was the potential for spatial autocorrelation (see figure A.1 in Appendix)..[74] To estimate spatial effects, spatial lag terms (Schnell et al., 2017; Weisburd et al., 2012) were created by placing 330 and 660-feet buffers around all street segments in the sample (see figure A.4 and A.5 in Appendix

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[74] The Moran's I test only tested for clustering of the dependent variable at the block-group level. Thus, further investigation into clustering at the micro-level was employed.

for a visualization of spatial buffers around street segments). Crimes occurring in 60% or more Black areas were spatially joined to the buffers around the street segments, capturing all crimes that occurred within those buffers.[75] As mentioned in previous sections, the distances were selected due to 330-feet representing the half-block and 660-feet representing a full block (Garvin, Cannuscio, & Branas, 2013). Further, since the effects of virtue locales are examined at the street segment level, creating smaller spatial lag buffers matches its theoretical concept (also see Legewie, 2019 for a discussion regarding the lack of theoretical grounding for choosing buffer sizes).[76] Finally, these spatial lag terms are utilized as a control variable in the models to account for nearby crime within the buffer distances. Moreover, each model was estimated with 330- and 660-foot buffers, separately.[77]

Multicollinearity Checks

Multicollinearity may create issues in estimating coefficients due to high correlation among independent variables (Farrar & Glauber, 1967; Mansfield & Helms, 1982). Collinearity diagnostics were initiated using the SPSS collinearity diagnostics option. After proportioning the independent variable of the proportion of virtue locales compared to risky facility on street segments, no independent variables had collinearity

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[75] This is an important inclusion because crimes that may not be in the final sample will still be captured if it occurred in the surrounding area (see: Weisburd et al., 2012 discussion).

[76] It is not necessary to examine large spatial buffers due to the influence that crimes that occur in the far distance impacting the statistical models.

[77] Models were tested with the two spatial lag terms to see if results varied by placing more nearby crime in the model. The findings section will demonstrate how using different spatial lag terms caused the results to sometimes vary.

concerns. Multicollinearity diagnostic tables of both the marched and observational sample can be found in the Appendix (Table A.1 and A.2).

Outlier Diagnostics

Outliers are observations that fall outside the overall pattern of the distribution (Moore & McCabe, 1999) that can influence the means and variance, while also reducing the power of significance tests (Hawkins, 1980; Zimmerman, 1994). Outlier diagnostics were examined by graphing the Anscombe and Deviance residuals. The two graphs showed that one observation was an influential observation (outlier) with leverage, and was, therefore, removed from the data. Both the Anscombe and Deviance residual plots can be found in the Appendix (Figure A.6 and A.7).

Model Diagnostics: Quasi-Experimental, Matched Design Sample

Research Question One: Model Diagnostics

Ensuring the best model fit for count data is an important step before estimating the results, such that mis-specified models may create inaccurate estimates (Ridout, Demetrio, Hinde, 1998). This section will present the diagnostic tests on the matched design sample in order to ensure the best model for the matched design sample. First, the distribution of the dependent variable was examined (see Appendix, Figure A.8), which appears to show excess zeros for the dependent variable. Due to the excess zeros, a generalized linear Poisson regression model with all variables was estimated. This model showed that there was large Pearson's and deviance statistics, suggesting that the Poisson model may not properly handle the excess zeros in the data (Dean & Lawless, 1989; Dean & Lundy, 2014; Piza, 2012).[78] A second test utilized to examine proper model fit is

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[78] Pearson's $(1/df) = 2.96$, Deviance $(1/df) = 2.94$.

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the method suggested by Rodriguez (2020) that compares the effectiveness of Poisson, negative binomial, and zero-inflated models in predicting zeros compared to the observed zeros in the data. Results from this test indicated that the negative binomial model is best suited to address the excess zeros in comparison to the Poisson and zero-inflated model (see table A.3 in the Appendix).[79] Another model diagnostic test utilizes the Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) scores. In comparing the two models' AIC and BIC scores, scholars suggest choosing the model with AIC and BIC scores closest to zero (Brame, Nagin, & Wasserman, 2006; Burhnam & Anderson, 2002; Deller, Amiel, & Deller, 2011; Garamszegi, 2011). Table A.4 (see Appendix) presents a comparison of the AIC and BIC scores of a negative binomial and a zero-inflated model.[80] The results indicated that the negative binomial model produced lower AIC and BIC scores.

Due to the nested nature of the data, consideration of multilevel modeling is necessary in order to choose the best model. Comparisons between the negative binomial regression model using clustered standard errors and a fixed-effects negative binomial regression were administered. The AIC and BIC of both the negative binomial with clustered standard errors and mixed effects negative binomial model were compared (see table A5 in Appendix). The results showed that both the AIC and BIC for the negative binomial with clustered standard errors were lower than the mixed effects negative binomial model, thus suggesting the single-level model is more compatible with the data.

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[79] This method is suggested by German Rodriguez to test for how count models handle excess zeros (Rodriguez, 2020)

[80] These three tests were initiated for all models in this research project to ensure proper model fit.

The model selected to test the first research question using the matched design sample is a generalized linear negative binomial regression using clustered standard errors. Scholars have suggested that utilizing clustered standard errors without utilizing multilevel modelling still produces valid results (for discussion see Cameron, Gelbach, & Miller, 2008; Esarey & Menger, 2019; Wooldridge, 2003). Moreover, there is also a discussion regarding the ineffectiveness of multilevel modelling when there are low numbers of clusters (see Bell, Ferron, & Kromrey, 2008; Kezdi, 2004; Rogers, 1993). The current dataset has 30 block groups (or clusters) within areas that are 60% or more Black, which may create difficulty in performing a multilevel model.

<div align="center">Research Question Two: Model Diagnostics</div>

To test research question two, crimes were broken down by daytime crime (crimes occurring between 4:00am-7:59pm) and nighttime crime (8:00pm-3:59am) and were tested separately. That is, separate models are created that use daytime crime as the dependent variable, while there will be a separate model for nighttime crimes. For the matched design sample consisting of 108 total street segments there were 219 daytime crimes and 99 nighttime crimes. The same diagnostic tests initiated for research question one was also utilized for research question two. The Rodriguez (2020) method examining the observed zeroes and predicted zeros for daytime crime of the Poisson, negative binomial, and zero-inflated model was estimated (see Table A.6 in Appendix). The Poisson was ruled out due to its inability to properly predict the observed zeroes in the model. Next, a comparison of AIC and BIC between the negative binomial and zero-inflated model was made (see Table A.7 in Appendix). The negative binomial model produced lower AIC and BIC scores compared to the zero-inflated model. Finally, a

comparison of the AIC and BIC of a negative binomial using clustered standard errors and a fixed-effects negative binomial model were examined (see Table A.8 in Appendix). The negative binomial using clustered standard errors produced lower AIC and BIC scores compared to the mixed-effects negative binomial model when examining daytime crimes.

The observed and predicted zeroes of nighttime crime of the Poisson, negative binomial, and zero-inflated model were compared (see Table A.9 in Appendix). The Poisson model was ruled out due to its inability to predict the zeroes in the data. Thus, negative binomial and zero-inflated models were considered. Both the zero-inflated and negative binomial models accurately predict the excess zeros in the data. Therefore, an examination of both model's AIC and BIC scores was undertaken (Table A.10 in Appendix). Again, negative binomial most accurately handled the excess zeros and it also had lower AIC and BIC scores compared to the zero-inflated model. Finally, the AIC and BIC scores of a negative binomial using clustered standard errors was compared to a fixed-effects negative binomial model were compared (see Table A.8 in Appendix). The negative binomial using clustered standard errors produced lower AIC and BIC scores, thus this method of analysis was adopted. The next section presents the findings utilizing this statistical method.

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Research Question One

This section presents the output of a negative binomial utilizing clustered standard errors. This analysis examines the matched design sample to test the first research question.[81]

Table 4.22. Negative Binomial using Clustered Standard Errors on Matched Design Sample

Variables	IRR	Robust S.E.	P-Value	95% Confidence Intervals	
Virtue Locales	.48	.15	.017	.27	.88
Age Crime Curve	.98	.01	.06	.96	1.00
Ethnic Heterogeneity	.24	.22	.12	.04	1.46
Arrests	1.07	.02	.00	1.02	1.12
Population Density	1.00	.00	1.00	1.00	1.00
Concentrated Disadvantage	1.10	.29	.71	.66	1.86
Residential Mobility	1.96	.67	.05	1.01	3.83
Street Length	1.00	.00	.77	1.00	1.00
Spatial Lag Term 660	.98	.01	.20	.96	1.00

Table 4.22 presents[82] the results of the matched design sample utilizing a negative binomial regression with clustered standard errors.[83] A proportional increase in virtue locales relative to risky facilities on a street segment is associated with a 52% decrease in crimes on that street.[84] This effect was significant ($p < .05$). The arrest variable was

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[81] All models presented in this research project are using two-tailed tests.

[82] The spatial lag term examining 330-foot buffers was also tested; however, no significant differences were seen between the 330-foot buffer and the 660-foot buffer. Results utilizing the 330-foot spatial lag term found statistically significant ($p = .043$, thus $p < .05$) with an IRR of .52.

[83] Although variables were matched in this sample, covariates are included in the model for two of reasons. First, including controls tend to improve the precision of the models and balance (Armitage, 1996; Taylor, Davis, & Maxwell, 2001). Second, because both the "treatment group" and "comparison groups" are not exactly alike, statistical controls may control for any differentiation between the groups (Gelber & Zelen, 1986; also see Patel, 1996).

[84] Another interpretation for this finding: For every proportional increase of risky facilities relative to virtue locales is associated with an increase in 2.08 crimes.

significant with marginally positive coefficients. Further, the residential mobility also had

significantly positive coefficients, suggesting that both variables may be associated with

crime increases.

Research Question Two

For the models presented below, the dependent variable was split into daytime

crime and nighttime crime.[85] The first model will offer daytime crime as the dependent

variable, while the second model will show the results examining nighttime crime as the

dependent variable.

Table 4.23. Negative Binomial using Clustered Standard Errors of Daytime Crime on
Matched Design Sample (660-Foot Spatial Lag Included)

Variables	IRR	Robust S.E.	P-Value	95% Confidence Intervals	
Virtue Locales	.43	.14	.00	.23	.81
Age Crime Curve	.98	.01	.23	.96	1.01
Ethnic Heterogeneity	.25	.28	.22	.03	2.24
Arrests	1.08	.03	.00	1.03	1.14
Population Density	1.00	.00	.54	1.00	1.00
Concentrated Disadvantage	1.34	.39	.31	.76	2.37
Residential Mobility	1.75	.63	.12	.86	3.55
Street Length	1.00	.00	.82	1.00	1.00
Spatial Lag Term 660	.94	.02	.00	.90	.97

Table 4.23 presents the results from a negative binomial regression utilizing

clustered standard errors on the daytime crime dependent variable with the matched

design sample. Street segments containing virtue locales are significantly (p < .05)

associated with crime reductions in comparison to street segments that do not contain a

virtue locale. A proportional increase in virtue locales relative to the proportion of risky

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[85] Phillips and Smith (2000) discussed phenomenological daytime as (4:00am-7:59pm)
and nighttime as (8:00pm-3:59am).

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facilities is associated with a 57% decrease in crime counts on the street segment.[86] It

should be noted that these results utilize the nighttime 660-foot buffer spatial lag term.

The next table will present the results utilizing the 330-foot buffer spatial lag term.

Arrests had marginally positive significant coefficients. Finally, the spatial lag term was

significant with a marginally negative coefficient.

Table 4.24. Negative Binomial using Cluster Standard Errors of Daytime Crime on
Matched Design Sample (Utilizing 330-foot Buffer Spatial Lag Term)

Variables	IRR	Robust S.E.	P-Value	95% Confidence Intervals	
Virtue Locales	.64	.25	.25	.30	1.37
Age Crime	.97	.02	.05	.93	1.00
Ethnic Heterogeneity	.19	.23	.16	.02	1.95
Arrests	1.04	.03	.24	.98	1.10
Population Density	1.00	.00	.77	1.00	1.00
Concentrated Disadvantage	1.11	.36	.75	.59	2.10
Residential Mobility	2.09	.85	.07	.94	4.62
Street Length	1.00	.00	.29	1.00	1.00
Spatial Lag Term 330	.89	.05	.02	.80	.98

The above table shows the results of a negative binomial regression using

clustered standard errors on the case control sample examining daytime crimes. The

virtue locale variable is now insignificant (p > .05) after utilizing the spatial lag term of

330-foot buffer distances compared to the 660-foot buffer spatial lag term. The sensitivity

of the model due to the small sample size (Bujang & Adnan, 2016; Weisburd, Petrosino,

& Mason, 1993) may be a reason the results fluctuated significantly by incorporating a

different spatial lag term. In this model the age-crime curve variable and spatial lag term

were significant with marginally negative coefficients.

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[86] Moreover, street segments that do not contain a proportion of virtue locales on street
segments is associated with an increase in 2.33 crimes on that street.

Table 4.25. Negative Binomial (Cluster Standard Errors) of Nighttime Crime on Matched Design Sample

Variables	IRR	Robust S.E.	P-Value	95% Confidence Intervals	
Virtue Locales	.32	.16	.024	.12	.86
Age Crime	.99	.01	.45	.96	1.02
Ethnic Heterogeneity	.92	1.34	.96	.05	15.89
Arrests	1.08	.03	.00	1.03	1.14
Population Density	1.00	.00	.63	1.00	1.00
Concentrated Disadvantage	.73	.24	.34	.38	1.40
Residential Mobility	1.17	.61	.76	.43	3.23
Street Length	1.00	.00	.31	1.00	1.00
Spatial Lag Term 660	.80	.11	.11	.61	1.05

Table 4.25 offers the results from a negative binomial utilizing clustered standard errors, which examined nighttime crimes within the matched design sample.[87] The association of virtue locales on street segments with reductions in crime counts holds true during the nighttime. At night, a proportional increase in virtue locales relative to risky facilities on a street segment is associated with a 68% reduction in crime on that street.[88] These associations are statistically significant (p < .05). The arrest variable was also a significant predictor, with marginally positive coefficients.

Utilizing the matched design sample, results suggest that street segments with virtue locales are associated with crime reductions. This relationship remains consistent regardless of time of the day. The next section will present the analysis and findings from the observational design sample (134 street segments).

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[87] Utilizing the 330-foot spatial lag term elicited similar results on the main independent variable (Virtue Locales). The IRR = .30 and p < .05 (p=.02).

[88] Another interpretation: A proportional increase in risky facilities relative to virtue locales is associated with an increase in 3.13 crimes on that street.

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Model Diagnostics: Observational Design Sample

Research Question One: Model Diagnostics

Utilizing the observational design consisting of 134 street segments, the same diagnostic tests were employed on the matched design sample were also initiated on the observational design sample. Table A.11 in the Appendix presents the observed zeros in the data compared to the expected zeros that predicted in the Poisson, negative binomial, and zero-inflated model. The Poisson and zero-inflated model underestimate the number of zeros in the data, while the negative binomial model more accurately predicts the number of zeros. Since the zero-inflated model came closest to predicting the observed zeros as the observed zeros in the data, a comparison of the AIC and BIC scores between the negative binomial and zero-inflated model was conducted.

Table A.12 presents the AIC and BIC scores of both the zero-inflated and negative binomial. Between the ability of the negative binomial in handling the zeros in the model and the lower AIC and BIC scores, the negative binomial is the final model for testing research question one utilizing the observational design sample. Finally, Stata provides a useful tool to be able to compare model fits across all types of models (Williams, 2006). Results from the Stata tool can be found in the Appendix, figure A.9.[89] Results from the countfit command in Stata indicated that the negative binomial regression was a better model fit as compared to the Poisson and zero-inflated model.

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[89] The "countfit" command did not execute for all models due to the small sample size. For example, when testing the second research question, the countfit command would not execute because the dependent variable was reduced by daytime and nighttime crime. For the models that the "countfit" command was successfully executed, they will be presented in the Appendix.

A comparison between the AIC and BIC scores of a single-level negative binomial using clustered standard errors and a fixed-effects negative binomial model can be seen in Table A.13. The single-level negative binomial using clustered standard errors produced lower AIC and BIC scores. Thus, the model of choice for research question one using the regression sample is a negative binomial using clustered standard errors.

Research Question Two: Model Diagnostics

Examining the observational design sample containing 134 street segments[90] with daytime crime as the outcome, the Poisson model appeared to be unable to predict the excess zeros for daytime crime (see Table A.14 in Appendix). Table A.15 presents the AIC and BIC scores of both negative binomial and zero-inflated models. The negative binomial was selected as a best model because it adequately predicted excess zeros in the data and it also had lower AIC and BIC scores compared to the zero-inflated model.

Predicted zeros of a Poisson, negative binomial, and zero-inflated model on nighttime crime utilizing the observational design sample were examined (see Table A.16 in Appendix). Since the Poisson model did not adequately predict the zeros in the data, a negative binomial and zero-inflated model were considered. The AIC and BIC scores of both the negative binomial and zero-inflated model were compared (see Table A.17 in Appendix). Due to the negative binomial model's ability to predict the excess zeros and lower AIC and BIC scores, the negative binomial is the model was selected.

Finally, a comparison was made between AIC and BICs of negative binomial and fixed-effects negative binomial models. The negative binomial using clustered standard errors had lower AIC and BIC scores compared to mixed-effects negative binomial

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[90] This sample contained 295 daytime crimes and 129 nighttime crimes.

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models in both the daytime and nighttime crime samples (see Table A.18 in Appendix).

A more detailed presentation of the findings now follows.

<div align="center">Findings: Observational Design Sample</div>

<div align="center">Research Question One</div>

Table 4.26. Negative Binomial using Clustered Standard Errors on Observational Design Sample

Variables	IRR	Robust S.E.	P-Value	95% Confidence Intervals	
Virtue Locales	.51	.15	.018	.30	.90
Age Crime Curve	.98	.01	.05	.96	1.00
Ethnic Heterogeneity	.23	.16	.03	.06	.86
Arrests	1.06	.02	.00	1.03	1.10
Population Density	1.00	.00	.80	1.00	1.00
Concentrated Disadvantage	1.17	.19	.33	.85	1.60
Residential Mobility	2.20	.40	.00	1.53	3.10
Street Length	1.00	.00	.40	1.00	1.00
Spatial Lag Term 660	.99	.01	.	.97	1.02

Table 4.26 presents the results from a negative binomial regression model using clustered standard errors.[91] Virtue locales are again significant ($p < .05$) with negative coefficients. A proportional increase in virtue locales relative to risky facilities on a street segment is associated with a 49% reduction in crime on that street.[92] The age-crime curve, surprisingly, had a slightly negative coefficient suggesting that more of the population ages between 16-24 years old is associated with crime reductions. Conversely, the residential mobility variable was significantly associated with crime increases on street segments.

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[91] The results of the model using the 660-foot buffer spatial lag term are presented above. However, results and significance did not vary substantially when utilizing the 330-foot buffer with IRR=.530 and $p < .05$ (p=.038) for virtue locales.

[92] Also, a proportional increase in risky facilities relative to virtue locales is associated with an increase in 1.96 crimes on that street.

The model testing the first research question finds that street segments with virtue locales are associated with crime reductions compared to street segments with no virtue locales. Both the regression analyses on the matched design sample and the observational design sample found support for the first research question. The next section will present models that test whether crime reductions attributed to virtue locales vary by time of the day.

<div align="center">Research Question Two</div>

Table 4.27. Negative Binomial (Cluster Standard Errors) of Daytime Crime on Observational Design Sample

Variables	IRR	Robust S.E.	P-Value	95% Confidence Intervals	
Virtue Locales	.81	.31	.579	.38	1.72
Age Crime Curve	.97	.02	.03	.93	1.00
Ethnic Heterogeneity	.35	.34	.28	.05	2.37
Arrests	1.07	.03	.00	1.02	1.12
Population Density	1.00	.00	.44	1.00	1.00
Concentrated Disadvantage	1.23	.26	.97	.81	1.85
Residential Mobility	2.63	.55	.00	1.74	3.97
Street Length	1.00	.00	.08	1.00	1.00
Spatial Lag Term 660	.95	.03	.07	.90	1.00

Table 4.27 presents the results of a negative binomial examining the observational design sample utilizing the 660-foot daytime spatial lag term. This model presents no statistically significant associations between virtue locales with crime reductions. However, note that the p-values for the virtue locale predictor has been significant in all of the previous models discussed. The next table will present the same analysis but using the 330-foot buffer spatial lag term.

Table 4.28. Negative Binomial using Clustered Standard Errors of Daytime Crime the Observational Design Sample (Using 330-foot Spatial Lag Term)

Variables	IRR	Robust S.E.	P-Value	95% Confidence Intervals	
Virtue Locales	.58	.18	.080	.32	1.07
Age Crime	.99	.01	.03	.96	1.01
Ethnic Heterogeneity	.34	.27	.17	.07	1.57
Arrests	1.05	.02	.00	1.02	1.09
Population Density	1.00	.00	.28	1.00	1.00
Concentrated Disadvantage	1.22	.21	.24	.87	1.72
Residential Mobility	1.90	.40	.00	1.26	2.87
Street Length	1.00	.00	.78	1.00	1.00
Spatial Lag Term 330	.85	.02	.00	.81	.89

Utilizing the 330-foot buffer spatial lag term, the p-value of the virtue locale variable is close to significant and is associated with a marginal reduction in crime. Further, in testing two-tailed hypotheses, p-values between .05 and .10 may still be considered significant (Gibbons & Pratt, 1975; Rice & Gaines, 1980).[93] Since this is the case, the association between virtues locales on street segments and reductions in crime counts can be conceptualized as significant in this model. Thus, a proportional increase in virtue locales relative to risky facilities on a street segments is associated with a 42% reduction in crime on that street. Moreover, the age-crime and spatial lag term predictors were significantly associated with a marginal decrease in crime counts. The arrest and residential mobility predictors were significantly associated with crime count increases.

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[93] To aid with interpretation of the p-value (.080) is to cut the value in half (p = .040), which would make the result significant.

Table 4.29. Negative Binomial using Clustered Standard Errors of Nighttime Crime on Observational Design Sample

Variables	IRR	Robust S.E.	P-Value	95% Confidence Intervals	
Virtue Locales	.31	.15	.013	.12	.78
Age Crime	.99	.01	.44	.96	1.02
Ethnic Heterogeneity	.48	.49	.47	.07	3.50
Arrests	1.08	.03	.00	1.03	1.13
Population Density	1.00	.00	.43	1.00	1.00
Concentrated Disadvantage	1.05	.20	.78	.73	1.52
Residential Mobility	1.73	.43	.03	1.07	2.81
Street Length	1.00	.00	.80	1.00	1.00
*Spatial Lag Term 660	.77	.11	.08	.58	1.03

Table 4.29 presents the findings from a negative binomial regression using clustered standard errors on the observational design sample to predict nighttime crime.[94] A proportional increase in virtue locales relative to risky facilities on street segments is associated with a 68% decrease in crime on that street.[95] These associations are statistically significant ($p < .05$) for the virtue locale variable. Arrests and residential mobility were both statistically significant with positive coefficients.

Based on the results from most of the regression models, street segments with virtue locales are associated with reductions in crime. Moreover, this relationship mostly holds true when the crimes were varied by daytime and nighttime crimes. In the next chapter, a discussion of the findings will be presented along with key insights that can be gleaned from the analyses.

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[94] This model was also estimated utilizing the 330-foot buffer spatial lag term which also held statistically significant ($p = .043$) crime reduction associations in the virtue locale variable (IRR = .55).

[95] Also, a proportional increase of risky facilities relative to virtue locales is associated with an increase in 3.13 crimes on that street.

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Chapter 5: Discussion

This chapter will discuss this study's findings, the contribution of virtue locales to the extant literature, and the policy implications derived from this research. Additionally, the limitations of the study and the implications for criminological research will be discussed. Ultimately, this chapter will provide a possible blueprint for scholars who are interested in environmental criminology and community context.

Each analytic strategy utilized in this study (descriptive analysis and regression analyses), provided support for the hypothesized link between virtue locales and crime-reductions on street segments. In the descriptive section, a crime repellant effect was uncovered through an examination of the mean and median distance of crimes within a given buffer size. Analyses at the 100-, 200-, and 330-foot distance showed that the mean and median distance of crimes from barbershops and beauty salons were one of the largest compared to other businesses. This would suggest a crime repellant effect, that regardless of what buffer distance examined, the mean and median distance of crimes of virtue locales were large. Moreover, examining the buffers that had at least one crime occur within, buffers containing barbershops and beauty salons had the lowest mean and median crimes within certain buffer distances. Moreover, there was some indication that

the average number of crimes that occur within given buffer distances were lower near

virtue locales such as barbershops and beauty salons than most of the other businesses.[96]

Descriptive analyses showed some interesting findings centered around the crime-

reducing effects of schools. When examining the average number of crimes that occur

within buffers, schools were found to have one of the smallest average numbers of crimes

that occur within its buffer (regardless of buffer size). Further, the analyses that looked at

the percentage of businesses that had at least one crime, schools were found to be the

least affected by one or more crimes. However, when examining the mean and median

distance of crimes to the business location, crime tended to occur at the immediate

location of the school. On one hand, this finding may suggest that crimes are most likely

to be recorded within the school walls or on the school campus, thus no crime repellant

effect. On the other hand, the fact that the average number of crimes and the lack of

school buffers that had a crime occur within, may suggest that overall, schools are not

criminogenic environments. This finding contradicts some findings from the extant

literature that suggests that schools are crime generators/attractors (see McCord et al.,

2007; Roncek & Lobosco, 1983). Instead, the study finds that schools are not

criminogenic, but act more as a virtue locale. Indeed, schools may be a secondary

socialization agent, in which students are taught morals and values, to report "bad"

behavior, and the value of positive social interactions (Cemalcilar, 2010; Revell &

Arthur, 2007). Schools also utilize various target hardening techniques such as locking

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[96]Virtue locales were not found to have lower average distances and average crimes
within every buffer size; however, there is some evidence that virtue locales remained
one of the businesses that had lower average crimes and distance among the businesses
considered. Regardless, the descriptive analyses were preliminary investigations before
examining more complex analyses utilizing controls and matching techniques.

certain areas and preventing outsiders from wandering the campus (Johson et al., 2018; Quarles, 1989). Finally, schools have a substantial number of guardians in the form of teachers, parents, and student-resource officers (Broll & Lefferty, 2018; Crawford & Burns, 2015). Thus, examining the extent that schools may serve as a virtue locale to youths is a worthwhile research avenue.

Almost all the regression analyses found statistically significant associations between proposed virtue locales and crime-reductions on street segments. Of the models that did not show significance (see Table 29 and Table 30), the small sample size may indicate that the models were sensitive. That is, interchanging the 330- and 660-foot spatial lag terms, changed the significance of the virtue locale predictor. By using the 330-foot buffer (as compared to the 660-foot buffer), the virtue locale predictor became significant (p = .80) since the regression utilized a two-tailed (Rice & Gaines, 1980). Even more, these associations remained significant regardless of time of the day (daytime or nighttime). Interestingly, stronger associations between virtue locales and crime-reductions were found during the nighttime, when most businesses (especially barbershops and beauty salons) are closed. Logically speaking, it makes sense that when the barbershop and beauty salon are open, and when workers who care for the environment and provide guardianship are around, there would be stronger crime-reductions. In sum, the results from the descriptive and regression analyses showed support for both research questions posed.

Virtue locales may have an ecological label (Brantingham & Brantingham, 2000) that signals to motivated offenders that the area is not an environment ripe for criminal opportunities. An ecological label is established through an offender's personal history

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with the location and whether he/she perceives certain locations to be attractive for criminal behavior (Brantingham & Brantingham, 1995). Crime attractors, for example, have a reputation among motivated offenders as a place to commit crimes due to the reduced chance of being spotted or arrested (Brantingham & Brantingham, 2013). Virtue locales may operate in a similar fashion to the extent that motivated offenders view these areas a "no-go zone," or an area where there is a good chance that their criminal behavior will be interfered with by police or civilians who care about the area. This ecological label could explain the strong crime-reduction associations found between virtue locales and nighttime crime. Regardless of whether the virtue locale is open or closed, daytime or nighttime, the location maintains an ecological label that suggests that the location is not a suitable environment for criminal activity.

The environmental backcloth is defined as "uncountable elements that surround and are part of an individual and that may be influenced by or influence his or her criminal behavior" (Brantingham & Brantingham, 1993, p.6). The backcloth is influenced by numerous characteristics of the environment including the socio-demographics, land use, type of the area (rural, suburban, or urban), and temporal influences (Lundrigan, Czarnomski, & Wilson, 2010). Individuals will interpret every backcloth based on their own personal needs and their perception of criminal opportunities that may arise at a given area at a specific time. Virtue locales may similarly impact the environmental backcloth of potential offenders. Since the environmental backcloth of a location is associated with the opportunity structure, virtue locales may create a reputation as a crime-free environment. Thus, motivated offenders' propensity to commit crimes near virtue locales may be reduced because these areas possess high levels of guardianship.

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Environmental criminology assumes some people are criminally motivated, thereby allowing scholars to shift their attention away from individuals and instead focus on the areas and environments that create criminal opportunities (Brantingham & Brantingham, 1981/1991). While this theoretical shift may allow researchers to explain criminogenic environments in greater detail, one cannot overlook the importance of low levels of guardianship in particular communities. Notwithstanding this fact, much remains unknown about why or how some areas are unable to exert higher levels of guardianship. Said differently, the environmental criminology paradigm would certainly benefit if more scholarly attention was focused on the characteristics and dynamics of areas that engender high levels of guardianship. Within this paradigm, low-crime areas are assumed to be areas that exert high levels of guardianship,[97] without providing explanations for why or how guardianship is established. The introduction of virtue locales may provide some insights into how high levels of guardianship are created and maintained. Thus, the introduction of virtue locale may serve as a bridge to environmental criminology by specifying how certain business may help environments exert increased levels of guardianship. Virtue locales can be thought of as the opposite of crime generators and attractors (Brantingham & Brantingham, 1995). The crime generator and attractor scholarship has generally focused on bus lines, bars and restaurants, fast food restaurants, pawn shops, payday lenders, and schools (see discussion in Drawve et al., 2016). However, the research virtue locales suggests that

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[97] This conclusion is that of the researcher's as the previous environmental criminology literature has given no other specification as to why certain areas have low crime rates.

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there is an opportunity for environmental criminologists to add to our understanding of the link between crime-reduction and business types.[98]

In a similar vein, routine activity theory posits that high levels of guardianship will reduce crime occurrences; however, little is known about the sources of guardianship throughout a city (Reynald, 2009; Tewksbury & Mustaine, 2005). Further, routine activity scholarship has largely turned attention away from the concept of guardianship and simply assumed that criminogenic environments are areas that lack guardianship (Hollis-Peel et al., 2011). The addition of virtue locales to the routine activity paradigm brings the importance of guardianship to the forefront of the theoretical framework. Guardianship provided by virtue locales may mitigate the other two pillars of routine activity theory, suitable targets and motivated offenders. Suitable targets may no longer become "suitable" in areas near virtue locales due to the guardianship provided by these businesses. Even more, motivated offenders may be deterred from the locations of the virtue locales due to the guardianship exerted. Future routine activity scholarship should acknowledge and re-focus on the importance of guardianship in reducing crime rates. Even more, routine activity should also acknowledge businesses structures as an important source in producing (or reducing) levels of social guardianship. Further, research should also consider the influence businesses (both criminogenic and virtuous businesses) have on neighborhood guardianship and crime rates.

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[98] One research avenue to explore is to place the concept of "defensible space" (Newman, 1972) at the forefront when examining virtue locales. The concept of "image" and "milieu" may be relevant to virtue locales. "Image" of the physical environment involves the perception of an area as well-kept, unique, and non-isolated while "milieu" discusses the importance of the surrounding environment's impact on a community. Creating measures of image and milieu may help push forward and refine the concept of virtue locales.

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Another contribution this research project provides to theoretical criminology is the emphasis on community context when examining land use effects. Other than the research performed by Kubrin and her colleagues (see Kubrin et al., 2011; Kubrin & Hipp, 2016), land use scholarship largely ignores how land uses may impact different racial/ethnic communities in various ways. This line of research shows that pawn shops, payday lenders, and quick cash stores prey on minority, disadvantaged neighborhoods due to the cash advances these stores provide to poor neighborhood citizens. Similarly, virtue locales acknowledge the influence of certain businesses through different racial community contexts. These are vital considerations because some businesses that are set up in certain communities may possess either virtuous or detrimental effects depending on the community in which it is established. For example, establishing breweries or coffee shops in disadvantage neighborhoods may not have virtuous effects for that community. These businesses have been suggested to be part of a gentrification process (Barajas, Boeing, & Wartell, 2017; Papachristos et al., 2011), in which gentrification has been found to push out and segregate low income, minority populations (Freeman, 2009; Wyly & Hammel, 2004). Moreover, these businesses may not provide much, if any, social capital to the citizens of disadvantaged populations (Grier & Perry, 2018; Waxman, 2006). Thus, these types of businesses may not "fit" within the community at which it is nested. Therefore, when considering potential virtue locales, a look into the history and cultural fabric of communities is necessary. For example, Mills (2013) traces the history of barbershops in Black communities to pre-Civil War times as a community gathering location and place of refuge. Thus, barbershops have played an important role in the Black community for many decades. Thus, it may be a logical assumption to think

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that these businesses are valuable to Black communities and may have crime-reducing effects. In sum, virtue locales provide an extension to both routine activity theory and environmental criminology by recognizing the influence of racial community context when examining the criminological effects of businesses and land uses.

While this research project did not directly test the effects of virtue locales as it relates to producing collective efficacy through social capital, the results suggest that virtue locales may create high levels of collective efficacy. Social capital is defined as "features of social organization, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit" (Putnam, 1993, p.36). Social capital may come in the form of civic organizations, local political organizations, ethnic/nationality clubs, neighborhood watch programs, and businesses (Sampson, Morenoff, & Earls, 1999). Virtue locales may provide neighborhoods with a form of social capital which in turn generates high levels of collective efficacy at the location. Some research has suggested that levels of collective efficacy may affect the type of businesses that are attracted to certain areas (Ford & Beveridge, 2004). However, research has ignored whether particular businesses may contribute to producing collective efficacy in neighborhoods. Interestingly, social capital has been measured by the type of businesses within cities (Besser, 1999; Moore & Recker, 2016), yet the connection between businesses producing collective efficacy in an area has yet to be made in this field. Virtue locales may provide a foundation for this line of research. It could be that an explanation for the associations of crime-reductions with virtue locales on street segments is due to these businesses helping to establish collective efficacy at the locations.

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Neighborhood-level scholarship has recently highlighted the importance of considering certain neighborhood effects and their influence on local crime rates (see Sampson et al., 2002 for a review). Recent research has begun to examine the influence of structural characteristics of neighborhoods on the crime effects of businesses. For example, Eck and colleagues (2010) showed how businesses have differential effects on neighborhood crime depending on the neighborhood's level of disadvantage at which the businesses are nested. Thus, a business may be more likely to be crime-prone based on the structural disadvantage of a given area (also see Wilcox et al., 2004). This finding suggests that the surrounding environment affects whether businesses are criminogenic or crime-reducing. However, the current research project proposes the opposite in that regardless of the surrounding environmental factors (e.g., high levels of concentrated disadvantage), virtue locales still provide a crime-reducing neighborhood effect. Thus, based on findings from this research project, scholars may need to reconceptualize how we understand businesses as potential neighborhood effects. As compared to studying how structural factors influence the effects of businesses, we should attempt to parse out how businesses influence (or mitigate) the effects of structural factors. The setting of this research project centered in areas suffering from various structural factors that are correlated with crime, such as concentrated disadvantage and residential mobility. However, virtue locales were associated with crime-reductions in this disadvantaged environment. Thus, virtue locales may be a neighborhood effect that mitigates some of the social ills and struggles of communities suffering from structural disadvantages.

Virtue locales not only contribute to new understandings within theoretical criminology but also have important policy implications. Policing criminogenic

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environments such as known crime generators and crime attractors is a policy supported by environmental criminologists (Guerette & Bowers, 2009; Smith & Cornish, 2003). While policing criminogenic facilities is a necessary policing strategy, protecting known virtue locales should also be strategy worth consideration. Ensuring that these businesses continue to be unharmed from crime will allow virtue locales to thrive and continue providing the benefits of social capital, collective efficacy, and social ties to the neighborhood. Third-party policing is a strategy in which police attempt to "coerce nonoffending persons to take actions which are outside the scope of their routine activities, and which are designed to indirectly minimize disorder caused by other persons or to reduce the possibility that crime may occur" (Buerger & Mazerolle, 1998, p.301). Virtue locales may be that community anchor to help police efforts to reduce crime and disorder through third-party policing. Since virtue locales are suggested to have high levels of guardianship due to the social cohesion and care for the business and surrounding area, employees of virtue locales may provide additional "eyes" on the neighborhood in which potentially criminal behavior may be deterred. Thus, police protecting and maintaining a cohesive rapport with these businesses is an important policy consideration.

Since virtue locales are community anchors, local residents may gather and discuss the "happenings" of the neighborhood and the social climate of the area. These locations may be suitable to various government-community meetings. For example, holding consistent community-police meetings for the residents to discuss their concerns of the neighborhood with the police may not only help with crime prevention, but will bridge the community and police relationship. In the current era, most police agencies

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implement community-policing philosophies, which focuses on co-productive relationship between the police and the community (Cordner, 1997; Renauer, Duffee, & Scott, 2003). Having meetings at virtue locales with citizens who care about the community will help build community-police relations and aid in crime prevention. Further, scholarship has documented the history of the tarnished relationship between communities of Color and the police (Weitzer & Tuch, 2005; Weitzer, Tuch, & Skogan, 2008). Holding these police-community meetings at virtue locales may be a conducive location in creating open discourse course between both parties. Meetings such as these may help bridge this historically strained relationship between communities of Color and police.

<div align="center">Limitations & Future Research</div>

One of the most substantive issues faced throughout this research project was the small sample size of the data examined. The matching sample only contained 108 total street segments while the observational design sample had 134 street segments. Further, there were only 30 street segments that contained one or more virtue locales in both samples. Small samples sizes contribute to the issues of having low statistical power, inflated effect size estimations, sensitive models, and misinterpretations of p-values due to false discovery (see discussion in Button et al., 2013; Colquhoun, 2014; Fan, Thompson, & Wang, 1999).

Sample size also affects the size of the standard errors and confidence intervals (Maas & Hox, 2005). Small sample sizes may create larger standard errors which may lead to less precise estimates (Wright & Herrington, 2011), while increasing sample sizes will lead to small and more accurate standard error estimates (Paccagnella, 2011).

Moreover, large standard errors create wider confidence intervals, in which the uncertainty of the estimates increases (Alper & Gelb, 1990; Graham & Bull, 1998). Future research should examine virtue locales with bigger sample sizes, which may require a different research setting or multiple research settings. Larger cities (e.g., Chicago) may provide more street segments for treatment and comparison groups, as well as a larger number of blocks or block-groups. More block-groups may allow for the opportunity for multilevel modeling which can help parse out the influences of level 2 variables (e.g., concentrated disadvantage) on level 1 predictors. Finally, larger cities will have more businesses (such as barbershops and beauty salons) in order to replicate this study with a bigger sample size that provides more statistical power.

This study utilized cross-sectional data collected at one point in time, examining one year of data. Due to the cross-sectional nature of the data, causal inferences cannot be made (Johnson & Hall, 1988). Therefore, the interpretation of coefficients in this study are correlational associations between virtue locales and crime reductions on street segments. Future research should examine the effects of virtue locales utilizing longitudinal data to examine if there are stable crime-reducing effects of such businesses over time. Moreover, it is important to note whether the length that barbershops and beauty salons have been in business may affect crime-reductions. Perhaps there may be stronger crime-reduction associations for barbershops and beauty salons that have been in the community for a substantial number of years, as compared to barbershops and beauty salons that have recently opened.

Quasi-experimental designs using matching techniques are a relatively strong design (Shadish et al., 2002); however, there are still threats to internal validity. For

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example, there is potential for erroneous conclusions since the researcher was unable to make perfect matches between "treatment" group and "comparison" groups (Cram, Karan, & Stuart, 2009). Another concern with the data is the issue of omitted variable bias, which is the concern that an independent variable that may be correlated to other independent variable that is omitted from the regression. Further, this omitted variable bias may significantly influence the dependent variable (Levitt, 2001), which may lead to erroneous conclusions. As Weatherburn (2001) states, "It is much harder to measure and monitor the factors which lead to crime-prone communities than it is to monitor the factors which lead to crime-prone individuals" (p.6). Further, it is also difficult to understand what places may prevent crime at the immediate area. Thus, it is possible this study suffers from omitted variable bias as street segments were matched on only a few variables.

Future research should implement stronger methodologies (e.g., true experiments and other quasi-experimental methods) when testing the effects of virtue locales in order to create more confidence that there are internally valid results (Spector, 1981). Moreover, this study should be replicated in other geographic areas of the United States to begin establishing external validity (McDermott, 2011). Perhaps replicating this study with larger sample size, in a different geographic region may be a step towards establishing both internal and external validity.

Crimes known data and arrest data were utilized to measure the dependent variable and formal social control, respectively. The limitations of official data are well-established in the criminological literature (see Chilton, 1982), including the issue that most crimes are largely not reported to police by citizens (Penney, 2014; Skogan, 1977).

Additionally, other technical issues of police departments in documenting and publishing data have contributed to the limitations of official crime and arrest data (Biderman & Reiss, 1967). Future research should use alternative crime data sources such as self-reported surveys, to mitigate the limitations of official data (Messner, 1984).

This study compared street segments that contained proposed virtue locales to other street segments with "risky facilities" suggested by the criminological literature. Virtue locales are believed to be a crime-reducing business in nature. While this is the first test of virtue locales, the findings may logically make sense due to the other businesses utilized to compare to virtue locales are considered to be criminogenic. Since virtue locales were compared to known criminogenic businesses, future research should also consider comparing virtue locales to "neutral businesses," or everyday businesses that have yet to be found by research as criminogenic or crime-reducing (for example, gyms, real estate firms, standard banks). Matching based on all "types" of businesses may shed light on how virtue locales compare to other businesses that have not yet been deemed "risky facilities."

Parsing out other land uses effects on risky facilities and virtue locales, future research should examine the nearby environment. On one hand, research has suggested that taking care of vacant lots in the form of "greening" may be crime-reducing effects on the nearby environments (see Branas et al., 2011). On the other hand, research has shown that nearby "incivilities" may affect crimes on nearby businesses (Kurtz, Koons, & Taylor, 1998). Understanding what kind of land uses that are established nearby that may help or impede virtue locales in exerting its virtuous effects may provide greater detail on what occurs at these environments.

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While barbershops and beauty salons were grouped together to form the main independent variable, both businesses may have different effects on the environment. That is, the barbershop may provide a haven or social gathering anchor for Black men within these communities. However, the beauty salon provides that same type of gathering for Black women in the community. Future research should take an intersectional approach to understanding the similarities and differences that barbershops and beauty salons provide for both Black men and women. While they may provide similar virtuous effects for the Black community, understanding what the different assets these locations provide for men and woman will paint a more complete picture of these honorable locations.

The concept of virtue locales is largely inspired by the routine activity and environmental criminology paradigm, which often attempts to explain "street crime" (Cohen & Felson, 1979). While these types of crimes were considered in the analyses, the crimes were grouped together as "crime counts." Future research should examine specific types of crimes that virtue locales may reduce. Perhaps virtue locales may only reduce "property crimes," as compared to "violent crimes" (or vice versa). Moreover, virtue locales may reduce different types of crimes when the business is opened and closed. The extant literature has suggested that businesses may be more prone to burglary when they are closed (Clarke, 2002; Gibbs & Shelly, 1982), but more vulnerable to armed robbery while the business is open (Bernasco, Ruiter, & Block, 2017; Taylor, 2002). Moreover, virtue locales may be more likely to reduce property crimes, such as theft and burglarly, due to the low perceived levels of *target* attractiveness by motivated offenders. For example, motivated offenders may not view barbershops and beauty salons to have prized

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possessions that would benefit the criminal (e.g., hair clippers).[99] Thus, establishing whether virtue locales reduce certain crimes while falling victim to other types of crimes is worth exploration. Finally, examining the various types of crime that may be affected by time of the day and location of the crime may give insight to the dynamic criminal opportunities that arise due to contextual factors (see Fisher et al., 1998; Land, 2018; Tillyer et al., 2011).

As previously stated, virtue locales are inspired by three prominent theoretical traditions including routine activity theory, environmental criminology, and collective efficacy theory. However, this research project only tested aspects of routine activity and environmental criminology paradigms. Uncovering whether virtue locales exert high levels of collective efficacy may require other types of methodologies such as survey data of neighborhoods and business owners and qualitative inquiry. Qualitative interviews or focus groups of businesses owners and neighborhood citizens may provide more context with regards to virtue locales. Qualitative inquiry may also uncover other businesses that may exert similar influences as virtue locales, yet they were overlooked by researchers. Further, these interviews may elicit additional concepts and variables to be tested in statistical models. Since virtue locales represent a new theoretical concept, utilizing different forms of data would be a worthwhile endeavor.

Anderson (1990) discusses the importance of "old heads" in the Black community. Old heads are men who serve as a "…guidance counselor and a moral cheerleader who preached anticrime and antitrouble messages…the old head acted as

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[99] Even if this is the case, virtue locales still provide benefits to the community including social capital, connections, ties, and collective efficacy.

surrogate father…" (Anderson, 1990, p.69-70). While Anderson (1990) suggests that old heads may be a church deacon, sports coach, or a street-corner man, qualitative research of barbershops may find that old heads gather at virtue locales. Other qualitative research discusses experiences and observations of older men "hanging out," telling stories of the past, playing checkers, and giving advice to youths at barbershops (Alexander, 2003; Jones, 2015). Virtue locales may serve as community anchors due to the high numbers of "old heads" who frequent the business. In turn, "old heads" can help mentor and oversee youth in the community. Examining these unique experiences through qualitative research will help shed more light on the dynamics that occur at virtue locales.

Since virtue locales are described as race/ethnicity-specific (or community context-specific), exploring virtue locales of other race/ethnicities warrants research attention. For example, coffee shops are a part of a gentrifying process of cities that tend to establish in mostly White neighborhoods (Smith, 2014; Grier & Perry, 2018).[100] Coffee shops may be a location where residents and customers establish social interactions, connections, ties, and perhaps develop collective efficacy within the area (Corcoran et al., 2018; Oldenburg, 1989).[101] While the research findings are inconclusive regarding the crime-reducing effects of coffee shops in Black and Latinx areas (see Papachristos et al., 2011; Smith, 2014), future research should examine if there are crime reducing effects of coffeeshops in mostly White neighborhoods. In addition to coffee shops, businesses such as smoothie shops, bagel shops, cafes, delis, and diners may be

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[100] Nonetheless, there may be a link between gentrifying areas and the proliferation of coffeeshops (Barton, 2016; Sullivan & Shaw, 2011).

[101] However, if exploring coffeeshops in White areas, researchers should acknowledge that these businesses do not have the same kind of history that barbershops have had in the Black community (see Mills, 2013).

businesses to consider exploring in majority White neighborhoods. These locations are also a part of the gentrification process of cities that may serve as a cohesive environment for its citizens (Lake, Sisson, & Jaskiewicz, 2015; Moreland et al., 2002; Newman, 2014; Raja, Ma, & Yadav, 2008; Rivlin & Gonzalez, 2017). In mostly Latinx communities, entrepreneurship in the restaurant industry is proliferating (Culhane, 2006). While restaurants have been suggested by criminological literature to be "risky facilities,"[102] specific to the Latino community, they may serve as a community anchor and virtue locale. These restaurants provide work opportunities and the potential for social interactions between members of the community. Thus, examining the effects of Latino restaurants in mostly Latino areas may be a research avenue worth exploring.

While this research project was centered on the crime-reducing effects of businesses in certain neighborhoods, it was largely influenced by the crime generator and crime attractor research. Continuing to explore and uncover crime generators and attractors yet to surface in the literature is important theoretically and practically, due to the detrimental effects these locations have on communities. Payday lending businesses have been documented as crime attractors, largely in neighborhoods with high concentrations of minorities (Kubrin et al., 2011; Kubrin & Hipp, 2016; Stewart, 2011; Wilcox & Eck, 2011). However, they may also have a presence in White neighborhoods. Therefore, it may be worthwhile to examine the criminogenic effects of payday lending businesses in White neighborhoods. Expanding how we think of criminogenic businesses (e.g., payday lenders, pawn shops, fast food restaurants) and how their effects vary by racial composition may shed an important light on how certain businesses affect

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[102] See Bowers (2014)

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neighborhoods. This line of research would have important policy implications if particular businesses were to be shown to have detrimental effects in predominately minority or White neighborhoods. For example, states are already prohibiting the establishment of payday lenders due to the negative influences they have on communities of Color (Barth et al., 2016). If other businesses are shown to affect only certain racial demographics, additional legislative actions can be taken to mitigate these harmful effects.

Columbia, South Carolina is one of the less healthy cities in South Carolina, as the 29203-zip code has one of the highest rates of diabetic-related amputations in the nation (Healthy Columbia, 2019). Public health literature has suggested that impoverished communities are also more likely to be "food deserts" which are areas that struggle to gain access to higher-priced, healthier foods (Allcott, Diamond, & Dube, 2017). Since popular grocery stores may abandon impoverished communities, gas stations and convenience stores may become the "grocery store" where unhealthy foods are sold (Blanchard & Matthews, 2007). To make matters worse, citizens who live in impoverished communities are less likely to own cars and have access to sustainable transportation (Johnson, Currie, & Stanley, 2009; Kain & Meyer, 1970), thus they are unable to travel to locations that have healthy and fresh foods (Algert, Agrawal, & Lewis, 2006). While this phenomenon has substantial public health implications, it may also have important criminological consequences. For example, gas stations and convenience stores in impoverished neighborhoods may lead to high concentrations of interactions of motivated offenders, suitable targets, and low levels of guardianship at these locations. Thus, within these disadvantaged areas, gas stations and convenience stores may be

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deemed crime generators and attractors. Moreover, these businesses may not have the same effects in more affluent areas. This is another example in which specific community contexts may influence whether certain businesses may be deemed criminogenic or virtuous to the neighborhood.

This section presented the limitations, how future research can mitigate these limitations, and new research directions that are inspired by this research project. Stronger methodologies, larger samples, and testing these concepts in other geographic regions will help refine the virtuous effects of these businesses. Moreover, continuing to refine and conceptualize this concept through qualitative and survey inquiry may bring about new ideas and formulations of virtue locales. Chapter six will provide a brief conclusion that summarizes the contributions of this research project.

Chapter 6: Conclusion

This research project introduced the theoretical concept called virtue locales. The inspiration of virtue locales evolved from phenomena of the uneven distributions of crime, ethnic groups, and social guardianship throughout space in American cities. Virtue locales is a concept that is grounded in the routine activity, environmental criminology, and collective efficacy paradigms. All three paradigms, in various way, attempt to explain the uneven distribution of crime, racial groups, and social guardianship throughout space and time. However, limited scholarly attention has been given to the areas and land uses that are not crime generating. That said, businesses may contribute virtuous effects (e.g., social capital, legitimate opportunities, guardianship) to communities that in turn aids in creating crime-reducing environments. Due to the social capital, social cohesion, social connections, positive social ties, social guardianship, and opportunities that "virtue locales" provide to neighborhoods, they may establish themselves as community anchors. Even more, virtue locales may influence individuals' routines and movement patterns due to the high levels of social guardianship and the ecological labels that they create.

Based on an examination of the effects of virtue locales, barbershops and beauty salons nested in predominately Black areas are associated with crime reductions on street segments. Moreover, this effect remains regardless of time of the day or whether these businesses are open or closed. These community anchors may be especially important to disadvantaged neighborhoods since the extant research suggests that disadvantaged

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communities are more likely to lack legitimate opportunities, social capital, and collective efficacy (Browning et al., 2004). Thus, in the future, scholars must be cognizant of the community context being studied.

Additionally, future research should examine virtue locales with larger datasets and various types of data (e.g., survey, qualitative) in order to validate the findings uncovered here. This study is a first, but important, step for a research agenda that focuses on whether business-type within neighborhoods do in fact provide benefit and virtue to the community. Such a focus has important theoretical and policy implications especially for law enforcement who would be better equipped to identify and protect these community anchors as well as utilize these them to foster better community-police relationships and build good will within the community. The introduction of virtue locales to the environmental criminology scholarship may be an important step in the right direction.

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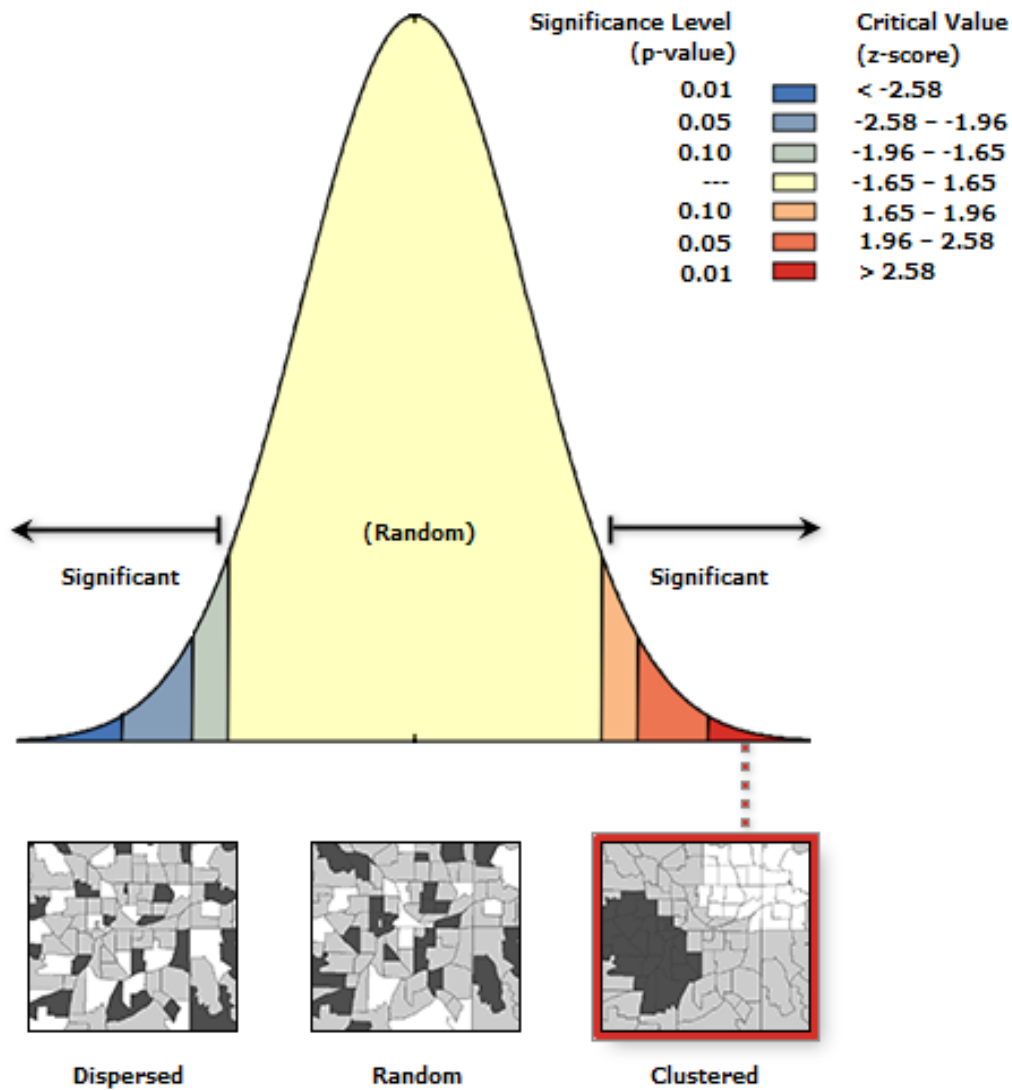# Appendix A: Model Diagnostics and Descriptive Statistics

Figure A.1 Moran's I Output from ArcGis Demonstrating Clustering of Crime

The Moran's I test has been used to test for spatial autocorrelation of the residuals

(Li, Calder, & Cressie, 2007; Tiefelsdorf & Boots, 1993). While this test gives the

researcher a general idea of spatial autocorrelation, it only examines whether crimes are clustered at block-groups. Thus, further investigation was needed into the effects of nearby crime at a micro-level. The creation of spatial lag terms was then placed in the model to control for the influence of nearby crime on the regression models.
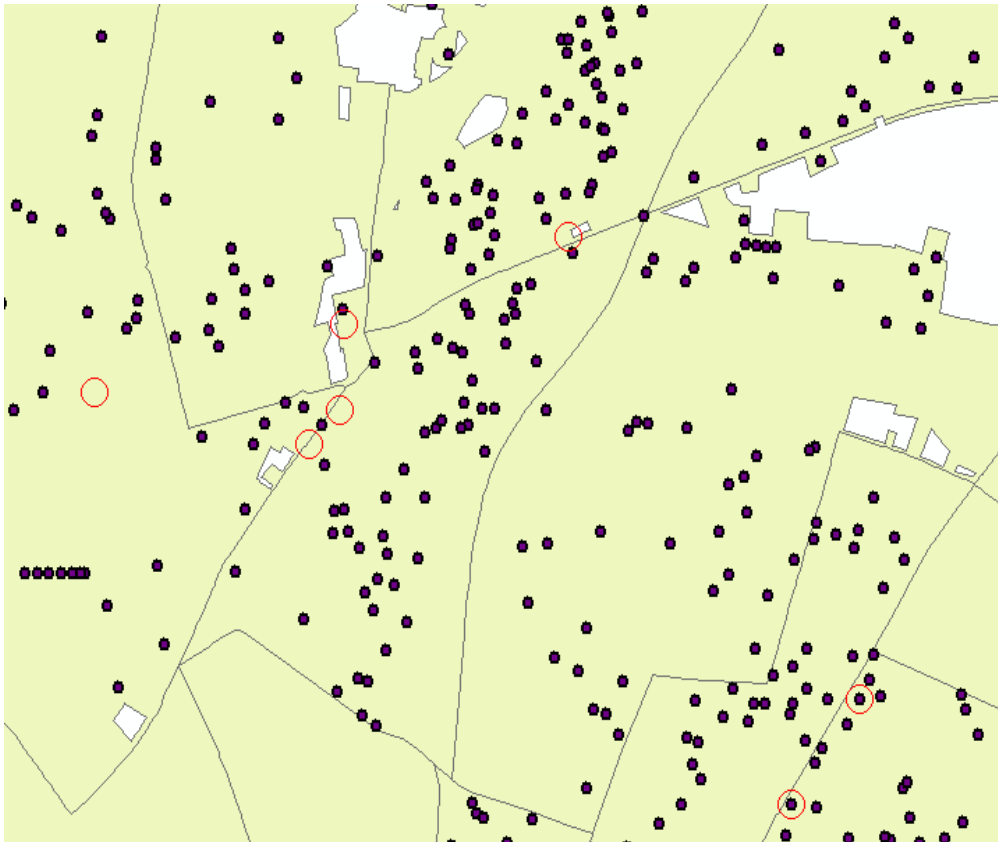

Figure A.2. Visual of a 200-Foot Barbershop/Beauty Salon Buffer

Figure A.2 provides a visualization of the buffers surrounding barbershops and beauty salons. The red circles are the 200-foot buffers surrounding the barbershops and beauty salons. The black dots are crimes nearby. If a black dot falls on or within the red lines, they will be counted as a crime occurring within the 200-foot buffer.
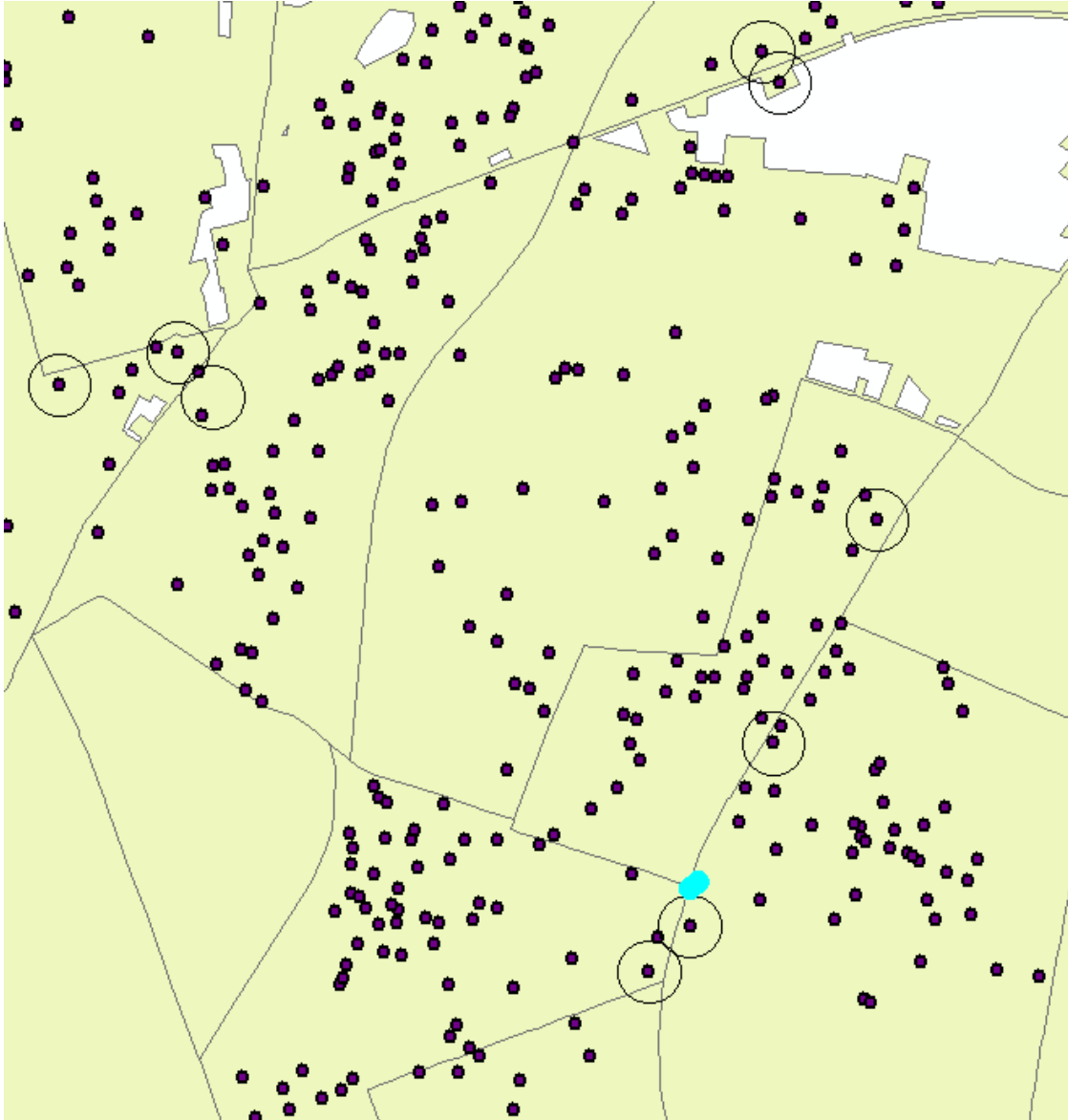
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Figure A.3. Visual of a 200-foot Gas Station Buffer and Crime

A.3 provides another visualization of a 200-foot buffer surrounding gas stations. The black circles represent the 200-buffer and the black dots represent crimes. If I crime lands on or within the buffer, they would be counted as occurring within the 200-foot buffer.
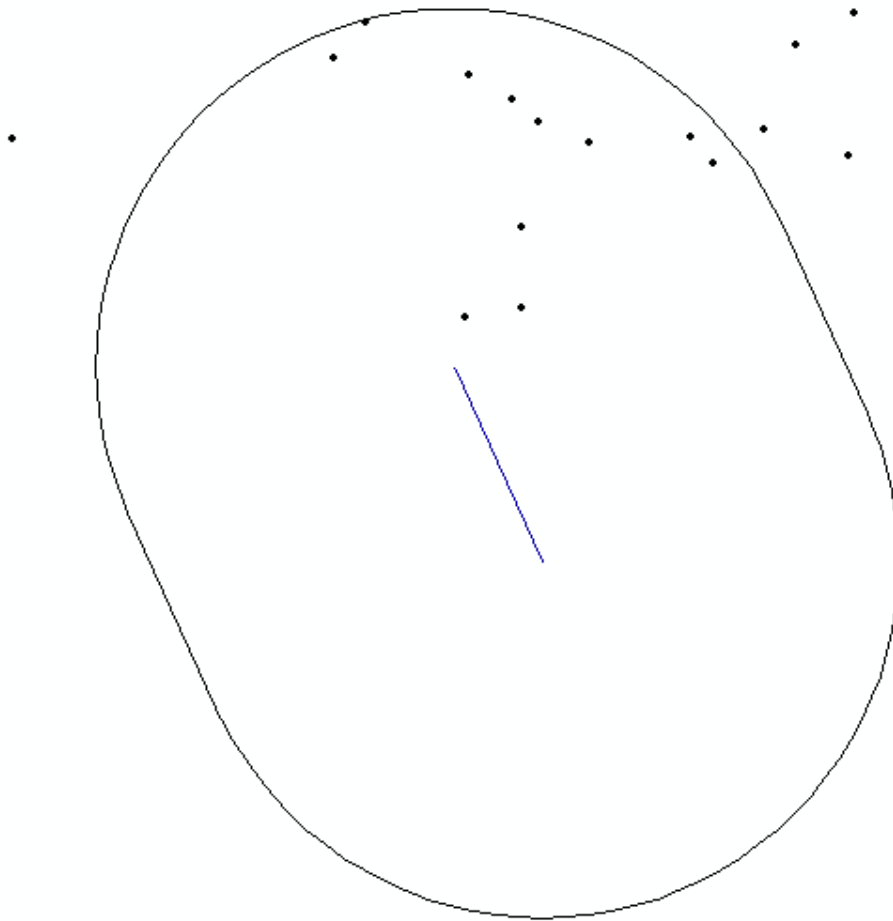
Figure A.4 Example of a 660-foot Buffer around Street Segment

Figure A.4 is a visual representation of a 660-foot buffer surrounding a street segment. In order to create a spatial lag term, all crimes that occur within this buffer will be used to account for all crimes that occur within this buffer distance. These crimes were then extracted to STATA to create the spatial lag term.
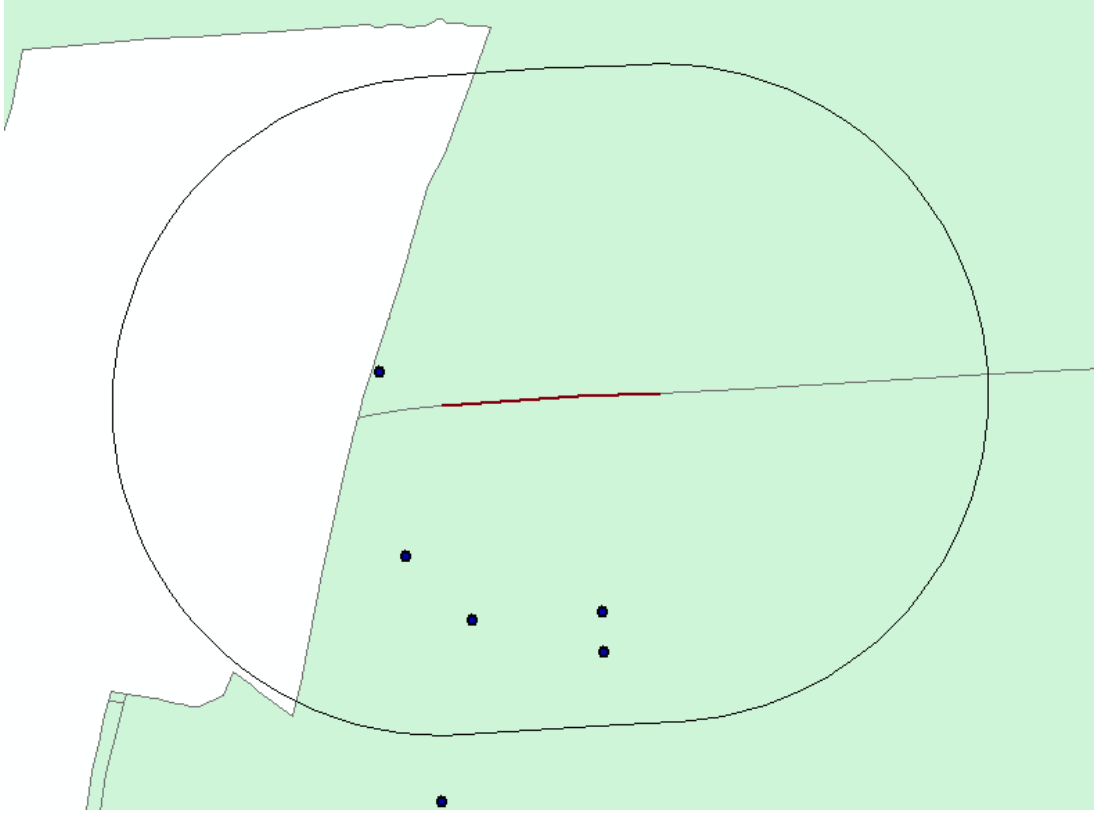
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Figure A.5. 660-Foot Buffer around a Street Segment with Five Crimes Within

Figure A.5 shows an example of a 660-foot buffer around a street segment in the

data. This visualization shows the variability of crime that occur within buffer distances.

Table A.1. Multicollinearity Diagnostics of Matched Design Sample (108 Street Segments)

Dim	Eigen	Cond	Cons	StLen	ResI	CD	Pop	Arres	EH	Age	VL
1	5.01	1.00	.00	.01	.00	.00	.01	.01	.00	.01	.01
2	1.40	1.90	.00	.01	.05	.11	.00	.00	.00	.00	.01
3	.80	2.50	.00	.00	.00	.00	.00	.79	.00	.01	.01
4	.73	2.62	.00	.02	.00	.00	.00	.00	.01	.00	.84
5	.46	3.31	.00	.02	.16	.08	.07	.01	.07	.01	.04
6	.28	4.23	.00	.55	.01	.03	.10	.15	.01	.08	.03
7	.17	5.42	.09	.08	.04	.07	.04	.02	.12	.58	.00
8	.10	7.14	.08	.08	.33	.31	.73	.00	.09	.31	.01
9	.05	9.71	.81	.24	.40	.38	.04	.02	.70	.00	.05

Table A.2. Multicollinearity Diagnostics of Observational Design Sample

Dim	Eigen	Cond	Cons	StLen	ResI	CD	Pop	Arres	EH	Age	VL
1	4.38	1.00	.01	.01	.00	.00	.01	.01	.01	.01	.01
2	1.43	1.75	.00	.03	.21	.12	.01	.00	.00	.00	.03
3	.95	2.15	.00	.01	.14	.63	.00	.05	.00	.00	.00
4	.80	2.34	.00	.00	.00	.09	.00	.79	.01	.01	.00
5	.73	2.45	.00	.00	.06	.00	.00	.00	.01	.01	.88
6	.26	4.08	.00	.27	.47	.11	.22	.04	.11	.04	.02
7	.21	4.52	.00	.55	.09	.05	.03	.05	.50	.01	.00
8	.17	5.15	.13	.00	.03	.00	.16	.04	.00	.79	.01
9	.07	7.81	.86	.13	.00	.00	.57	.01	.36	.13	.05

Table A.1 and A.2 both present collinearity diagnostics of the independent variables in both samples. Based on these results, there is no concern over independent variables being highly correlated. Large eigenvalues of two different variables would suggest high correlations with each other; however, no values score high in this column (Zhang & Ibrahim, 2005).

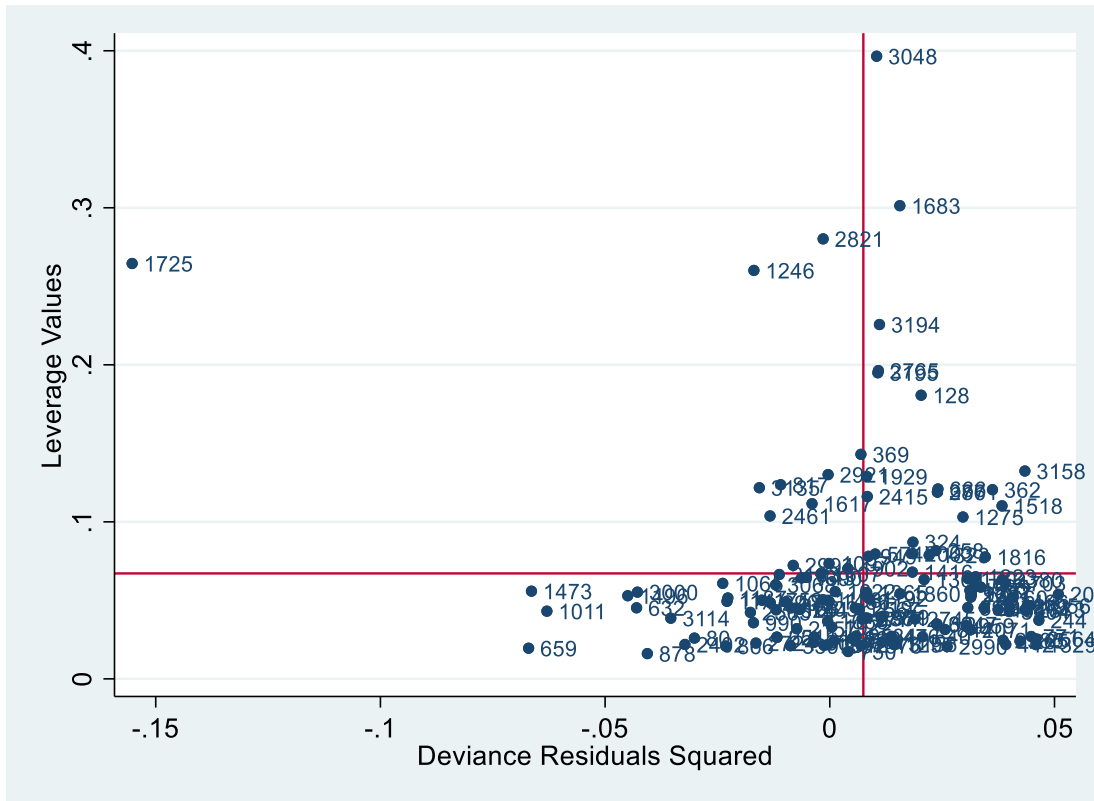Figure A.6 Anscombe Residual Outlier Graph

Figure A.7. Deviance Residual Outlier Graph

Both figure A.6 and A.7 present outlier diagnostic graphs executed in Stata 16. The graphs show that case number 1725 is an outlier. This case was removed from the regression model due to its potential influence on the results. Both Anscombe and Deviance residuals have been suggested to be an adequate test for identifying outliers in the data (Oh, Carriere, & Park, 2000).
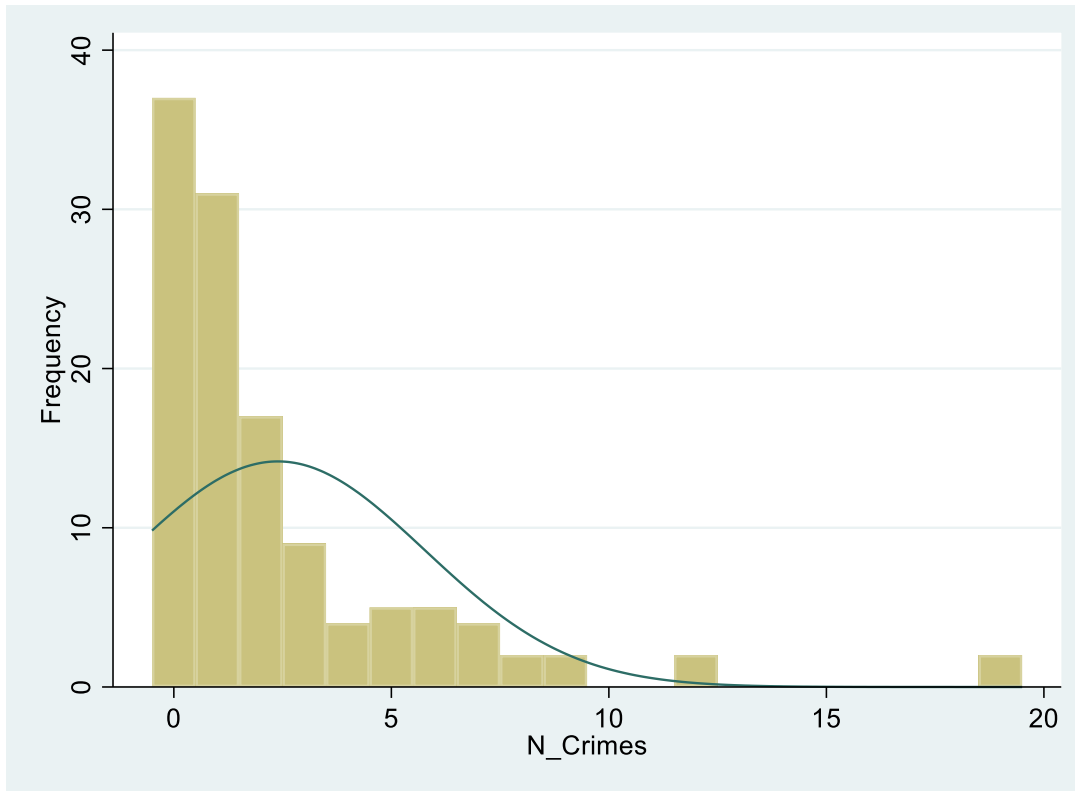
Figure A.8 . Distribution of Dependent Variable

Figure A.8 presents the distribution of the crime counts on street segments
(dependent variable). This graph is a preliminary test when considering which count
model to consider. Based on the above figure, there is a large number of zeros in the
outcome. Thus, further investigation is needed in assessing the best model fit.

Table A.3. Predicted Zeros in the Poisson, Negative Binomial, and Zero-Inflated
Models in Matched Design (Research Question 1)

	%
Percentage of Observed Zeros in Data	29.66
Percentage of Zeros Predicted by Poisson	19.31
Percentage of Zeros Predicted by Zero-Inflated	31.02
Percentage of Zeros Predicted by Negative Binomial	34.96

Table A.3 shows the zeros that a Poisson, negative binomial, and zero-inflated

model would predict compared to the observed zeros in the sample. The Poisson model

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underpredicts the observed zeros in the sample, thus should not be considered. However, the negative binomial and zero-inflated model both account for the observed zeros in the sample.

Table A.4. Comparison of AIC and BIC of Negative Binomial and Zero-Inflated Count Models (108 matched street segments)

	AIC	BIC
Negative Binomial	418.54	445.36
Zero-Inflated	466.88	515.15

Table A.4 shows there are lower AIC and BIC scores among the negative binomial in comparison to the zero-inflated model. Based on these scores, the negative binomial would be the model of choice.

Table A.5. Comparison of AIC and BIC of Negative Binomial and Mixed-Effects Negative Binomial (108 matched street segments)

	AIC	BIC
Negative Binomial	418.54	445.36
Mixed-Effects Negative Binomial	420.83	444.97

Table A.5 shows lower AIC and BIC scores for the negative binomial using clustered standard error as compared to a mixed-effects negative binomial model. These numbers would suggest that a single-level model using clustered standard errors is a better fit than the multilevel model.

Table A.6. Predicted Zeros Poisson, Negative Binomial, and Zero-Inflated Models for Daytime Crime in the 108 Matched Street Segments Sample (Research Question 2)

	%
Percentage of Observed Zeros in Data	45.37
Percentage of Zeros Predicted by Poisson	21.43
Percentage of Zeros Predicted by Zero-Inflated	43.72
Percentage of Zeros Predicted by Negative Binomial	47.90

Table A.6 shows that both the Poisson and zero-inflated model both underpredict the observed zeros in the dataset. The negative binomial better predicts the observed

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zeros in the dataset. However, since the zero-inflated model is close to predicting the

accurate number of zeros in the sample, a closer comparison between the negative

binomial and zero-inflated model is needed.

Table A.7. Comparison of AIC and BIC of Negative Binomial and Zero-Inflated Count
Models Testing Daytime Crime (108 street segments)

	AIC	BIC
Negative Binomial	401.11	427.93
Zero-Inflated	509.86	558.14

Table A.7 offers the results of a comparison of the AIC and BIC scores of a

negative binomial and zero-inflated model. Both AIC and BIC scores are lower in the

negative binomial model compared to the zero-inflated model. Based on the previous two

tables, a negative binomial is the better model choice.

Table A.8. Comparison of AIC and BIC of Negative Binomial and Mixed-Effects
Negative Binomial (108 matched street segments) of Both Daytime and Nighttime Crime

Daytime Crime		
	AIC	BIC
Negative Binomial	399.11	423.25
Mixed-Effects Negative Binomial	401.11	427.93
Nighttime Crime		
Negative Binomial	274.08	298.22
Mixed-Effects Negative Binomial	276.08	302.90

Table A.8 presents the AIC and BIC scores of a negative binomial using clustered

standard errors and a fixed-effects negative binomial for both daytime and nighttime

crime as the outcome variable. For nighttime crime, the mixed-effects model scored

lower, but marginally. Since the negative binomial using clustered standard errors has

been the model of choice based on a multitude of tests and a marginal difference in this

diagnostic, interpretation of coefficients will be more efficient for the reader and

researcher.

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Table A.9. Predicted Zeros Poisson, Negative Binomial, and Zero-Inflated Models for Nighttime Crime in the 108 Matched Street Segments Sample (Research Question 2)

	%
Percentage of Observed Zeros in Data	65.74
Percentage of Zeros Predicted by Poisson	45.91
Percentage of Zeros Predicted by Zero-Inflated	65.75
Percentage of Zeros Predicted by Negative Binomial	66.47

Table A.9 shows the predicted zeros of a Poisson, negative binomial, and zero-inflated model. The Poisson underpredicts the zeros while the negative binomial and zero-inflated model both accurately account for the observed zeros in the sample.

Table A.10. Comparison of AIC and BIC of Negative Binomial and Zero-Inflated Count Models Testing Nighttime Crime (108 street segments)

	AIC	BIC
Negative Binomial	278.33	305.15
Zero-Inflated	297.37	345.65

Table A.10 shows an AIC and BIC comparison between z negative binomial and zero-inflated model. The negative binomial is the better model choice due to lower AIC and BIC scores.

Table A.11. Poisson Model Predicting Zeros in Observational Design Sample (Research Question 1)

	%
Percentage of Observed Zeros in Data	35.07
Percentage of Zeros Predicted by Poisson	22.80
Percentage of Zeros Predicted by Zero-Inflated	32.58
Percentage of Zeros Predicted by Negative Binomial	38.14

Table A.11 presents an examination of the predicted zeros of a Poisson, negative binomial, and zero-inflated model and the observed zeros in the sample. Both the Poisson

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and zero-inflated model underpredict the observed zeros in the sample. Thus, the negative

binomial appears to be the better model choice for the sample.

Table A.12. Comparison of AIC and BIC of Negative Binomial and Zero-Inflated Count Models of Observational Design Sample (Research Question 1)

	AIC	BIC
Negative Binomial	504.23	533.14
Zero-Inflated	563.13	615.15

Table A.12 shows a comparison of the AIC and BIC scores between a negative

binomial and zero-inflated regression model. The AIC and BIC scores for the negative

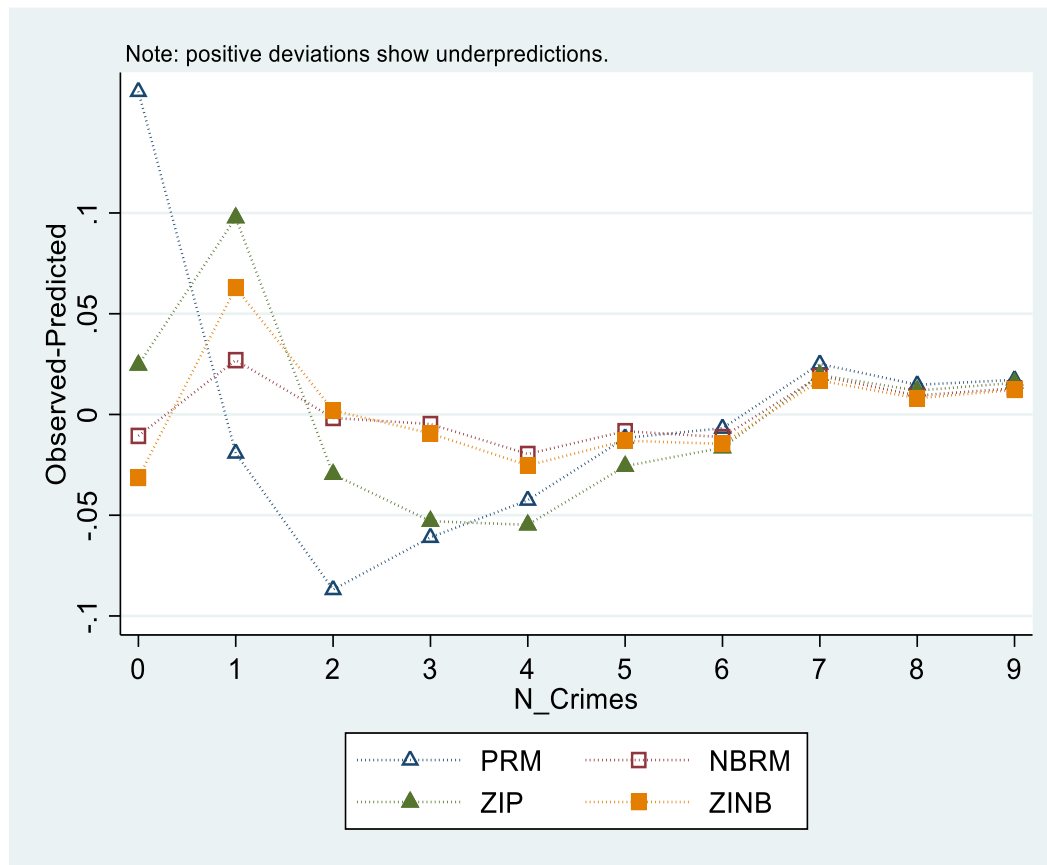binomial model are lower than the scores of the zero-inflated mode.

Figure A.9. Countfit Comparison of Statistic Control Sample

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Figure A.9 shows the countfit graph of a Poisson, negative binomial, zero-inflated, and zero-inflated negative binomial model in predicting the observed crime counts in the sample. Models that hover closer to the zero y-line suggests a better model fit. The negative binomial hovers closer to the 0 line for most crime counts.

Table A.13. Comparison of AIC and BIC of Negative Binomial and Mixed-Effects Negative Binomial (Observational Design Sample)

	AIC	BIC
Negative Binomial	504.23	533.14
Mixed-Effects Negative Binomial	514.80	543.78

Table A.13 shows a comparison of AIC and BIC scores between a negative binomial using clustered standard errors and a fixed-effects negative binomial model. The negative binomial using clustered standard errors has lower AIC and BIC scores, suggesting a better model for the sample.

Table A.14. Predicted Zeros Poisson, Negative Binomial, and Zero-Inflated Models for Daytime Crime in Observational Design Sample (Research Question 2)

	%
Percentage of Observed Zeros in Data	47.01
Percentage of Zeros Predicted by Poisson	31.18
Percentage of Zeros Predicted by Zero-Inflated	45.33
Percentage of Zeros Predicted by Negative Binomial	49.46

Table A.14 presents an examination of the predicted zeros by a Poisson, negative binomial, and zero-inflated model. The negative binomial model is the only model that accurately predicts the observed zeros in the model.

Table A.15. Comparison of AIC and BIC of Negative Binomial and Zero-Inflated Count Models Testing Daytime Crime (Observational Design Sample)

	AIC	BIC
Negative Binomial	443.34	472.32
Zero-Inflated	456.19	508.35

Table A.15 examines the AIC and BIC scores of a negative binomial and zero-inflated model. The negative binomial model is the better model fit for the sample due to the lower AIC and BIC scores.

Table A.16. Predicted Zeros of Poisson, Negative Binomial, and Zero-Inflated Models for Nighttime Crime in the Observational Design Sample (Research Question 2)

	%
Percentage of Observed Zeros in Data	64.93
Percentage of Zeros Predicted by Poisson	56.55
Percentage of Zeros Predicted by Zero-Inflated	61.07
Percentage of Zeros Predicted by Negative Binomial	67.07

Table A.16 shows a comparison of predicted zeros of a Poisson, negative binomial, and zero-inflated model of nighttime crimes in the observational design sample. The negative binomial model is the only model to closely predict the observed zeros in the model.

Table A.17. Comparison of AIC and BIC of Negative Binomial and Zero-Inflated Count Models Testing Nighttime Crime (Observational Design Sample)

	AIC	BIC
Negative Binomial	296.37	325.35
Zero-Inflated	309.82	361.98

Table A.17 presents the AIC and BIC scores of a negative binomial and zero-inflated model of nighttime crimes in the observational design sample. Lower AIC and BIC scores were reported for the negative binomial model, thus suggesting the better model fit.

Table A.18. Comparison of AIC and BIC of Negative Binomial and Mixed-Effects Negative Binomial (Observational Design Sample) of Both Daytime and Nighttime Crime

	AIC	BIC
Daytime Crime		
Negative Binomial	443.34	472.32
Mixed-Effects Negative Binomial	498.01	529.88
Nighttime Crime		
Negative Binomial	296.37	325.35
Mixed-Effects Negative Binomial	347.50	379.38

Table A.18 shows a comparison of a negative binomial using clustered standard errors compared to a fixed-effects model of both daytime and nighttime crime in the observation design sample. Lower AIC and BIC scores were both reported for the negative binomial using clustered standard errors in the daytime and nighttime sample.