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SPOT BUS LOCATIONS: A SOCIAL ECOLOGICAL
APPROACH FOR CONDUCTING A QUASI-EXPERIMENTAL
DESIGN AND TESTING DEFENSIBLE SPACE CONCEPTS

presented by

BRANDON ROBERT KOOI

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ENVIRONMENTAL CRIMINOLOGY AND MAPPING HOT SPOT BUS STOP LOCATIONS: A SOCIAL ECOLOGICAL APPROACH FOR CONDUCTING A QUASI-EXPERIMENTAL DESIGN AND TESTING DEFENSIBLE SPACE CONCEPTS

By

Brandon Robert Kooi

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ABSTRACT

ENVIRONMENTAL CRIMINOLOGY AND MAPPING HOT SPOT BUS STOP
LOCATIONS: A SOCIAL ECOLOGICAL APPROACH FOR CONDUCTING A QUASI-
EXPERIMENTAL DESIGN AND TESTING DEFENSIBLE SPACE CONCEPTS

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Physical disorder can contribute to the growth of social disorder. Reciprocally, social disorder inhibits interaction and a sense of collective cohesiveness among residents. As social cohesion decreases, incivilities increase. Incivilities attract potential offenders to place specific areas where cohesiveness is low. Perhaps nowhere is this phenomenon more prevalent than urban area bus stop locations where routine activities bring strangers and potential offenders together in space and time. A key research question is whether areas that contain bus stop locations play a role in escalated crime when controlling for other block group ecological characteristics that surround the location.

There were three main parts to this research project. 1) A modified structural equation model tests the Sampson, Raudenbush, and Earls (1997) collective efficacy hypothesis with 2000 census data, two years of criminal incident data (1999-2000) and 114 block groups as the unit of analysis. This model tested the significance of social disorder on crime through the mediation of collective efficacy as hypothesized by Sampson et al., (1997). 2) Within those block groups 638 bus stop locations were mapped using ArcView 8.1 mapping software. Areas that were significantly similar in terms of social disorder variables were matched with non-bus stop locations serving as the control. Findings from the quasi-experimental design indicated that bus stop locations were more highly correlated to criminal incidents than non bus stop locations

when controlling for relevant social disorganization characteristics. 3) Defensible space and crime pattern concepts were analyzed qualitatively through systematic observations of hot spot bus stop locations. Crime mapping software was utilized to determine the main hot spot bus stop locations. These locations were qualitatively analyzed through nonparticipatory systematic observations in terms of defensible space concepts in an effort to determine why these bus stop locations attract a disproportionate amount of crime clustering. Each bus stop was rated through a series of windshield surveys according to a predesigned checklist that served as an auditing process for the presence or absence of defensible space concepts at the bus stops. These checklists allowed for a systematic process that enhanced reliability since identical observations can be repeated at later dates by future researchers.

ACKNOWLEDGEMENTS

Within the dissertation process there comes a time to reflect upon the thoughtful feedback and support that has been provided by countless individuals through the lifelong educational process. During my childhood education, a few vivid memories remain etched in my mind from comments made by teachers that encouraged me to dream of higher aspirations academically than I would have ever discovered through my own initiatives. Specifically, the late Mary Moreno has remained instrumental in my desire to reach my full potential and realization that individual encouragement and challenges by respected individuals can create life-altering events. Several university professors during my undergraduate and graduate education also provided me with the feedback and encouragement that planted a seed to continue my educational growth. Specifically, I would like to thank Dr. Tom Ellsworth, Dr. Beverly Smith, Dr. Frank Morn, and Dr. Mark Fleisher for their encouragement and support during my time within the Criminal Justice Department at Illinois State University.

The sacrifices made by individuals who complete their Ph.D. degrees at reputable universities can be immense. By every account, there was no exception in this case. These sacrifices are often difficult to accept for both students and family alike. This section of the dissertation allows for the acknowledgement of those sacrifices made by friends and family during my years working at the School of Criminal Justice at Michigan State University. My family was fortunate to have a support group that not only appreciated our life goals but also supported our hardship. Thank you Mom and Dad Beisbier and Mom Kooi for all of the help and child care assistance along the way.

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CHAPTER I

INTRODUCTION

Crime and violence within public transportation has received increased attention

since the horrific events of September 11, 2001 with far reaching implications.

According to recent reports published by the U.S. Transportation Department, buses and

trains in the United States are becoming inviting targets for terrorists acts (Macko, 1998).

The U.S. Transportation Department's intelligence office was created directly after the

December 1988 bombing of Pan Am Flight 103 and continues to work with local transit

agencies to improve overall security. Outside of terrorism, general disorder and high

crime that surrounds public transportation in urban areas has a direct impact on overall

community health. Violence and disorder, whether actual or perceived, undermine the

value and potential for public transit (Needle and Cobb, 1997). Current national

economic conditions and energy conservation policies have served to heighten the need

for efficient, safe, and secure public transportation systems. However, high crime rates

and general disorder has been shown to deter the use of mass public transit (Levine,

Wachs, and Shirazi, 1986) at a time when responsible public officials are recognizing that

increased use of public transit is one of the best ways to reduce excessive dependence on

foreign oil. High rates of victimization have been found among transit users, which

greatly impede governmental efforts to promote the use of public transportation. For

example, one study found that transit users run twice the risk of being victimized as non-transit users in the same city (Thrasher and Schnell, 1974).

Past Research Projects on Public Transportation

National attention towards increased security within public transportation is not new. In fact, since the early 1900s security has been a concern for transit companies with some allowing vehicle drivers to carry weapons in order to protect themselves from the public (Siegel, 1979). Widespread public attention to transit crime occurred in the 1960s and was directed at areas such as the New York City subway system and the Washington, DC metro. In 1980, the New York Senate Committee on Transportation held a National Conference to look more seriously at issues surrounding mass transit crime and problems with vandalism. The National Conference was led by the Urban Mass Transportation Administration of the U.S. Department of Transportation and 150 participants were in attendance from across the United States and Canada (Office of Transportation Management, 1980). This conference was the first and only of its kind on a national scale that focused on crime and disorder problems surrounding public transportation.

Today, it is now common for transit companies to hire their own transit police or contract private security companies for full-time deployment in response to increased crime and public concern surrounding public transportation. Responses to a recent survey conducted by the National Transportation Research Board found that transit security professionals recommend uniformed patrol as the "most effective" strategy for controlling crime on buses and trains. These patrols include fixed-post assignments at heavily trafficked transit centers, task forces, truancy sweeps, and a variety of other "high

visibility" strategies (Needle and Cobb, 1997). However, these policing/security initiatives have focused primarily on centralized bus terminals or subway systems rather than on wider and more plentiful bus stop locations.

Security strategies at central terminals or subway systems have shown some success. For example, security surrounding the Washington, DC Metro was built within a Crime Prevention Through Environmental Design (CPTED) approach and actually experiences lower crime rates than reported above ground (LaVigne, 1997). Throughout the 1970s, public restrooms in the New York City subway system were closed to combat crime. Today, these restrooms remain open to the public and the system has reported 30-year lows in crime while ridership is experiencing 50-year highs. While it may be expected that more riders should equate to more chances for victimization, this has not been the case throughout the New York City subway system according to published reports (www.utu.org). Many urban areas have not implemented these same security approaches within bus stop locations.

In addition to a lack of practitioner attention, academic research on public transit crime has also been primarily focused on centralized bus terminals, underground subway systems or railways. Several of these studies have conducted pre and posttest methodological designs to analyze the effects of cleaning up vandalism, increasing patrol, or eliminating fare beating. New policing strategies directed towards fare beating and minor offenses have been attributed to a reduction in less serious crime (Kelling and Coles, 1996). Again, despite these seemingly positive results, these same practical initiatives have generally not been directed towards bus stop locations. In addition, little academic research has been directed towards the open ecological environments of bus

stop locations. A breakdown of past research methodologies and findings, directed

mainly at subways, bus terminals, or the interior of buses is presented in Table I.1.

Table I.1. Prior Research Conducted on Public Transportation Facilities.

Researcher	Scientific Method	Tactic	Setting	Results
LaVigne, 1997	No preintervention measures; correlates tactics and crime	Subway system design	Washington, DC metro subway	System design may prevent crime
Carr and Spring, 1993	Pre-post design without control place	Improved cleaning and vandalism repair; patrolling	Public transportation system in Victoria, Australia	45% improvement in train availability. 42% reduction in crimes against persons
Felson, et al., 1997	Pre-post design with time-series designs with at least 5 time periods prior to intervention	63 different tactics implemented about the same time	Port Authority Bus Terminal, New York City	Reduction in robberies & assaults but not compared to surrounding area; reductions in incivilities
Kenney, 1986	Pre-post design with time-series designs with at least 5 time periods prior to intervention	Guardian Angles (ICPSR # 8531)	Subways	No detectable impact on crime
Poyner, 1988	No preintervention measures; correlates tactics and crime	CCTV	Buses	Steady decline in vandalism
Webb and Laycock, 1992	Pre-post design with time-series designs with at least 5 time periods prior to intervention	CCTV (and other tactics)	Stations and London underground	11% to 28% reduction in robberies
Chaiken, Lawless, and Stevenson, 1974	Pre-post design without control place	Exact fare evasion	Buses in New York City	90% decline in robberies of bus drivers

Table I.1. Prior Research Conducted on Public Transportation Facilities

Researcher	Scientific Method	Tactic	Setting	Results
Poyner and Warne, 1988	Pre-post design without control place	Protective screens for drivers	Buses in Cleveland, Great Britain	90% reduction in assaults on drivers
Clarke, 1993	Pre-post design with time-series designs with at least 5 time periods prior to intervention	Automatic gates to prevent fare evasion	London Underground	Elimination of problem of slug use within 4 months of modification
Clarke, Cody, and Nataranjan, 1991	Pre-post design without control place	Modification of ticket vending machines	London Underground	Elimination of problem of slug use within 4 months of modification
DesChamps, Brantingham and Brantingham, 1992	Pre-post design without control place	Increase in rush hour attendants to check tickets, training in fraud detection	Ferry terminal	20% decrease in fare evasion rate
vanAndel, 1989	Pre-post design without control place	Recruiting over 1100 young unemployed people as public transit monitors	Buses, metro trains and trams in 3 large cities in the Netherlands	18% to 78% decrease in fare dodging depending on the city and mode of transport, 60% decline in attack and harassment victimization
Weidner, 1997	Pre-post design with time-series designs with at least 5 time periods prior to intervention	Installation of new fare gates	Stations on New York City subway	Fare evasions declined in target station

Despite these sporadic research initiatives, there is still ambivalence towards analyzing crime problems surrounding mass transit, especially in America where the

automobile remains the primary means of transportation (Clarke, 1996). This ambivalence has led to conflicts over policing and funding crime prevention projects within public transit systems, often at the cost of increased crime, especially as it relates to local bus transportation.

Extent of crime within public transportation

Thrasher and Schnell (1971) completed one of the earliest studies measuring the number of crimes within public transit. The study included 37 U.S. and 4 Canadian systems. The study concluded that the risk of being involved in a criminal incident is at least 2 times greater when riding in most major transit systems than in using other means of private transportation. Conclusions from the study indicate that personal security is an important factor in the decision making for people choosing to utilize public transportation and transit users will be deterred if the system seems to be unsafe. Further, transit crime is extensive in most large U.S. cities and the magnitude of the problem is far greater than is shown in published statistics (Thrahser and Schnell, 1971).

In one of the few studies that did focus on crime at bus stop locations, Levine and Wachs (1986) examined three bus stop locations where the largest number of crimes had occurred. Their findings indicated the factors contributing to crime differed for each bus stop location, suggesting that a site-specific analysis is required to determine the individualized security problem. The researchers suggested that each location should be examined separately to determine the root cause of the problem so that individualistic or unique countermeasures can be implemented to correct the situation.

Problem Identification

Within most urban areas throughout the United States, mass public transit is more likely to be a public bus system. Unlike urban subway/train systems, there is far less information concerning bus crime and what research does exist has focused primarily on the interior of buses or fare dodging at the central terminal. Little research has been directed towards the open environments of bus stop locations in terms of analyzing the effects of ecological and physical attributes that surround bus stop locations. One exception is research conducted through the UCLA School of Public Policy and Social Research, which has recently analyzed crime surrounding Los Angeles bus stop locations (Sideris, 1999). However, most of this research has been atheoretical and limited by qualitative and ethnographic methodologies without consideration to model testing, the use of official data, or the impact of latent social ecological attributes. Unlike the research conducted on bus stop locations by the UCLA School of Public Policy and Social Research, this dissertation proposes to quantitatively measure the social ecological correlates of crime as well as qualitatively analyze the physical attributes that surround specific bus stop locations.

A recent study released in January 2003 was conducted on the perception of crime among bus riders within the same state utilized for the given dissertation. This research took place over a two ½-year period from 1998 through 2001. The research consisted of a case study approach and utilized several federal, state, and local funding agencies. This type of initiative highlights the desire for additional research directed towards urban bus safety. The research methodology included interviews, site visits, observations, surveys of bus riders, picture preference surveys and focus group discussions. Survey

participants were asked about their perceptions of bus design features in relation to crime. Next, bus riders were shown pictures of buses in an effort to find reliability in the former survey perceptions of bus safety. Results from the study indicated that the appearance of buses and bus stop locations could be altered in a way that increases the perception of personal security for riders and potential riders (Lusk, 2003). While the design of buses and bus stop locations appear to effect fear of crime, the study does not test for the impact of surrounding social characteristics on bus stop crime or make use of measuring any type of official crime data that could further be used to rate the actual risk of specific bus stop locations.

Placing bus stop locations

The geocoding of bus stop locations throughout the given city utilized for the dissertation research was completed after a series of meetings with state and local governmental boards and private businesses. Most state government agencies have a separate Department of Transportation division. Public transportation planners consider attributes such as travel time, cost, comfort, convenience, and availability when evaluating and designing the location of bus stops but usually underestimate the safety aspect (Hoel, 1992). These branches of government focusing on transportation determine the amount of funding provided to local areas that is supposed to be spent on upkeep, route design, and potential safety programs. City bus routes often experience changes based on road construction, new area businesses, budget cuts, or community feedback. Funding for this service comes from state tax dollars and is dependent on governmental transportation budgets. Although several studies have been conducted at the state level

strategically analyzing traffic flow, usage patterns, and bus maintenance scheduling, very few published studies exist that look specifically at safety issues surrounding the location of bus stops. In essence, bus stop locations appear to be politically defined rather than located due to rider safety concerns.

The limited research conducted on bus transportation has found high rates of crime and disorder to be quite persistent (Levine, et al., 1986; Sideris, 1999) and a serious concern for public community officials. In fact, the roots of this dissertation project arose during a neighborhood action meeting attended by the primary investigator in which several community citizens expressed their displeasure towards police administrators and local politicians regarding crime and public disorder that surrounded several bus stop locations throughout the city used for this research. Attendees of the meeting included representatives from the city bus company, the Chief of Police and several other high-ranking police administrators, owners of a local contract private security company, streets and sanitation managers, several elected politicians, and area business owners. At this meeting, two local politicians requested that some specific high crime bus stop locations in the city be eliminated because it was their belief that the disorder and crime within the area could be attributed to the bus stop locations. However, these bus stops were not removed due to the need for public accessibility and an untested assumption that the bus stop itself was generating higher rates of crime and disorder. No scientific evidence existed at the time of this meeting to determine if these bus stop locations had actually impacted crime within the area surrounding the bus stop locations.

Throughout the dissertation research process, meetings took place with officials from the transportation authority that manages the city's bus system used for data

collection purposes. These meetings took place in order to discuss the breadth of the given dissertation research project and to obtain the locations of each bus stop location throughout the given unit of analysis. Each of these bus stop locations were aggregated spatially to block group locations. During these meetings officials from the transportation authority stated that no one has ever researched crime problems surrounding the bus stop locations and crime or safety issues are generally not utilized to in determining the location of bus stops. The process of selecting bus stop locations is made through analyses by the state's Department of Transportation that looks at data such as population density, area business needs, and public demand. Some of this same data was used within the dissertation. For example, data from the decennial census provided information such as the percentage of people who report using public transportation to get to work or the percentage of people who do not own a car.

According to the analysis conducted on choosing bus stop locations, it could be hypothesized that bus stops would be concentrated around the highest percentage of individuals who do not own a car or report using public transportation to get to work. Figure I.1 shows a map of block group locations for the areas with the heaviest concentration of bus stop locations, concentration of the highest percentages that use public transportation and clustering of the highest percentages that do not own a car. Four block groups made up the highest neighboring clustering for those that do not own a car (26-51% of residents in these block groups). Only one block group showed a high clustering of those who reported use of public transportation to get to work or for recreational purposes (12% of residents) and two block groups showed a high clustering of 19-25 bus stop locations.

Figure I.1. Clustering of bus stop locations, percentage not owning a car, percentage of residents reporting use of public transportation.
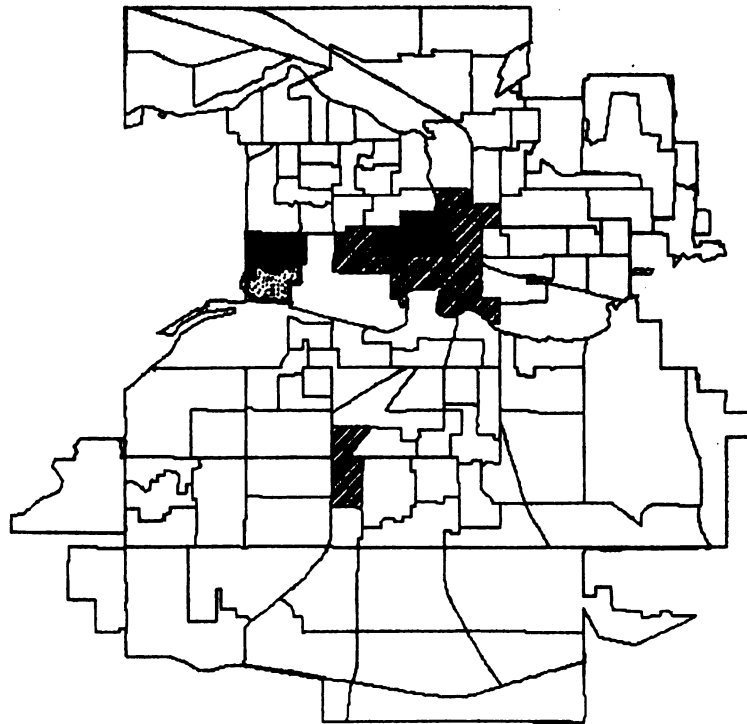
No Car — Uses Bus — Bus Stop Locations

NOCAR

☐	0.00 - 5.04
☐	5.05 - 10.10
☐	10.11 - 15.93
☐	15.94 - 26.52
▨	26.53 - 51.22

PUBTRANS

☐	0.00 - 0.55
☐	0.56 - 1.47
☐	1.48 - 2.77
☐	2.78 - 6.01
▦	6.02 - 11.99

BUSSTOP

☐	0 - 3
☐	4 - 7
☐	8 - 13
☐	14 - 18
■	19 - 25
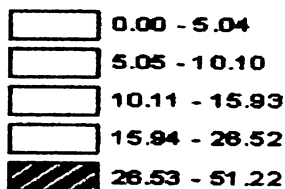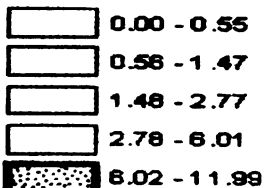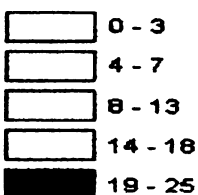
According to the given map, the clustering of bus stop locations appears to be well matched for providing services to those who report using public transportation. However, there is one block group where the population reports high rates of not owning a car that does not appear close to a clustering of bus stop locations. It is quite possible that this area has increased bus overcrowding, although this possibility was not tested for within the dissertation analysis. It is also quite possible that residents near the high clustering of bus stops report using public transportation because there is more available bus stop locations near their residency. According to the transit officials, bus stop locations are determined by public necessity. Officials further reported that police official statistics or other transit safety issues have never been utilized in determining the location of bus stops throughout the city.

Within other urban areas, research findings have shown that bus stop crime is spatially concentrated and temporally ordered (Levine et al., 1986; Sideris, 1999). This means that crime linked to bus stop locations has been found to occur nonrandomly in terms of space and time. This dissertation attempted to extend and test the reliability of these findings. Such evidence would indicate that resource allocation could be better served through use of past incident data analysis once an understanding of current demographic information is taken into account. Spatial analysis of crime will often utilize ecological theories that account for hot spot analysis and researching why some spatial areas become crime generators. However, spatial research focusing specifically on crime surrounding public transportation while accounting for both physical as well as social attributes surrounding bus stop locations is indeed unique.

Within the framework of needing more in depth spatial crime research, it also became necessary to determine the effects of the social ecology surrounding bus stop locations. Although bus stops are public places, this research argues that these locations are invariably affected by block group level social and specific place-based physical attributes that surround each location. This dissertation tested the impact of social attributes on crime within block group locations, compared bus stop locations and locations without bus stops, and concluded by qualitatively and systematically analyzing those bus stop locations with the highest concentration of criminal incidents.

Purpose of Research

Understanding geographic physical and social disorder in public spaces is fundamental to understanding urban environments (Sampson and Raudenbush, 2001). The research project used 114 urban block group locations containing 638 bus stop locations as the units of analysis. The main dissertation proposition states that crime stems from social disorder and the structural characteristics of certain locations throughout the city. Disorder and crime can be measured within specific neighborhood block group attributes. These attributes consisted of macro-sociological or structural determinants of crime (i.e., neighborhood disorganization and residential instability). In addition, the physical characteristics of bus stops can either promote or deter crime and direct correlations can be seen between crime rates and the built environment (Sideris, 1999). Perhaps the most promising implication of this type of research is that unlike railway transit stations, bus stops are not typically permanently fixed to the urban

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landscape and can be moved based on the results of spatial crime analysis. This allows for an inexpensive alternative for designing out crime.

In an effort to understand and measure social disorder surrounding bus stop locations, demographic data gathered from the US Census was mapped within block group locations of a Midwestern city. In addition, official crime statistics were mapped within these block group locations. An analysis of the impact of disorganization variance on crime consisted of testing a modified model of variables hypothesized by Sampson, Raudenbush, and Earls (1997) within the city of Chicago. The given demographics of the city used for this analysis did not allow for an exact replication of the Sampson et al., (1997) factored latent constructs but every attempt was made to formulate a model that closely matched the constructs developed in the Chicago neighborhood research. The dissertation model tested direct as well as mediating effects of informal social control on social disorganizations variables.

Next, a quasi-experimental design was used to spatially test the impact of bus stop locations on crime within a single urban environment. Areas with bus stop locations were compared to areas without bus stop locations after statistically matching the control and experimental areas according to the predefined social disorganization variables. Crime in areas with bus stop locations were matched and compared to areas without bus stop locations to determine if bus stops influence crime in the surrounding area.

Lastly, this dissertation references Brantingham and Brantingham's (1981, p. 25) advice for "drilling down into the data" or narrowing the focus within place-based research. In an attempt to empirically support findings from the model test and area comparison, qualitative observations of hot spot bus stop locations took place during a

seven-month period (June 2003 – December 2003). These systematic non-participatory observations also included some unstructured interviews with potential guardians of the observed physical spaces. A predefined checklist of physical attributes and social patterns that represented defensible space and crime pattern concepts was used as a windshield survey during the observational periods. The windshield survey was designed to record visual and spatial impressions that define the bus stop location. The built environments surrounding the hot spot bus stops were analyzed to see if defensible space and crime pattern concepts were supported. The three-part mixed methodological analysis strategy represented a holistic account of the ecosystem surrounding the bus stop locations, which extends research that would otherwise be limited by only including one specific methodology.

CHAPTER II

THEORETICAL AND EMPIRICAL CONTRIBUTIONS

A recent revitalization by environmental criminologists has refocused attention

towards mapping out spatial characteristics of crime settings (Brantingham and

Brantingham, 1991, 1993; Geason, 1989; Eck and Weisburd, 1995; Perkins et al., 1993;

Taylor and Harrell, 1996). Within spatial crime research, neighborhood units of analysis

contain specific areas that are reserved for a narrow range of function. An example of

one specific area that serves a particular function is a bus stop location. Most crime is

highly concentrated around a small number of places (Brantingham and Brantingham,

1981) and routine activities theory (Cohen and Felson, 1979; Felson, 1994) predicts that

crime will cluster in a few specific place locations. This clustering also remains

relatively stable over time (Spelman, 1995). These findings suggest that there is

something about a specific place location and the attributes that surround those locations

that facilitate a disproportionate amount of crime and something about other places that

successfully prevents crime. Research data from the given dissertation analyzed crime

concentration in and around bus stop locations and drew heavily on place level theory as

proposed by environmental criminologists and social disorganization as proposed by

social ecologists.

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A timeline of environmental criminological research is presented in terms of

researching the physical and social attributes that surround crime locations. The roots of

spatial crime analysis begin with early French mapping and the Chicago School

ecological research. Criticisms of the Chicago School led to other techniques for

conducting social area research, which were followed by the environmental design

movement. The environmental design movement was preceded by the spatial school

with relevant analysis of street and traffic flow in terms of conducting research on bus

stop locations. This research led to a closer analysis of community organization and

crime locations through routine activities, situational crime prevention, and extensions of

social disorganization theory. An understanding of the research progression provides the

foundation for further analysis of bus stop locations as proposed through this dissertation.

Table II.1 presents a summary of the historical evolution of environmental criminology

beginning with early mapping initiatives in France and concluding with contemporary

extensions of social disorganization theory that include mediating effects of informal

social control. A more detailed analysis of these theories and research follows Table II.1.

Table II.1. Summary of environmental criminology.

Researchers	Theory	Methodology	Variables	Findings
Guerry, 1833 & Quetelet, 1842	Probability theory	Mapping violent and property crime and compared spatial variance according to available social statistics	Department level violent and property crimes and social demographic data	Crime not homogeneously distributed, property and violent crimes varied spatially, crime was stable over time and crime varied by climate and season

Table II.1. Summary of Environmental Criminology (cont.)

Researchers	Theory	Methodology	Variables	Findings
Shaw & McKay, 1942	Social ecology, social disorganization (Concentric zonal model)	Mapped official data and conducted life history case studies on select subjects. (Offender focus)	Arrest rates of juveniles over three different time periods, census, housing and welfare records	Higher rates of social disorganization correlated with higher crime
Landers 1954; Bordua 1958; Shevsky & Bell, 1955; Chilton, 1964	Social area analysis, social disorganization	Multiple and partial correlation analysis, factor analysis (Spatial focus)	Education levels, rental property, number of persons per room, vacant buildings, % of minorities	Findings conflict in terms of how significantly socioeconomic variables and ethic segregation contributed to crime rates
Jacobs, 1961	Social control (Urban renewal and city planning)	Anecdotal content: Case study arguing that patterns of street and building architectural designs contribute to crime patterns	New York City housing and neighborhood design	Advised improving urban vitality through increased natural surveillance, clear demarcation between private and public space, and dense concentration of people within short blocks to deter crime
Jeffery, 1971	Crime prevention through environmental design (CPTED), Behavioral learning theory	Argued that certain blocks have the highest crime rates due to negative environmental attributes	Focused on the physical design and physical environment	Small environmental design projects seen by Jeffery as more successful than defensible space projects (Jeffery, 1990)

Table II.1. Summary of Environmental Criminology (cont.)

Researchers	Theory	Methodology	Variables	Findings
Newman, 1972	Defensible space	Compared public housing facilities through stepwise multiple regression, trend analysis, ANOVA, and interviews	Crime records, physical variables, and tenant characteristics	Crime attributed to physical defensible space mechanisms
Brantingham & Brantingham, 1981, 1991	Crime pattern, rational choice	Spatial analysis of crime through aggregate-level and micro-level analysis	Varies by unit of analysis but includes physical and social indicators	Crime is not direct result of motivation but mediated by perceived opportunity. Crime is not random and exploring urban structures and how people interact can lead to predictions on the spatial distribution of crime.
Cohen & Felson, 1979	Routine activities (Rationale choice assumptions)	Macro-level proportions and risk ratios that spans space and time with emphasis on victim behavior/decisions	Macro-level crime property crime rates over thirty year time frame	Amount of time spent away from the home significantly related to level of crime. Found increases in household burglary over past three decades as proportion of households unattended increased over time
Sampson, Raudenbusch, & Earls (1997)	Social ecology – Social disorganization	Factor analysis, hierarchical modeling, surveys, interviews, systematic social observations of face blocks	Census demographics factored to concentrated disadvantage, immigrant concentration, residential stability and violent crime	Collective efficacy mediates effects of social disorganization

Table II.1. Summary of Environmental Criminology (cont.)

Researchers	Theory	Methodology	Variables	Findings
Newman, 1975	Defensible space-Territoriality	Regression analysis measuring social and physical variables	Housing residential welfare, poverty, number of entrances, structure size	Social variables predicted more crime than physical attributes but physical attributes mediated or had an interaction effect with social variables

Historical timeline of environmental criminology

1830s (Guerry and Quetelet)

There has been an evolutionary timeline in environmental criminology, especially as it relates to spatial crime analysis. Beginning in the 1830s, French sociologists (Guerry and Quetelet) conducted some of the first research in scientific criminology (Vold, 2002). The French scholars were one of the first to use shaded maps of urban areas and analyze regional differences in property and violent crime (Sylvester, 1984). They were also interested in analyzing and explaining differences in crime based on varying social conditions of the residential population. They found that crime was not homogeneously distributed across the country and spatial differences existed. For example, Guerry tested the poverty-crime relationship and found that the wealthiest areas had higher rates of property offenses but only half the rate of violent crime, leading to the conclusion that opportunity was a more critical factor in criminality than poverty (Vold, 2002). Guerry attempted to account for the variation in crime by the differences in social conditions and changes in the legislation (Sylvester, 1984). The spatial variation in crime is the underlying discovery of environmental criminologists that seek an explanation.

These findings were also of interest due to stability of the crime rates over time, a finding that was supported a century later in the United States.

1930s-1940s (Shaw and McKay)

The second wave of interest in spatial criminology began in the United States (Brantingham and Brantingham, 1981). Researchers at the University of Chicago developed a framework for an ecological approach to understanding the interaction between neighborhood environments and crime causation. The sociological emphasis at the university developed around studies of migration and city growth patterns. In their study "Juvenile Delinquency and Urban Areas" (1942), Shaw and McKay theorized that social relations and urban social structure relates to crime patterns in Chicago. Their original data came from records obtained from the Cook County (Illinois) Juvenile Court. They mapped the residencies of known juvenile delinquents in Chicago and found their neighborhoods were characterized by very high rates of residential turnover, low rates of home ownership, poverty, and high unemployment. Using the Burgess model of concentric circle, Shaw and McKay used a zonal model explanation and showed the rate of delinquent residency was highest in areas adjacent to the central business district and neighborhoods that were in transition. Delinquency rates declined as distance increased outward away from the central business district and towards neighborhoods with greater stability. This phenomenon was explained by the theory of social disorganization and argued that delinquency rates were related to growth processes in the city.

Juvenile arrest rates throughout the city of Chicago were examined during three periods: 1900-06, 1917-23, and 1927-33. By comparing the rates of arrests during these

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different time periods, Shaw and McKay attempted to show whether delinquency was caused by new immigrant groups or by the environment in which the immigrants lived. If high delinquency rates for specific immigrants remained high in proceeding generations as they migrated through different ecological environments, then delinquency could be associated to the environment. If delinquency rates decreased as immigrants moved through different ecological environments, then delinquency could not be associated with particular immigrants, but had to be connected to the environment. In comparing maps of average arrest rates throughout the city during these separate time periods, Shaw and McKay found that certain areas of the city had high crime rates no matter what immigrant group lived there. They concluded that patterns of delinquency remained constant over time in the same geographic areas and corresponded to the concentric zonal model.

Along with being responsible for the emergence of ecological studies in sociological research, the Chicago School represented a paradigm that encouraged a synthesis of qualitative and quantitative methodologies. As levels of analysis become more place specific, qualitative analysis often becomes useful for tying together quantitative social attributes. The social ecological foundation presented by Shaw and McKay also led to later developments in criminological theory such as Sutherland's differential association and Thrasher's (1927) mapping of locations where street gangs formed. Thrasher attempted to distinguish areas where gangs formed from nongang areas. Through these projects, researchers began to look more closely at social disorganization variables such as poverty levels, race, immigrant concentration, socioeconomic status, and overall residential stability. Theories that evolved were based

on these social variables and provided an outline for researching crime generating

environments.

Several criticisms or points of differentiation should be noted with the work of

Shaw and McKay that are relevant for the given research dissertation.

1. Their research still dealt with the criminal rather than crime sites. This allowed their research to maintain a positivistic doctrine of studying individual offenders in determining why people commit crimes. (Brantingham and Brantingham, 1981, p. 227).
2. The level of analysis in proceeding studies have moved from national to state to regional to city and intracity levels. The closer the analysis comes to the actual crime site the better conclusions a researcher can draw in terms of predicting which variables are influential to crime. Brantingham and Brantingham (1991) refer to this as the "cone of resolution" moving the research project to a more narrowed focus of analysis.
3. These early sociological works from the University of Chicago committed an ecological fallacy when explaining individual behaviors through aggregate level data. (Brantingham and Brantingham, 1981, p. 17; Davidson, 1981).

Ecological fallacies continue to plague spatial research today and often are a

source of criticism. For example, Rengert & Wasilchick (2000) studied distance patterns

of suburban burglary incidents for the offender's place of residency. Their data was

collected ethnographically from individual offenders and their results were reported as

aggregates of the suburban areas from which the offenses occurred. In another analysis,

Capone and Nichols (1976) used aggregated robbery rates in Miami police data as a basis

for drawing conclusions on individual behaviors. By making conclusions about an

offender's rational decision making process based on aggregated data researchers commit

an ecological fallacy. This occurs because aggregated data is used in attempting to

explain individual-level rationale and statistical findings may vary if individual data is

collected.

Another criticism made towards the Chicago School research is directed at their emphasis on the criminal (i.e., juvenile delinquency) rather than on the crime site or on the social rather than on the physical environment. The proceeding environmental research dissertation has attempted to divert these criticisms by analyzing the physical environments that surround crime while still allowing for attention on latent informal social control mechanisms that are hypothesized to mediate the effects of the ecological variables.

1950s (Extending Shaw and McKay: Social Area Analysis)

Sociologists of the 1950s began to focus on aggregate data, mainly through census tract variables that were readily accessible. Increased computer technology allowed for data such as income, housing, and racial composition to be quickly analyzed statistically. Landers (1954) was one of the first to look at variables such as education, rental property, number of persons per room, vacant buildings, and percentage of minorities in census tracts. Several of these variables were combined through factor analysis leading to one variable labeled "anomie" from Durkheim's early research (Durkheim, 1893). The concept of anomie defined a lack of social integration and cohesiveness as the main explanatory variable of higher crime. Landers also reported that crime was not related to the socioeconomic status of the census tract. In the proceeding research, Bordua (1958) and Chilton (1964) contradicted Landers study and found that socioeconomic variables were highly significantly correlated to crime rates.

Shevsky and Bell (1955) used social control, urbanization, and ethnic segregation factors to explain crime in specific social areas. Although their study showed

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correlations between the predicting factored variables and crime, they did not provide

causal meaning or directionality. For example, its is not known whether ethnic

segregation effects social control and also crime or if all three are related to another

variable. Because of these flaws, the Shevsky and Bell research was highly criticized by

Brantingham and Brantingham (1984, p. 315). Specifically, criticism was directed at

social area analysis that ignored space and location as variables in ecological research

and the lack of theoretical development that flowed from this early research.

Baldwin (1979, p. 53) was even more critical towards these early attempts at

social area analysis:

> "to return to the discussion of criminological applications of social area analysis
> and factorial analysis, we must, it seems, stress the sterility of each approach.
> This research has yielded many new insights, and despite the immense effort
> extended, our knowledge of delinquency areas has been scarcely advanced."

Baldwin (1979) also criticized these early studies for not being theoretically or

empirically valid and falling into the trap of inferring individual behavior patterns from

census tract data, or what has otherwise been referred to as an ecological fallacy. Also,

Brantingham and Brantingham (1981, p. 17) point out the early confusion of criminal

residence and crime locations. Most researchers used these terms interchangeably.

Research questions about criminal motivation are assumed when analyzing offender's

residency, which cannot directly be answered with ecological data. However, research

that is concerned with the effectiveness of crime prevention policies and are directed

towards analysis of crime sites can be addressed with ecological data.

Criticism of research during the early attempts at social area analysis led to the

development of environmental criminology, mainly through the work of C. Ray Jeffery

and Oscar Newman. Independent research by Jeffery and Newman attracted a multidisciplinary approach from criminologists, urban planners, geographers, environmental psychologists and architects to the study of criminal environments (Brantingham and Brantingham, 1981). Their work was appealing since it offered a way to design out crime and save enormous costs and time for the police, courts, and prisons. Jane Jacobs (1961) was first to introduce this argument for the necessity to conduct better city planning and architectural designs that create an environment for residents to more freely interact.

1960s (Jacob's American City Structural Design)

Research in the 1960s-1970s focused on the structural layouts, architectural designs, and street patterns that surround concentrated crime patterns. Jacobs (1961) focused on the physical characteristics of where crime takes place in her pivotal publication, "The death and life of great American cities." Although anecdotal in nature, Jacobs was one of the first to point out that new forms of urban design broke down many of the traditional controls on criminal behavior and the ability of residents to watch the street day and night. Jacob's work was:

> "an indictment of post-war urban planning policies that gave precedence to the needs of the automobile at the expense of conditions fostering local community life" (Clarke, 1980, p. 2).

She argued that streets are unsafe when they lack adequate surveillance and properly built structures can increase surveillance and foster residential interaction, which will in turn prevent crime. Jacob's contended that crime flourished in areas where people did not know and meaningfully interact with their neighbors. Within these areas, residents are

less likely to notice an outsider who may actually be a criminal who is scanning the environment for potential targets or victims. Through this argument, Jacobs believed that more people would equate to more control and less crime. However, later research showed that taverns, night clubs (Ramsey, 1982), or even crowded bus stop locations (Sideris, 1999) can become hot spots for crime. This is especially true for socially disorganized areas that may encourage crime by providing more "coverage" for strangers to circulate (Angel, 1968; Brantingham and Brantingham, 1978). Jacobs "planning" approach for increasing residential surveillance opportunities over-estimated the influence of natural surveillance and the physical environment on offending. More importantly, social cohesiveness and the willingness to intervene are critical in researching crime specific locations.

It has been further pointed out that creating better physical structures may not be enough and informal social control occurs only when resident's make use of the opportunities to intervene in criminal or disorderly situations (Taylor and Harrell, 1996). In addition, potential offenders have to perceive that both surveillance and social control is active and they cannot easily escape intervention if they behave disorderly or victimize a space user. These concepts are especially challenging in terms of mapping and researching public spaces. It is not enough to test for negative physical attributes. There must also be a holistic understanding of the social ecology that surrounds these locations.

1970s (Newman's Defensible Space Theory)

Criticisms of Jacob's theories led into Newman's architectural research and 1972 publication of "Defensible Space." Newman's work is perhaps the most well known link

from the built environment to the individual offender's behavior (Brantingham and Brantingham, 1991). Newman claimed that the physical or built features surrounding specific places could contribute to decreases in social control capacities of crime suppressors. Roncek and Francik (1981) backed up Newmans's findings when their research showed that elevated crime levels were present in and near public housing facilities, even after controls were implemented for residential population and other social variables. Their study provided support for the facility itself serving as a criminogenic role independent of the space users.

Newman argued that crime would be high when public housing designs prevent residents from exercising proper surveillance and informal social control over their environment. Informal control mechanisms evolve from natural surveillance, image and feelings of territoriality among the space users. Newman defined surveillance as the ability of inhabitants to observe the territories they use in their daily activities. Image is the stigma (positive or negative) attached to the physical space. Areas with vandalism or broken windows have a low image leading to increased crime (Wilson and Kelling, 1982). Territoriality arises from feelings of possessiveness or belonging that space users maintain. Newman recommended that housing should be designed in a way that gives residents better surveillance of vulnerable areas (e.g., stairways, outside courtyards, etc.) and increases a sense of territoriality.

Newman attempted to prove his theory in two ways. First, he analyzed 70,000 criminal incidents in 133 public housing complexes in New York. He found that most crime occurring in the housing complexes were in elevators, stairways, or hallways. Important to Newman's findings were these crimes occurring away from public view.

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Second, Newman compared two housing complexes and found low crime in the one that had more defensible space mechanisms in place. Newman assumed that areas where natural surveillance was high informal social control would also be higher. Despite the interesting findings supporting defensible space, Newman was criticized for not considering the origins of informal social control or the true origins of crime (Taylor and Gottfredson, 1986).

Other criticisms were directed towards the generalizability of Newman's work outside of the United States. Newman's social control/defensible space model was found to be inaccurate through replicated studies comparing London's high-rises with low-rise housing. According to Newman, high-rise housing projects should have lower rates of surveillance and territoriality than low-rise housing equating to higher crime. However, Mayhew (1979) found that the principles underlying defensible space did not hold up in London and high-rises experienced lower crime than low-rise housing.

Others have argued that defensible space is based on several untested and erroneous assumptions such as Newman's assertion that people will naturally exercise a policing function and make use of surveillance (Taylor and Gottfredson, 1986). Mayhew (1979) points out that there is a lack of territoriality among the average citizen despite the level of natural surveillance. Only people employed to exercise surveillance and social control (i.e., police, private security, or employees) will actively intervene and report crimes to the police (Taylor, 1997). Oc and Tiesdell (1997) argue that:

> "by prematurely dismissing social factors it may nullify attempts to make use of the theory to control crime" (Oc and Tiesdell, 1997; p. 55).

In this context, it is necessary to take into account different levels of territoriality. Murray (1983, p. 107-122) defends Newman's revised crime control model by extending

the caveat that defensible space is least effective in places with the worst crime problems, whereas defensible space is effective in neighborhoods where people are already allied.

Newman's reformulated defensible space theory (Newman, 1975; Newman and Franck, 1980) became less physically deterministic and directed more towards territoriality. Newman (1975) found that social characteristics of residential populations were stronger predictors of crime rates than the physical characteristics of design. This finding came from 1967 New York City Housing Authority Police Data within 87 public housing units. Through a multivariate regression analysis, the social variables were more prominent in predicting crime rates with percentage of residential population receiving welfare being the highest predictor of crime. In analyzing the physical factors, Newman looked at the height of housing developments, number of entries to each building, and the total number of dwelling units in each building. Each of these physical aspects was found to correlate significantly to crime, although at lower rates than the social attributes.

These findings were significant in terms of social and physical theoretical integration and extending defensible space theory. Newman argued that physical characteristics can either reinforce or counteract levels of social control by residential inhabitants. Thus, the larger the low-income housing projects are with fewer entry points and the more low-income residents surround the housing projects, the higher crime is expected. Although socioeconomic characteristics were independently the strongest predictors of crime as found through multivariate regression analysis, the physical characteristics of the buildings were also found to mediate these effects. The size and form of the residential environment occupied by low-income families could either improve or aggravate the problems the residents faced (Newman, 1975). The highest

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crime housing projects were found to consist of the worst mixture of social and physical attributes.

Although not tested for directly, a primary mediating effect discussed by Newman (1975) was neighborhood cohesiveness or life-styles of residential inhabitants. According to his argument, a high degree of recognition among neighbors has been shown to produce low crime. This recognition is the product of residential similarity defined by shared ages and lifestyles, the number of years of continued residency in the same building, and the degree of interaction among the residents resulting from shared life-styles. Increased recognition of one's neighbors leads to higher levels of territoriality or sense of ownership that residents have in ensuring their own safety and residential well-being.

Newman's arguments are especially challenging for researching public spaces such as bus stop locations. It is not enough to test for negative physical attributes. There must also be a holistic understanding of the social characteristics that surround bus stop locations, especially in terms of mediating the effects of social cohesion on traditional disorganization variables and crime. Within this type of framework, it is predicted that social disorganization variables will affect both crime and informal social control levels. The absence and need for testing the mediating effects of territorial social control on disorganization was summarized in a report by the National Institute of Justice (NIJ) (Rubenstein, 1980) in which they argued that concepts such as territoriality, image, and social cohesiveness were not being effectively defined or operationalized. The research report pointed out that models being presented were flawed and lacking the use of potential intervening variables between the environment and crime. Encouragement was

directed towards better defining concepts such as territoriality and social cohesiveness as intervening variables in order to make links from both the social and physical environment to crime.

1970s (Jeffery's Crime Prevention Through Environmental Design-CPTED)

Newman's work in developing defensible space concepts for urban space users led to several national funding programs to implement crime prevention through environmental design (CPTED). C. Ray Jeffrey coined the term CPTED in his 1971 publication. The concept is rooted in psychological learning theory of B.F. Skinner and the role of that the physical environment plays in the development of pleasurable and painful experiences for the offender. This approach to crime prevention involves taking proactive action against crime before it occurs, which stands in stark contrast to criminal justice model that waits for crime to occur. Jeffrey separates CPTED from defensible space by arguing that crime prevention is either 1) physical design effecting the physical environment, or 2) social control effecting social surveillance (Jeffrey, 1990). According to Jeffrey, his CPTED model is based on an ecological model of the physical environment and its interaction with the physical organism. The human-made environment is critical to his model as is the characteristics of individual crime sites, such as the type of building, location of streets, parking lots, bus stops, etc. Jeffrey argues that the physical environment can be used to control behavior by removing the reinforcements for crime and unlike defensible space projects, CPTED strategies have been more successful (Jeffrey, 1990).

However, the similarities between defensible space and CPTED strategies are more apparent than the contradictions. Others have pointed out that the physical design of place structures can increase territoriality, which has been defined as a sphere of influence that arises in space users who develop a sense of proprietorship over the space they occupy (Crowe, 2000, p. 23). Jeffrey also argues that the physical environment affects levels of social control and the nonrandom nature of criminal events and the CPTED model offers a multidisciplinary analysis of urban environments and crime.

> "Crime rates are highly correlated with the physical features of the environment, such as streets, parks, buildings, highways, and public transit. Most areas of the urban environment are crime-free; crime is very selective where it occurs. Some blocks have many murders and robberies, others have none. Crime prevention involves the design of physical space. This is a joining of urban design, environmental psychology and social ecology into a meaningful relationship" (Jeffery, 1978, p. 160).

This type of interdisciplinary approach is useful for studying both the physical and social attributes that affect crime in and around bus stop locations.

Recent NIJ research suggests several ways in which CPTED and community policing initiatives should be coordinated to move towards a comprehensive approach for improving community security (Fleissner and Heinzelmann, 1996). Basic principles outlined include using traffic diversion to control and promote neighborhood cohesion and reducing criminal opportunities through territoriality reinforcement. This would give residents a sense of security in the settings where they live and work during their daily activities. Community policing programs that encourage informal control of the environment are believed to contribute to reduced crime and enhanced quality of life (Greenberg, 1985). Strategies to enhance defensible space can be initiated by both the

police and residents through a combination of CPTED and community policing philosophies.

1980s (Brantingham and Brantingham: The Spatial School)

Through a focus on designing environments to detract crime, came new research and theoretical development that analyzed where and when crime occurred. In the 1980s, researchers began to look at the behavioral settings in which crime occurred with a focus on the environmental choices made by offenders. Paul and Patricia Brantingham (1981; 1984) studied the spatial patterning of burglary rates and formulated a spatial choice or crime pattern theory. Within their theory, they argued that an offender's behavior is normal and rational and they will operate most often near their home residency or within their normal daily activities. As offenders travel, they begin to develop mental maps or 'awareness space' of their surroundings. Certain places within these surroundings become crime generators due to some recognizable physical and/or social negative attribute(s). The more negative attributes that are present the greater the opportunity to commit crime.

Further arguments are made that crime occurs not as the direct result of motivation, but is mediated by perceived opportunity. In this manner, Brantingham's foundation fits assumptions of rational-choice theory and situational crime prevention (Clarke, 1980; Cornish and Clarke, 1986). The perceived opportunity is influenced by the distribution of opportunities, which can include various disorganization variables and signs of residential transience. Since criminals are not seen to strike targets or victims randomly, urban structures can be analyzed to discover how people interact. These

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findings can then lead to predictions that are more coherent on the spatial distribution of crime as well as explaining some of the variation in the volume of crime between urban areas and between neighborhoods.

Central to crime pattern theory are notions of 'nodes' 'paths' and 'edges'. Nodes represent departure and arrival points in the journey. The Brantinghams used a bus stop location as an example of a node. Other examples include home, work, school, or leisure activity locations. Paths represent the journey between the nodes. Offenders find targets of accessibility while conducting their personal activity in and around the nodes and paths. Most often people will offend or be victimized within their daily paths. However, other crimes are likely to occur at the edges or boundaries of the paths. In these insistences, offenders make a concerted effort not to be recognized. These crimes are more likely to include face-to-face violent encounters such as armed robberies.

In addition to crime type, the timing of offenses is an important area that has been analyzed through temporal spatial analysis. Much like the nonrandom spatial nature of crime the timing of these events has also been found to be nonrandom (Ratcliffe and McCullagh, 1998). Temporal mapping is able to show crime disproportionably occurs at select hours of the day, days of the week, or months out of the year with links made to pedestrian path flows. Areas of interest can include bars closing, children being let out of school, people boarding buses or any other processes that would influence the crime patterns and path flows from different nodes.

In an expanded theoretical development of crime pattern theory, Brantingham and Brantingham (1996) theorized that certain places become 'crime attractors' or 'crime generators' due to their locations and site structure that draw people together who, if it

were not for the location, would not be together. The 'crime generator' theory has implications for research on bus stop locations since many bus stops often become areas of high activity as a side product of its actual purpose. People will often socialize and congregate at bus stop locations even when they have no intention of actually using the bus. Due to the level of accessibility to the public, certain bus stop locations can become crime attractors. However, according to Brantingham's school of thought, bus stop locations can also become crime detractors. This refers to something in the physical and/or social structure that may be discouraging offenders, such as the presence of natural surveillance or neighborhood watch signage that is supposed to signify an attempt to increase territoriality among legitimate space users.

The Brantinghams argued that transportation systems, especially major intersections represent major-crime areas. Human activity flows along major transportation routes, such as public transportation. Urban development is present in areas where major transportation routes intersect. Therefore, bus stop locations that are used more frequently should also experience crime that is more frequent. The design of streets and public transportation also affects crime through the level of accessibility that is present to potential offenders. For example, it has been argued that dead-end streets, cul-de-sacs, and one-way streets should project a private atmosphere that will cut down on stranger access and increase the presence of legitimate space users (Enger, 1997). Newman and Wayne (1974) looked specifically at this issue in comparing public and private streets adjacent to one another in St. Louis. They found that streets maintained by residents through landscaping, gates, or other features had less crime and more interaction between the residents as compared to other public streets. Although these

findings are encouraging, comparability did not actually exist in this study between experimental and control groups.

Other studies have found that more accessible streets with higher pedestrian traffic will experience higher rates of crime (Beavon, Brantingham, and Brantingham, 1994; Buck, Hakim, and Rengert, 1993; Jeffery, Hunter, and Griswold, 1987; White, 1990). Duffala (1976) looked at pedestrian traffic over a 24-hour period in two urban cities. Findings showed that establishments in high-traffic areas were more vulnerable to crime than those that were in low-traffic areas. The interest of the dissertation research is to determine if similar findings will result when systematically analyzing high crime bus stops and to determine if high pedestrian traffic results in high crime.

Brantingham and Brantingham (1981) made note of the concentration of certain crimes in identifiable places adding to the obvious value of place-based analysis of crime. Sherman (1995) defined hot spots as:

> "small places in which the occurrence of crime is so frequent that it is highly predictable" (p. 35).

The concentration of crime among repeat places is more predictable than repeat offenders (Spelman and Eck, 1989). By knowing when and where crimes are likely to happen allows for the police or other guardians to be present to prevent it. Knowing the distribution of crime allows crime analyzers to explore further the surrounding factors that may be causing the crime to occur. Sherman et al., (1989) conducted one of the first research studies to quantify concentrations of crime in relatively few places. Their study found that 3.3 percent of addresses in Minneapolis created 50.4 percent of all calls for police service. Replicated studies have shown similar patterns (Pierce, Spaar, and Briggs, 1988; Sherman, 1992; Weisburd and Green, 1994).

Research that examines the spatial distribution of crime has demonstrated that specific uses of space and population characteristics are associated with being part of crime hot spots. For example, Roncek and Maier (1991) found a positive relationship between crime and the number of bars located in city blocks of Cleveland. Crime was even greater when bars were located in areas rated as having low guardianship. Interestingly, half of the top ten hot spots identified in Sherman, et al., (1989) included the presence of bars. Cohen, Gorr, and Olligschlaeger, (1993) found that drug hot spots tended to be in areas with condemned residencies/buildings, or areas with high poverty and family disruption as measured by percentage of female-headed households. The goal of this dissertation is to conduct a similar analysis of hot spot bus stop locations.

When determining if hot spot locations contribute to crime in any type of causal way it is important to determine if the observations are systematic (meaning regular and predictable) or just random occurrences. If hot spots are random and occur nonsystematically, then crime does not depend of the distinctive features of the place specific locations. In addition, crime reduction efforts that target those features are likely to fail based on flawed scientific evidence. Researchers are warned about the critical nature of carefully identifying hot spot locations with methodologically sound analyses that utilize extensive data over long time periods before linking crime to space (Anselin, et al., 2000).

1980s-1990s (Felson and Clarke: Routine Activities and Situational Crime Prevention)

Around the same time as the spatial school was being formulated under the direction of Brantingham and Brantingham, a renewed interest in the ecological and

social disorganization perspective took place though various victimization studies. The analysis of the spatial school (Brantingham and Brantingham, 1981) coincides with much of the research and foundation purported by routine activities theory (Cohen and Felson, 1979) and situational crime prevention (Clarke, 1983) in terms of reviving research on the location of crime. Routine activities theorists sought to extend the ideas of Shaw and McKay (Bursik, 1988) with the exception of focusing on crime incidents rather than offenders and discovering why certain places maintain ecological stability over time.

Routine activities theory was introduced by Cohen and Felson (1979), and refined by Felson (1987, 1994). It became especially relevant to crime pattern theory (Brantingham and Brantingham, 1993), with place-based crime research becoming the central focus. The routine activities approach incorporated previously underutilized contextual variables including community organization and crime location as predictors of potential victimization (Cohen and Felson, 1979).

The foundation introduced by routine activities calls for naturally occurring crime prevention alternatives to limit offender opportunity. Criminal opportunity and criminal victimization theories stress the convergence of motivated offenders, suitable targets, and the absence of guardianship in time and space (Cochran, 2000). Routine activities theory predicts that specific place locations will become crime generators through the normal occurring social activities of the space users and the best strategies for reducing crime should be directed towards those routine pathways. The theory further argues that a large percentage of criminal offenses and general disorder is related to everyday patterns of social interaction and as patterns of social interaction changes so will the number of offenses (Cohen and Felson, 1979). The term routine activity refers to any commonly

occurring social activity that provides for basic needs, such as the use of public transportation.

Routine activities theory researches why certain groups of people are at a disproportionate risk for victimization. Proponents of the theory argue that patterned lifestyles and daily activities lead to skewed victimization rates and opportunity is the cornerstone for all criminal behavior (Felson and Clarke, 1998). Reducing these opportunities leads to a reduction in overall levels of crime with little displacement effects (Felson and Cohen, 1980). The opportunities arise through the normal everyday movements and activities of both potential offenders and victims, making the likelihood of crime highly situational.

Situational crime prevention research encourages integrating several theories that are traditionally neglected in prior work through an examination of crime prevention techniques (Clarke, 1988). Routine activities theory has direct links to situational crime prevention strategies (Felson and Clarke, 1998) and environmental criminology. As is the case with routine activities, situational crime prevention also draws on rational choice and lifestyle theories. Since rationality of offenders is an assumption, policy implications are directed at reducing opportunities to commit crime by increasing the effort and risks while also reducing the potential rewards from crime (Clarke, 1992). Situational crime prevention can be easily incorporated to an analysis of bus stop locations since the focus is placed on those locations rather than on the offender.

Crime maps are useful for understanding and locating areas where opportunities are highest and developing methods for blocking these opportunities (Matthews, 1992). Situational crime prevention focuses on changing the physical surroundings that can

affect crime (Clarke, 1992). From an administrative perspective, an interesting argument

within the situational and routine activities crime prevention perspective holds that the

analysis of physical space:

> "is promising because, once understood, available technologies can be used to
> modify patterns and abate crime without doing significant damage to basic human
> rights" (Brantingham and Brantingham, 1981: 18).

Both situational crime prevention and routine activities theory utilizes an

ecological assumption that criminal events occur when motivated individuals and

unguarded targets come together in space and time. Like situational crime prevention,

routine activities theory is part of what has been referred to as the integrative

"criminologies of everyday life" (Garland, 1999). These related criminological theories

include rational choice, routine activities, and lifestyle theory. Rationale choice is a

critical assumption of routine activities (Clarke, 1995), which argues that crime is

committed by rational individuals who balance opportunities hedonistically through a

cost benefit analysis (Cornish and Clarke, 1986). Routine activity theory argues that

researchers should:

> "focus on crime incidents rather than on offenders themselves, examining how
> these incidents originate in the routine of everyday life" (Felson, 1994: p. xii).

Lifestyle theories argue that victims' lifestyles, including work and leisure activities,

contribute to differential risks for victimization (Hindelang et al., 1978). For example,

use of public transportation during weekend evenings may put users at more risk than

during a weekday morning commute. Temporal crime mapping allows for a more

thorough analysis of when and where victimization may be highest and these findings can

be linked directly to lifestyles of the space users.

Through this type of foundation, crime can be explained through the convergence of motivated offenders, suitable targets (e.g., a vulnerable person at a bus stop location) and the absence of capable guardians against crime (e.g., lack of surveillance of the bus stop from surrounding residencies or an unwillingness to intervene in situations of victimization/disorder). These three elements make up routine activities theory and argue that crime prevention strategies should be directed at preventing one or more of these three factors. For example, city planners may consider routine activities when deciding where to place bus stop locations. Surveillance may be increased and guardianship better promoted among bus stop locations that are placed in areas of low visibility or weak territorial social control. Thus, a thorough analysis of the crime location is an important component for utilizing routine activities theory and situational crime prevention.

Increasing guardianship and limiting the vulnerability of targets is the basis for situational crime prevention. This includes reducing crime through environmental design that utilizes defensible space concepts. Situational crime prevention is particularly relevant to urban bus stop locations in terms of qualitatively analyzing the overall environment of bus stops. This type of approach argues that changing offenders' lifestyles so they do not commit crime is a very costly and time-consuming venture. In addition, Felson and Clarke point out that:

> "statistical analyses used to unravel individual causes of crime are highly complicated and seem to go in circles. We see no immediate prospect of success in resolving the many controversies about what causes individual crime propensities" (1998, p. 2).

Situational crime prevention is unique in this matter since most criminological theories focus attention on the individual offender's behavior rather than on why individuals are or are not criminally inclined in different environmental circumstances.

Situational crime prevention focuses on the criminal event and the location of the crime rather than the offender (Clarke, 1980). Since every crime needs a physical opportunity to occur, target hardening the environment may be one solution to preventing crime. Based on this theory, empirical observations of high crime bus stop locations were predicted to yield evidence that defensible space mechanisms are lacking and are present within low crime bus stop locations that are otherwise similar.

Through this type of analysis of bus stop locations, it became critical that early ecological roots from the Chicago School are taken into account. As is the case with routine activities, the Chicago School perceived human behavior as being social and at least partially a product of the social environment in which their routine activities take place. These environments provide the cultural values and definitions for appropriate behavior and disorganization within these environments is measurable through family disruption, low socio-economic status, high concentration of new immigrants, or high levels of residential transition. When social disorganization begins to occur, routine activities are also disrupted. Therefore, when theoretically analyzing crime through routine activities, it is also important to recognize that changes in routine paths can be affected by social disorganization and these social variances must be accounted for within any type of spatial analytic research.

Bursik and Grasmick (1993) presented a systematic model of neighborhood victimization that integrated a revised version of social disorganization with routine activities theory. Their main thesis was that routine activities mediate the effects of structural organization in terms of victimization patterns and different levels of guardianship. Patterns of routine activities are linked to neighborhood social order. In

testing their hypotheses, the researchers used data from the Chicago Neighborhood Study (Taub, Taylor, and Dunham, 1984). Their main hypothesis stated that the effects of routine activities on victimization would be invariant among neighborhoods with similar social orders and the effects of routine activities would vary across neighborhoods with different social order characteristics. They used burglary and vandalism as their criterion (dependent) variables. Tests for variance across different neighborhood structures uniformly supported their framework showing that routine activities are affected by social disorganization variables.

Within research directed towards crime surrounding bus stop locations, it is necessary to account for the routine activities of transit users but also the surrounding social attributes that affect their pathways. Sampson et al., (1997) research proposed that both crime and social disorder stem from structural characteristics present within certain neighborhoods, most notably poverty concentration and residential instability. These social constraints promote increased crime and disorder, but also inhibit informal social control mechanisms that can mediate disadvantage, or lessen its impact on crime within specific neighborhoods or built environments, such as bus stop locations.

1990s (Sampson: Social Ecology)

Technological advances in computer capabilities have provided the catalyst for recent analytical advances in the methodologies available for analyzing place-based crime data. Computer mapping applications and geographic information systems (GIS) are the fundamental application for measuring and displaying spatial relationships in ecological data analysis. Advances in representing computerized police records within

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neighborhood relationships have created a revival in contemporary ecological studies of crime. Contemporary social ecology research has evolved into a more specific focus on spatial theories of crime with references made to defensible space concepts, crime pattern theory, routine activities theory and situational crime prevention (e.g., Sampson et al., 1997).

Specific focus has been placed on the need to more efficiently define and operationalize social cohesiveness as part of an extension from earlier Chicago School research (LaFree et al., 2000; Sampson et al., 1997; Sampson & Groves, 1989). Sampson (2001, 1995) and colleagues (Samspon and Morenoff, 2003; Sampson, Squires, and Zhou, 2001; Sampson & Groves, 1989; Sampson, et al., 1997) have utilized a community social organization model by building on Kasarda and Janowitz (1974) and extended the ecological model by analyzing how community members become empowered to take action against crime and outsiders despite their socio-demographic makeup. Indicators of social disorganization tested under this model include population density/heterogeneity, ·impoverished areas, non-native residents, family disruption (as typically measured through female-headed households), and residential mobility (Baldwin and Bottoms, 1976; Bottoms and Wiles, 1986; Bursik and Grasmick, 1993; Sampson et al., 1997; Shaw & McKay, 1969). These variables are seen as impediments to how well space users know their neighbors and would intervene or recognize an outsider. All of these variables are hypothesized to ultimately effect cohesiveness, which mediate victimization risk. The inclusion of multiple disorganization indicators is meaningful and has precedent from early ecological research.

Shaw and McKay found that the most significant indicator for predicting crime was levels of concentrated poverty (1942, p. 320). A main part of the social disorganization variation encompasses economic status, which is found throughout ecological studies that transcended the earlier Chicago School model (Bordua, 1958; Chilton, 1964; Lander, 1954). However, the findings of these prominent studies are mixed. Lander (1954) and Bordua (1958) argued that if home ownership is controlled for within a multivariate analysis, the effects of poverty on crime are weak. Gordon (1967), however, is highly critical of Lander and argues that poverty is a very strong predictor of delinquency. Sampson and Groves (1989) found that neighborhoods with poor socioeconomic conditions had higher burglary rates and lower rates of informal social control than did wealthy neighborhoods. In addition, Kornhauser reviewed multiple studies on ecological crime research and concluded that correlations between poverty and crime is secure (1978, p. 100). While most ecological studies have demonstrated a positive bivariate relationship between poverty and crime, there is ambiguity once variables are controlled through multivariate analyses (Byrne and Sampson, 1986), and more advanced structural modeling techniques are necessary. A disentanglement of variables such as racial composition, family disruption and economic levels on the social ecology of crime is a major focus for the first part of this dissertation project.

Studies that look only at economic distress may be inadequate at measuring the ecological effects on crime in their totality. For example, family disruption has been shown to be an important component affecting informal social control throughout neighborhoods (Samspon, 1986) by reducing effective guardianship (Cohen and Felson, 1979), especially in the case of increased juvenile delinquency. Sampson (1986) argues

that ecological studies testing race and socioeconomic status (SES) are misspecified when they fail to account for a community's family structure. Both race and SES status have been found to be positively related to rates of divorce and female-headed households, so there is a possibility that causal inferences made towards race and poverty are actually due to family disruption. Thus, ecological analyses of crime-specific place locations should take into account race, SES, and family disruption variables. In addition, Sampson and Laub (1993) indicate that variables of family disruption and residential stability tend to have stronger effects on crime than racial composition or income inequality. From these findings, Sampson (1993) argues that studies emphasizing only economic and racial factors (e.g., subcultural and strain theorists) are also misguided.

Neighborhood-level research generally analyzes the following ecological predictor variables influence on crime: percent minority, poverty, public assistance, unemployment, social transition, proportion of youth, and concentration of immigrants. As is the case with analyzing various economic variables, the levels of multivariate correlation between these predictor variables and crime is often blurred due to collinearity problems, but still follow the tradition of the early Chicago School sociologists. Byrne and Sampson (1986, p. 4) point out that the importance of ecological research is relative and can be misleading since there is great variation in:

1. Dependent variable data sources (e.g., UCR, victimization surveys).
2. Statistical analyses (e.g., bivariate, multivariate).
3. Different levels and units of analysis (e.g., intercity, intracity).
4. Sample sizes and cities used vary considerably (e.g., populations 4,000 to over 100,000).
5. Different research designs utilized (e.g., cross-sectional, longitudinal).
6. Different measures and types of predictor and criterion variables used between studies (e.g., only economic distress or racial minority percentage).

The need for ecological research reform led to a large multilevel study under the

Project on Human Development in Chicago Neighborhoods (PHDCN). The primary

reference for utilizing an ecological model in this dissertation will be the Sampson et al.,

(1997) study of Chicago neighborhoods, which was funded through the PHDCN. In their

ecological study, Sampson et al., (1997) tested the hypothesis that collective efficacy is

linked to reduced violent crime. Unlike guardianship (Cohen and Felson, 1979),

collective efficacy (Sampson et al., 1997) argues that surveillance is not enough and

space users must be willing to intervene when they witness disorder or criminal incidents.

Collective efficacy was defined as a working trust and shared willingness to intervene in

informal social control. This follows the definition of self-efficacy, which can be defined

as one's belief in their ability to influence outcomes or events (Bandura, 2000). Sampson

et al., (1997) argue that collective efficacy may increase with community member's ties

to their neighborhoods and decrease when these ties are weak.

The collective efficacy hypothesis predicts that residents can overcome the

sociological effects of disorganization if there is a mediating effect of community

stability. This type of foundation is useful from a spatial analysis perspective because it

allows for the potential of layering social data into maps and making predictions on

where hot spots may be located based on demographic data and how levels of

neighborhood cohesion may mediate the effects of these demographics. However, a

major conceptual limitation of past ecological research is the lack of attention directed

towards operationally mediating the effects of community characteristics on crime (Byrne

and Sampson, 1986). While most ecological studies will analyze the effects of census

variables on crime in order to infer support for a specific theory, often there is a lack of

empirical evidence shown in model specification for testing any mediating effects. Both

the Sampson et al., (1997) research and the model proposed for testing collective efficacy

in this dissertation measures the mediating effects of specific community characteristics

on crime.

Data for the Sampson et al., (1997) research was retrieved from multiple sources

in 343 Chicago neighborhoods and police records used to measure crime in 1993. The

research included systematic observations (SSO) of both physical and social disorder.

Qualitative signs observed through video taped observations of neighborhoods included

physical disorder documented graffiti, condoms, illicit drug needles, etc. Documented

social disorder included adults openly drinking alcohol on the street, drug dealing,

prostitution, and loitering. The research was multilevel since it included surveys from

3,864 randomly selected households and 8,782 residents in 196 census tracts in addition

to utilizing neighborhood level census demographics. The census data accounted for

aggregate-level data used to measure concentrated disadvantage that consisted of

factoring poverty, public assistance, unemployment, female headed households, and

concentrated immigration. The surveys accounted for individual-level data on

neighborhood perception of collective efficacy. When individual-level characteristics

were taken into account from the survey data and aggregate-level census data was also

used, collective cohesion was shown to have a negative effect on violence after

controlling for measurement error and prior violence. Levels of concentrated

disadvantage and immigrant concentration were mediated by certain levels of cohesion,

meaning that indirect effects on crime could be shown once accounting for the collective

cohesion of the group. Whereas individual-level research explores the effects of

individual survey respondent's willingness to exercise informal social control, the aggregate-level research explored neighborhood-level stability as measured through census data that provided spatial concentration for those who own a home as opposed to rent or have lived at their residency for more than five years. These residential stability variables have been used as an indicators for cohesiveness in several other studies (Bursik, 1988; Bursik and Grasmick, 1993; Sampson and Groves, 1989; Sampson and Lauristen, 1994).

The essence of social disorganization theory is at the aggregate-level and measuring the effects of informal social control in terms of a community's ability to manage the behavior of its residents. The percentage of people in the same area with the same characteristics over a number of years represents a measurement of neighborhood stability. More stable neighborhoods have less acceptance for crime, disorder or non-conformity (Rank and Hirschi, 1988). Lack of stability increases the effects of social disorganization variables such as poverty, unemployment, family disruption, or high concentration of immigrants. According to this premise, areas with low mobility and/or higher owner-occupied housing would be expected to have lower reported crime incidents than areas where mobility high. These variables can be measured spatially at the aggregate-level through a variety of different predefined governmental boundaries.

Within the aggregate-level analysis Sampson et al., (1997) utilized census tract demographic data with the assumption that collective efficacy can be measured uniformly across large geographic areas, such as census tracts in the city of Chicago. However, within ecological research, different levels of spatial analysis exist. For example, macro-level research involves studies at the highest level of spatial aggregation involving

research on the distribution of crime between countries, states, or cities. Meso-level analysis is directed at areas of comparison within the city. These units can include police beats, census tracts, block groups, or face blocks. Micro-level spatial analysis involves the study of specific crime sites. Spatial patterns of crime will differ depending on which of analysis is selected.

Unlike the Sampson et al., (1997) multilevel research, this dissertation only utilized aggregate-level data at the block group level as the primary unit of analysis. Typically, census tracts are broken into several different block groups allowing for a more micro-scale neighborhood analysis and better justification for homogeneously measuring collective efficacy ties across neighborhoods. In addition, the final analysis of the dissertation includes systematic observations of micro-level bus stop locations to qualitative test defensible space and crime pattern theory. The justification for using aggregate-level data over individual-level surveys was determined by both cost and time constraints. In addition, it is an interesting challenge to the research of Sampson et al., (1997) to determine if aggregate-level data that is available free of cost through the US Census can equate to the same information as retrieved through multi-million dollar sampling of Chicago residents. It can also be argued that by utilizing this aggregate-data at a lower level (i.e., block group) as opposed to the census tract the main unit of analysis will serve as a better proxy for neighborhoods as opposed to utilizing the larger census tract units of analysis.

Both census tracts and block groups provide a convenient geographic unit on which to base neighborhood variation and measurement because of the large amount of data available through each decennial census. In addition, administrative governmental

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data, such as crime incidents, can be aggregated into both of these same units of census boundary geography. Since block groups are sections within census tracts, they may provide a better area of analysis for determining differences in the given data as well as being an improved measure of the geographic space in which residents actually perceive as their neighborhood (Coulton, et al., 1997). In terms of research ethics, aggregating crime incident data to the block group level also allows for the data to be sanitized so direct links cannot be made to specific address locations and block group comparison could be made through the use of the census data.

Block groups may provide the best proxy representation of neighborhoods when utilizing aggregate-level data. One study found resident's perceptions of their neighborhoods come close to producing the same values of many indicators in an area that official boundaries produce, such as block groups. This pilot study was completed in response to uncertainty in the field about how accurate official boundary files were to residential perceptions of what encompassed their neighborhood (Coulton, et al., 1997). Residents were asked to draw boundary lines around what they defined as their neighborhood and these results closely matched official government boundary lines of the census block groups.

Perkins, Abraham, and Taylor, (1993) argued that both residents and potential criminals take a variety of environmental cues from several blocks as opposed to a single block in terms of territorial markers. Taylor (1997) notes that multiple blocks represent ongoing, ecological settings in which environmental features facilitate specific behaviors for both residents and outsiders, but census tracts may represent more heterogeneous demographic characteristics. Therefore, researchers have often used block group

locations as an indicator of neighborhood representation (Harries and Kovandzic, 1999;

Lowenberg and Bandurraga, 1982; Novak, James, and Smith, 2002; Paschall and

Hubbard, 1998). A more accurate picture of social disorganization and its impact on

potential offenders and victims can be drawn from a multiple blocks analysis. A block

group unit of analysis will allow for data over multiple blocks to be accounted, given that

these areas can better define neighborhoods and measure the impact of residential census

survey variables on surrounding commercial property and bus stop locations. After

accounting for the general social make-up surrounding bus stop locations, the

microenvironment of the bus stops were more thoroughly analyzed allowing for a mixed

methodological focus to the dissertation.

Summary of theoretical contributions to environmental criminology

- Guerry (1833) and Quetelet (1842) found patterns of crime varied spatially but

  were stable over time. Their findings opened the debate for the relative

  importance of offender motivation and opportunity that would become the main

  assumption under future environmental spatial research.

- Shaw and McKay (1942) questioned the correlation of crime rate increase and

  levels of economic stress. Lead future researchers to focus on specific crime sites

  rather than offenders and develop more sophisticated models to avoid ecological

  fallacies.

- Landers (1954); Bordua (1958); Shevsky and Bell, (1955); Chilton, (1964)

  attempted to extend Chicago School sociological research by focusing on crime

sites rather than offenders. Findings indicated that socioeconomic correlations to crime were complex and lack of reliability existed in many studies.

- Jacobs (1961) was instrumental in challenging previous assumptions about modern city planning and architecture. Introduced the need to measure and test the impact of physical attributes on crime and disorder.

- Jeffery (1971) introduced the concept CPTED and focused specifically on the impact of the physical environment on crime.

- Newman (1972, 1975) developed defensible space theory and analyzed how both social and physical attribute data may interact in terms of crime surrounding public housing.

- Brantingham and Brantingham (1981, 1991) theorized about the impact of place locations in terms of crime patterning and available opportunities. Their research linked routine activities and social disorganization theory at the micro-level.

- Cohen and Felson (1979) introduced routine activities theory at the macro-level to analyze the role of victims within place-specific locations.

- Sampson, Raudenbusch, and Earls (1997) multilevel research allowed for extending social disorganization theory by spatially mapping and systematically observing correlates of crime. Their research avoided ecological fallacies and found mediating effects on social disorganization variables from informal social control mechanisms.

CHAPTER III

THE PRESENT STUDY

Within recent extensions of social disorganization theory, various methodologies have been used to tap into how informal social control mediates social disorder variables as represented by socioeconomic status (SES). The research conducted by Sampson et al., (1997) through the Project on Human Development in Chicago Neighborhoods (PHDCN) appears to be one of the most promising and comprehensive approaches at measuring the mediating impact of informal social control or what they have labeled collective efficacy (Bower, 1997).

The theoretical evolution presented in Chapter II utilizes an ecological analysis of crime that looks towards analyzing criminal activities as part of the overall neighborhood ecosystem. Gradually, ecosystem research has been directed towards an environmental perspective or a social disorganization perspective. This dissertation attempts to bring the two fields together in the spirit of Newman's reformulated defensible space theory that concentrated attention on territoriality and Sampson et al., (1997) focus on mediating the effects of social disorganization variables through collective efficacy. By including an analysis which accounts for both physical and social attributes of crime this study attempts to systematically test social disorganization and defensible space concepts.

Within this type of ecological analysis, assumptions of rational choice are critical since focus will be placed on spatial crime incidents and not directed towards offenders. Defensible space concepts draw together social and physical structure contributions to crime through surveillance and territoriality. It is argued that territoriality is dependent on levels of residential stability, which provide an indication of the likelihood of social control being exercised in public spaces that are within the neighborhood. The impact of these controls were measured through an SEM model test in Part I of the dissertation methodology.

Part I: SEM Model Test of Social Attributes

Quantitative links from the social environment that surround bus stop locations are made through a structural equation model (SEM) test to determine which social attributes have the greatest effect on official crime incidents. Demographic social disorganization data were factor analyzed to make up latent indicating variables in the model.

In an effort to test some of the same concepts as the Sampson et al., (1997) research, the first part of this dissertation was directed at analyzing the extent of residential stability mediation on neighborhood disorganization through structural equation modeling (SEM). The SEM model allows for the measurement of informal social control to act as both a dependent variable of social disorganization and a mediating independent variable predictor of crime at the same time.

According to Sampson, et al., (1997), the single latent variable of concentrated disadvantage should include factor loadings from indicator variables poverty, public

assistance, unemployment, female-headed households, African-Americans, and youth (ages 17 and under). These variables were seen as all measuring the same construct of disadvantage. Taken as a whole, disadvantage is a direct causation of increased crime and a direct causation of lowering informal social controls or collective efficacy. However, collective efficacy has been found to mediate the effects of disadvantage and have a negative correlation on crime.

In addition, low collective efficacy was predicted in spatial areas that have a high concentration of immigrants or foreign-born residents. Much like concentrated disadvantage, Sampson, et al., (1997) also predicted that immigrant concentration would have a direct positive effect on crime, a direct negative effect on residential stability, and an indirect mediating effect on crime through residential stability. Indicators of immigrant concentration included percentage of foreign-born and Latinos.

Sampson, et al. (1997) was testing the mediating effects of these disorganization variables on crime. The mediating effect was labeled collective efficacy or informal social control and can be defined as cohesion among space users who share similar expectations for informal social control of public space (Sampson et al., 1997). These types of constraints on disorder are not necessarily economic but can be measured through levels of home ownership and low levels of transience. According Sampson et al., (1997) higher levels of home ownership and lower levels of transiency equate to higher levels of collective efficacy. It was hypothesized that in areas where stability/collective efficacy mediation is high, rates of crime would be low, regardless of the socio-demographic composition. Thus, residents in stable areas are seen to have

higher levels of informal social control mechanisms to intervene in preventing disorder and crime in public places such as bus stop locations.

Part II: Quasi-Experimental Design

After completing the SEM test, an identification of bus stop locations that serve as crime attractors/generators and detractors was determined through the use of ArcView software[1]. Block group comparisons were made by comparing bus stop presence with non-bus stop presence. Social disorganization data was controlled for within logistic regression models and block group locations were compared in an effort to determine if bus stop locations statistically contribute to high crime rates compared to non-bus stop locations. This second methodological strategy allows for a comparison of crime statistics that coincide with bus stop locations to areas without bus stop locations while controlling for socio-demographic characteristics. This type of logistic analysis provides some of the first scientific evidence in determining if bus stop locations can be attributed to increased crime.

Part III: "Mixed Methodological Spatial Analysis"

Neither practitioners nor academics take full advantage of all the potential sources of information that could be useful for inferring patterns of crime (Maltz, 1990). Part of

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[1] ArcView is the world's most popular desktop GIS and mapping software, with more than 500,000 copies in use worldwide. ArcView provides data visualization, query, analysis, and integration capabilities along with the ability to create and edit geographic data. ESRI is located in Redlands, California and produces yearly updated additions of ArcView software. ArcView version 8.1 was utilized for data analysis throughout this dissertation.

the reason for this discrepancy is lack of data in areas such as crime specific locations. In addition, as the level of analysis becomes more specific to geographic locations the less standard statistical techniques can be employed (Maltz, 1990). It has been advocated that mixed methodological approaches be used to combine different types of data into a place specific crime analysis. Sampson (1993) referred to this type of mixed methodological approach as "dynamic contextualism" or "narrative positivism" with the goal of better understanding the effects of deteriorating informal and formal controls. Maltz (1994) advocates the use of graphical techniques to present different types of data in ways that permit researchers to infer patterns. This reaches Wild's (1994, p. 168) prediction that in the future:

> "the primary language for promoting the human understanding of data will be sophisticated computer graphics rather than mathematics."

There is a qualitative nature to measuring and interchangeably mapping place specific activities. Sampson and Raudenbush (1999) reported on the necessity of conducting systematic social observations of disorder within urban neighborhoods. These types of mixed methodology designs combine quantitative and qualitative approaches within different phases of the research process (Creswell, 1995; Nau, 1995; Patton, 1987).

With this mixed methodology spirit in mind, bus stop locations with the highest amount of crime were analyzed more thoroughly through a qualitative observational analysis of the built bus stop environment. The environments were analyzed through systematic observations from a predefined checklist adding to future reliability of the findings. Crime pattern theory and defensible space concepts will be tested through these observations to see if similar empirical findings can be found within high crime bus stop locations compared to low crime bus stop locations. These observations allowed for a

more thorough analysis of census level social attributes and documenting signs of traffic flow, routine activities, social control mechanisms, and possible deterioration within select areas based on mapped data. In addition, signs of defensible space theory were documented such as natural surveillance and general images of the areas that surround bus stop locations.

Justification for Utilizing a "Mixed Methodology"

Other studies have used a similar mixed methodological process. For example, Cohen (1980) conducted a mixed methodological study of prostitutes in New York City by first conducting a quantitative spatial measure of social disorganization and then following with qualitative observational research. Findings indicated that prostitution spans all levels of income across different census tracts, however, qualitative observations noted remarkable similarities within the face blocks and street corners where prostitutes worked and johns solicited services. Cohen also noted features of the built environment within areas with high incidences of prostitution such as wide streets (provided an inconspicuous traffic flow through the area), business establishments (indirectly used to attract prostitute clientele), and spatial proximity of unlit alley ways, parks, or parking lots (providing locations for sex). Cohen's (1980) work provided an empirical study that qualitatively and quantitatively analyzed crime-facilitating spaces that included "motivated" offenders as proposed by routine activities theory (Cohen and Felson, 1979).

Cohen's work was instrumental in highlighting the importance for specifying the correct unit of analysis in ecological research studies. In researching public spaces within

block groups, such as bus stop locations, it is necessary to take into account influences from the surrounding area, but then also to look at the specific environment of the unit of analysis. For Cohen, this became the street corners that the prostitutes used to solicit their services. Cohen (1980) found that when examining the presence of the socioeconomic structure, there were actually few differences between areas with prostitutes and areas without. However, when Cohen examined variation within the census tracts, important differences emerged, thus, showing the importance of qualitative analytical techniques for creating a more accurate picture of ecological studies.

New GIS computer crime mapping technology makes this process easier since point data of locations from specific criminal incidents can be obtained. It is now more routine to map out crime variables to smaller place level locations, allowing for greater variation to be detected. However, in researching areas as small as bus stop locations, it is still necessary to actually go to the site of these locations and conduct a qualitative analytical comparison of the physical features that incorporate the location.

Within mapping micro-environments researchers have discovered that the presence of special-purpose places such as taverns, 24-hour convenience stores, or bus stop locations have links to increased crime within their immediate vicinity (Block and Block, 1995; Roncek and Meier, 1991; Roncek and Pravatiner, 1989; Sideris, 1999; Spelman, 1993). These research initiatives are founded on theories and assumptions of routine activities, (Felson, 1986, 1987; Cohen and Felson, 1979) rational choice theory (Clarke and Cornish, 1983; Cornish and Clarke, 1986), social disorganization (Sampson and Groves, 1989), crime pattern theory (Brantingham and Brantinham, 1991) and situational crime prevention (Clarke, 1992) that argues increased opportunity produces

increased crime. These opportunities arise through spatial target attractiveness based on the social and physical attributes of the surrounding area.

Research Questions

The first objective of this dissertation was directed towards testing the impact of informal social control on block groups throughout a medium sized Midwestern city. Block groups were compared in terms of traditional social disorganization variables such as levels of poverty, unemployment, minority concentration, youth, immigrants, and residential stability. Theoretically, long standing social disorganization theories argue that areas with higher disorder will have higher rates of crime than areas with less disorganization. Therefore, the first research question came from social disorganization and more specifically, collective efficacy theory:

1. Do block groups with higher levels of concentrated disadvantage and immigrant concentration have higher crime rates? Do block groups with higher levels of residential stability mediate the effects of disadvantage and immigrant concentration on crime? Which variables have the largest impact on crime?

The second objective of this dissertation was to determine if block group locations with bus stops have higher crime rates than neighborhoods without bus stop locations. Theories such as routine activities and crime pattern theory argue that as daily pathways are brought together in a given place location with low levels of guardianship, crime will be higher. A quasi-experiment methodology included crime statistics and social disorganization variables within the city's block group locations to compare areas based on matched social disorganization scores to determine the adverse impact of bus stop locations. From this perspective a second research question for this project included:

2. Do bus stop locations have a detrimental secondary affect on crime within block group locations after all social disorganization variables are controlled for within comparison block groups?

The final objective of this dissertation was to conduct a systematic qualitative analysis of the physical attributes and social movements that surround the built environment of high crime bus stop locations. These locations were analyzed in terms of defensible space and crime pattern theory. According to these theories, areas with low natural surveillance and poor image should have higher crime rates. In addition, crime pattern theory predicts areas with lower crime will have higher defensible space, less pedestrian traffic and less empirical physical and social disorder.

3. Do high crime bus stop locations also exhibit signs of physical disorder, social movements conducive to crime, and low natural surveillance from surrounding businesses and/or residential housing?

CHAPTER IV

METHODOLOGY

<u>Research Design, Data Defined</u>

PART I

Unit of Analysis

This study analyzed the effects of social disorganization and residential stability on official crime statistics over two years (1999-2000) at the block group level. The use of these dependent variables is contemporaneous to the timing for the 2000 census allowing for proper causal order. Since the census count actually took place in 1999 with results being publicly available in 2000, the contemporaneous crime data actually occurred during the time of the census data collection and one year later. This allows testing the causal prediction of census demographic data with the given crime data. The data was spatially geocoded and aggregated to 114 block group locations from the Midwest urban city that was utilized for this study. Selected crime incidents were mapped using ArcView 8.1 software according to individual addresses of each incident recorded by the local police department.

The underlying theories presented for this research dissertation provided the foundation for conducting a spatial analysis at the neighborhood level. Construct validity was determined by how well the study stays focused under the confines of its purpose and theory. Since spatial crime analysis deals with the specific geographic areas in which the crime takes place, emphasis was placed on the locations of the crime incident data and social ecological variables present within the block group units of analysis.

Differences from Sampson et al., (1997) Chicago study

This study made use of the most recent census data from the year 2000 to analyze covariances within two years of crime incident data. Since both crime and ecological factors are seen as concentrated and stable (Spelman, 1995) 2000 census data was seen to be close enough in time to predict 1999 and 2000 crime data. A difference between the Chicago study and the city used for this research was the use of 1990 and 2000 census data. In addition, the city site used for this research had a 2000 census total population of just over 114,000 compared to Chicago's 1990 population of 2,783,726. However, this dissertation study included a test for external validity of collective efficacy theory by using a smaller urban setting. Subtle changes in variable comparisons were due to the different demographics between these cities, and every attempt was made to ensure constructs determined through a factor analysis remained conceptually the same.

The dissertation conceptual model allowed for minor adjustments in terms of selecting disorganization indicator variables from the original Sampson et al., (1997) study. Differences in two variables reflect differences in the given unit of analysis and the results of the primary component analysis. For example, all minorities are accounted

for within the dissertation data rather than separating African-Americans as was done in Sampson et al., (1997). Considerations for limitations of producing a summary component for all minorities were evident. Part of this limitation results in the possibility of ignoring the effect that one minority group has over another minority group. However, in accounting for the latent construct for concentrated disadvantage, the dissertation attempted to include predictor variables of all ethnic isolation in determining spatial areas where these levels were most concentrated. Areas with the highest risk families, greatest ethnic isolation, highest unemployment and public assistance, and largest proportion of youth were defined conceptually as concentrated disadvantage.

The other difference from the Sampson et al., (1997) study and the dissertation research consisted of indicators for immigrant concentration. Sampson et al., (1997) achieved factored indicators from Latino and foreign-born. The Latino population in the dissertation unit of analysis was too low to account for its own factor score. In addition, Sampson et al., (1997) use of Latino as an indicator for foreign-born may be misleading since many Latinos are second or third-generation citizens and not necessarily under the same constraints as new immigrants. Based on past research, it has been found that new immigrants exercise less collective efficacy (Butcher and Piel, 1998). For this reason, separate loadings for foreign-born and speaks little to no English were deemed better predictors for immigrant concentration within the dissertation model.

The dissertation model still reflects a test for the effects of disorganization variables on crime and the hypothesized mediating impact of collective efficacy. Unlike Sampson et al., (1997) this mediating effect was only tested at the aggregate block group level through census residential stability variables and not through individual surveys of

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residents. Following the tradition of the Chicago School, indicating variables selected for

this dissertation represented block groups that can be defined as disorganized based on

their given demographics. Shaw and McKay focused their research on indicators of

social decay, such as poverty and high unemployment rates. These rates were used to

demonstrate why crime is a normal response to specific social, structural, and cultural

characteristics of the neighborhood ecosystem. Within their model, their independent

variables represented the economic conditions by square-miles as well as heterogeneity

and population turnover. Variables used for this dissertation followed this example. A

breakdown of the variables used for the dissertation and the sources of those variables

appear in Table IV.1. A more extended definition of these variables proceeds Table IV.1.

Table IV.1. Definition of variables.

Variables	Measure	Data Source
Dependent		
Armed/Unarmed robberies, alcohol/narcotic violations, assaults, disorderly conduct, domestic abuse, truancy, obstruction, weapon violations	Crime	Official violent and disorderly incidents recorded over six-year period by the municipal police department within the main unit of analysis
Independent		
Poverty	Income below federally set threshold	U.S. Census Bureau (www.census.gov)
Public assistance	Households receiving government income	U.S. Census Bureau (www.census.gov)
Female-headed household	Families headed a woman	U.S. Census Bureau (www.census.gov)
Unemployed	Residents 16 years and over part of civilian labor force and classified as unemployed	U.S. Census Bureau (www.census.gov)

Table IV.1. Definition of variables (cont.)

Variables	Measure	Data Source
Independent		
Youth	Individuals below age 18	U.S. Census Bureau (www.census.gov)
Minorities	Summary-scale of all non-white residents	U.S. Census Bureau (www.census.gov)
Does not speak English	Summary-scale for those who answered does not speak English very well or at all on their census survey	U.S. Census Bureau (www.census.gov)
Foreign-born	Any resident not born in the United States	U.S. Census Bureau (www.census.gov)
Owner-occupied housing	Residents who own their home as opposed to rent	U.S. Census Bureau (www.census.gov)
Living is same residency 5 years or longer	Residents who either rent or own and have lived at the residency 5 or more years	U.S. Census Bureau (www.census.gov)

Variables Defined

Dependent (endogenous) variables: Crime Incidents

Crime incidents include offenses reported to the police that they record which

may or may not end in an arrest. A selected mix of disorder and violent crimes were

included in an SEM model test, unlike other tests of social disorganization that look

solely at violent crime. In this manner, this study attempted to extend the work of

Sampson et al., (1997) by testing their theory against multiple crime incidents, which are

believed to most frequently affect users of public transit. A two-year total of 7,914

incidents was used for analysis and included armed/unarmed robberies, alcohol/narcotic

violations, assault, disorderly conduct, domestic abuse, obstruction, truancy, and weapons violations. In addition, any incidents that were coded as occurring indoors (e.g. inside an apartment or family dwelling) were excluded from the analysis. This allowed for only an analysis of 'outdoor' incidents since it is theorized that collective efficacy, and especially guardianship, discourages crime through naturally occurring surveillance within outdoor geographic spaces. The exclusion of 'indoor' crimes is also unique from Sampson et al., (1997) research.

Within an initial factor analysis, crime incidents loaded separately from the indicator census variables. Attempts were made to separate incidents into two factors (i.e. nonviolent and violent crime), but this was not successful. For purposes of hybrid model testing, all incidents became part of a summary scale used as a total crime main effect exogenous variable. As suspected, criminal incidents per block group varied substantially ranging from 1 to 594 per block group, with an overall mean of 68 (SD=87). This finding supported past research that has shown a clustering of incidents in place specific neighborhood-level locations (Sherman, 1995). Therefore, a log transformation of the incident data was used to normalize the variable (Keene, 1995) as is commonly done with crime data before beginning the structural equation model test.

Independent (exogenous) Variables- Concentrated Disadvantage

The following indicator variables represent the aggregate-level ecological replication of Sampson et al., (1997) study. These exogenous variables were all seen as indicators for social disorganization that are positively related to crime and negatively related to collective efficacy. The indicating variables were factor analyzed into two

categories representing concentrated disadvantage and immigrant concentration as

directed by Sampson et al., (1997). The following include variable definitions as

specified by the US Census main webpage.

1) Poverty- Following the Office of Management and Budget's (OMB) instruction, the Census Bureau sets income thresholds that vary by family size in determining poverty levels. If a family's total income is below the threshold, they are determined to be below poverty.
2) Public assistance- Includes any households that receive government public assistance income
3) Female-headed household- Families headed by a woman with no husband present.
4) Unemployed- Community members ages 16 and over who are part of the civilian labor force and classified as unemployed.
5) Youth- Individuals who are below the age of 18.
6) Minorities- Summary scale of all non-white respondents.

In terms of minority percentage, Sampson et al., (1997) used African-Americans

as an indication of concentrated disadvantage and Latinos as an indication of immigrant

concentration. This study differed by combining all minorities into one group as an

indication of concentrated disadvantage. This type of summary scale of non-white

residents is limited in terms of not justifying the potential impact of racial differences that

could have a varying effect on how disorganization is spatially defined or correlations to

crime are determined. Because of the low percentages of Latinos within the given unit of

analysis, the factor scores would not load Latino or African-Americans into a separate

construct. Combining all minorities within one category is ideally not a good indicator of

racial clustering since racial groups will naturally vary in terms of attitudes, customs, and

residential housing location. However, when combined, the minority variable did load

heavily on the concentrated disadvantage construct.

Despite these limitations, the minority variable indicator appears to measure racial

isolation and can serve as an indicating variable for disadvantage. As an indicator, the

minority variable loaded highly on the same construct as poverty, unemployment, public assistance, female-headed household, and youth variables. This finding indicated that the percentage of minority clustering within a block group, when combined with poverty, unemployment, public assistance, female-headed households and youth, serves as an indicator of ethnic isolation, which is attributed to social disorganization (Sampson, 1998).

Other researchers have argued using census tract data that divorce and female-headed households reflect disruption of family life and are expected to attenuate community social control (Felson and Cohen, 1980; Cohen and Felson, 1979). These disruption factors were hypothesized to increase the number of criminal incidents in areas that report high disadvantage with the percentage of reported female-headed households being one indication of disadvantage. Along with labeling these households as part of the disadvantage concept, Felson and Cohen (1980) also argued that these situations signify a lack of guardianship and potential increase for victimization. Therefore, block groups that have a high proportion of single-parent households and are otherwise disadvantaged, present a more attractive crime target than areas with strong families.

Felson and Cohen (1980) provide further empirical support for their arguments by showing that changes in households had a significant and positive effect on crime trends in the United States from 1950 through 1972. Their conclusion stated that "the convergence in time and space of suitable targets and the absence of capable guardians can lead to large increases in crime rates without any increase or change in the structural conditions that motivate individuals to engage in crime" (Cohen and Felson, 1979, p. 604).

Independent (exogenous) Variables- Immigrant Concentration

The concept immigrant concentration included indicators for the percentage of individuals who do not speak English very well or at all in place of Latinos. Again, since the given unit of analysis did not have as large of a population to draw from or ethnic diversity as the Chicago study, not enough Latinos were present for a separate factor. Individuals who do not speak English very well or at all may be measuring the same construct, immigrant concentration, which Latinos measured in the Chicago study. In addition, foreign-born citizens were also found to be an indication of immigrant concentration. Within this variable selection, there is the possibility of double counting individuals who classified themselves as both minority and foreign-born. It is impossible to separate these two indicators from the given census data. It can further be argued that the given theoretical foundation of social disorganization and spatial crime analysis calls for measuring the impact of both foreign-born immigrants and minority concentration, even if these individuals are double counted.

Sampson et al., (1997) researchers utilized Latinos as being part of the immigrant concentration construct. However, second and third generation Latinos who were born in the United States should no longer be considered foreign-born, yet under the Sampson et al., (1997) model, these individuals are still being included in the immigrant concentration category. When dealing with factoring independent crime predictors, the principle guide should be directed by the theoretical foundation. In addition, factor scores utilized were not forced for the given analysis, meaning that scores were free to vary. The given dissertation model is based on the factor analysis and serves as a best

attempt for completing a modified version of Sampson et al., (1997) collective efficacy hypothesis within a different unit of analysis.

Independent (endogenous/mediating) Variables- Residential Stability

Residential stability included the percentage of owner-occupied housing and percentage of housing (rental or owner-occupied) that have had the same residents for at least five years. Selection of these indicators for residential stability represent collective efficacy and also follows Coleman's (1988) social capital theory, which argues that shared territory and responsibility over one's space promotes social capital. In addition, higher levels of social capital equate to more commitment to residential stability and deterring disorder and crime. Findings have shown that higher levels of social capital relate to lower levels of resident-reported crime and physical disorder (Rosenbaum, 1994; Skogan, 1990). Based on these findings, it was hypothesized that a different residency during the past five years lowered overall territoriality for place specific locations and was not expected to correlate with other residential stability factors. However, there is no indication of how long collective efficacy takes and it is quite possible that residents who have moved into an already existing cohesive block group would be able to exhibit territoriality within a five-year period. Despite the potential for this problem, these variables are the best census-level indicators for neighborhood stability.

PART II

Quasi-Experimental Design for comparing bus stop locations to non-bus stop locations

The second part of the dissertation research design compared block group locations in terms of crime incidents and bus stop presence. During this stage, the chosen

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quasi-experimental research design attempted to address the second research question and answer if bus stop locations predict higher spatial crime. This part of the dissertation moved from an entire city social disorganization model test to a more specific block group comparison between bus stop locations and non-bus stop locations. Brantingham and Brantingham (1981) referred to this process as the cone of resolution in terms of a spatial research project moving towards a more narrowed focus.

Potential internal validity threats are a possibility in quasi-experiment al designs since randomized assignment has not been achieved (Cook and Campbell, 1979). In order to ensure procedural validity and evidentiary reliability of these findings, the research accounted for error rates. The error rate refers to a probability statistic (i.e., significance test) for accepting the results as true, when it may actually be false (Bachman and Paternoster, 1997). The erroneous rejection of the null hypothesis is referred to as a Type I error. It is important to acknowledge the error structure of this study as this serves as an indication of the reliability. Studies that fail to acknowledge and confront issues of error rate risk losing credibility. The error rate is determined by calculating an estimation of a population characteristic that summarizes the data that was collected. Next, that statistic is compared to the degree of chance allowed. It is convention in social science research to see the error rate at 5 percent or less (Cohen and Cohen, 1983).

Specific assumptions are typically made in order for certain statistical tests to be applied to the data in addition to calculating error rates. The most critical assumption is that the units of analysis (e.g., survey respondents) are randomly selected from the population or randomly assigned to experimental and control groups (Babbie, 1998) to

limit potential spurious effects. The results of these random assignments are as reliable as the set error rate. However, in place-based crime research, it is not always practical to randomly assign the units of analysis. For example, it is not feasible to randomly assign bus stops to specific experimental locations in the city and assign other bus stops to control areas in order to determine if crime increases or decreases around bus stops relative to the control areas. Bus stop locations are built for transit user convenience rather than research practicality.

In these particular instances, adherence to professional scientific standards is necessary to insure methodological integrity and validity of the study. This part of the dissertation attempted to match block groups according to similar social disorganization attributes in the geographical areas surrounding the bus stop locations and compare those with a bus stop and those block groups without a bus stop location. Instead of utilizing a randomization technique, the matching strategy approximated a control function for determining potential differences in crime rates surrounding locations with or without bus stops present. This quasi-experimental approach looked at whether certain public space structures (i.e., bus stop locations) caused adverse secondary effects on crime, meaning the bus stops could facilitate crime problems by increasing available targets (i.e., opportunities) in areas that may contain motivated potential offenders.

Scientific criteria for matched comparisons

In this second part of the dissertation, the impact of bus stop locations on crime was considered. Under this type of contextual analysis, various criteria were met in order to insure proper implementation of the study. First, in order to make accurate

comparisons, control areas were statistically selected that were equivalent to spatial areas with bus stop locations. Variables used for matching comparisons were tested and analyzed through the first part of the dissertation. Since crime rate comparisons are the main research purpose, variables related to crime were again utilized, such as similar concentrated disadvantage constructs, immigrant concentration, total population, and residential stability. Second, an adequate amount of crime data over an extended period was necessary to insure that the research study was not detecting some erratic pattern of activities that only lasted for a month or year. The use of two years of crime data for analysis provided some stability for the estimates of the potential effects of bus stop locations. Third, the crime rate should have been measured according to the same valid sources for all areas considered. The same dependent crime variables used in the model testing of collective efficacy were used for the quasi-experimental comparison research. Cook and Campbell (1979) point out the importance of matching the dependent variables so that the same information sources for the control and experimental sites are used throughout the entire comparison study. It would not be accurate to measure calls for service or arrests in non-bus stop locations and criminal incidents in the bus stop locations. Therefore, only criminal incidents were compared between the control block groups (i.e., no/few bus stops) and the experimental block groups (i.e., many/some bus stops).

Summary of strengths from the quasi-experimental research design

Specific criteria were used to insure this quasi-experimental design of

secondary crime effects was conducted on the bus stop presence. First, in an effort to make a valid and fair comparison, locations without bus stops were selected that is equally comparable to areas with bus stop locations. Second, an adequate amount of time (i.e., two years of crime data) was utilized in an effort to adjust for any eradicate or temporary patterns in offender activity or police presence. Third, criminal incidents were used as the main dependent analytical variable for all areas of comparison as factually compiled and supplied by the local police department. Calculated error rates were used to determine if there are any differences between areas with bus stop locations and comparison areas and if these differences are due to chance or true dissimilarities.

Matching bus stop locations and comparison areas on social disorganization variables

In an effort to add credibility to the results, it was critical that areas surrounding bus stop locations and the comparison areas were matched in terms of social disorganization variables addressed in Part I of the dissertation's model test. Past research has shown links between crime hot spots and high levels of poverty (Cohen, 1993) and disadvantage (Sampson, et al., 1997). Also family disruption variables should be controlled for since hot spot locations have also been shown to be associated with low family cohesion (Cohen, 1993; Sampson, et al., 1997; Sherman, 1995). Since both routine activities (Cohen and Felson, 1979) and defensible space (Newman, 1973) predict higher population densities effect crime, total population was also equalized in bus stop locations and the comparison locations. All of these matching strategies were critical for adding to the credibility of the results that were obtained in order to determine if bus stop

locations alone had secondary crime effects on spatial locations and not other spurious factors.

Independent t-tests for the equality of means for controlling the independent social disorganization variables were used to compare the bus stop locations against comparison locations. If these statistical tests do not reach statistical significance according to the preset alpha level ($p<.05$), then this meant that the comparison and bus stop location areas did not statistically differ from one another and can be considered well matched. These statistics also help to insure that any differences in crime incidents that are later found were actually the result of the presence or absence of bus stop locations and the not the result of a contaminating outside variable. This also added to the internal validity of the quasi-experimental comparison or what has been defined as:

> "The extent to which differences observed in the study can be unambiguously attributed to the experimental treatment itself, rather than to other factors" (Campbell and Stanley, 1966).

In the dissertation quasi-experiment, the presence of the bus stop is seen as the 'treatment' with the prediction that a positive correlation will exist in terms of increased bus stop concentration and increased recorded crime.

Spatial Autocorrelation

In comparing bus stop and non-bus stop locations it is quite possible that other bordering block groups' variable data contributes to crime incidents in other block groups. Spatial autocorrelation allows a test to determine the effect of these issues before generalizing specific findings. Spatial autocorrelation deals with the values of one location being dependent on the values observed at a neighboring block group location.

As part of the first law of geography, everything is related to everything else, but near things are more related than distant things. Spatial autocorrelation is valued when an understanding of the relationship between place and crime also requires the knowledge of the dynamics of hot spot development over time (Anselin, et al., 2000).

The spatial autocorrelation coefficient is determined by modeling the spatial covariance between pairs of observations as it changes with distance (Baller et al., 2002). There are a variety of techniques for testing spatial autocorrelation including time series analysis (vector autoregression), quadrant count, kernel estimation, moran scatterplots, or other distance-based statistics. These techniques represent a specialized method for conducting spatial regression analysis (i.e., spatial econometrics) in order to avoid the potential of receiving biased results and faulty inferences due to the presence of spatial dependence (Anselin et al., 2000). Findings of minimal spatial autocorrelation would mean that the values within an observed location are not dependent on the values observed at a neighboring location. This also means that the spatial pattern of values is just as likely as any other spatial pattern. This can be determined by simulating randomized crime clustering and then comparing actual rates.

Spatial autocorrelation is found to exist in areas where similar values cluster in space and neighborhoods (i.e., block groups) are judged compatible or otherwise similar. Studies that utilize several years of crime data should test for the impact of spatial autocorrelation in better determining the impact of bordering units of analysis. Positive spatial autocorrelation is common in finding crime patterns in which neighboring areas are alike and crime is statistically clustered into hot spots. Spatial autocorrelation can be a problem similar to multicollinearity, meaning the variable data may not be independent

of one another. In other words, the occurrence of a criminal event in one block group

may increase, or constrain, the probability of the occurrence of an additional crime in a

neighboring block group.

Part III

Qualitative analysis of top hot spot bus stop locations

In reference to Brantingham and Brantingham's (1981) recommendation of

conducting research through a cone of resolution, the final step for this spatial analysis

project was directed towards qualitatively inspecting the surrounding locations in the top

hot spot bus stop locations. A total of 638 bus stop locations were mapped to the 114

block groups in the city used for the dissertation. The locations of each bus stop location

came from a database given to the researcher from the main bus company. These

locations were recorded by the bus company in 1999, so links closely matched both the

criminal incident data and the census variables. From the mapping software, those bus

stop locations that contain the highest amount of criminal incidents over a two-year

period were highlighted and analyzed qualitatively through systematic observation.

Sampson and Raudenbush (1999) note that direct observation is fundamental to

the advancement of knowledge and Reiss (1971) advocates systematic observations as a

key measurement strategy within natural social phenomena. By systematic, Reiss calls

for observations and recording devices that are completed according to explicit rules that

can be later replicated. Therefore, a checklist for defensible space and crime pattern

concepts was developed allowing for future replication. Physical disorder attributes that

surround these bus stop locations were through systematic nonparticipatory observational

research. In order to reach uniformity within each bus stop observed, the coding sheets filled out for each bus stop location chosen will be rated on the presence or absence of the same physical attributes.

Empirical measurements of physical disorder are referenced by deterioration of urban landscapes. According to Sampson and Raudenbush (1999), this can include graffiti (i.e., in or near the bus stop location), abandoned cars, broken windows, and/or garbage on the streets. Hunter (1985) referred to the visible evidence of disorder as "incivilities" which has also been labeled as central to a neighborhood's public presentation (Goffman, 1963). These incivilities have been connected to both crime and fear of crime (Kelling and Coles, 1996; Skogan, 1990) as well as presenting a signal that space users are unwilling to confront loiters, intervene in criminal situations, or call the police when necessary. Because disorder is seen to trigger predictions about crime from both insiders and outsiders, it was also predicted to have measurable effects on bus stop use or disuse and serve as a catalyst to crime that is more serious.

Observation of "soft crimes," such as those represented by graffiti or prostitution, has been shown to be a reliable measurement for more serious crime (Wilson and Kelling, 1982). A combined quantitative and qualitative study of two Canadian cities also looked at the effects of minor crime on more serious crime (Hagan and McCarthy, 1997). Findings demonstrated a close connection between predatory youth crime and the social/physical settings of public disorder (e.g., open prostitution, vagrancy, vandalism, trash, drug selling). For this reason observation and acknowledgement over the control of social/physical disorder was seen as an important component of both research and crime prevention.

By this stage of the research, it was predicted that visual cues surrounding bus stop locations do matter and systematic observations of these locations should be conducted to see if social and physical disorder surrounding the area is equated with the given crime incidents. In this manner, the association of independent measures of officially recorded data from both the census bureau and the local police department were tested against the systematic observations of high crime and low crime bus stop locations.

Since the research methodology at this stage was nonparticipatory observation, special attention was placed on the physical image surrounding the bus stop locations and specific social movements rather than strictly on social interaction. Although specified as an ecological construct, neighborhood disorder has been researched mainly through individual perceptions and individual-level research methodologies (Sampson and Raudenbush, 1999). Other examples of observational research conducted on units independent of persons or social units can be found in the research of Taylor and colleagues (Taylor, Shumaker, and Gottfredson, 1985; Taylor, Gottfredson, and Brower, 1984; Covington and Taylor, 1991; Perkins et al., 1992; Perkins and Taylor, 1996). Taylor and Harrel (1996) observed the environment of 20% of all occupied face blocks in 66 Baltimore neighborhoods and linked physical incivilities with nonresidential land use. Their findings matched correlations between perceived disorder and fear of crime that were found among neighborhood individual-level survey data.

Very few studies have employed observational ratings across multiple ecological contexts (Sampson and Raudenbush, 1999). Based on the potential benefits that come from direct observation, this dissertation integrated observational research with record-based methodologies at the neighborhood level. Within this type of approach, a more

reliable picture is believed to have been drawn in determining the predicted causes of neighborhood criminality and the impact of bus stops within those neighborhoods. This type of approach is supported through a theoretical framework that accounts for the impact of defensible space concepts, social disorganization and informal social control mechanisms and assumptions that underline routine activities and crime pattern theory.

This segment of the research fell against the backdrop of the higher-level model testing that analyzed residential stability effects and other structural constraints that impede neighborhoods from self-policing. Because illegal activities are seen to feed off the spatial and temporal structure of routine activities, especially within public transit, differential land use of bus stops were taken as a key for comprehending neighborhood crime and patterns of disorder. Thus, the effect of concentrated disadvantage, immigrant concentration, and residential stability were considered in reference with other structural characteristics such as the built environment surrounding bus stops, transit density, and street activity.

CHAPTER V

ANALYSIS AND RESULTS

A fundamental component of descriptive spatial crime analysis is attempting to

answer the "where" question before attempting to answer the question "why." The where

question is directed towards hot spot analysis, which has become one of the most critical

issues facing spatial researchers and administrators since most policy recommendations

are made based on concentrated crime incidents. Limited resources and increasing

demands for policing services require better allocation based on improved spatial analysis

and hot spot identification (Block, 1993). Unusual clustering of events may cause a

recommendation for saturated patrol or research into the underlying social conditions that

may be affecting the proportion of crime incidents in specific locations. Levels of

sophistication used to identify hot spot locations vary. There are basically four types of

analysis used to identify hot spot locations: visual inspection, descriptive mapping, basic

analytical mapping, and advanced analytical mapping (Canter, 1998).

> 1. Visual inspection calls for identifying hot spots based on "pin mapping"
> and officers "knowledge" of an area. However, this method of analysis is limited
> since many officers do not consistently work within the same areas so their
> knowledge may be limited or biased. In addition, studies have found that
> officer's cognitive maps of hot spot areas often differ from where the actual hot
> spots are located according to the given data (Block and Block, 1995).

2. Descriptive mapping of hot spot locations is the easiest method for identifying areas with concentrated crime and is used by more police than any other method (Weisburd and McEwen, 1998). Within these maps, polygons (or in the case of the dissertation block group boundaries) are used to represent a number of events over time and hot spots are created for areas with the highest number of crimes. However, this type of mapping fails to control for other information that can potentially influence crime such as socio-demographic data, land use or population density. These maps are also influenced or limited by boundary issues rather than being able to find hot spots across predefined boundary lines. Thus, how the data is aggregated could influence the map interpretation and different levels of aggregation could mean changes in the location of hot spots.

3. Analytical mapping allows for more sophisticated hot spot recognition showing crime concentration that crosses otherwise predefined boundary lines. For example, hot spots can be identified by determining any cluster of crimes that have a value of two standard deviations above the mean regardless of latent boundary lines.

4. Advanced analytical mapping methodology is based on inferential statistics that analyzes clusters of incidents that cannot be viewed as occurring by chance alone. This type of methodology allows for testing models that account for a number of layered variables within a map and begins to tap into the why question while visual and descriptive mapping answer the where question.

In terms of descriptive mapping, a common practice for both researchers and departmental crime analyzers has been to aggregate point data to a larger unit of analysis such as a census tract, block group, or face block. Within the spatial analysis conducted for this dissertation, crime and census demographic data have been aggregated to the block group level. Before attempting advanced analytical spatial analysis, a fundamental element of any research should be directed towards providing summary statistics of the pertinent variables within these block group locations. Within this process, descriptive statistics accompanied with descriptive maps are presented to numerically and graphically show the breakdown and spatial location of all the pertinent variables used for this dissertation.

Levels of Crime (1999-2000)

The dependent crime variables utilized in this dissertation project represent official incidents recorded by the police within the given unit of analysis. Only incidents that were recorded as occurring outdoors were included for this analysis since these were seen as having the greatest impact on bus stop locations and offered the greatest potential for limiting the opportunities to commit these crimes due to the potential influence of social and/or physical attributes.

The dependent variable data used for this research included incidents coded by police officers as occurring in the following outdoor locations: alley, parking lot/parking ramp, park/playground, yard/field, street, or an undeveloped area. Specific crime locations included intersecting street names and/or specific addresses allowing for this data to be layered into a street map of the given city that was utilized for the given dissertation project. The breakdown of all the criminal incidents (or the main dependent variables) used for this research project is listed in Table V.1.

Table V.1. Descriptive Statistics of Official Incidents (1999-2000)

Year	Alcohol	Armed Robbery	Assault	Disorderly Conduct
1999 (rates)	4.49	0.49	1.81	5.92
1999 (raw)	647 (16.27)	71 (0.02)	261 (6.56)	852 (21.42)
2000 (rates)	4.42	0.36	1.68	5.45
2000 (raw)	637 (16.18)	52 (1.32)	242 (6.15)	785 (19.94)
Total (rates)	---	---	---	---
Total (raw)	1284 (16.23)	123 (1.55)	503 (6.36)	1637 (20.68)

NOTE: Total crime rate is standardized per 1,000 residents living in each block group location. Raw statistics are followed by percentage of total crime in parentheses.

Table V.1. (cont.) Descriptive Statistics of Official Incidents (1999-2000)

Year	Domestic Abuse	Narcotics	Obstruction	Truancy
1999 (rates)	1.52	4.93	5.99	1.09
1999 (raw)	219 (5.51)	710 (17.85)	863 (21.69)	157 (3.95)
2000 (rates)	1.31	4.64	6.09	2.15
2000 (raw)	189 (4.80)	668 (16.97)	877 (22.28)	310 (7.87)
Total (rates)	---	---	---	---
Total (raw)	408 (5.15)	1378 (17.41)	1740 (21.99)	467 (5.90)

NOTE: Total crime rate is standardized per 1,000 residents living in each block group location. Raw crime statistics are followed by percentage of total crime in parentheses.

Table V.1. (cont.) Descriptive Statistics of Official Incidents (1999-2000)

Year	Unarmed Robbery	Weapons	Total
1999 (rates)	0.63	0.73	27.62
1999 (raw)	92 (2.31)	105 (2.64)	3977
2000 (rates)	0.36	0.87	27.34
2000 (raw)	52 (1.32)	125 (3.17)	3937
Total (rates)	---	---	---
Total (raw)	144 (1.82)	230 (2.91)	7914

NOTE: Total crime rate is standardized per 1,000 residents living in each block group location. Raw crime statistics are followed by percentage of total crime in parentheses.

Table V.1 represents a descriptive breakdown of all 7,914 criminal incidents used for this analysis over the two-year period. In both years, obstruction constituted the most incidents recorded with 22 percent of the total. Next was disorderly conduct with 21 percent of the total incidents recorded. Both these incidents also had a rate of 5.9 per 1,000 people. These incidents offer the police a great deal of discretion in terms of exercising their authority. According to the city ordinance, obstruction is defined broadly as any action that makes it more difficult for the police to carry out their duties. Disorderly conduct is also defined broadly as any act that endangers self, others, or otherwise deprives inhabitants of the peace they are entitled. Not surprisingly, violent offenses of armed and unarmed robbery appeared least in comparison with the other

incidents used for analysis making up a little more than three percent of the total crime incidents recorded in 1999-2000.

Since youth is a variable measured in Sampson et al., (1997) factor analysis, truancy was also included within the dependent variables. Both Sampson et al., (1997) and the dissertation research measured the youth variable by the percentage of the population under 18 years of age. Within the city utilized for the dissertation, the researcher learned from first-hand account that truancy and loitering youths at the main city bus terminal was an on-going problem that many transit users had brought to the attention of both the police and private security officers that worked at the terminal. In an effort to alleviate this problem, in 2000 the city introduced additional community police officers to the bus terminal during school hours and greatly increased recorded incidents of truancy. This strategy greatly increased police presence within the main bus terminal[2]. However, no research was conducted to measure potential displacement effects or the potential for crime to move away from the terminal after an increase in police presence. The year 2000 accounted for 43 percent of truancy incident data over a six-year period beginning in 1995. Most of these truancy incidents (87%) were mapped to the main city bus terminal.

In addition to total crime numbers, crime rates per 1,000 residents within each block group were also calculated to standardize incident data according to total population within each block group. The calculation of the crime rate allows more meaningful comparisons to be made spatially between different block groups. However,

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[2] In an unrelated research project, it was found that public police and private security officers rated their relationships more highly as increased non-dispatched contact was made during these truancy (or "community policing") sweeps at the main bus terminal (Kooi, 2001).

there is also an assumption being made that the rate calculated for each block group means that areas with a low population are more at risk. This assumption may not be warranted since movement between block groups are more fluid and risky block groups may be more attributed to land use (e.g., presence of taverns, bus stops, liquor stores, etc.) rather than total population. For this reason, both crime rates and raw crime figures are displayed where appropriate. Rates were calculated per year in Table V.1 but it was not intuitive to give these rates over the combined two-year period.

Answering the 'where' question and addressing problems with point-analysis

Geocoding official crime statistics is a method of specifying the location of a crime incident, emergency call for service, or arrest within official statistics. Each of these three official crime recordings offers benefits and limitations and hot spot locations can vary depending on which data source is utilized within the map. In addition to using different data sources of official statistics, single data source hot spot identification can also vary by different methodologies including simple visual interpretation of point data to calculating the standard deviational ellipses of raster map images (Jefferis, 1998).

Most police departments have remained simplistic in plotting incident locations on a base map (Eck, Gersch and Taylor, 1997) and then visually interpreting the distribution of crime (Mamalian and LaVigne, 1999). About 25 percent of large departments[3] use a variety of software packages for hotspot identification purposes, but very few use any type of statistical spatial analysis. Several problems exist in regards to interpreting point maps without the use of some type of statistical software. Repeated incidents may be represented by overlapping points making the map uninterruptible in

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[3] Large departments have been defined as 100 police officers or more (Mamalian and LaVigne, 1999).

terms of actually knowing where crime is clustering. In addition, research among map-readers found visual interpretation differences regarding cluster perceptions (Sadahiro, 1997). Therefore, bias results are probable when blindly interpreting simplistic point maps.

It is often difficult to interpret point maps in terms of face validity since many points (i.e., incidents) may fall on the border of block groups. In these cases, it becomes difficult to interpret if an incident actually falls within a specific "neighborhood" or not. As a whole, the field of spatial crime analysis lacks a systematic methodology for comparing and utilizing appropriate techniques within either visual or statistically computer aided hot spot identification. However, there have been suggestions made for creating more statistically robust crime maps (Chainey and Reid, 1999; Williamson et al., 1999) and moving to more advanced analytical mapping methodologies.

One technological effort is a software package developed by the Illinois Criminal Justice Information Authority called Spatial and Temporal Analysis of Crime (STAC). The STAC software was created in response to requests by local law enforcement administrators who wanted to improve their crime spatial analysis capabilities. The STAC software is able to locate clusters of criminal activities by automating various analytical functions such as the time of day, month, season, etc. In addition, the program calculates statistical summaries of hot spot areas without being restricted by jurisdictional boundary lines or temporal issues. The STAC software overlooks artificial boundaries and summarizes point data through complex algorithms (Block, 1993) taking into account space and time. This type of software and robust statistical analysis serves as an improvement over aggregating crime data to census tracts and block groups and then

determining those predefined boundary areas that have the highest amount of crime. Often times hot spot areas cross-jurisdictional boundaries and software that is more advanced is necessary for locating those hot spot locations.

In addition to aggregation issues involving borders and locating hot spot locations, there is also the issue of hot spotting by year, month, day, or time. It is possible that hot spot locations will change when comparing specific temporal issues. Place level theory testing must account for these temporal issues when attempting to answer the 'where' question while arguing that crime is not a randomized event but takes place due to increased opportunities in particular locations and at particular times.

Findings showing that crime often tends to concentrate in relatively small places or hot spots (Sherman and Weisburd, 1995; Maltz, Gordon and Friedman, 1990; Pierce, Spaar, and Briggs, 1988; Weisburd, Maher, and Sherman, 1992) has been accepted throughout the criminological field. In addition, temporal elements invariably affect crime rates. For example, early and current research has found similar patterns for city level data showing that property crimes are highest in the fall and winter and crimes of aggression peak in mid-summer and are lowest in January (Cohen , 1941; Block, 1983; Anderson, 1987). Table V.2 shows that data used in this dissertation shows temporal indicators of crime. These temporal issues persisted over a five-year period and during the main two years (1999-2000) that were critically analyzed throughout the dissertation.

Table V.2. Monthly crime incidents from 1996-2000.

Months	1996	1997	1998	1999	2000	Total
Jan	205 (6)	195 (6)	246 (7)	219 (5)	219 (5)	1276 (6)
Feb	188 (6)	262 (8)	257 (7)	260 (6)	337 (8)	1483 (7)
Mar	221 (7)	235 (7)	258 (7)	258 (6)	315 (8)	1588 (7)
Apr	235 (8)	239 (7)	252 (7)	365 (9)	322 (8)	1692 (8)
May	247 (8)	267 (8)	308 (8)	382 (10)	396 (10)	1879 (9)
June	280 (9)	310 (9)	342 (9)	397 (10)	395 (10)	2086 (10)

Table V.2. Monthly crime incidents from 1996-2000 (cont.)

Months	1996	1997	1998	1999	2000	Total
July	324 (10)	342 (10)	363 (10)	397 (10)	385 (10)	2217 (10)
Aug	367 (12)	318 (10)	331 (9)	406 (10)	410 (10)	2219 (10)
Sept	307 (10)	351 (11)	341 (9)	401 (10)	351 (9)	2074 (10)
Oct	293 (9)	308 (9)	344 (9)	370 (9)	334 (8)	1966 (9)
Nov	261 (8)	233 (7)	294 (8)	291 (7)	266 (7)	1311 (6)
Dec	192 (6)	226 (7)	250 (7)	228 (6)	203 (5)	1279 (6)
Total	**3120**	**3286**	**3588**	**3977**	**3937**	**21290**

NOTE: Incidents are totals from armed/unarmed robberies, assaults, domestic abuse, disorderly conduct, weapons, alcohol/narcotic violations, obstruction, and truancy. Yearly percentage breakdowns appear in ( ).

Within Table V.2, the warmer months appear to be a clear indication that the given crime incidents remain higher than in colder months. The months of July and August both have double-digit percentages for crime concentration in all six years of data in comparison to other months. Clearly, Table V.2 shows a seasonal temporal pattern for the given incident level crime data.

Contemporary 'opportunity' theories used as a framework through the dissertation, such as routine activities, crime pattern theory, and rational choice [4] provide the foundation for analyzing these seasonality temporal crime issues. For example, routine activities theory (Cohen and Felson, 1979) reports that opportunities to commit crime are concentrated in time and place with temporal differences having an effect on the convergence of 1) motivated offenders, 2) worthy targets, and 3) the absence of capable guardians. Seasonality can affect one or all three of these components within routine activities theory in a number of ways. Hylleberg (1995) produced a structural model that grouped several exogenous variables of crime causation into classes of seasonality such as school vacation days, weekends, and weather issues. The argument made was that time of the year and specific days affect opportunities to commit crime

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[4] Felson and Clarke (1998) provide an overview of opportunity theories.

since offender and victim routine activities will vary according to the day of the week, time of the day, and climate. Cohen and Felson (1979) and Felson (1987) had similar findings in determining levels of risk were highest during the evening weekend hours since potential offenders and victim paths are more likely to cross without the presence of adequate guardianship.

Within the mapping analysis over the critical two-year data period used in the dissertation, it was apparent that concentrations of crime incidents were disproportional within specific areas of the city. Spelman (1995), along with Shaw and McKay (1942), found that spatial patterns in crime persisted and were generally spatially and temporally stable. These findings were backed by the data mapped in the dissertation research. This means that hot spot block groups did not change year to year. Hot spot block groups were determined by dividing crime up equally for each year into five quartiles. Block groups with the largest (i.e., most extreme) quartile of crime were shaded and labeled as the hot spot block group for that year. Also, both 1999 and 2000 data can be combined to calculate hot spot locations over a 24-month time period.

There are several different techniques designed to identify hot spot locations (Sherman, et al., 1989). Since criminals and incidents of crime do not respect governmental boundaries, it becomes necessary to measure crime clusters without the restriction of predefined boundary lines. In addition to aggregating all crime data to block group locations for hot spot analysis, the more advanced analytical version of hot spot identification was conducted through a similar software to STAC called CrimeStat (Levine, 1999). This software utilizes a partitioning technique or what has been frequently referred to as the K-means technique. Within this process, crime incidents are

partitioned into a specific number of groups according to how closely they occur to one another spatially. This process operates as a technique for hierarchically clustering criminal incidents together according to their spatial proximity. The clustering is repeated until all points appear in a cluster. The software displays the highest clustering in ellipses on the map. For demonstration purposes, a single ellipse appears in the map figures presented throughout this dissertation representing clustering of criminal incidents across block groups within the city used for this analysis. The hot spot ellipse closely matches the hot spot block groups for each year of data and for each incident of crime showing overall stability in hot spot locations year to year.

As findings from past spatial studies have indicated, crime incidents do cluster in terms of space once mapped according to the location that police officers or dispatchers recorded they occurred. Within the data used for the dissertation, not only did yearly incidents not vary much in terms clustering, different crime types also did not vary substantially in terms of concentration. For example, during the two-year period hot spot crime rates for incidents of alcohol violations, armed robberies, assault, disorderly conduct, domestic abuse, narcotic violations, obstruction, and unarmed robbery all appear at the same single block group location. Only truancy and weapons violations appeared slightly different with an expanded multiple hot spot block group. Each individual crime type was mapped to block group locations and is presented in Figures V.1-V.3. In addition, Figure V.4 shows total raw crime hot spot block group locations and the areas with the largest number of clustered bus stop locations. Following the pattern of identification in the first three figures, the number of incidents occurring in each block group location was split into five quartile classifications. Block groups that contained the

highest number of criminal incidents are shaded representing hot spot block groups. The ellipse indicated by the CrimeStat software for hot spot identification of all crime incidents is used for comparison purposes.

Figure V.1. Two years crime rate for alcohol, armed robbery, assault, disorderly, domestic abuse, narcotic violations, obstruction, and unarmed robbery and total crime hot spot block group and ellipse.

1999-2000 Total Crime

CRIMERAT

	0.00 - 54.05
	54.06 - 161.04
	161.05 - 379.38
	379.39 - 936.91
	936.92 - 4204.55
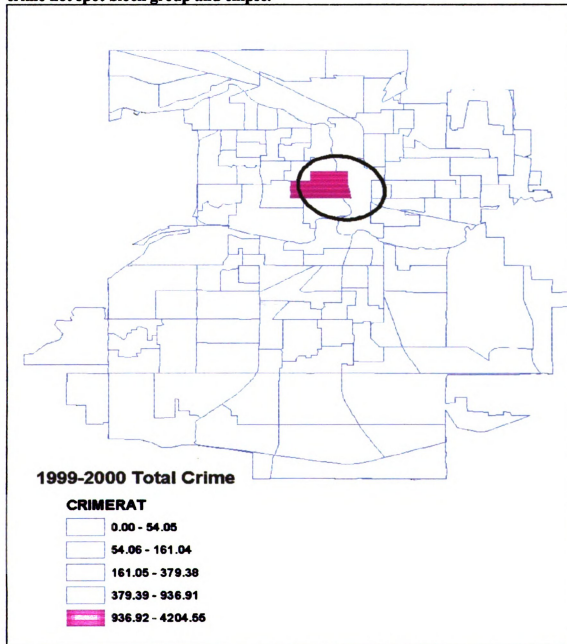
Figure V.1 presents the most concentrated hot spot block group for total crime and multiple other categorized offenses. The legend presents only total crime rate over the two-year period, however the same single block group represents the same hot spot location for each of the given offenses. In other words, when categorizing total crime into the specific offenses utilized for the dissertation analysis, each of these offenses also concentrates at this same block group location. This spatial finding is important for a couple reasons. One, it shows that the spatial data used for this research is fairly concentrated rather than random. Second, it also points out a problem with standardizing the crime incident data through rates. The block group that is highlighted in figure V.1 also happens to have the lowest population concentration.

Part of the problem with standardizing crime rates by population throughout areas as small as block group locations is that some block groups do have a very low populous but high crime. In the given hot spot block group shown in figure V.1, the total population is 44 but there were 185 crime incidents over the two-year time period, meaning the actual high crime rate is 4,204.54 per 1,000 at that block group. Obviously, the 44 people living in the block group are not being victimized at this rate and residents living in other block groups have frequent activities in this block group. Because of this complication with standardizing data into crime rates discussion and presentation of hot spot block group raw crime data precedes the rate calculations and are presented with other hot spot block group incidents.

The raw statistics for calculating the hot spot block group was calculated through the ArcView software dividing up the 114 block group crime statistics into five quartiles. In Figure V.2 this meant that the hot spot block groups contained a minimum of 37

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truancy violations in order to fall in the last or most extreme quartile. Again, this is a raw statistic, but the same finding can be shown through the rate calculation as the main hot spot block group also contains the lowest numbers for block group residential population.

The finding that crime has the highest concentration in low populated areas as per the census calculations is not surprising. Further qualitative analysis of this block group location reveals that this area is mainly commercial and lacks residential areas. A challenging research question evolving from the dissertation looks at how concentrated bus stop locations within these non-residential areas may serve as facilitators for increased crime in areas which contain a high number of motivated offenders and lack of territoriality (Newman, 1973; 1975) or collective efficacy (Sampson et al., 1997).

In figure V.2 the same block group as total crime is highlighted as having the highest concentration of truancy rates. However, a second block group just to the south also makes up the highest concentration of truancy rates. This second block group contains the main bus terminal, which became a target for a community initiative to cut truancy during the years of the data used for this dissertation research. Because of this community policing tactic, it was no surprise to find the large increase of truancy rates at the bus terminal. However, when looking a total crime, the bus terminal remains the prime hot spot for the given unit of analysis. This finding will be explored in more detail throughout the dissertation, but leads directly into the given research questions exploring why routine pathways of transit users accompanied by motivated offenders would produce spatially and statistical crime hot spots at these locations. In addition, when analyzing the mapped data presented in these figures over a two-year time period, what type of response is most appropriate for the community and the police when

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acknowledging potential causes of crime concentrating in these specific areas. Again, these issues will be addressed more uniformly throughout the dissertation.

Figure V.2. Two years truancy hot spot block groups and statistical ellipse.

Truancy
TRUATRAT
	0.00 - 2.64
	2.65 - 8.24
	8.25 - 20.04
	20.05 - 36.94
	36.95 - 272.73
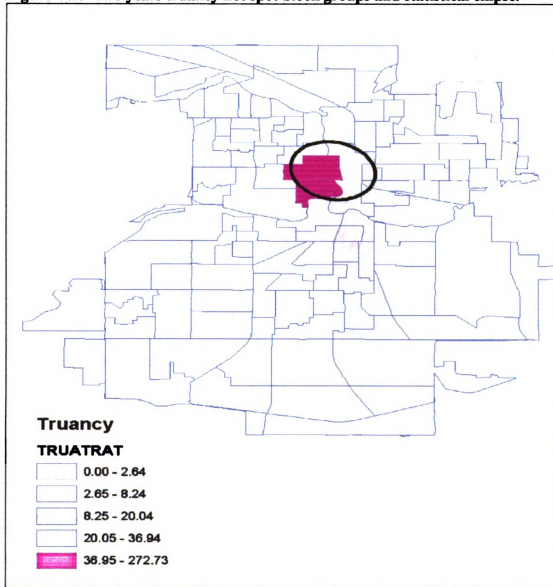
Figure V.3 shows weapon violations and a high concentration of incidents in both block groups highlighted under the truancy data and also a third block group. Interestingly, all three of these block group locations cluster very close together and are stable throughout several years of data (i.e., 1995-2000). There are several possibilities

for why weapon violations may concentrate in multiple block group locations unlike other offenses selected for analysis. However, an exploration of these possibilities is beyond the scope of the current dissertation project.

Figure V.3. Two years weapon violations hot spot block groups and ellipse.

Weapon Violations

WEAPRATE

	0.00 - 0.66
	0.67 - 2.24
	2.25 - 4.27
	4.28 - 7.51
	7.52 - 22.73
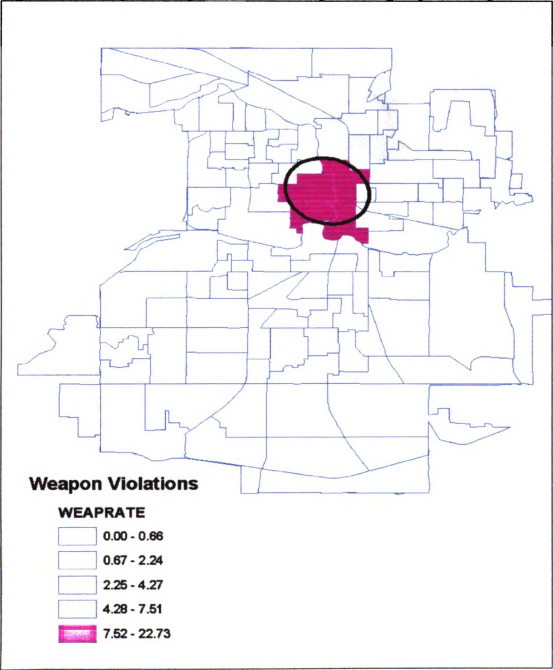
Figure V.4. Total Raw Crime Hot Spots and clustered Bus Stop locations.

Bus Stops — Total Crime

Count_
- 0 - 21
- 22 - 58
- 59 - 133
- 134 - 309
- 310 - 594

BUSSTOP
- 0 - 3
- 4 - 7
- 8 - 13
- 14 - 18
- 19 - 25
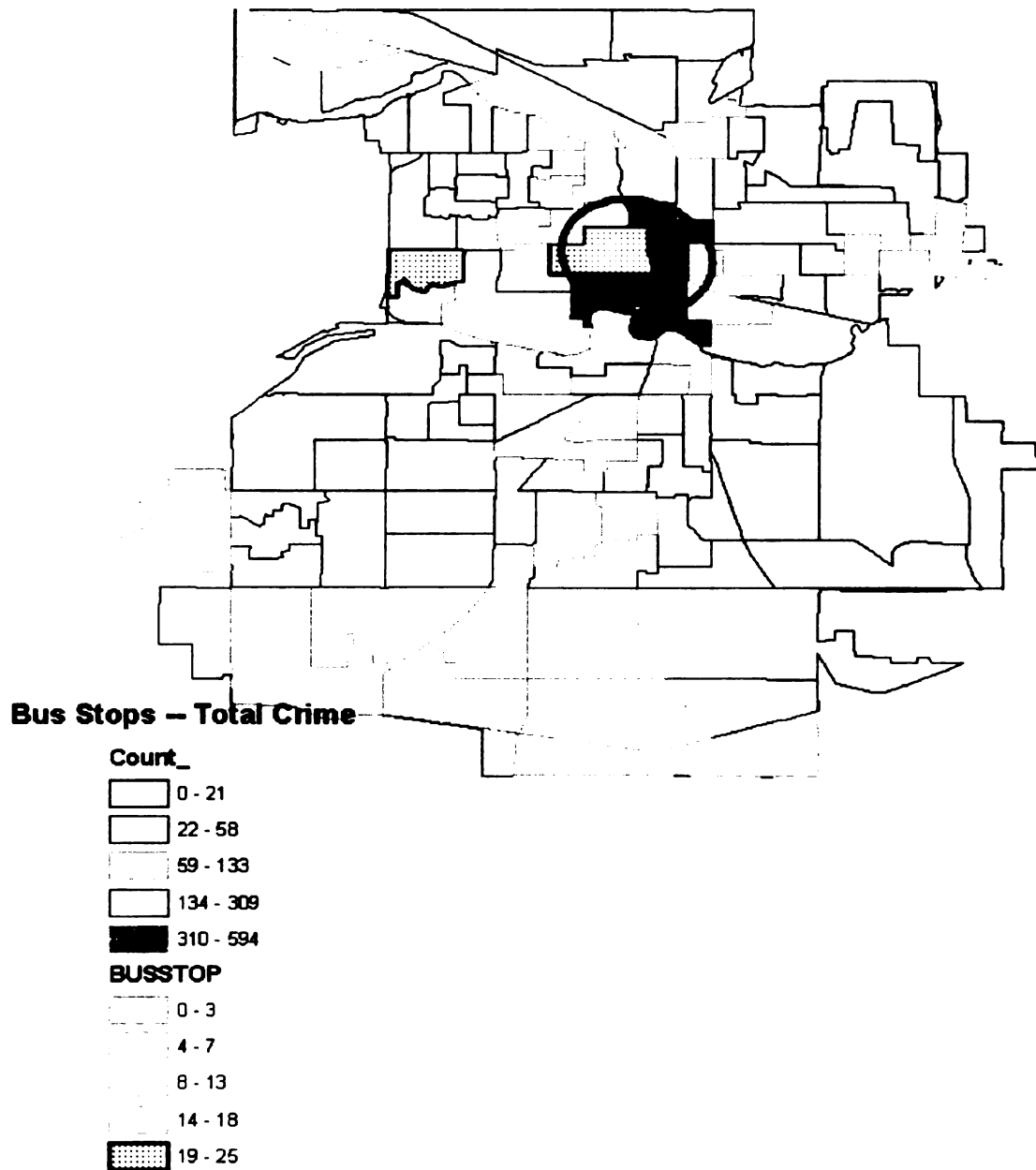
Note: The most clustered bus stop location block groups ranged from 19-26 bus stops and hot spot raw crime incident block groups ranged from two-year total of 310-594 incidents. Total raw crime incidents per 114 block groups varied substantially ranging from 1 to 594 per block group, with an overall mean of 68.28 (SD=87).

Figure V.4 demonstrated that clustered bus stop locations appear in the block group adjacent to the hot spot total raw crime block group. In addition, clustered bus stop locations appear in the same hot spot block group as hot spot crime rates. An argument can be made that areas with high bus stop concentration may be correlated with high crime. Although this correlation is only visual at this point, it was further tested in more advanced analytical models. The next figure takes a closer look at the hot spot block group and the clustering of bus stop locations that are within that block group. This map appears in Figure V.5.

Figure V.5. Hot Spot Block for crime rates and bus stop locations.
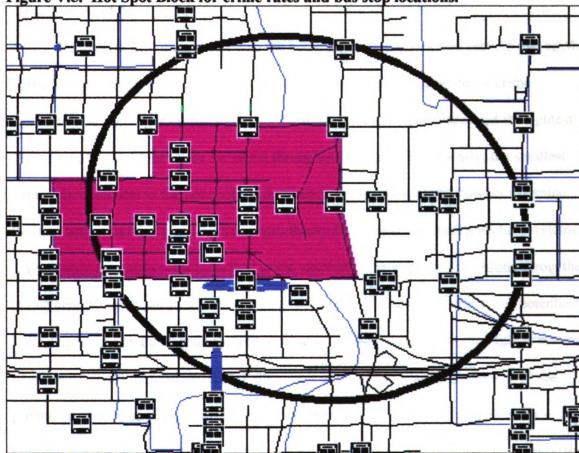
NOTE: 25 bus stops located within the hot spot block group. The large ellipses accounts for statistical crime clustering across block group boundaries identifying the main crime hot spot in the city. Smaller ellipse circles just south of the hot spot block group include the **tightest clustering of crime events in the city, which occurs at the main bus terminal.**

Interestingly, one of the block groups that has the largest number of bus stop locations (18-26) borders the main hot spot block group for total raw crime and is within the same block group for the main hot spot crime block group when using crime rates. Figure V.5 gives visual support for Brantingham and Brantingham's (1981; 1991) crime pattern theory. Research within crime pattern theory finds that offenders pick their targets in close proximity to areas within their routine pathways and within areas they are most familiar. From this assertion, it is assumed that offenders within the block groups containing the highest number of bus stop locations are familiar with these areas and these same offenders are more likely to be within these block groups because of the concentration of bus stop locations.

Of interest in Figure V.5 is also the hot spot crime ellipses that appears just south of the hot spot block group. These ellipses represent a tighter clustering of crime incidents than the larger ellipse to the north. In fact, these ellipses represent the tightest clustering of all outdoor crime incidents throughout the city. Empirically, the smallest ellipse circle closest to the hot spot block group is the location of the main bus terminal. Routine activities theory and crime pattern theory both argue that transportation systems may provide the catalyst for increased crime since stranger pathways are brought together in one centralized location where opportunity is high and collective efficacy is potentially low. The main city bus terminal offers several reasons why it attracts the highest amount of crime. According to unstructured interviews conducted with administrators of the private security firm that patrols the main bus terminal, security officers patrol the terminal during all opened hours and report several incidents of crime and disorder to the local police. Although formal guardianship is high within the terminal, the external area

surrounding the bus terminal is not customarily patrolled by security. In addition, local police officers will often patrol the terminal and find probation violators or truants. It may be of no surprise that given the crime data utilized for this dissertation the tightest clustering of crime is found at the bus terminal. However, analysis of all crime incidents recorded by the police (indoors and outdoors) still shows the bus terminal as being the main isolated single location hot spot for the given city in the same years utilized for the dissertation.

Both hot spot ellipses appearing in Figure V.5 were created through the CrimeStat software nearest neighbor index (Nna) which provides an approximation about whether points are more clustered or dispersed than would be expected on the basis of chance (Levine, 1999). The ellipses are determined by comparing the average distance of the nearest crime incident (i.e. nearest neighbor) with a spatially random expected distance. This statistic is achieved by dividing the expected average nearest incident distance by the expected random distance. From this iterative process, clustering of crimes can be determined and adjusted as displayed by the small and large ellipse hot spots in Figure V.5. Further advanced analytical techniques will be utilized to test the correlation of bus stop locations on crime rates.

Knowing where crime has occurred descriptively is the first part of processing and analyzing spatial data. Beyond knowing that crime is spatially and temporally stable (the where?), it then becomes critical to analyze the "why" question. Within this process, the dissertation analysis moves beyond visual inspection and towards a more advanced analytical methodology.

Part I: Factor Analysis, Descriptive Mapping, and SEM for mediating informal social control constructs

Social Ecological Demographics

Census demographic data chosen for this study attempted to replicate those variables used by Sampson et al., (1997), with a few changes that were noted in the beginning of Chapter IV. One hundred-fourteen block group locations made up the main unit of analysis for this spatial research. The initial factor analysis included all independent and dependent variables. The dependent variables (i.e., crime incidents) loaded separately from the indicator census variables. Attempts were made to separate crime incidents into two factors (e.g., nonviolent and violent crime, officer initiated incidents and victim initiated), but neither of these were successful. For purposes of hybrid model testing, all incidents became part of a summary scale used as a total crime rate main effect exogenous variable. As noted in Figure V.4 criminal incidents per block group varied substantially ranging from 1 to 594 per block group, with an overall mean of 68.28 (SD=87). This finding supported past research that has shown a clustering of incidents in place specific neighborhood-level locations (Sherman, 1995). Therefore, a log transformation of the incident data was used to normalize the variable (Keene, 1995) as is commonly done with crime data.

In addition to crime, residential stability and owner-occupied housing also represent endogenous dependent variables. The main independent demographic variables, along with a dependent summary scale of all criminal incidents, are presented in a bivariate correlation matrix in Table V.3. Nonsignificant correlations are highlighted in bold. Table V.3 represents the results of the correlations along with descriptive mean percentages and standard deviations for the main unit of analysis. Mean scores indicate

percentage representation of the variables for the entire unit of analysis. For example, the 2000 unemployment rate was 4.4% and 6.1% of residents were on public assistance.

High correlations between independent variables were noticeable indicating the potential of multicollinearity problems. Multicollinearity problems may exist when independent variables are more strongly related to other independent variables than with dependent variables (Weidner et al., 2002). An examination of the bivariate correlation table revealed that several indicator variables correlated more highly with each other than with the dependent variables showing that multicollinearity could be an issue in regards to the use of these variables. The highest bivariate correlation (.76) existed between foreign-born and speaks little to no English. In addition, owner-occupied housing and residential stability had the second highest correlation (.75). In the proceeding SEM model tests, it was determined that these variables were redundant and the model was respecified to drop variables that were most highly contributive to multicollinearity problems.

In this study, the goal was to make substantive as well as methodological contributions to collective efficacy neighborhood-level research. The research analyzes how neighborhoods mediate crime through guardianship (Cohen and Felson, 1979), territoriality (Newman, 1972; 1975) or collective efficacy (Sampson et al., 1997). Through this type of foundation, crime is ecologically concentrated through the presence or absence of collective efficacy. The main research question analyzes whether cohesion, as measured through residential stability, mediates the effects of both concentrated disadvantage and immigrant isolation on total crime incidents. Since ecological factors and crime concentration is seen as being relatively stable (Spelman, 1995), incident rates

over a six year time period can be explored in relation to census variables that define concepts from earlier social disorganization studies.

Several studies have made use of factoring ecological variables (Elliott et al., 1996; Sampson, et al., 1999; Sampson et al., 1997; Taylor and Covington, 1988). A factor analytic approach is useful in ecological research since many aspects of neighborhoods are related (e.g., poverty rates related to minority populations and to female-headed households). One of the goals of collapsing several correlated variables into a single factor is to limit multicollinearity and yield more stable coefficients with greater statistical power. Data used for this dissertation was factor analyzed as a reflection of Sampson et al., (1997). However, it should be noted that the dissertation model is not an 'exact' replication of Sampson et al., (1997) Chicago neighborhood analysis and some differences between choices in variables do exist due to differences in the city's being analyzed as noted in Chapter IV (page 62-63).

Building a model to test the collective efficacy hypothesis occurred in three stages. In the first stage, a principle components analysis was completed to compare the results with the Sampson et al., (1997) factor analysis. In the second stage, a preliminary path model was set up based on the given structure of the confirmatory measurement model. A test of the full model involved estimating a hybrid structural equation model through SAS software. The third stage presents a final model based on diagnostic analysis, the bivariate correlation matrix, suggested modification indices and deleting insignificant paths. Changes made provided an acceptable and parsimonious fit of the data that were relevant to the integrity of the theoretical foundation.

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Table V.3. Descriptive Percentages, Standard Deviations, and Bivariate Correlations

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10
1 Poverty	13.62	10.95										
2 Public Assistance	6.07	5.36	.73**									
3 Female-headed household	26.39	12.93	.66**	.65**								
4 Unemployed	4.41	3.40	.38**	.39**	.27**							
5 Youth	25.73	8.21	.37**	.54**	.47**	.17						
6 Minority	31.46	17.06	.57**	.56**	.60**	.39**	.42**					
7 No English	2.01	2.47	.44**	.33**	.34**	.33**	.27**	.33**				
8 Foreigner	5.33	5.10	.39**	.27**	.30**	.29**	.18	.35**	.76**			
9 Stable housing	48.26	13.38	-.37**	-.18	-.16	-.40**	.20*	-.21*	-.32**	-.39**		
10 Owner-occupied	61.43	24.47	-.47**	-.26**	-.36**	-.49**	.19*	-.30**	-.41**	-.47**	.75**	
11 Total Crime (raw)	185.79	213.21	.39**	.31**	.30**	.33**	.16	.39**	.51**	.48**	-.38**	-.59**
12 Total Crime (rate) per 1,000	103.34	401.27	.123	-.043	-.149	-.038	-.26**	.021	.02	.06	.29**	.35**

NOTE: N = 114, ** $p < .01$, * $p < .05$

Principle Component Analysis (PCA)

Measures of the key ecological constructs are consistent with much of the early

literature on social disorganization theory and specifically to Sampson et al., (1997).

These indicator variables represented three broad constructs- concentrated disadvantage,

immigrant concentration, and residential stability. The results of the given principle

component analysis provide support for defensible space concepts as indicated by

(Newman, 1975) and incivilities or lack of stability as indicated by (Sampson et al., 1997;

Shaw and McKay, 1942). The three factors extracted from the data included

characteristics that identify instability and social disorganization follow research from

early Chicago School sociology and include indicators for poverty, family disruption (as

measured through single-female headed households), ethnic heterogeneity, and

residential mobility (Shaw and McKay, 1942).

Loadings for the given census variables were comparable to the Chicago study.

Factor scores retained included those with eigenvalues greater than 1.00. The eigenvalue

measures explained variance as the sum of squares of the factor loadings. Variables with

eigenvalues of less than 1.00 did not become part of the analysis since they did not

significantly contribute to the construct. Along with the minimum eigenvalue score, a

scree test and proportion of variance accounted for selecting the number of factors. The

scree test showed a natural break indicating three factors existed for the comparison city,

showing a close comparison to what was found in Sampson et al., (1997) Chicago study.

Comparison of factor scores from the dissertation factor analysis and the Sampson

et al., (1997) study appear in Table V.4.

Table V.4. Factor comparisons to Sampson et al., (1997)

Variable	Factor Loading (Sampson et al, 1997)	Factor Loading (Comparison city)
Concentrated Disadvantage		
Below poverty	.93	.84
Public Assistance	.94	.88
Female-headed household	.93	.85
Unemployed	.86	.86
Less than 18	.94	.66
Black [a] / Minorities	.60	.78
Immigrant Concentration		
Latino [b] / Speaks no English	.88	.94
Foreign-born	.70	.93
Residential Stability		
Same house as in 1985[c] / 1995	.77	.89
Owner-occupied housing	.86	.91

[a] Sampson et al., (1997) used percentage black concentration while the dissertation used a summary scale for percentage of all combined minority concentration.
[b] Sampson et al., (1997) found percentage Latino loaded separately from disadvantage. The dissertation found Speaks no English loaded separately disadvantage.
[c] Sampson et al., (1997) used census data from 1990. Residents reporting that they have lived at the same residency since 1985 were coded as being stable. The dissertation used the most current census data from 2000. Residents reporting that the have lived at the same residency since 1995 were coded as being stable.

Both Sampson et al., (1997) and the dissertation factor analysis utilized an oblique rotated component matrix. Significant loadings on the given components occurred when the absolute value of the factor loading was greater than .50 and less than .50 for all other factors, although the lowest significant loading for these studies was .66 (youth) and .60 (blacks) for Sampson, et al., (1997). Interestingly, youth was one of the highest loading variables in the Sampson, et al., (1997) study and the lowest within the dissertation data.

The minimal loading extraction of .50 is reasonable within criminology in order to reduce otherwise spurious inclusions. The choice to use an oblique rotation to determine these loadings is also not without merit. Oblique rotation has increased in popularity in the social sciences, not only because it often results in simpler factor

structure matrices, but also because even if census data are not correlated in a given population it is quite possible that the data will be correlated in the sample (Norusis, 1985). This type of linear transformation creates a better solution by lowering low to moderate loadings and raising high loadings to be more recognizable. An oblique rotation allowed the extracted components to freely correlate since it was predicted that the given census factors that measure disadvantage and immigrant concentration are correlated. An empirical comparison of the results of orthogonal varimax and oblique promax rotation in SAS demonstrated that oblique rotations did tend to result in simpler, less ambiguous solutions.

Conceptual Model

Within the initial recursive model, the latent concept of concentrated disadvantage showed high convergent validity with factor loadings from indicator variables poverty, public assistance, unemployment, female-headed households, minorities, and youth. Taken as a whole, concentrated disadvantage is a direct causation of increased crime and an indirect causation of lowering informal social controls or collective efficacy, which then directly affects crime rates. These variables all measured the same construct of disadvantage in the initial factor analysis that appears in Table V.4.

The latent concept of immigrant concentration, based on Sampson et al., (1997), and more specifically on Butcher and Piehl (1998), was predicted to have a direct effect on crime and an indirect effect on lowering collectively efficacy, which leads to increased crime and disorder. This hypothesis follows the argument that immigrants often have a more difficult time initially becoming a collective part of neighborhoods and are less

likely to exercise informal social control by intervening in situations where they do not

yet understand the culture. They are also less likely to reach out to formal social control

mechanisms when victimized or witnessing victimization (Butcher and Piehl, 1998).

Indicators of immigrant concentration included the block group percentage of foreign-

born residents and the percentage of residents who spoke little to no English.

The mediating latent variable labeled collective efficacy also showed high

convergent validity between two manifest variables. These indicating variables included

the percentage of owner-occupied housing and those who lived in the same housing

(owner or rental) for 5 years or more. A completed hybrid model from the given factor

analysis appears in Figure V.6.

Figure V.6. Complete hybrid model of concentrated disadvantage and immigrant concentration mediated by residential stability.
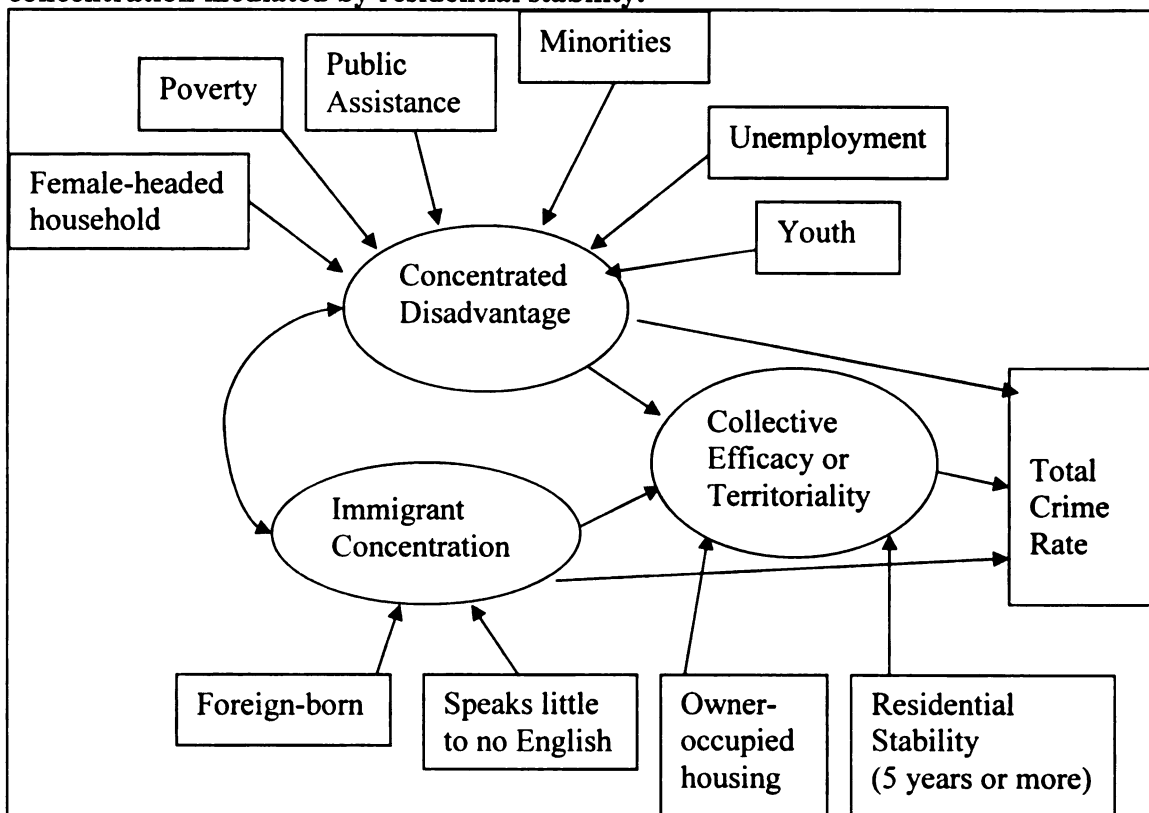
The strategy of factor analyzing the given variables is also beneficial for mapping purposes since it may be easier to visually interpret a latent construct of concentrated disadvantage as opposed to mapping several manifest indicator variables that account for this concept. In addition, overall territoriality or collective efficacy can be easily displayed in terms of residential turnover and owner-occupied housing. It was hypothesized that those block groups with a high degree of measurable residential stability and a low degree of concentrated disadvantage will have lower incident rates. In this manner, residential stability serves as a mediating variable for social composition. According to both Sampson et al., (1997) and Newman (1975) stable housing results in an increased sense of ownership and social cohesion. It was predicted that within these types of neighborhoods residents are more likely to look after one another and intervene in disorderly or criminal situations. Thus, despite the level of disorganization, crime is mediated by the extent of residential stability or collective efficacy.

A spatial presentation of the factored constructs appears in Figures V.7-V.9. Again, the ellipse crime incident hot spot calculated from CrimeStat appears in each map to help better determine spatial identification of concentrated crime compared to the disorganization latent constructs. Block groups that are shaded represent the neighborhoods that have the highest concentration of disadvantage, immigrants, or lack of stability. From this analysis, it was hypothesized that areas of high disadvantage and immigrant concentration would also appear within the crime hot spot ellipse. It was also predicted that areas with the lowest amount of stability (i.e. high rental areas and high transition in housing) would also appear within these crime hot spot ellipse. For presentation purposes, Figure V.9 identifies the block groups with the lowest stability

factor. However, Figures V.7 and V.8 identify the block groups with the highest levels of concentrated disadvantage and immigrant concentration.

Figure V.7. Concentrated Disadvantage

DISADVAN
-1.98725 - -1.05102
-1.05101 - -0.34238
-0.34237 - 0.47098
0.47099 - 1.41798
1.41799 - 3.01377
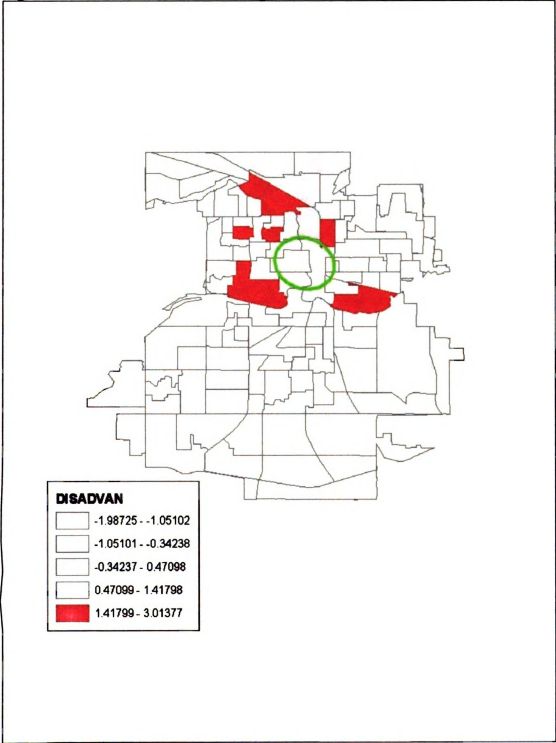
Figure V.8. Immigrant Concentration

IMMIGRNT

	-1.28558 - -0.61611
	-0.61610 - -0.13233
	-0.13232 - 0.57687
	0.57688 - 1.64306
	1.64307 - 3.73144
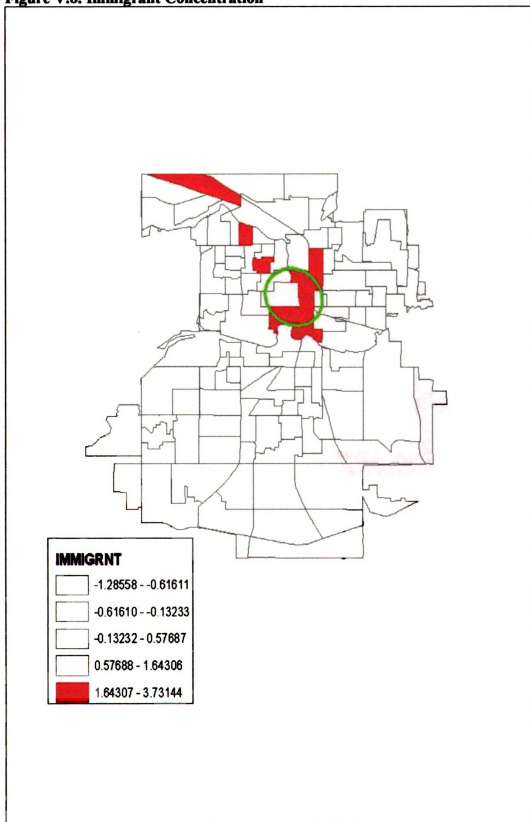
Figure V.9. Residential Stability / Collective Efficacy

Stability

STABILITY

■	-3.16475 - -1.52159
□	-1.52158 - -0.59718
□	-0.59717 - 0.07028
□	0.07029 - 0.67239
□	0.67240 - 1.63719
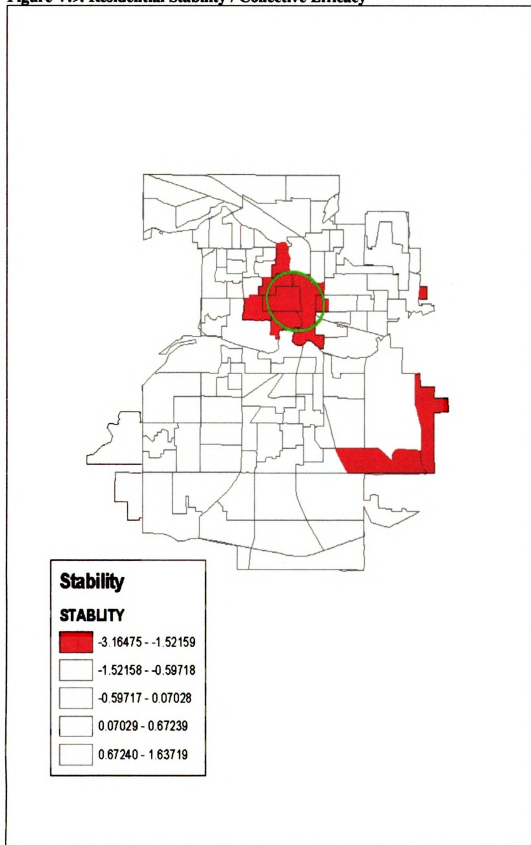
Figure V.7 indicates that the areas with the highest concentration of disadvantage may not be spatially related to the given crime incident data. In comparison, there are high levels of immigrant concentration that appear within the hot spot crime incident ellipse. Perhaps most revealing is the low levels of residential stability being concentrated within the hot spot crime ellipse except for one section on the east side of the map. After completing the visual descriptive mapping of the disorganization latent constructs it is important to also analytically process this data within a model test that will better determine the impact of the disorganization data on crime. This analytical process will take place through an SEM test utilizing the given factored constructs.

Hypothesized model testing

The initial hypothesized hybrid structural model came from the results of the factor scores appearing in Table V.3. Pathways that show the directional hypotheses indicate the regression coefficients that were tested within the SEM analysis. Pathways that show the directional hypotheses indicate the regression coefficients that were tested. All directional pathways are based on findings from past research. Problems with this initial model included only using two manifest indicators for a latent construct. Findings from other structural models have indicated that the inclusion of only two indicator variables per factor have been shown to exhibit problems in terms of identification and convergence (Anderson and Gerbing, 1988; Bentler & Chou, 1987; Kline, 1998). Other additional concerns included finding out which indicators may be redundant and taking away from the power of the overall model. The preliminary factored model showing only latent constructs appears in Figure V.10.

Figure V.10. Factored SEM model of demographic predictors mediated by collective efficacy/territoriality functions.
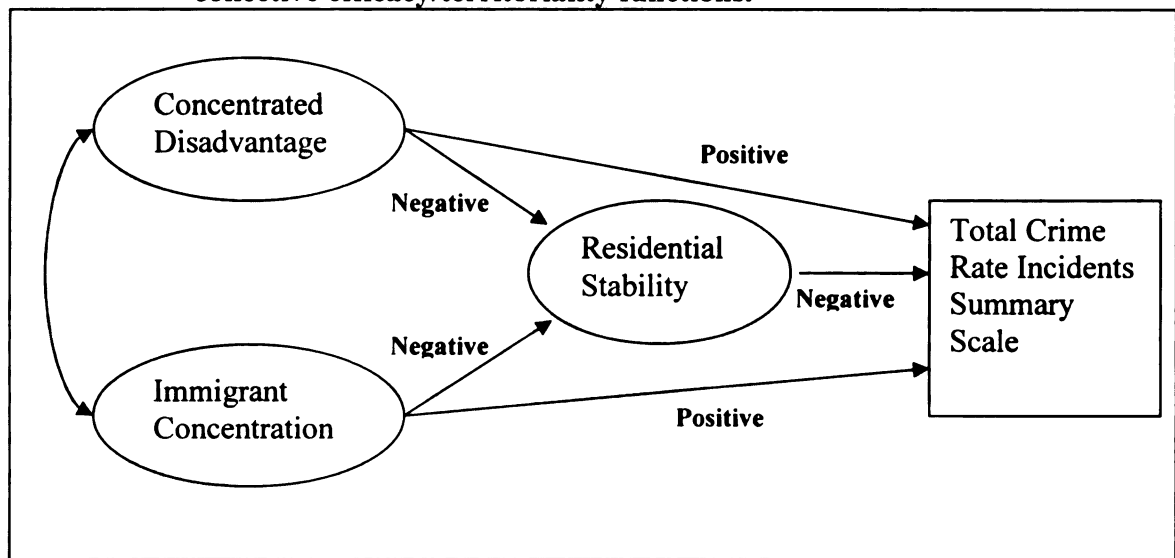
The latent construct concentrated disadvantage is hypothesized to positively influence crime incidents and negatively influence the amount of stability within each block group. This pathway shows that as disadvantage increases, residential stability will decrease in terms of increased residential turnover and reduced owner-occupied housing. Reciprocally, these events directly and indirectly increase crime within the block group. Immigrant isolation also reduces residential stability, leading to increased crime. In addition, the covariance (unanalyzed association) between the exogenous latent constructs concentrated disadvantage and immigrant concentration will be computed.

RESULTS

Results from the initial confirmatory factor analysis were processed through a full structural equation model test and produced a number of problems. The initial

hypothesized model did not show a very good fit for the given data: (GFI =.84, NFI[5] = .81, CFI =.86, and RMSEA[6] =.15). The chi-square was highly significant ($\chi2$ =134, df =39), and the $\chi2/df$ ratio was unacceptable at 3.44. The null hypothesis indicating model fit was rejected since the chi-square statistic was significant and the ratio to degrees of freedom was high. However, all hypothesized paths from the initial model were in the predicted direction and significant except for the direct effect of immigrant isolation on crime. These findings coincide with the Sampson et al., (1997) model, since they also found that immigrant isolation did not directly affect crime but did so indirectly through collective efficacy.

Modifying the Model

Several steps focused on finding a more parsimonious model. In terms of the total crime scale, no single block group consumed a disproportionate amount of influence on the coefficients after the log transformation was completed. Regression analyses were examined for influential outliers using a variety of diagnostic tests such as Cook's D and leverage scores. Outliers observed in scatterplots caused a high multivariate kurtosis of 36.67. However, there was concern with deleting entire block groups from the analysis since the sample size only consisted of 114 block group locations. This was a limitation of the research in comparison to multilevel analyses [i.e., Sampson et al., (1997)] that could more justifiably delete highly skewed individual surveys. In addition, deletion of

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[5] The normed-fit index (NFI) was proposed as an alternative to the chi-square test. NFI values over .90 indicate an acceptable fit of the data to the model (Bentler and Bonett, 1980).

[6] Root mean square error of approximation (RMSEA) compares the observed and predicted covariance matrices. Confidence intervals suggest there is a good model fit if RMSEA is less than or equal to .05. By this criterion, the model is rejected since RMSEA is equal to .15.

block groups from diagnostic tests did little to lower multivariate kurtosis problems and was not chosen as a strategy for creating a better-fit model.

After rerunning the model, kurtosis problems still plagued the analysis. Redundant variables removed one at a time tested the model fit. Although all factor indicators of concentrated disadvantage were significantly correlated ($p<.01$), poverty, public assistance, and unemployment were seen to be a redundant representation of low income. Public assistance loaded the highest in the initial factor analysis, so the revised model dropped poverty and unemployment. All indicators significantly correlated with the total crime scale except youth (.16). Therefore, the youth indicator does not appear in the final model. This left the latent construct concentrated disadvantage with three indicators- public assistance, female-headed households, and minorities. Thus, single indicators representing low income, family instability, and ethnic isolation may be all that is necessary for measuring the concept of concentrated disadvantage and including other variables in a structural model test are unnecessarily redundant.

Final Full Model

Significant path coefficients

The final hybrid modified model appears in Figure V.11. The measurement model for the single latent variable concentrated disadvantage included three indicators. Since public assistance loaded the highest in the initial confirmatory factor analysis, its path was fixed at 1 to avoid a scale indeterminacy problem so no error rate is reported. All path directions remained as predicted by previous hypotheses.

Figure V.11. Final Modified Hybrid Model.

NOTE: N = 114, *** p < .001, ** p < .01, * p < .05
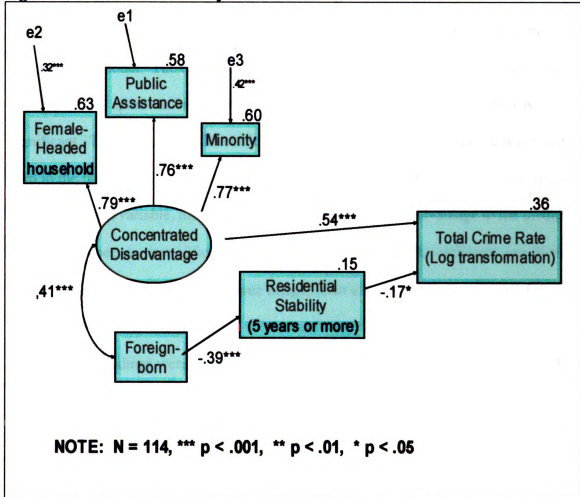
Path coefficients for concentrated disadvantage remained significant and were positively related to total crime (β = .54; t = 5.49; p<.001) and its coefficient was larger than in the original model (β = .38; t = 3.83; p<.001). However, the negative effect from the mediating manifest variable on total crime was smaller in the final hybrid model going from (β = -.29; t = -3.00; p<.01) to (β = -.17; t = -2.15; p<.05), but remained significant. The prediction that immigrant concentration will reduce residential stability was supported by the significant (p<.001) path coefficient (β = -.39).

Insignificant path coefficients

Path coefficients were reassessed after deleting redundant indictors from the measurement model. The direct paths between the manifest variable foreign-born and total crime was spurious, but the indirect path through the mediating variable was significant. Therefore, the path coefficient of foreign-born directed at crime was fixed at zero in the final model. In addition, after deleting redundant indicators from the single remaining latent variable, the direct path from concentrated disadvantage to the mediating variable also became insignificant. In the initial model, this path coefficient was (β = -.22) and significant ($p<.05$) but became insignificant after limiting the concept of disadvantage to three indicators.

These findings were again similar to Sampson et al., (1997). Their research also found statistically direct effects of concentrated disadvantage on crime but insignificant effects of percent foreign-born on crime. However, they did find significant indirect effects with both concentrated disadvantage and ethnic isolation mediated by collective efficacy. This finding may be due to their larger sample size within the city of Chicago and the greater number of indicators for defining the mediating variable.

After removing insignificant paths, an analysis of modification indices was conducted that suggested model improvement by fixing and freeing certain causal paths. Due to the small sample size (N=114) and utilizing only two years of crime incidents, data-driven modifications were seen as risky (MacCallum, et al., 1992). Suggestions from LaGrange multipliers called for directly linking measurement model indicators to each other or to the total crime scale. The suggested modification involved a series of cause and effect issues and challenges to discriminant validity that went beyond the scope

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of testing collective efficacy as hypothesized by Sampson et al., (1997). Therefore,

modification indices were not used for the final model presentation.

Percentage of Variance in Endogenous Variables

Determinations for R^2 appear on the top right corner of each variable within the

final model Figure V.20. A relatively high proportion of explained variance in total

crime was indicated with an R^2 of .36. Although residential stability also had a relatively

high R^2 of .15, there was 85% unexplained variance and a .92 residual path coefficient or

estimated correlation between residential stability and its disturbance. This also means

that 85% of the variance in the residential stability variable is shared with its disturbance.

With this proportion of shared disturbance, and since concentrated disadvantage was seen

to insignificantly effect residential stability, it may be argued that a single measure is

inadequate for capturing the full conceptual meaning of collectively efficacy as defined

by Sampson et al., (1997).

Indirect and Total Effects

Calculations of indirect and total effect path coefficients were completed and the

only indirect effect came from residential stability mediating the exogenous manifest

variable foreign-born residents. Standardized results appear in Table V.5. The indirect

effect was a multiplicative product of the direct negative effect of foreign-born on

residential stability and the direct positive effect of residential stability on total crime.

The indirect effect was insignificant[7] (β = .07; p=.07) with a total effect of (β = .02).

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[7] Significance of the indirect mediator path coefficient could not be determined through SAS. I ran a Sobel test (Sobel, 1982) through an interactive webpage set up by the Ohio University. Unstandardized

Concentrated disadvantage had the highest significant direct and total effect (β = .54; p<.001) and the mediating variable had a significant direct and total effect (β = -.17; p<.05).

Table V.5. Standardized Structural Model Effects

	Direct	Indirect	Total
Concentrated Disadvantage	.54***	---	.54***
Foreign-born	-.39***	.07	.02
5 years in residency or more	-.17*	---	-.17*

NOTE: N = 114, *** p <.001, ** p < .01, * p < .05

Standard Error Issues

Differences that are more serious existed between the Sampson et al., (1997) study and the dissertation unit of analysis. In their study, they found indirect effects for each aspect of the social composition variables (Raudenbush and Sampson, 1999) and each indirect effect was far larger than its standard errors, which provided additional evidence of a statistically mediating effect of collective efficacy. Within the dissertation data, the mediating effect was significant, but only for foreign-born residents and not for concentrated disadvantage. In addition, there were small standard errors within the path coefficients leading to the total crime scale (concentrated disadvantage=.03, residential stability=.01). These small standard errors indicate an estimation problem and linear dependence issue between the parameters that could invalidate the test scores. It is possible that the low sample size of 114 block group locations is problematic. Despite

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regression coefficients between foreign-born and the mediating variable and the standard error was inputted in addition to the raw coefficient for the association between the mediating variable and crime along with its standard error. The results from the Sobel test and Goodman (I&II) tests all indicated that the indirect effects from the mediating variable were insignificant with p-values=.07, .08, and .07, respectively.

these problems, the final model did show an excellent fit in comparison to the initial

hypothesized model.

Model Fit Summary

The initial model and the final model fit summary comparisons appear in Table

V.6. The chi-square of the final model is again significant but the χ^2/df ratio of 1.00 is

well within general acceptance. Removal of redundant indicators in the measurement

model and fixing insignificant path coefficients greatly improved the final model fit and

overall multivariate kurtosis issues from the original hypothesized model.

Table V.6. Model Fit Summary Comparison

	Initial Model	Final Model
Goodness of Fit Index (GFI)	.84	.97
Non-normed Index (Bentler & Bonett, 1980)	.80	1.00
NFI (Bentler & Bonett, 1980)	.81	.96
Comparative Fit Index (CFI)	.86	1.00
X^2 / df Ratio	3.44	1.00
RMSEA Estimate	.15	.00
Multivariate Kurtosis	36.67	7.36
R^2 Collective Efficacy	.24	.15
R^2 Total crime	.40	.36

Multivariate kurtosis was reduced 29.31 after eliminating redundant indicators.

The major fit indexes were all seen to exceed .9 with some being rounded to 1.00; GFI

=.97, NFI = .96, CFI =1.00, and RMSEA =.00. The goodness of fit index (GFI) indicates

the proportion of observed covariances explained by the model and serves as an

alternative fit indicator to the chi-square statistic (Jöreskog and Sörbom, 1996). The

normed fit index (NFI) indicates the proportion of improvement of fit in the model

relative to a just-identified model (Bentler and Bonett, 1980; Kline, 1998). The NFI of

.96 indicates that the final model is 96% better than the null hypothesized model. The

comparative fit index (CFI) was designed as a modification to the NFI without being restricted to sample size (Bentler and Bonett, 1990). The CFI score of .999 rounded to 1.00, again indicating a nearly perfect model fit.

The collective efficacy hypothesis from Sampson et al., (1997) was supported within the SEM model test with the data used for the dissertation. The latent construct concentrated disadvantage had the largest impact on increasing the total crime scale but indicators for collective efficacy still had a significant direct positive impact on crime incidents. There was also a mediating effect for immigrant concentration, meaning that although immigrant concentration does not directly effect crime within the given city, it does indirectly effect crime by reducing residential stability, which in turn increases crime. This model is not as strong as Sampson et al., (1997) since disadvantage is not mediated by stability.

PART II: Binary Logistic Regression within a Quasi-Experimental Design

In moving from a macro-level to a more meso-level analysis, this section of the dissertation analysis tests if bus stop locations significantly influence crime compared to non-bus stop locations. Before conducting this type of comparison analysis, it is useful to have a full understanding of the impact of social disorganization and stability factors on crime. Since these variables have been found to significantly affect crime, either directly or indirectly, it is necessary to control for their effect when comparing bus stop and non-bus stop block group locations on crime. Within a quasi-experimental design it is critical that experimental and control areas are matched for the same characteristics before

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testing the experimental effect. Since bus stop locations cannot feasibly be randomly allocated, quasi-experimental designs seek alternative strategies for matching group characteristics. In the case of the dissertation units of analysis, these match scores will include the factored scores that resulted in the latent constructs of concentrated disadvantage, immigrant concentration, and residential stability.

This second part of the dissertation analysis proceeds in three sections. First, a dichotomous variable for bus stop locations and non-bus stop locations was created. Within these locations, descriptive statistics are reported for the presence of each independent and dependent variable within the bus stop and non-bus stop block groups. Second, independent-sample t-tests are conducted to match the latent constructs that were originally used in the SEM test. These tests are conducted in an effort to statistically match bus stop and non-bus stop block groups. Lastly, a binary logistic regression analysis was conducted to test the predictability of bus stop locations on each individual crime incident while controlling for independent variables that were not otherwise statistically matched within the independent-sample t-tests.

Dummy coding bus stop and non-bus stop locations

In order to test the impact of bus stop locations versus non-bus stop locations dummy codes were created for block groups containing bus stop locations against those that did not contain bus stop locations. This allowed for a dichotomous variable of bus stops versus no bus stops. Frequency quartiles were conducted for the number of bus stop locations within each block group. Those bus stops falling within the 25 percent quartile (i.e., representing the fewest number of bus stop locations) were coded as (0) or

block groups without a bus stop location. Thus, any block group location that contained fewer than three bus stop locations was coded (0). Any location that contained three or more bus stop locations was coded (1). This logic followed the assumption that more bus stop locations in a block group location would be correlated with higher levels of crime. The dummy variable created denotes group membership. In the case of this quasi-experiment, bus stop locations are coded as the "experimental" group with a value of (1) and non-bus stop locations become the "control" group with a value of (0). In order to test if concentrated bus stop locations are truly attributed to crime, bus stop locations were also dichotomously dummy coded into concentrated (8 or more bus stops) and not concentrated (less than 8 bus stops). A total of eight or more bus stops within a block group made up the most concentrated quartile after dividing up the 114 block groups.

After block groups were classified as either bus stop or non-bus stop locations, general descriptive data could be obtained for these locations. Table V.7 represents this descriptive information for bus stop and non-bus stop locations. These descriptive statistics include mean (μ) scores for each crime incident type, total crime, and mean percentages for each independent disorganization variable that indicated the latent constructs for disadvantage, immigrant concentration, and stability. Raw crime incident scores are used for presentation and comparison purposes since two years of combined data may be more intuitive than the average rate.

Table V.7. Descriptive statistics on Bus stop and non-bus stop block groups.

	Bus Stops Raw number (μ)	No bus stops Raw number (μ)	8 or more bus stops Raw number (μ)	Less than 8 bus stops Raw number (μ)
Total Block groups	97	17	35	79

Table V.7. Descriptive statistics on Bus stop and non-bus stop block groups (cont.)

	Bus Stops Raw number (μ)	No bus stops Raw number (μ)	8 or more bus stops Raw number (μ)	Less than 8 bus stops Raw number (μ)
Dependent Incident Variables [a]				
Alcohol	1182 (13.43)	85 (6.54)	704 (20.71)	563 (8.40)
Armed Robbery	114 (2.33)	4 (1.00)	73 (2.81)	45 (1.67)
Assault	450 (5.42)	47 (4.70)	240 (6.86)	257 (4.43)
Disorderly Conduct	1482 (16.65)	117 (7.80)	851 (25.03)	748 (10.69)
Domestic Abuse	360 (4.14)	39 (3.55)	181 (5.66)	218 (3.30)
Narcotics	1239 (13.92)	114 (7.60)	597 (17.56)	756 (10.80)
Obstruction	1563 (16.63)	146 (10.43)	860 (24.57)	849 (11.63)
Truancy	433 (7.10)	30 (3.75)	283 (10.88)	180 (4.19)
Unarmed Robbery	132 (2.64)	12 (1.71)	75 (3.13)	69 (2.09)
Weapons Violations	203 (3.17)	22 (2.44)	112 (3.73)	113 (2.63)
Total Crime	7263 (73.90)	651 (36.24)	4049 (113.83)	3865(48.10)
Independent Variables [b]				
Poverty	13.70	13.26	15.92	12.61
Public Assistance	5.86	7.13	6.80	5.75
Unemployed	4.63	3.34	4.62	4.32
Female-headed Household	26.68	24.95	30.24	24.68
Under 18 years of Age	25.48	26.98	26.18	25.53
Minority	32.88	24.37	39.52	27.89
Speaks little to no English	2.08	1.69	2.64	1.74
Foreign-born	5.66	3.64	6.35	4.87
Owner-occupied Housing	59.60	70.57	54.50	64.50
Address not changed in past five years	48.05	49.30	48.57	48.12

[a] Dependent crime incidents contain raw numbers followed by mean scores in parentheses
[b] Independent variables contain mean score percentages for the given block groups.

In comparing block groups containing three or more bus stop locations and those that had less than three bus stop locations, there is a difference with the bus stop block groups having more crime than non-bus stop locations. This is evident with a difference of 6,612 more incidents in block group locations coded as having at least three bus stop locations compared to those block groups that had less than three bus stop locations. However, these findings are far from being scientific since there have been no controls adjusted for potential differences in total population, income levels, disadvantage, immigrant concentration, or overall stability. Without these types of controls it is not possible to determine what is actually causing the increased crime within these block groups that contain three or more bus stop locations. In addition, there are 44 fewer block group locations for non-bus stops represented within the given comparison than there are bus stop locations. Therefore, controls that are more sophisticated are necessary for conducting the quasi-experimental comparison between bus stop and non-bus stop locations.

Matching Block Groups through independent-sample t-tests

Independent sample t-tests were conducted to see if block groups that had bus stop locations statistically matched those that did not have bus stop locations. This match was created according to the factored scores for concentrated disadvantage, immigrant concentration, and residential stability. Significant results from the t-test scores would indicate that a match had not been made and that differences existed between the bus stop and non-bus stop block groups. The results from this test appear in Table V.8.

Table V.8. Matching bus and non-bus stop block group attributes. Independent sample t-tests.

	Mean (No bus stop)	Mean (bus stop)	F	t-test	Sig.
Latent constructs					
Disadvantage	.271	-.047	.346	-.044	.965[a]
Immigrant	-.003	.001	.136	-1.187	.245[a]
Stability	.152	-.027	6.974	1.291	.063[b]
Manifest indicators Concentrated Disadvantage					
Poverty	14.44	13.52	1.018	-.156	.876[a]
Public Assistance	7.85	5.80	2.449	.944	.347[a]
Unemployment	3.42	4.63	4.500	-2.202	**.033[b]***
Female-head	26.69	26.68	1.530	-.531	.596[a]
Youth	27.85	25.35	2.128	.727	.469[a]
Minority	26.63	32.55	.878	-2.010	**.047[a]***
Manifest indicators Immigrant Concentration					
No English	1.87	2.06	.239	-.627	.532
Foreign-born	3.83	5.65	5.256	-2.065	**.046[b]***
Manifest indicators Residential Stability					
Stable address	51.92	49.18	4.603	.448	.657[b]
Owner-occupied	69.49	59.77	2.561	1.803	.074[a]
Other match variable					
Total population	1057.88	1299.22	2.244	-.943	.348[a]

[a] **Equal variances assumed.**
[b] **Equal variances not assumed**

Table V.8 establishes the match between bus stop block groups and non-bus stop block groups. Accordingly, the three latent constructs established through the principle components analysis for the SEM model test are insignificantly dissimilar. Although there were only 17 non-bus stop block groups to compare against 97 bus stop block groups, the t-test comparisons provide the best alternative for first establishing matched block groups within a quasi-experimental design, and then comparing the crime rates

between these block groups. Another limitation can be seen with significant differences

in unemployment, minority concentration and foreign-born residents. However,

comparisons of the latent constructs that represent all of the given independent variables

shows that there are no significant differences between these block groups. Therefore, it

was determined that bus stop block groups and non-bus stop block groups are well

matched and comparisons can further be made between t-tests. Crime rates and raw

incidents numbers (i.e., dependent variables) are then compared between bus stop and

non-bus stop block groups through independent sample t-tests in Table V.9.

Table V.9. T-test crime rate comparisons between bus stop and non-bus stop block groups (Rates are incidents per 1,000 total block group population)

Crime Rates / Crime Raw	Mean (No bus stop)	Mean (bus stop)	F	t-test	Sig.
Alcohol Rate	5.50	23.40	.920	-.652	.516
Alcohol Raw	6.54	13.43	2.049	-1.177	.242
Armed robbery Rate	.84	4.35	.390	-.432	.667
Armed robbery Raw	1.00	2.33	4.255	-4.563	.000
Assault Rate	5.08	6.45	.306	-.288	.774
Assault Raw	4.70	5.42	.304	-.494	.622
Disorderly conduct Rate	8.32	29.42	.855	-.627	.532
Disorderly conduct Raw	7.80	16.65	2.459	-1.441	.153
Domestic abuse Rate	4.04	5.52	.459	-.333	.740
Domestic abuse Raw	3.55	4.14	1.758	-.546	.587
Narcotics Rate	9.43	18.76	1.006	-.720	.473
Narcotics Raw	7.60	13.92	3.082	-1.420	.159
Obstruction Rate	11.41	23.27	.572	-.569	.571
Obstruction Raw	10.43	16.63	1.741	-1.231	.221
Truancy Rate	3.36	12.30	1.024	-.616	.540
Truancy Raw	3.75	7.10	.554	-.620	.538

Table V.9. T-test crime rate comparisons between bus stop and non-bus stop block groups (Rates are incidents per 1,000 total block group population) (cont.)

Crime Rates / Crime Raw	Mean (No bus stop)	Mean (bus stop)	F	t-test	Sig.
Unarmed robbery Rate	1.56	3.05	1.928	-1.043	.301
Unarmed robbery Raw	1.71	2.64	1.754	-1.110	.272
Weapons Rate	2.73	3.39	1.889	-.558	.579
Weapons Raw	2.44	3.17	1.698	-.803	.424
Total Crime Rate (1999-2000)	40.02	114.43	.843	-.704	.483
Total Raw Crime (1999-2000)	36.24	73.90	2.604	-1.658	.100

In comparing incidents of crime between bus stop and non-bus stop block groups there appears to be no significant differences. All individual incidents were tested as well as total crime and total crime rate combined over the two years of data. The two main mean scores being compared for total raw crime statistics had a difference of 37.66 with bus stop locations having a higher mean of crime. However, the t-test comparison of the means was non-significant (.10). In a comparison of six years of crime data (1995-2000) bus stop block groups contained a mean difference of 147.34 crimes, which was very significant (p<.000). However, since independent variables utilized for this research were collected in 1999 through the decennial census, serious internal validity issues would exist in terms of predicting past dependent variable incident data. However, the stability factors of crime presented in Figure V.1 suggest that future crime within the given units of analysis may show that bus stop location crime does significantly differ from non-bus stop block group locations over a period of years. This finding would also indicate that crime does occur disproportionally and certain place characteristics attract crime while other place locations detract crime. Despite the insignificant differences

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between bus stop and non-bus stop block groups, correlations between bus stops and crime can be determined through logistic regression analysis, which also allows for other predictor variables to be controlled for within model specification.

Binary Logistic Regression Analysis

Unlike path models, logistic regression is part of statistical models called generalized linear models. Logistic regression allows one to predict a discrete outcome, from a set of variables that may be dichotomous and/or continuous. This means that logistic regression does not make any assumptions about the distribution of the independent variables in terms of being normally distributed, linearly related or of equal variance within each group. The main predictor variable is dichotomous meaning that bus stop locations have a value of 1 (i.e., bus stop present within the block group) and non-bus stop locations have a value of 0 (i.e., bus stop not present within the block group). This type of variable is also referred to as binary allowing for constraints of the logistic distribution to estimate probabilities that lie between 0 and 1. The dependent variable, which measures the presence of crime within the block group, is equal to 1 if crime was highly present within the two years of data and 0 if crime was very low or not present at all within the block group location. The logistic regression model was used to estimate the factors that influence crime within the block group locations.

The goal of logistic regression analysis is to predict the outcome of individual independent variables using the most parsimonious model (Menard, 1995). In order to accomplish this goal, the model used within this quasi-experiment tests the null hypothesis that bus stop locations (i.e. predictor variables) do not significantly predict the

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response variable (i.e. individual crime rate incidents). Separate models were run including a prediction for each crime incident. These models were conducted through a binary logistic regression analysis (using continuous bus stops as the predictor variable) and multivariate logistic regression using the latent social disorganization constructs and total population as control variables.

Each individual crime incident type became a dichotomous dependent variable for separate analyses conducted with bus stop locations being the primary predictor variable. Therefore, incident types were dummy coded according to the results from frequency quartiles. Incidents that did not fall within the high 75th percentile were coded (0) and incidents falling within the 75th percentile were coded (1). Table V.10 indicates the results of the frequency distribution on how block groups were dichotomously coded for each crime incident.

Table V.10. Coding block groups for crime incident presence.

Incident Type	Crime Rate (per 1,000): Coded (0) not present rate	Crime Raw Numbers: Coded (0) not present total
Alcohol Violations	2.6719 or less	2 or less
Armed Robbery	.8748 or less	1 or less
Assault	2.1288 or less	1 or less
Disorderly Conduct	4.1569 or less	3 or less
Domestic Abuse	1.2797 or less	1 or less
Obstruction	4.7643 or less	5 or less
Truancy	1.4968 or less	1 or less
Unarmed Robbery	1.2037 or less	1 or less
Weapons	1.3201 or less	1 or less
Total Crime	20.8540 or less	19 or less

Table V.10 represents the dichotomous breakdown for crime incident presence in order to complete the logistic regression analysis. An assumption is made that block groups within the upper 75th percentile of crime will be affected more by bus stop

locations than those areas that contain fewer crime incidents within the logistic regression analysis. Within this type of model, bus stop locations are being tested in terms of predictability of high crime block groups, or at least those that fall within the 75th percentile.

The main use of logistic regression is to calculate the probability of success over the probability of failure by giving an odds ratio. Logistic regression utilizes a maximum likelihood estimation (MLE) method, which is an iterative process that allows for an estimation of the coefficients within the given model. The MLE process maximizes the log likelihood and provides a measurement for the probability or the odds of observing a particular set of values in the dependent variable based on the observed values of the independent variable (Menard, 1995). In the case of the quasi-experimental model, this means testing for bus stop locations in areas with the highest crime. The prediction being made is that the higher the likelihood estimation the higher the probability of observing bus stop locations.

The slope coefficient (ß) is interpreted as the rate of change in the "log odds" as the predictor variable changes. Since the dependent variable is dichotomous, within logistic regression the slope coefficient is not very useful and the interpretation of the log coefficient or odds ratio is usually more intuitive. The actual value of the dichotomous dependent variable has no intrinsic interest but the 'odds' of probability that the variable can be predicted from the independent variables is of interest. Each individual crime incident was run as its own dependent dichotomous variable after completion of dummy coding. Therefore, each incident was utilized within a separate model to test for the effects of bus stop locations on specific crime type. In Table V.11, the binary logistic

regression analysis controlled for the latent constructs established in the full hybrid model test; concentrated disadvantage, immigrant concentration, residential stability, and also total population within each block group as determined by the 2000 census data.

Table V.11. Multivariate Logistic Regression models predicting crime incidents at Bus Stop locations while controlling for total population, concentrated disadvantage, immigrant concentration, and residential stability. [a] Official crime incidents as dependent variables. (n=114)

Incident Rates	ß	S.E.	Wald	Odds Ratio	Sig.	X^2	Model Sig.	Nagelkerke R^2
Alcohol	.206	.063	10.693	1.229	.001	26.951	.000	.292
Armed Robbery	.219	.056	15.147	1.244	.000	30.085	.000	.319
Assault	.207	.062	11.022	1.230	.001	37.111	.000	.377
Disorderly	.168	.059	8.098	1.183	.004	46.779	.000	.462
Domestic Abuse	.236	.076	9.624	1.266	.002	40.642	.000	.438
Narcotics	.340	.092	13.536	1.404	.000	57.529	.000	.556
Obstruction	.288	.079	13.301	1.333	.000	40.198	.000	.425
Truancy	.150	.050	9.152	1.162	.002	21.183	.000	.227
Unarmed Robbery	.165	.055	9.100	1.179	.003	36.970	.000	.377
Weapons	.185	.058	10.350	1.203	.001	36.503	.000	.365
Total Crime Rate	.266	.081	10.862	1.305	.001	37.416	.000	.416

[a] Logistic regression utilized continuous bus stop independent variables and dependent dummy coded crime rates for block group locations containing total crime rates higher than 20.85 incidents per 1,000 residents or block groups labeled as concentrated with 20 total incidents or more.

Model fit statistics also appear within the table since these will change for each crime incident. The model fit gives the chi-square (χ^2) statistic, which reflects any error associated with the model. Significant chi-square statistics means that the null hypothesis of the slope (ß) coefficients being (0) or none of the independents being linearly related to the log odds of the dependent variable can be rejected. As seen in Table V.11 all the model chi-squares were very significant. The last statistic is the Nagelkerke R^2, which gives the logistic analogy to R^2 in OLS regression. For all of the crime incident types, the dichotomous bus stop coefficient was positive and statistically significant.

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Table V.11 provides the most detailed information on the impact of bus stops for each individual crime incident. Rates of crime within each block group were left out to avoid redundancy since findings were similar. Bus stop locations carry the greatest predictability power for narcotics violations with almost one and half times the likelihood of these type of violations occurring in block groups that have bus stop locations compared to those block groups that have fewer than three bus stop locations. Overall, bus stop locations predict 1.3 times as many of the given crime incidents occurring compared to non-bus stop block group locations.

These models were also conducted with bus stops that appeared in the 75th percentile. This allowed only 35 block groups to be represented by the highest concentration of bus stop locations rather than 74 in the previous models tested in Table V.11. Within the analysis that includes concentrated bus stop locations, the odds of any crime rate incident occurring is 5.75 times more likely than block groups that contain less than eight bus stop locations. Concentrated disadvantage, immigrant concentration, residential stability and total population were again controlled for within the logistic regression model and the chi-square was significant (χ^2 =30.024; p<.001; Nagelkerke R^2 = .345). These statistics become even more interesting when using data over a six-year period (1995-2000) as opposed to two years of crime data. When six years of crime data is used, the log odds of a crime incident occurring in areas with concentrated bus stop locations (i.e., more than 8 bus stops present within a single "neighborhood" block group) is over 20 times the likelihood of crime incidents occurring in non-bus stop concentrated areas. However, this type of analysis is biased through the use of past dependent variable data being predicted by more current independent census variable data.

According to these results, both crime pattern theory and routine activities theory appear to be supported. Both these theories predict that crime occurs within individuals routine paths. If bus stop locations do predict crime, it can be argued that more incidents are likely to occur in place-specific areas that bring individuals together within their routine paths. It can also be argued that crime occurring in or around these areas occurs when there are suitable targets, motivated offenders, and lack of capable guardians. Policy implications should direct police resources towards areas that contain eight or more bus stop locations in an effort to provide more capable guardianship. Unlike collective efficacy solutions that require rallying community members or attempting to increase residential stability and home ownership, these police initiative solutions provide quick short-term directives. Other immediate solutions may include spreading out bus stop locations over other areas of the city and testing if changes in their locations decrease incidents of crime based on making changes to resident's routine pathways. This type of routine activities situational solution would fall under a CPTED crime prevention approach for designing out crime.

Part III: Systematic Observations of Hot Spot Bus Stop Locations and problems with data interpretation

Although more sophisticated statistical software was utilized for this dissertation to locate hot spots throughout the given unit of analysis, a mixed methodological approach was also chosen to add more depth to answer the 'why' questions that naturally follow the 'where' findings. This strategy again references Brantingham and Brantingham's (1981) recommendation for conducting research through a cone of

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resolution with the final step of this spatial analysis project being directed towards

qualitatively inspecting the physical attributes in the top five hot spot bus stop locations.

The observations that took place were completed through a systematic yet

unobtrusive methodology. These observations of the social interactions and physical

surroundings of the select bus stop locations did not include any direct contact with the

users of the space. A nonparticipant research methodology within the natural setting was

believed to be the best strategy for obtaining the most accurate information about the

social and physical reality surrounding the bus stop locations.

Properly conducted observational research can be characterized by the following:

1. The observations capture the natural social context where the particular behavior occurs.
2. The observations grasp significant events or occurrences that might influence the social interactions of the participants.
3. The observations aid in determining the reality of particular geographic locations.
4. The observations help identify regularities and recurrences in social life by comparing and contrasting data obtained in one study with those obtained in studies of similar natural settings.

(Babbie, 2001, p. 222).

These types of observations differ from experimental research observations in

which events are deliberately manipulated to affect certain results. The observational

research used in the dissertation attempted to capture the natural context of specific bus

stop locations without having any type of influence over those locations. The major

purpose for conducting the observational research portion of this project includes the

following:

1. Permitted the researcher and the raters to view the processes which lead to a given phenomenon that is the focus of this study by observing a reality that is untapped by the other data gathering methods.

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2. Provided the opportunity to give a graphic description of particular segments of social life that cannot be acquired through any other means but direct observation, thus supplementing the information that evolves from the official data. This type of mixed methodology allows for triangulation of more than one data gathering tool for investigating bus stop locations. Thus, the end product is a more complete picture of why criminal incidents may be higher at particular bus stop locations in comparison to other locations.
3. Observational research gave an exploratory insight into what types of future research would be necessary for a more enriched understanding of this type of street-level crime that encompasses public transportation.

All 638 bus stop locations in the given city used in this research project were mapped to the 114 census block groups. The locations of these bus stops came from a database that was put together by the main bus company. Bus stop locations were recorded by the bus company in 1999, so links closely match both the criminal incident data and the census variables. A map showing the location of the bus stops appears below in figure V.12. As suspected, most of the bus stop locations appear clustered along major thoroughfares throughout the city used for analysis, which may challenge the results of the logistic regression findings. Brantingham and Brantingham (1984) showed how crime tends to cluster around major thoroughfare pathways or nodes since these areas typically produce higher frequencies of routine activities and easier escape routes for offenders.

The proposition made is bus stops are often located within areas with high street accessibility. While this is convenient for transit users to locate a bus stop, it may also produce increased crime since these street segments are easily accessible to heavier volumes of traffic and criminal opportunities. Complex street networks with limited access (e.g., dead-ends, cul-de-sacs) can restrict traffic flow in an area and serve to reduce the exposure to criminal opportunity (Brantingham and Brantingham, 1984). An

argument may follow that frequent transit users will eventually learn where bus stops are located, even if they are not positioned within the busiest street segments.

Figure V.12. City map of streets and bus stop locations.
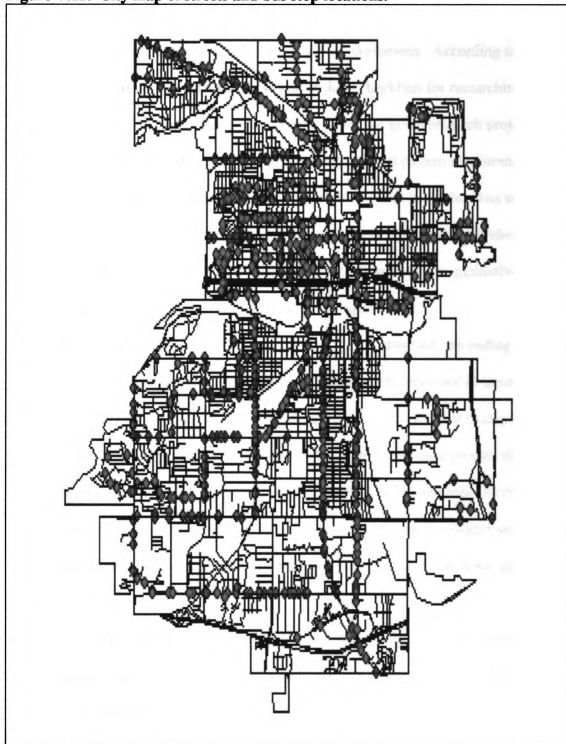
From the ArcView mapping software, the top five locations with the highest amount of criminal incidents over the two-years of incident data were highlighted and chosen to be analyzed qualitatively through systematic observation. This methodological strategy follows Reiss's (1971) recommendation that advocated systematic observations as a key measurement strategy within natural social phenomena. According to Reiss (1971) this type of situational analysis should include checklists for researching crime pattern concepts. These checklists were developed for the given research project allowing for future replication and testing reliability. Social pattern measurements and physical disorder attributes that surrounded both hot spot and low-crime bus stop locations were quantified through nonparticipatory observational research checklists or 'windshield' surveys. A checklist indicating the variables that were qualitatively observed within each bus stop location appears in Appendix A.

In order to reach uniformity within each bus stop observed, the coding sheets filled out for each bus stop location chosen were rated on the presence or absence of the same social patterns and physical attribute measurements. In an effort to improve reliability of the findings, each location was observed at a minimum of nine time periods over a seven month span (June 2003-December 2003). These observational times allowed for ecological differences such as weather environment in summer versus winter months and time differences such as morning rush hour, evening rush hour, and late evenings.

The literature points to observing, "immediate settings in which behavior occurs" or conducting situational analysis by "searching for regularities (i.e., patterns) in relationships between settings and behaviors" (Patton, 1987, p.113). The observations of

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the hot spot bus stop locations attempted to do the latter in search of what Felson (1996) labeled natural crime prevention, or lack thereof. Observations were conducted during multiple periods of the given month to consider ecological daytime and nighttime differences. In addition, interrater reliability was improved by utilizing six different recorders, including the main researcher, during this seven-month period of observations on the top five hot spot locations.

General agreement was found within each of the locations whenever multiple raters were used, which showed that interrater reliability did exist. The measure of intercoder agreement among the raters was conducted by comparing rating sheets that were done at the same time by multiple raters. Intercoder reliability means that consistency was found in the content analysis conducted by the observers (Tinsley and Weiss, 2000) and independent coders reached identical conclusions about the physical and social surroundings of specific bus stop locations.

Several undergraduate student coders were recruited to complete this phase of the research dissertation. Five students were able to conduct observations. The student researchers that conducted the qualitative analysis were trained to fill-out observation sheets separately without verbalizing what they were recording. Ratings and observations were then compared and found to match in almost every case and no rater was believed to record carelessly or cause any real divergence. According to Tinsley and Weiss (2000), intercoder agreement within this type of spatial analysis exists when different judges record the same observation (pp. 98). This intercoder reliability is a critical component of the qualitative analysis since it offers increased confidence pertinent to the qualitative aspects of the research design. As pointed out by Neuendorf

(2002), the goal of this type of qualitative analysis "is to identify and record relatively objective (or at least intersubjective) characteristics, reliable findings are paramount. Without establishing some level of reliability, the results are useless" (pp. 141). Numeric results from these surveys appear in Table V.12.

Table V.12. Results of windshield surveys.

	#1 hotspot (bus terminal)	#2 hotspot	#3 hotspot	#4 hotspot	#5 hotspot
Number of observations	27	8	9	9	9 (2 bus stops)
Observation times	7-9am, 11am-1pm, 3-7pm, 8-11pm	8-10am, 3-6pm, 8-10pm	9-10am, 3-6pm, 10-11pm	9-10am, 3-6pm, 9-12pm	8-9am, 3-6pm, 9-11pm
Unstructured interviews	YES	NO	YES	NO	NO
Total Traffic Lanes	4	4	4	4	4
Street lights	YES[a]	YES	YES	YES	YES
Cars per minute	38	27	N/A	40	55
Loitering youth	YES[b]	YES	YES	NO	YES
Loitering adults	YES[b]	YES	YES	YES	YES
Public drinking	YES[c]	YES	YES	YES	NO
Illicit drug use	NO	NO	NO	NO	NO
Prostitution	YES- once, external	NO	NO	NO	POSSIBLY
Vandalism/Garbage	YES- internal and external	YES- also, trash cans present	YES	YES	YES
Vacant buildings	NO	YES	N/A	NO	NO
Target hardening	YES	YES	YES	YES	YES
Natural surveillance	YES	NO	NO	NO	YES & NO
Easy escape paths	YES	YES	YES	YES	YES
Damaged buildings Broken windows	NO	NO	NO	NO	NO
Vacant/unused lots	NO	YES	NO	YES	NO

[a] Parking lot lights across the street from the main entrance of the bus terminal shut off at 10pm.
[b] Youth and adults often loiter but mainly on the outside of the terminal. Loiters inside the terminal are told to leave by the contract security officers.
[c] Public drinking is not allowed at the bus terminal and transit users are often warned not to drink at the terminal and some are issued temporary no trespass citations for drinking

By this stage of the research, it was predicted that visual cues surrounding bus stop locations do matter and are highly correlated with crime clustering that was observed through the mapping software techniques. In this manner, the association of independent measures of officially recorded data from both the census bureau and the dependant data from the local police department were tested against the systematic observations of high crime bus stop locations. Since the research methodology at this stage was conducted through nonparticipatory observations, special attention was placed on the physical image surrounding the bus stop locations rather than on social interaction observations. However, through the use of Brantingham and Brantingham's (1984) foundation, street pattern measurements were also used that included number of traffic lanes, volume of traffic, loitering youth/adults, public drinking, illicit drug sales, and suspected prostitution. Outside of these basic street pattern measurements, the main theoretical test was directed towards physical attribute measurements originally defined in Newman (1973). These measurements included type of residential/business establishments, recognition of vandalism/litter, vacant buildings/lots, structures with some type of security presence, and an overall rating of the area surrounding the bus stop location.

Assumptions of bus stop locations

Bus stop locations represent public spaces and, unfortunately, official statistics utilized within the given unit of analysis do not specify when crimes occur in or near bus stop locations. Often incident data includes intersecting streets or a specific address. In attributing crime data to bus stop locations, the geocoded bus stop locations (as seen in figure V.12) were layered within the geocoded crime incident mapped data.

Interestingly, the top ten hot spot crime specific locations all appear at or very close to bus stop locations. The top five hot spot crime locations within the city were chosen for a more in depth analysis through systematic nonparticipatory observation.

The main assumption made at this stage of the research was that the crime incidents within specific hot spot locations could be attributed to the bus stop location. However, there were several public space structures besides bus stop locations that often appeared at intersections or even specific addresses, such as phone booths, liquor stores, convenience stores, etc. Since the incident data only provides general locations without additional information about the specificity of the crime site or additional information on offenders/victims, it is not possible to know with exact certainty what element within the hot spot location can be claimed to have potentially contributed to the incident. However, it was of interest that all of the top ten hot spot specific crime locations all appeared within very close vicinity to a bus stop or the main city bus terminal. In addition, since the incident data was sanitized to only account for outdoor related crimes as coded by the reporting police officers, the construct validity appeared to be sound. At the very least, the spatial data results appears to indicate that bus stop locations may facilitate crime problems within hot spot areas by adding potential targets to areas that may already have an over abundance of motivated offenders.

Some general similarities were found in systematically analyzing the top five hot spot areas throughout the given unit of analysis. First, each hot spot location included at least four traffic lanes and appeared at busy intersections. The volume of traffic was averaged through the three locations by counting the number of cars per minute. The average hot spot location acquires an average of 38 cars per minute. In addition,

pedestrian traffic remained high at these locations during the warmer months and during

prime times such as 3-6pm and during weekend evenings. Although no known illicit

drug selling or prostitution was witnessed during any of the observations, informal

contact with both city police officers and contracted security made claims that all five hot

spot locations have frequent problems with these types of crime.

Nonparticipatory Observational Analysis of the Top Five Hot Spots

#1 Hot Spot Location

The main bus terminal represents the single largest clustering of crime incidents

in the given city for the two years of analyzed crime data. Although the terminal itself

was considered different from the typical bus stop locations, it cannot be ignored within

this study. Like most other urban areas, transit security measures are directed solely at

the centralized terminal since the terminal is the location for the highest number of raw

criminal incidents and greatest passenger vulnerability. Within conducting a systematic

observation of the bus terminal, a unique checklist was developed separate from the bus

stop observations. The checklists were completed multiple times by three different

researchers during the months of July, August, and November. This checklist was also

unique since it did not fit the "windshield" survey format since much of the unobtrusive

observation took place inside the bus terminal or outside of the terminal. Unlike the bus

stop locations, it was much easier for the observers to fit-in at the often crowded bus

terminal.

The observation checklist for the bus terminal was developed by referencing other

risk assessment audit observations from similar public transit settings. For example, Hoel

(1992) argued that the principle objective of security measures directed within bus

terminals should focus on the visibility of transit users to the bus company's personnel,

police, security, and other passengers. This visibility follows Newman's (1981) natural

surveillance theory and argues that criminal acts have a greater likelihood of being

prevented or help can be summoned quickly enough to deter easy escape paths.

According to suggested architectural design of transit station areas (Hoel, 1992, p. 515)

the following defensible space considerations were analyzed when observing the main

bus terminal as part of the systematic observations:

1. Ticket collection/information booth centrally located for greatest visibility.
2. Straight corridors and passageways, with ample width and good lighting.
3. Closed-circuit TV monitors on platform areas and other hidden locations
4. High levels of illumination.
5. Clearly defined station and circulation areas no larger than needed for passenger boarding.
6. Provision of variable-size areas for peak and off-peak periods to avoid passenger isolation and feelings of vulnerability.
7. Minimum number of exit and entry points.
8. Locked and supervised toilet facilities.
9. Clearly defined corridors and waiting areas partitioned from storage and nonpublic spaces.
10. Fences, one-way gates, and other directional devices to control passenger flow.
11. Warning alarms to attract attention, break up fights, or summon police.

A checklist that referenced Hoel's (1992) model was used as part of the

systematic survey instrument for the city's main bus terminal and can be seen in

Appendix B following the general observational bus stop checklist. Based on the security

risk analysis checklist, the main bus terminal was rated according to the presence and/or

absence of the above features, in addition to a thorough analysis of the immediate

exterior surrounding the terminal. This combined interior and exterior observational

rating system was unique in comparison to bus stop locations since the main terminal offered a unique structure and a unique quantity of official crime incidents.

Exterior physical attributes noted that surrounded the bus terminal included a four lane intersection. This area of the city produces some of the greatest traffic flow with an average of 48 cars per minute that passed the bus terminal during prime time observation periods (i.e., 3-6pm) weekdays. Surrounding land use includes only commercial properties with no residential housing within the immediate area. A shared parking lot for a local college and surrounding strip malls increases additional traffic around the terminal. In addition to the city bus station, another company that runs buses throughout the state also operates within this same terminal allowing more transient pathways to interact with local community members who are using the public bus system.

It is also interesting to note the bus terminal opened in October 1997. The old bus terminal was located a block away. When comparing crime data within the intersection of the new bus terminal prior to 1998 against data from 1998-2000, it is clear that crime has risen quit dramatically within the given space after the opening of the new bus terminal. There was a 43% increase in the incident data at the location of the new bus terminal in 1998-2000 as compared to 1995-1997 data. However, it is challenging for researchers and law enforcement personnel to equate the new terminal to actual increased crime or increased reporting of crime due to new contract security guardianship that more accurately observes, interferes, and records criminal activities within this given space. Regardless, law enforcement presence and official statistics have made the space within and surrounding the new bus terminal, the number one hot spot in the given city and this location requires observation that is more direct.

Figure V.13 shows a photograph inside the main city bus terminal. Clearly most of the defensible space strategies suggested by Hoel (1992) can be seen within figure V.13 and were observed while completing the predefined checklist. The information booth appears at the center of the terminal providing a centralized location for guardianship. CCTV cameras are posted above the information booth and cameras point down the aisles to either side of the main booth. In addition, CCTV cameras appear near the end of the aisles and there are two additional exterior cameras. Wide, straight and well-lit corridors allow for clear lines of sight and natural surveillance. There was no vandalism present inside of the bus terminal at any of the three periods (i.e., July, August, November) in which observations took place. An incidental amount of fast food litter was found during the November observation. However, a full-time cleaning staff as well as contracted security personal generally keeps the terminal free from litter or graffiti.

Although the bus terminal reports some of the highest crime concentration in the city used for analysis, the inside of the terminal appears to be fairly secure. Because of the high security, data also points to frequent incident reporting conducted by the contract security inside and outside the immediate bus terminal. This presents some serious questions in terms of the accuracy of official crime data. In areas with paid guardians, we might expect high official incident data since it is the job of these space handlers to report any ordinance, status, disorderly, or criminal acts. These findings also present challenging questions for criminologists who utilize official data since it may not be readily recognizable if maintenance of physical and social disorder in specific spatial locations can have a deterrent effect on crime and disorder. Because of these challenges bus stop locations outside of the terminal were also analyzed.

Figure V.13. Interior of main bus terminal.

Despite the observed defensible space mechanisms, the bus terminal location produces the highest amount of crime incidents in the entire city used for the dissertation research project. While it appears that the physical design features can affect crime and fear, the literature has shown that there is no guarantee that proper design will produce expected results. This kind of research finding was discovered by Merry (1981) who conducted a participant observation study of a single public housing facility with

numerous defensible space target-hardening devices, which failed to have any effect on residents' feeling of safety. Merry (1981) concluded her study by arguing that the general failure of the defensible space concept to bring about reductions in crime must be placed on the inability of the physical environment to effectively create feelings of territoriality (i.e., collective efficacy). In other words, good defensible space design does not guarantee that a space will appear safe nor that residents will care to defend the space. An area may be defensible, yet undefended (Lab, 2000).

Further analysis of the exterior bus terminal was also conducted since the official crime incident data does not specify an exact location of the offense, only the address of the bus terminal. The intersection of the bus terminal was used for mapping purposes, so any crime occurring in or around the terminal is attributed to the structure.

A further examination of the exterior perimeter surrounding the bus terminal found less defensible space mechanisms in place. Figure V.14 and V.15 shows the area where buses arrive and depart from opposite directions. These areas are frequently crowded according to interviews with contracted security personnel that work at the bus terminal. These areas also become frequent locations for disorderly conduct, alcohol violations, assaults, and drug dealing. According to unstructured interviews with the contracted security personnel, most of the security reports and police officer intervention arise from the exterior of the bus terminal.

While both the interior and exterior terminal locations offer many opportunities for victimization or illicit narcotic sales, it also offers high natural surveillance to potentially intervene and report these offenses. However, one of the challenges Newman (1972) faced from his critics was that increased natural surveillance does not generalize

to lower crime. Transit users are often surrounded by strangers and are not likely to intervene in situations for which they do not feel any type of collective efficacy. In these instances, capable guardians may be lacking (Cohen and Felson, 1979) if the contracted security presence, made up mainly of young college students, is not constant or not seen as a major deterrent. Outside of the contracted security personnel, there is not a strong likelihood that the movement of bus passengers will deter much of the misconduct at the terminal. This premise was based on observations that the majority of passengers are only at the terminal temporarily while they await their bus transfer and their motivation is usually directed at leaving the terminal as quickly as possible rather than paying attention to or intervening in any type of misconduct. Consequently, the terminal can be seen as having low collective efficacy.

Observations conducted on the exterior of the bus terminal noted numerous occasions of loitering youth and adults. Although the contract security personnel strives to make sure loiters do not frequent the bus terminal, this becomes difficult when youth will loiter on the streets surrounding the terminal and walk in and around the terminal. This problem was especially noteworthy during observation that took place during the warmer months when loitering youths and adults often used the exterior of the terminal for socialization and places to meet up with friends and relatives. According to Felson et al., (1996) public transit loitering can cause a series of problems including increase fear of crime among older transit users and a higher potential for disorderly acts of conduct.

Figure V.14 shows the exterior area in front of the buses that often becomes heavily crowded during peak hours. Figure V.15 shows the bus terminal from the opposite side in addition to showing an alley way and an area that offers less natural

surveillance in addition to quick escape routes to and from the terminal. The exterior areas become particularly crowded by younger students (or truants) going to and coming from school during the early morning hours and mid-afternoon. Informal discussions with employees from the bus company revealed that many of the students who utilize the city's bus system have had their school bus privileges revoked because of misbehavior and are now forced to use the city bus system to get to and from school. Consequently, there seemed to be some indication that these children are more disorderly than other schoolchildren.

Several youth have had no trespass citations written against them due to loitering, disorderly conduct, or other criminal activities that they have participated in while at the bus terminal. These youth often face arrest for violating the no trespass citation issued by the police or the contract security. During these situations, these youth are then supposed to wait at the surrounding bus stops to transfer buses rather than at the terminal. Each of these situations provides unique challenges for both the contract security at the terminal and the wider community. Businesses surrounding the immediate space around the terminal are particularly affected by loitering youth around bus stop locations, especially those who are not allowed in the terminal by security. Once outside the terminal, the contract security does not exercise any authority at the actual bus stops. However, they may once the transit users enter the interior of a bus.

Figure V.14. Exterior of main bus terminal.

Figure V.15. Exterior of Bus Terminal.

#2 Hot Spot

The second highest hot spot for crime is located within the number one hot spot block group. Photographs of this intersection appear in figures V.16-V.19. Observation within this location revealed several characteristics that have been attributed to both fear and increased official crime. As figure V.16 reveals, some efforts have been made to improve the area surrounding this bus stop location, including multiple trash receptacles and a neighborhood watch sign.

Figure V.16. #2 hot spot noting multiple trash receptacles, neighborhood watch, and overgrowth landscaping.

The goal of any neighborhood watch is to prevent crime by increasing community awareness and problem solving. The catalyst for these programs is often found through mutual problems of area residents and business owners who participate with the goal of increased feelings of communal needs and joint activities to meet those needs. In its most effective form, these programs should provide informal social control over the area of the community that needs attention. However, Bursik and Grasmick (1993) point out that many neighborhoods are socially disorganized and unable to exert control over residents or illegitimate users of space. Further analysis of the #2 hot spot location shows landscape overgrowth that can symbolically serve as a sign that no one cares about the area and intervention by neighborhood residents is not likely (Wilson and Kelling, 1982). A more in depth observation revealed additional problems.

Bursik and Grasmick (1993) utilized early Chicago School research from Shaw and McKay (1942) and argued that neighborhoods should draw on a variety of resources to control social behaviors. These include, but are not limited to, local businesses, churches, schools, and other local networks. One way in which the neighborhood watch program contributes to the social control level at this intersection is through the heavy use of surveillance, which requires the ability to distinguish legitimate space users from illegitimate users of an area. Some areas of concern for this hot spot location are noted in figure V.17.

Figure V.17 shows rental housing with several signs attached to the windows providing some indication that this property is not currently occupied. Therefore, surveillance is unlikely, collective efficacy is probably low, and the owners may be finding it difficult to find renters at this location. These rental signs remained in place

during observations in June, July, and September but were removed during observations in December.

Figure V.17. #2 hot spot bus stop noting low collective efficacy, rental housing, and neighborhood watch signage.

The last photograph of the intersection for this #2 hot spot bus stop location (Figure V.18) shows a 24-hour convenience store that sells liquor late into the evening and often becomes a meeting place for loitering youth and adults. Research is fairly consistent that points to a relationship between the presence of liquor establishments and crime in the surrounding area (Roncek and Bell 1981; Roncek and Pravatiner 1989; Roncek and Meier 1991; Block and Block 1995). Further research has shown that some areas that sell liquor produce a disproportionate amount of crime and violence (Sherman, Schmidt, and Velke 1992).

One of the troubling aspects of this research project was being able to adequately disseminate the data and articulate the catalyst for the given crime statistics. It is very likely that much of the crime incidents that were coded by the police as occurring outdoors at this #2-hotspot location were being driven by the 24-hour convenient store that also sells alcohol. However, it can also be suggested that the bus stop location, on the opposite side of the intersection from the convenient store, provides even more risk for this area since transit users' routine pathways are forced into this geographic space that is already at-risk. Consequently, it is not being suggested that the bus stop location causes increased crime, but at the very least, it may be argued that the location within an already viable space may be seen as a facilitator for increasing crime. To use an appropriate analogy, the bus stop location may be seen as fuel (i.e., providing suitable targets) to a fire (i.e., motivated offenders) within the hot spot location.

A leading question follows, which came first, the crime or the bus stop location. In answering this type of chicken or egg question, the matter becomes more complicated since the data is incomplete regarding accurate spatial recordings or time-series analyses

actively being conducted on public transit locations. This lack of research is not unique for the given city utilized for the dissertation, but for all cities throughout the country. Although every attempt was made to determine the timing of putting in the bus stop locations in the city used for the dissertation analysis, the company has unfortunately never kept track of this type of data.

Figure V.18. #2 hot spot showing the 24-hour convenience store, liquor sales, loitering youth/adults, and rental property across the intersection from the bus stop.
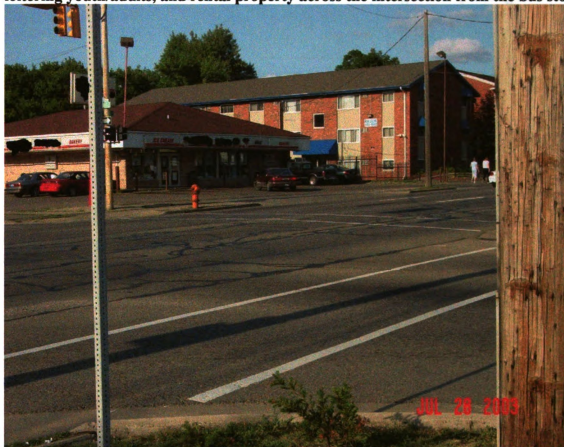
#3 Hot Spot location

The third location with the highest amount of official crime incident clustering takes places at the address of a large grocery-shopping chain store. Again, it is important

to note that crime data used for the dissertation analysis does not include any incidents that occurred inside the store. In addition, incidents such as motor vehicle theft or theft from a motor vehicle are not included within the given crime statistics. As seen in V.19 the bus stop is located within the shopping center's parking lot and includes a bus shelter rather than simply a sign as was found in the #2 hot spot location.

Figure V.19 #3 hot spot bus location noting large shopping center parking lot

Figure V.20 shows a wider photograph of the bus stop location in reference to the shopping structure. The bus stop sets off to the east side of the shopping structure rather than in front of the building cutting off much of the natural surveillance. Again, it is

quite possible that many of the incidents recorded at this location occurred in the parking

lot or in front of the store location rather than specifically at the bus shelter. Since this

type of information is not readily available through the incident data utilized for the

research, it is assumed that many of the recorded incidents have also occurred at the bus

stop location that is located about 75 yards away from the east side of the shopping

structure.

In terms of the observations that took place at this location, traffic lane use was

not applicable, but the shopping structure provided an obvious need for the bus stop

location. Consequently, pedestrian traffic remained high, including multiple observations

of loitering youth and adults in and around the bus shelter location. Other incidents

recorded at this location included public drinking at the bus shelter location while noting

that the shopping structure is open 24-hours and does carry a liquor license. Since this

area contains only the shopping structure and a large parking lot, little collective efficacy

exists from the customer base. The question then becomes if the employees, especially

full-time employees, are likely to become "capable guardians" of the surrounding

structure.

Eck's dissertation (1994) recommends a tripling of guardianship with guardians

of targets, handlers of potential offenders, and managers of places. The guardian

provides surveillance and protection of the area, the handler is suppose to exert control

over the movement and behavior of the potential offender, and the managers are suppose

to take action to keep the offenders and victims from coming into contact with one

another. Eck's (1994) suggestions are particularly challenging, and noteworthy, for

shopping areas such as the #3 hot spot location. These suggestions directly challenge

assumptions of responsibility on the part of the business to ensure safety for both employees and customers.

The store utilizes a staff of proprietary security officers. However, unstructured interviews with the security personnel found that the main emphasis of security is directed internally toward employee theft and limited external protection against shoplifting. The proprietary security team, other than reactively contacting the local police department upon a customer complaint, initiates very few incidents that occur within the parking lot. Two CCTV cameras record the parking lot area on a 24-hour basis, but this is mainly done for liability concerns in major cases such as homicide or abduction.

Figure V.20. #3 hot spot location noting the bus stop location is not positioned within the front site line of the shopping structure.

The #4 hot spot location for crime incidents also contained a 24-hour convenient store that holds a liquor license. The outside of this store is adjacent to the bus stop location in figure V.21. In fact, this same store is part of a chain found at the #2 hot spot location. Similar observations were found at the #4 hot spot location as the #2 hot spot location. Again, the traffic included a four-lane highway and loitering as well as public drinking was observed at the bus stop location, especially during the evening hours. Unlike the #2 hot spot location, this bus stop was closer to the 24-hour convenience store and did not have trash receptacles at the bus stop location. Consequently, it was not surprising to find more litter surrounding this bus stop location than other locations. In addition, the convenience store included a gas station, unlike the #2 hot spot location.

Since the incident level data acquired from the city police department only includes the intersection as the location for the #4 hot spot, it is not possible to determine any type of spatial catalyst for crime with any type of certainty. It is, however, being suggested that several features within this intersection may be creating the hot spot. This includes the rental housing within the area and lack of collective efficacy, the 24-hour convenient store with a liquor license, lack of natural surveillance at the bus stop location from the gas station/store or the main intersection, and easy escape paths from the intersection area towards the rental housing units. Other photograph angles of this intersection are shown in the proceeding figure V.22.

Figure V.21 #4 hot spot location noting 24-hour convenience store, gas station, litter surrounding the bus stop location.

Figure V.22 shows a photograph of the #4 hot spot intersection taken from across the street. Through this observation angle, other areas of interest included a public pay phone (also seen in figure V.21) and the rental buildings across a field from the bus stop location. This field, along with the surrounding trees, was seen to potentially block natural surveillance of the bus stop area and provide an easy escape path, again citing Newman's (1973) defensible space theory.

Figure V.22. #4 hot spot location noting public phone and rental property in the background along with easy escape paths.

Figure V.23 also highlights the general isolation of the #4 hot spot intersection. According to (Brantingham and Brantingham, 1993, 1996) this bus stop location would be considered part of a node of activity between pathways. Offenders are likely to develop mental maps of this area after extensive use. In terms of other structures surrounding this intersection, the bus stop can also be described as part of the edge of the node because of its isolation to the main area. According to Brantingham and

Brantingham (1981) edges are areas that constitute prime spots for deviant behavior since there is limited natural surveillance.

Figure V.23. #4 hotspot noting isolation and lack of natural surveillance.

Again, the assumption made is that this bus stop location is a catalyst for much of the recorded crime at this intersection location. It is quite possible that the convenience store/gas station is a major mechanism for crime at this location. However, multiple observations of this location noted frequent crowding by both legitimate transit users and loiters. Crowding and safety issues at this particular bus stop were frequently noted during informal conversations with both transit management and local police officers. In addition, the bus stop location is on the side of the 24-hour convenience store out of the

normal visual range of customers and employees. For these reasons, it may also be possible that this bus stop location is at the edge of the given node and provides a suitable target for motivated offenders within an area of low collective efficacy.

#5 hot spot

The last hot spot explored contained two bus stop locations within one of the busiest intersections of the given city. This intersection has several businesses and can be considered somewhat of a strip mall. Interestingly, the bus stop locations appear to be in better visual surveillance to area businesses and the intersection in general. However, some early spatial research points to some reasons why this may not always be an effective crime prevention strategy.

Angel's (1968) study of street crime in Oakland, California looked at the relationship between crime and population density. Angel argued that crime is related to the intensity activity on the street and as this intensity increases from very low to low, potential targets warrant the attention of potential offenders. However, Angel also asserted that higher levels of use cause crime to fall because there are enough people to ensure informal surveillance. Angel's research further showed that commercial strips were especially risky areas to crime since the linear nature of the strip tends to decrease the intensity of pathways making it easier for offenders to commit crime. The bus stop in figure V.24 shows a regular sign bus stop set some distance from the strip mall area across the intersection. Figure V.25 shows a second bus stop shelter location, which is again situated some distance from the strip mall area.

Figure V.24. #5 hot spot intersection noting heavy traffic and commercial property.

Figure V.25. #5 hot spot noting a second bus stop shelter location

CHAPTER VI

CONCLUSIONS

On September 25, 2000, the American Sociological Association and the

Consortium of Social Science Associations held a joint Congressional seminar (Sampson,

Squires, Zhou, 2001). At this seminar, Chicago sociologist Robert Sampson spoke about

the need to observe neighborhood contexts as units of analysis separate from individuals.

He emphasized that understanding the pathways to healthy and unhealthy communities

can lead to crime prevention strategies that cost less than traditional methods. Sampson

also noted that the concentration of disadvantage, immigrants, and racial segregation

have shown increasing gaps among neighborhoods in recent studies. Ecological

concentrations of disadvantage lead to geographic hot spots for not only violence and

crime, but also disproportional higher rates of infant mortality, low birth weight, and

physical abuse. According to Sampson, a mediator to these unhealthy spatially

concentrated variables is collective efficacy, in which residents increasingly intervene to

protect their territories. The concept of collective efficacy was measured in the

dissertation through owner-occupied housing and those who have lived in their residency

for more the five years. Although the measurements for collective efficacy were not as

detailed as has been used in Sampson's work (1997, 1998), the results from this study show that neighborhoods do matter and a great deal of value can be placed on investing in local communities and empirically analyzing problems in areas where crime shows unusual clustering.

Applying social ecology to criminal justice policy has various ethical, legal, and political concerns. Sampson (1986) accurately points out the legacy of Shaw and McKay's research in Chicago continues to offer support for programs such as the Chicago Area Project (CAPS), which looks towards social control through community organization rather than changing individual offenders. The assumption of the social-control strategy is that the social ecology of neighborhoods does affect individual behavior. Future research endeavors strive to test problem-oriented solutions within the given ecological settings.

New GIS technology has enabled the visualization of these ecological constructs, crime patterns, trends, and the identification of hot spots that have already come to the attention of the police. However, an ideal analysis would incorporate early warning systems across time and space that would be used to make more informed proactive responses in terms of problem-oriented and crime prevention policing. These predictive models would be able to identify hot spots of crime and disorder as well as areas where crime is abating (Groff and LaVigne, 2001). However, only a few published works exist on the use of GIS spatial crime analysis for predicting future crime escalation (Olligschlaeger, 1997; Rossmo, 1995; Groff and LaVigne, 2001).

Summary of Theoretical Foundation

Crime theory can be generally divided into looking at criminal offenders or looking at criminal events. In the past, criminological theory was dominated by a focus on offenders (Clarke, 1980), but researchers and crime prevention practitioners have increasingly become aware of the role that specific environmental areas play in crime. These environmental areas have been referred to as crime places throughout recent criminological literature. Places are defined as very small areas such as specific street corners, exact addresses, or bus stop locations. At the place level, explanations focus on crime events rather than analyzing criminal offenders.

Four areas of theoretical foundation utilized for research focusing on crime places have consisted of collective efficacy, rational choice, routine activities, and crime pattern theory. All four theories were utilized throughout the dissertation research, which emphasized criminal places. These theories can be considered mutually exclusive under environmental criminological perspectives.

Collective efficacy

This theory was tested following the PHDCN model in Chicago. Within the literature, social cohesion has been defined as the willingness and ability to act on behalf of the public good. From this definition, social capital was defined through owner-occupied housing percentage within block groups, which was argued to represent a willingness to make efforts for the larger good based on higher levels of capital. This increased capital was shown to mediate the effects of being a foreign immigrant and significantly relate to lower criminal incidents in the dissertation data. It can be further

argued that this correlation occurs through shared values of the homeowners and encourages additional support through more interactional patterns than in neighborhoods with less capital. These shared values encourage more enforcement of prosocial norms than those areas with lower levels of collective efficacy. These findings indicate the importance of encouraging collective efficacy in areas surrounding high crime areas. This encouragement is perhaps more challenging in commercial areas rather than residential areas, but can still be seen as a worthwhile goal for city planners and progressive proactive police management.

Rational choice theory

This theory provided the basic rationale for defining place and crime by suggesting that offenders will select their targets through a hedonistic cost benefit rationale (Cornish and Clarke, 1986). There have been claims that this type of perspective may be untestable since it may always be possible to interpret behavior as rational from the perspective of the offender (Parsons, 1951) except in the cases of extreme mental disorder. Other researchers have demonstrated that it is possible to test various forms of rational choice theory (e.g., Hogarth and Reder, 1987; Cornish and Clarke, 1986). Rational choice assumptions were critical for the given research project, although no emphasis was placed on analyzing individual offender choices. Rational choice assumptions provide the link for a more empirical analysis of situations, routine activities of both victims and offenders, and crime pattern theory. It has been suggested that bus stop locations in areas with high crime rates, may increase the opportunity for motivated offenders by providing increased targets. Areas that lack adequate surveillance

(i.e., costs) may provide increased opportunity (i.e., benefits) for offenders who are making rational cost benefit analyses within the given spatial targets.

Routine activities theory

The use of the routine activities theory focused on the behaviors of targets and the possibility that controllers (e.g., handlers, guardians, and place managers) affect the amount of crime by their mere presence. Guardianship was measured within block groups through the amount of home ownership and general stability in terms of time at a residency. This theory also argues that as routine activities change so may the amount of crime. Bus stop locations provide a unique spatial area that forces routine activities to those areas and the research has shown that these areas become more risky for the space users. It was no coincidence that the spatial areas most at risk in the city also contained bus stop locations. These locations invariably force routine activities of potential victims and offenders into these locations through space and time. Qualitative findings pointed out that the addition of other risky structures (i.e., 24-hour convenient stores with liquor licenses, rental property, loitering youth/adults, and litter) can have additive ramifications for transit users during their routine activities.

According to routine activities, motivated people (e.g., teenage loiters, drug users, unemployed adults) are ones most likely to commit crime. If these individuals congregate in a particular neighborhood, or in a particular part of the neighborhood such as the bus stop, this area has an increased propensity to become a hot spot. Clearly, the observational research conducted on these hot spot bus stop locations invariably found the presence of motivated potential offenders. Yet, motivated offenders must still have

the opportunity to find suitable undefended targets before they commit a crime, and legitimate transit users appear to provide unlimited numbers of targets in areas that lack adequate surveillance.

Crime Pattern Theory

Crime pattern theory integrates rational choice with routine activities theory (Clarke and Felson, 1993). However, the focus of crime pattern theory is how targets come to the attention of offenders over time, space and availability (Brantingham and Brantingham, 1993). This rational decision-making process occurs during the offenders' routine activities. As potential offenders conduct their normal daily/nightly activities, they become aware of easy targets. While it is recognized that a few offenders may aggressively seek out areas that are not part of their routine, most will conduct their searches within areas they are most familiar with and this search will take place through the course of noncriminal activities. It was shown that bus stop locations may be seen as easy targets for offenders during their normal everyday patterns.

The use of these theories provides the foundation for constructing a general theory of crime places. This type of theory should continue to be developed through the growing literature that links crime and place and has been encouraged in the past (Eck and Weisburd, 1995). Studies of criminal offenders and crime places can compliment each other. Offenders who are considered motivated still need the opportunity or crime event in order to issue an explanation. In attempting to develop a theory about crime places, it is necessary to determine why some targets are attractive and others are not. Therefore, a future research direction should be directed at further analyzing the

attractiveness of some bus stop locations over others. We may want to know what type of routine activities of offenders, victims, and guardians contribute or deter the likelihood of crime occurring in a particular place.

There is a practical relevance to the given research presented in this dissertation. Within the growing recognition of crime place and crime control, this recognition is perhaps best exemplified by the number of law suits that have come about claiming that certain areas are inherently unsafe or unnecessarily dangerous[8] (Fischer and Green, 1998). Through local community policing efforts, resources can be made available to assist residential and commercial property managers in their efforts to secure their property and deter illegal activity. In addition to acknowledging the legitimacy of the dissertation research findings, training programs have been developed through the federal government to assist neighborhoods in their fight against public outdoor related crime (U.S. Department of Justice, Bureau of Justice Assistance, 2000).

Three part conclusions

Part I: Collective Efficacy Model Test

The ecological model developed by Sampson et al., (1997) argues that community residents become empowered through their knowledge of and trust in each other to take action against threats. Within these communities, there is a greater likelihood that formal alliances will be made through neighborhood watch groups and community policing initiatives. Public spaces, such as bus stop locations, should also be better protected

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[8] "We've heard a lot about corporate responsibility as it relates to accounting practices. But management and community responsibility goes much further than the bottom line. It also extends to assuring that employees and the public are free from the threat of harm on the job or in their neighborhood."
-Senator Joe Biden, August, 2003.

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within these communities. Often, these bus stop locations are part of the property owned by a business or private resident. Nonresidential land use and population turnover affects residents' ability to know one and another. These variables also affect the willingness of legitimate space users to observe and intervene in disruptive actions that take place at the bus stop location. In Sampson et al's., (1997) reformulation of social disorganization theory, residents high in collective efficacy have the ability to overcome disorganization. According to Sampson and Raudenbush (1999):

> "A theory of collective efficacy does not render structural constrain irrelevant; rather, it proposes a mediating mechanism while at the same time instating on an independent role for agency in all corners of the social structure" (p. 613).

Through spatial identification of both collective efficacy concepts and crime clustering, proactive police management strategies are better positioned for collaborative enforcement and problem-solving initiatives than in any other time. These departments have become much more risk-focused in terms of identifying the underlying causes of disorder and the factors that place space users most at-risk for criminal and problem behaviors (Rich, 1999). As these causes become more well-known, police departments are being encouraged to share their findings with the wider community. A strategy for engaging the community to get involved with crime control is through making aggregate crime data available to the public, often , through the department's website. Several police departments now have interactive maps within their departmental websites. These websites may be best served to also display levels of informal social control or collective efficacy with an explanation of the Sampson et al., (1997) research. This type of data should be gathered through other means such as surveys rather than simply through home

ownership or residential mobility, as this is seen as a limitation of the collective efficacy dissertation data and discussed more thoroughly in the limitations section.

Community leaders in one community have commented that the mapping system improved communication between the police and residents by ensuring that they shared a common platform on which to judge the nature and extent of neighborhood problems (Redlands Police Department, 1999). As this information becomes increasingly shared, an expectation arises for legitimate space users to more uniformly take a role in crime prevention initiatives that are risk-focused. In addition, as residents become more educated on the need and benefits of collective efficacy and become consumers of tracking their own neighborhood crime data realities rather than erroneously gathering this information from television news drama, it can be expected that general levels of informal social control may also increase. This type of data may also serve as a mechanism of lowering overall fear of crime.

Part II: Quasi-Experimental Design testing crime predictability of bus stop clusters

The quasi-experimental design was used to test the overall impact of bus stop locations on the number of crime incidents while controlling for the latent concepts that were established in the first part of the dissertation methodology. These tests showed that bus stops clustered closely together do indeed seem to attract increased crime incidents, while controlling for other social ecological variables; total block group population, concentrated disadvantage, immigrant concentration, and residential stability. Policy implications of these findings may appear somewhat obvious, or at the very least point

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out the need to separate bus stop locations within high crime areas or remove them altogether.

This removal of bus stop locations within high crime areas may be seen as part of an overall gentrification movement. For example, community changes are often seen as occurring within cycles. As these changes occur, progressive police administrators and city planners often look towards revitalizing certain neighborhoods that appear disorganized. Urban areas often undergo stages of decline in terms of socioeconomic status and increased population density (Bursik and Grasmick, 1993) followed by renewed efforts to replace obsolete housing and increase businesses. As part of this renewal or gentrification process, planners would be wise to also look at the availability of potential victims within high crime areas and determine if there reasons that the routine pathways of these victims are unnecessarily encountering a large clustering of motivated potential offenders.

Part III: Systematic Qualitative Observations of Bus Stop Locations

Findings from the observational research appear to be justifiable. The part I structural equation model research design was based on the assumption that human behavior can be explained by "social facts", which were investigated by various methodologies that utilized a more "deductive logic of the natural sciences" (Horna, 1994, p. 121). This quantitative measurement strategy attempted to measure "how much", and "how often" (Nau, 1995) in terms of correlational research for examining the behavioral components of specific public space usage. The weakness of this approach lies mainly in the failure to ascertain a deeper underlying meaning and explanation for

why crime incidents cluster. The qualitative research design was associated with an interpretative approach rather than only utilizing discrete, observable data.

Since the bus stop locations and intersections that contain bus stop locations are at the smallest micro-level data, it was decided that the given incident data was appropriate for investigating these spaces qualitatively; provided the information would not otherwise have been found through the aggregate independent variable data. This depth allowed the project to achieve "*verstehen*" or a more empathetic understanding of the social/physical environments that surrounds the hot spot locations. Specifically, the qualitative approach gave a more explicit view of the given data.

This dissertation "blended qualitative and quantitative methods of research to produce a final product which highlights the significant contributions of both (Nau, 1995, p. 1). In addition, it can be argued that the "qualitative data supported and explicated the meaning of the quantitative research" (Jayaratne, 1993, p. 117), especially in terms of observing low collective efficacy within the hot spot locations. Qualitative information about the immediate environment of block groups with the highest number of criminal incidents was generated through the windshield surveys. Most spatial crime analysis is still largely exploratory. As such, the use of the qualitative methods allows for the possibility that unexpected developments may arise as part of the research process (i.e., serendipity). The quantitative analysis complements the findings of the qualitative research by indicating the number of incidents that were formerly found in and around the bus stop locations. The qualitative analysis appeared to confirm the data that emerged from the quantitative analysis. These systematic observations helped to provide further

information about why particular bus stop locations attract a higher number of criminal incidents than other bus stop locations.

Each windshield survey entailed a systematic inspection of the bus stop location and the immediate surroundings of the bus stop. A rating sheet was developed prior to the inspection. Separate investigators were used at the same time and in the same vehicle to rate the attributes surrounding the bus stop locations in an effort to reduce potential rater bias. Each individual rated their areas independent of the other researchers and responses were later compared to assess reliability. Little bias existed in comparing systematic rating sheets, indicating high inter-rater reliability. The information from the windshield surveys were used to assess defensible space and incivility concepts.

Incivility refers to a variety of factors involved in disorder and general community decline. Two general categories of incivility that were concentrated on through the observations included negative physical attributes and social interactions. Physical attributes of incivility included broken windows, abandoned property, litter, graffiti, vandalism, etc. Social incivilities included public drinking, loitering youth/adults, illicit drug sales, prostitution, etc. Both transit users and potential offenders are believed to see signs of incivilities surrounding the bus stop locations as an indication of a lack of social cohesion, high transiency, a lack of resources, and/or overall low social control (Lewis and Salem, 1986; Skogan, 1990).

According to Patton (1990) and Nau (1995) these types of systematic observational studies coupled with mixed quantitative analysis provides enough "trustworthiness" information to validate research findings and argue against other limitations. Just as data speaks for itself and emerges into themes and patterns, so did the

understanding of the environments surrounding bus stop locations providing "trustworthy" empirical information through the systematic efforts of the raters to find credible, confirmable, and dependable data. The use of an audit trail offers visible support that the observational research data was integrated into the overall research findings of the dissertation project. Technical literature, comparable observations by multiple raters, and links with official data all combine to confirm that a research design that utilizes mixed methodologies can provide a more in depth and complete analysis. The use of a triangulation of multiple data sources also addresses both the internal validity concerns and/or limitations.

Weick (1968) proposed that when one specifically observes a particular phenomenon increased validity occurs. The synthesis of official data sources, mapping specific locations of those data sources, and actually observing those locations provides an image of what is "real." These combined approaches are believed to provide a more full understanding of the complexity of relationships between various sources of data. In addition, these qualitative steps also provide some arguments for the complexity of spatially mapping data and accurately recording and spatially locating raw data.

Expanding hot spot spatial analysis

Place-oriented crime prevention strategies have begun to carry critical importance in police resource allocation and policy implementation. We now know that crime does not occur evenly through urban landscapes, but is concentrated in relatively small places that generate more than half of all criminal events (Pierce et al., 1988; Sherman et al., 1989; Weisburd et al., 1992). Research has also shown that even in the most crime-

ridden neighborhoods, crime clusters in a relatively few discrete locations and other areas remain relatively crime free (Sherman et al., 1989). Arguments that follow claim that crime problems can be alleviated more effectively when police administrators focus their attention on these discrete hot spot locations (Sherman and Weisburd, 1995; Weisburd and Green, 1995).

In their review of spatial place-oriented crime research, Eck and Weisburd (1995) identified four components that dealt with the role of place in crime that seem to fit within the dissertation analysis of bus stop locations and crime. The first component was labeled *facilities* and deals with structures such as bars, churches, or rental properties that have an immediate environmental impact on crime surrounding these locations depending on the type of people attracted, the way the space is managed, or the level of collective efficacy present through business owners, security or the police. The next component is *site features* such as easy escape pathways, lack of guardianship, and the presence of valuable items, which can influence offenders' choices, and general opinions of the area. Third, studies of *offender mobility* suggest that offenders select easy targets according to characteristics such as gender, age, race, demeanor, and the overall distribution of crime targets. The fourth component mentioned occurred through a direct outgrowth of offender mobility patterns and is directed at researching *target selection* arguing that offenders seek places that give cues that indicate acceptable risks and gains. These target selections are found during daily legitimate routines.

Within the Eck and Weisburd (1995) component research summation, locations external to *facilities* should also be taken into consideration. Although structures, or *facilities*, have been shown to impact crime, often the behavior that occurs outside of

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these establishments provides the most visible signs conducive to raising fear and effecting general neighborhood health. As shown within this research dissertation, it can argued that outdoor related crime matters most in terms of the overall health of the neighborhood and these crimes do cluster. Many of these disorderly/criminal behaviors were seen in and surrounding bus stop locations. Events such as open prostitution, illicit drug sales, loitering youth, and public drinking occur most frequently in areas that already have negative facilities, such as liquor stores, abandoned housing, rental property, 24-hour convenient stores, etc. However, these events may be further enhanced through features external to the facilities that also cause an influx of increased targets through forced routine activity movement, such as bus stop locations.

Recommendations

Studies have found that more transit crime occurs at bus stops (Levine et al., 1986; Sideris, 1999) than bus vehicles, yet most transit agencies focus their attention driver safety and property damage within the vehicle. In addition, most of the attention by transit authority toward bus stops recommends police presence rather than exploring environmental design solutions (Transit Cooperative Research Program, 1994). Even with the focus on increased police presence at suspected high-crime bus stop locations, responses by public officials are not always positive since the question of responsibility always arises.

Who is responsible for transit security?

The tendency to discourage crime will vary with the primacy of responsibility: personal, assigned, diffused, and general responsibility (Felson, 1995). Those with

personal responsibility will be most likely to intervene with a potential offender and decrease within the given order. However, those with general responsibility are likely to ask someone with more responsibility to talk with the potential offender or wait until a crime has occurred and then contact the police afterwards. By this time, the crime has already taken place and very likely, the offender has fled. According to Felson (1995), the level of responsibility not only affects the likelihood that crime will be discouraged but also that such discouragement will occur directly and quickly. The public is unpredictable in terms of exercising responsibility to offenders and it becomes necessary to look towards other assigned forms of responsibility.

Are the Police responsible for bus transit safety?

The viewpoint of most public transit management is that crime within the transit system is part of the overall urban crime problem and the responsibility of the local law enforcement agency (Hoel, 1997). This contention assumes that the existence of a new bus stop location or bus terminal does not create new crime or increased risk for a community. However, spatially and statistically we can see by the given dissertation that bus stops are highly correlated with crime and the main city bus terminal reports the largest concentration of crime within the city. Many bus companies validly concerned with increased security/police initiates putting additional strains on their budgets. Furthermore, transit management contends that it is the obligation of local law enforcement agencies to protect citizens within their jurisdiction and employees of these

policing agencies should be better trained and equipped to provide security within public transportation[9] (Hoel, 1997).

However, local law enforcement officials often regard large-scale public transportation as a specialized problem beyond their means to address. Within urban areas, the transit systems are within their own separate governmental agency with their own resources. Consequently, it is often viewed by police administrators that it is the responsibility of the transit system to provide its own security force or to reimburse the local police for additional protection it may furnish. According to Wallace and Buren (1974) several problems exist in relying on local law enforcement to furnish transit security:

1. Jurisdictional confusion. When transit lines cross governmental boundaries, what happens when a crime occurring in one community is reported to the police in another community.
2. Reporting and response to crime. Lack of centralized control of crime reports within the city's public transportation system may cause delays or inconsistency. Lack of coordination, ill-defined chain of command, and lack of accountability lead to loss of confidence from transit administrators and the public.
3. Police patrol coverage. The temporal and number of police assigned to patrol transit properties can vary considerably without any reliable record keeping of their deterrent effect.
4. Crime recording. Methods for recording crime may vary considerably and its often difficult to systematize data with transit user feedback.
5. Specialized training required by transit police. Policing transit systems often requires special skills and knowledge, including the understanding of the characteristics of transit users and crime types most often effecting transit systems. This is often why a single police force accountable to only the transit system may be more effective with furnishing a centralized location for reporting crimes, conducting specialized patrol procedures, creating more accurate crime statistics, and providing specialized training for specific transit problems.

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[9] This information and opinion was verified through personal interviews with the transit management company that was utilized throughout the dissertation process.

Ultimately, the type of police organization available to service transit systems will affect the level of security given to transit users. If the services lack coordination and effective administration, then the deterrent effect of any security program may be limited. The planning stages that surround policing terminals and bus stop locations typically involve an assessment of past problems, as was completed throughout the dissertation. The results of these assessments should be utilized to further the organizational and fiscal responsibility of transit agencies and the local community for providing security functions to combat crime and disorder problems that surround public transportation and affects overall community well-being.

In 1983-85 Levine et al., (1986) conducted a study of bus crime in west central Los Angeles. They documented several intersections where there was a heavy concentration of crime, bars, adult bookshops, massage parlors, liquor stores, and bus stops. A transit crime task force was established after their research to examine ways of improving security around the most dangerous bus stops. Recognition from the preceding dissertation results could lead to more attention placed on improving the overall security of transit users in those locations that are most at risk. Solutions include the removal of bus stop locations in areas of known crime hot spots. As part of an ongoing research venture, these bus stop removals should be followed by a post measurement analysis of official statistics within those areas to determine if the bus stop location did contribute to the given crime hot spot. In order to effectively measure and compare results, police presence and response to the area would have to remain the same as it was before removing the bus stop or stops.

As pointed out in the preceding limitations section, official statistics may not provide the best means for measuring performance of formal/informal social control mechanisms. If the police are to take bus stop related crime seriously, newly developed police performance models, referred to as "change agent" models, would enhance measurements of the official and unofficial effects of bus stop crime and bus stop removal on crime. These change agent models seek to measure inputs and outputs created by police departments (Thibault, Lynch, and Mcbride, 2001). This type of model is necessary for looking not only at official crime statistics but for also concentrating on crimes or nuisances that may not be reported to the police but are nonetheless raising the fear of crime. The change agent model recommends that the police results and performance measures be based on quantitative measures (e.g., How many services were provided? How much did we produce?) and qualitative measures (e.g., How well did we deliver the services? How good were our products?). The qualitative measures look towards creating positive changes in the quality of life in a community (Thiabault, Lynch, and Mcbride, 2001) and potentially increasing levels of collective efficacy and various forms of guardianship. Ratings for the qualitative effectiveness of these strategies can be measured through direct contact with transit users. In addition, other modes of gathering data reactions include community leadership meetings and discussions with questionnaires, focus groups from the community where services are targeted, and community attitude surveys being handed out to those areas with the highest levels of transit users or areas with the highest levels of transit related crime. Questions and feedback should look for issues concerning the courtesy of officers, how fearful transit

users feel, and general questions about how well the police or transit security are doing within the community.

Sherman (1992, 1995) challenges the argument that an analysis of official data alone cannot lead to beneficial results. Through official data, he found that "chronically violent couples can be identified and predicted and chronic locations of domestic calls can be predicted" (Sherman, 1992, p. 214). He also found that "over half (53%) of all domestic calls in Minneapolis occurred at buildings with four or more calls in 1986" (1992, p. 227). Sherman's research findings add to the internal validity of the dissertation research and use of official data. Within the "dial-a-cop" community mentality, Sherman (1989, 1995) argues that chronic hot spot locations determined through official data are not normally given extra attention to try to reduce the heavy demand on police. Within proactive police systems, we may expect that agencies would provide extra coverage for hot spot areas since this type of police presence has beneficial results without serious displacement issues (Sherman, 1995). This combined proactive police presence within known hot spot areas could be used first before having to remove bus stop locations. However, if hot spot area bus stops are removed in addition to increased police presence, later research results would be biased since it would not be known if the bus stop location did in fact increase crime within the given hot spot locations.

A more aggressive police approach by spatial data analysis is not without its challenges. Often, data organization problems exist, defining hot spot locations vary, and overall effectiveness of choosing known crime incidents, arrest locations, or calls for

service are all debatable and in need of further research. Challenges for the proactive

policing strategies based on the use of the official data include:

1. Having more specific incident locations from spatial analysis: For example, recorded spatial data often includes multiple names, such as Martin Luther King, Blvd. being labeled MLK, Martin, Luther, or King Blvd. within a single database. More sophisticated crime analysis has to be conducted to ensure that the data is accurately accounting for the fact that these are all one location.
2. Finding a criterion for defining a hot spot location, such as rates of incidents, actual raw number of incidents, types of crime, distinguishing from outdoor or indoor related crimes, use of calls for service, incidents, arrests, etc. All of these choices may cause hot spots in different areas of the community.
3. Getting more accurate information about criminal incidents and making better efforts to record and map the data to the appropriate location. For example, bus stop locations could more accurately be used within the crime data statistics rather than an intersection address that could include multiple structures within the given intersection.

An evaluation of effectiveness should combine the number of recorded police

incidents related to the lowering of police incidents within the area. Within this type of

evaluation, pre and posttest questionnaires are given to the users of hot spots spaces to

evaluate the success or failure of police intervention. These questionnaires could also be

given outside of the hot spot areas to evaluate any displacement issues. Transit users may

benefit greatly from this type of response.

Debating general responsibility and assigned responsibility: Environmental solutions?

Newman (1972) and Jacobs (1961) argued that the power of natural surveillance

and proper environmental construction would increase general responsibility. In contrast,

Mayhew (1981) and Clarke (1992) emphasize the need for assigned responsibility. Out

of this debate, Felson (1995) makes an interesting argument that new technology will

continue to improve the impact of general responsibility through wide ownership of video

camera equipment and cellular phones. Felson (1995) also points to new uses of electronic bulletin boards that help citizens share data and general information about criminal activities.

A more simplistic and perhaps realistic response to crime problems surrounding bus stops would be to device situations in which the opportunity to commit crime is less abundant. The location of the bus stop has to invariably be taken under consideration. Some bus stop locations can be target hardened, such as replacing a sign with a shelter so transit users are separated from the nontransit space users[10]. Other specific design solutions could include widened sidewalks or the creation of nubs that extend the sidewalk only at the bus stop location (Sideris, 1999). These nubs are believed to help minimize the conflict between transit users and other pedestrian traffic (Fitzpatrick, 1997).

The use of the space surrounding bus stop locations has been shown to be a critical component of the research findings. Negative land uses such as 24-hour convenient stores that also carry a liquor license appear to generate crime. The bus stops may provide easy targets for these already crime filled areas. High crime areas that also include a bus stop location push transit users' routine activities into areas that increases the risk of their victimization. It is also possible that the bus stops themselves have a reciprocating influence on the number of incidents within the hot spot locations since an increased number of transit users are as likely to be offenders as they are victims. There is growing evidence that crime victims are much more likely to commit crime themselves (Ireland and Widom, 1995).

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[10] The decision to invest in replacing a bus stop sign with a shelter should undergo consideration. During informal interviewing of transit management, it was pointed out that some shelters become targets for vandals and have been replaced by signs because of the vandalism problem.

Because of these seemingly reciprocating problems, the location chosen to place a bus stop should consider the outlying area. The use of space surrounding bus stop locations is vital to the area's quality of life. This quality of life can also be affected by the placement of a bus stop location. A bus stop location placed in an area can serve to increase the opportunity to commit crime and can negatively impact the quality of life for not only transit users but also other legitimate space users. Placing a bus stop on the side of a parking lot or on the side of businesses without any consideration for natural surveillance issues is likely to increase the risk of victimization. Bus stops placed within the visibility of active businesses, homes that are owned and not vacant, and in areas with little transience are likely to be less at risk. These areas are also more likely to have increased collective efficacy, which was shown earlier in the research to mediate some of the other neighborhood social attribute problems.

According to Neman's (1972) approach, defensible space concepts provide the best model to inhibit crime surrounding bus stop locations by creating a physical expression of a social fabric that defends itself. That is, the physical characteristics of an area can influence the social interactions and behaviors of the space users. The four elements that Newman's (1972) defensible space theory includes some of the best recommendations for placing bus stop locations in a manner that inhibits rather than discourages crime:

1. Territoriality- ability and desire of legitimate users of an area to lay claim to the area through the establishment of real or perceived boundaries.

2. Natural surveillance- designing the public space so that legitimate users can be observed during the day or night, inside or outside, without the aid of special devices.

3. Image- maintaining the social space so that it has an appearance that is not seen as isolated and is cared for and that area space users will take action when ever anything is amiss.

4. Milieu- the placement of the bus stop location should be within an area that has low-crime and high-surveillance that will inhibit criminal activity.

These strategies were reworked into four intermediate goals that also fit within recommendations for creating bus stop locations that do not adversely affect crime: access control, surveillance, activity support, and motivation reinforcement (Kushmuk and Whitemore, 1981).

1. Access control- the ability to regulate who comes and goes from an area, with the intent of limiting access to legitimate space users. This can be accomplished through redesigning bus routes and bus stop locations so that the flow of transit user space is brought into areas that have low-crime and and/or high surveillance. These actions may also help eliminate easy escape routes for offenders who do illegitimately enter the area.

2. Surveillance- actions to enhance the ability of legitimate space users to observe the presence of others and their activities by placing bus stops in the direct site lines of area businesses employees, customers, or residents. By placing bus stops in commercial areas directly in the center of business site lines, both employees and customers help to provide increased natural surveillance. Area businesses should also be observed to ensure that there are unobstructed views out the windows. Underlying these suggestions is the assumption that increased surveillance may also increase some form of collective efficacy and observers will inform the police or take some other type of action if disorder or crime is occurring.

3. Activity support- functions that assist and enhance the interaction between transit users and other legitimate space users in the surrounding area. Many transit users become regular users of space and may indeed develop relationships with area businesses or even residents that surround their bus stop location. Many live close to their bus stop locations. The ability for a community atmosphere to develop a caring attitude is built, in part, through the physical appearance and design of an area (Neman, 1972; Kushmuk and Whittemore, 1981). Since the impact of access control and surveillance rely on the behavior of the space users, these individuals must be willing to intervene in situations where public space is not be used legitimately. As this willingness increases, the effort and risk for the offender should increase as the greater chances of observation and intervention increase.

4. <u>Motivation reinforcement</u>- enhancing the feelings of territoriality and social cohesion through physical design features and building pride in the area.

Motivation reinforcement is perhaps the most challenging features from this model. However, through community policing approaches, a combined official response with a more systematic look at spatial crime causation, can have lasting effects on increased residential safety. The following strategies are proposed to combat bus stop crime.

1. Remove bus stop locations from high crime areas and measure crime for a specific period of time after the bus stop removal. If the bus stop cannot be removed do to public demand, create a shelter that separates waiting transit users from other pedestrians on the sidewalk and enforce no loitering policies within that shelter from the city police department and/or patrols by private security firms. Reschedule buses to reduce overcrowding at the bus stop location.
2. Move the bus stop to a safer location where lighting may be improved or less official crime is being reported. Create tougher ordinances against liquor sales in areas with high crime.
3. Create public educational programs for public bus stop safety. Within commercial neighborhoods, create a "business watch" program similar to neighborhood watches, while utilizing private security personnel with local police coordination to create a safer public space sidewalk environment.

In addition to concentration directed at bus stop locations, serious safety consideration should also be directed towards the number one hot spot location, the main city bus terminal. Within the terminal CCTV cameras are used but may not be serving as any type of deterrent effect. Recommendations include not only utilizing CCTV cameras, but also allowing for monitors to be posted within the terminal so transit users can see what the cameras are actually recording. Public-view monitors have been shown to reduce theft in retail stores (DiLonardo and Clarke, 1996), but remain untested in reducing crime in such places as public transit. Several entrances/exits exist throughout the terminal for boarding buses. There are also entrance/exit doors at the ends of the

terminal that could possibly be closed to deter non-transit pedestrian sidewalk traffic from more freely entering the terminal.

Hoel's (1993) suggestion of locking toilet facilities does not seem feasible although the New York City subway system did just that in the 1970s. Informal interviews conducted with security personnel at the terminal did confirm that drug selling/use and alcohol consumption is frequent within the toilet facilities at the bus terminal. The last possible suggestion is to implement a warning siren as suggested from Hoel (1992) in #11 suggestion that appeared on pg. 141 of this dissertation. Again, informal interviews with security personnel at the bus terminal found that fights are frequent within or nearby the terminal and security personnel have been injured breaking up these fights. In several cases security personnel have used mace against the parties involved and this has caused injuries to surrounding transit users as well as the security personnel. The warning siren offers the possibility of quickly deterring or ending the problem situation as well as attracting the attention for increased intervention. This type of implementation would need to be measured through a pre and posttest design over a period of months.

Limitations

One of the problems with research utilizing official statistics within the link between crime and place is the failure to differentiate crime density (i.e., crimes per land area) and victimization risk (i.e., crimes per target) (Brantingham and Brantingham, 1977). Boggs (1965) pointed out that most calculations of crime rates are not estimates of crime risk since researchers will often use inappropriate measures of crime

opportunities (i.e., targets) as the denominator for their calculation. For example, rates of robbery were calculated in this research by dividing the number of robbery incidents reported to the police by the population of a block group. Since the focus of the study was on bus stop locations, a more efficient denominator in a risk calculation would have been the number of transit users or number of people who have routine activities within the given block group. Counting the number of people who use a block group location rather than the number who live in the block group is a better determination of a risk calculation. This type of data acquisition is a difficult and time-consuming process. However, it is quite possible that crime will be concentrated in one area rather than another simply because there are more targets. Use of this data would add to validity issues when testing is completed at the neighborhood level.

Sherman et al., (1989) suggested that micro-level spatial analysis on small distinct areas is a necessary step for progressing criminological research. The increased use of crime mapping technology and widespread use of computer-aided police data has allowed for more thorough analyses of spatial crime data that has not been previously available to researchers. Maltz (1994) argues that the next frontier of statistical analysis is in the development of finding better ways to display various official data through spatial analysis. This argument urges the let the data speak for itself rather than being filtered through statistical algorithms (Maltz, 1994). While the suggestions of both Sherman et al., (1989) and Maltz (1994) were taken under consideration in the research process, a serious limitation of the dependent data utilized for the dissertation research was also recognized. Researchers have used victimization surveys in the past to specifically show that bus stop crime is underreported (Levine and Wachs, 1985, 1986).

Police officers believe that bus stop crimes are grossly underreported because victims do not believe that their stolen property can be recovered or the perpetrators of the offense will not get caught (Sideris, 1999). In addition, although immigrants were accounted for in the collective efficacy model test, it can also be predicted that new immigrants may be fearful of authorities and tend not to report crimes. This prediction was found to be true when bus stop riders were surveyed in Los Angeles (Sideris, 1999). Other studies have found through survey data that much more crime occurs than is reported to the police, as referred to as the dark figure of crime. Almost half of robbery victims and 60 percent of simple assault victims do not report being victimized to the police (Bureau of Justice Statistics, 2001).

Official sources of crime data, such as the FBI's Uniform Crime Report or the police data used for the dissertation research, have inherent flaws and biases related to the measurement methodology and potential reporting biases from the officers who write the reports. However, crime data used in most environmental research typically comes from official statistics, despite the criticisms that have been levied against this type of data (Hindelang, 1974; Savitz and Wolfgang, 1970; Skogan, 1990). The primary weakness of using official data is the limitation of an analysis that only looks at crime that has come to the attention of the police. If increased immigrant concentration occurs in some neighborhoods, less crime may be reported, thus, biasing conclusions researchers draw from the use of official data. However, since it was predicted that areas with high immigrant concentration, concentrated disadvantage, and/or concentrated bus stop locations would produce more crime than areas without these attributes, criticism for not

including unofficial (i.e., not reported or not recorded by the police) provides some reliability support.

The limitations of official data for transit crime research is particularly challenging since phones may not be readily available to report crimes at these locations. Researchers have argued that true transit crime may be far greater than is shown in any type of formal criminal justice statistics (Sideris, 1999; Levine and Wachs, 1986; Felson et al., 1996). Other issues revolve around the reporting mechanisms surrounding public transit. It was noted that a new bus terminal was opened in October 1997 within the city used for the dissertation research. A substantial increase in crimes was reported during the following three years after the opening of the new bus terminal. However, it is quite possible that the new contract security team and better patrolling by the local police department amounted to more accurate crime reporting rather than actual increases in crime. In addition, other spurious effects exist such as the crackdown on truancy that was shown to greatly increase the number of reported truancy incidents for data in the year 2000. Despite these events, this data was accounted for with the rest of the incident data. Since the incident data did not factor separately in the initial principle components analysis, violent and disorderly incidents were analyzed in the aggregate.

According to a study of violent crime against transit employees, a study of transit crime should differentiate between violent, property, and quality of life crimes (Reed, Wallace, and Rodriguez, 1999). However, since incidents did not load separately data in the aggregate was seen to relate directly to transit users. In addition, all crimes were coded as occurring outdoors. However, it may have been useful to make a distinction between crime types as was done by other transit crime researchers. Quality of life

crimes have included public drunkenness, vandalism, and disorderly conduct while violent offenses could include assaults, robberies, etc. However, many quality of life crimes are not recorded within official statistics and were not available through the data given by the police department utilized for this research. Thus, this much of this data would have had to been acquired through alternative sources.

Along with acquiring unofficial data for further analysis, another limitation of using only official data is having no knowledge of transit users' perception of crime. Fear of crime can cause obvious reductions in the use of public transportation. In fact, residents responding to a survey cited "fear of safety" as the most important deterrent for not using a public bus system (Sideris, 1994). A study of multiple urban public transit operations found that perceptions of crime severity vary by factors such as the size of the region served, type of transit service available (Hartgen et al., 1993), and other factors associated with riders, such as their age and gender (Sideris, 1994). In addition, individuals who use the transit system infrequently or not at all are more likely to be fearful and perceive more crime than is actually present (Reed, Wallace, and Rodriguez, 1999). Consequently, this type of research knowledge is beneficial to transit managers and local law enforcement.

Other Limitation Concerns

Part I: Collective Efficacy Model Test Limitations

Part of the limitations of this research was not analyzing temporal ordering between the mediator variable and concentrated disadvantage on total crime. For example, Skogan (1990) reports findings that crime rates play a role in overall

neighborhood dissatisfaction and intentions to move. In addition, Dugan (1999) studied 22,375 households and found that any crime that occurs near one's residency affects their likelihood of moving, but this finding is limited by income capabilities. Recent studies have found that persistent unemployment increases the risk of poverty (Taylor, 2002; Taylor and Morrell, 2002), thus creating a temporal issue for the original factor indicators of concentrated disadvantage.

Another limitation of the research comes from the problem of multicollinearity when there is not a clear separation from the predicted outcome of disorganization (crime) and disorganization itself. Multicollinearity among ecological variables is a well-known problem in social disorganization research (Land, et al., 1990). The problem occurs when the causal construct (exogenous variables) are equated with the crime phenomenon, creating a cause and effect dilemma. This problem was evident from the bivariate correlation matrix presented in Table V.2 and the intercorrelations seen between the indicating variables, as well as the low standard errors leading to the main exogenous crime variable. The high correlations between predictor variables was a specification problem with early Chicago School research under Shaw and McKay (1942) and continues to affect contemporary research in social disorganization. Future research projects should test temporal issues through nonrecursive models as well as properly specified models that will avoid the problem of multicollinearity.

Other temporal issues may occur between the main endogenous variable (crime) and the ecological indicator variables. Crime effects income and racial distribution. In a panel study of Chicago census tracts, Bursik (1988) reported that delinquency rates have an affect on the number of blacks, number of owner-occupied homes, and number of

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unemployed. Liska and Bellair (1995) conducted an extensive 40-year panel study of a variety of cities and found that crime rates, especially robberies, reduce the size of white populations. These temporal issues further complicate the given model and call for increased use of non-recursive models and feedback loops, along with longitudinal data or lagged measures[11] of crime that avoids assumption biases present in the use of cross-sectional data.

Kornhauser (1978) challenges ecological researchers by asking if place specific crime rates are the result of aggregate neighborhood characteristics or characteristics of individuals that are selectively aggregated to communities (p. 104). Sampson et al., (1997) offered one of the first controls for solving individual-level effects through their multilevel data analysis. However, the variables used in the dissertation included only official crime statistics or wider social level census data rather than individual based data and does not allow for a more complete address of contextual multilevel issues.

Despite the limitations of the data, several researchers have shown that official data can be used reliably to assess differences in ecological crime (Hindelang, 1978; Gove et al., 1985; Sampson and Lauritsen, 1997). The exclusion of data sources, such as self-report of individual-level surveys, can produce an underestimation of the variables being used for theoretical testing. However, official data sources used along with other ecological indicators can provide reliable estimates of crimes most likely to effect bus stop locations. The type of crime data used in this dissertation represents the official public response to crime in an outdoor setting and can include businesses, individuals, adults, and children. This is not always the case in survey or self-report data, which are

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[11] Sampson and Raudenbush (1999) used a sample of 195 Chicago neighborhoods and identified their models through the use of lagged crime measures in their equations.

more likely to be subject to various sampling errors and confidence level limits. In addition, surveys have to deal with recall, wording and interviewer bias, and sampling limitations.

Part II: Quasi-Experimental Limitations

It can be fairly difficult to locate truly comparable units of analysis where socio-economic and demographic factors become controlled. Researchers continue to struggle to find such localities, even 30 years after Newman's original study (Cozens, Hillier, and Prescott, 2001). This study attempted to match block group locations while controlling for other important social attributes that have been found to correlate highly with crime. In an effort to show that the presence of clustered bus stop locations does positively effect crime rates while controlling for other variables, the temporal order issue again arises. The main assumption being made through the quasi-experiment is that bus stops create higher crime. However, it is quite possible that increased pedestrian traffic within an area causes increased risk for victimization, in addition to the need for more public transit use. Although the increased pedestrian traffic within a spatial area does not empirically cause a bus stop to appear, it may contribute to the need for placing that bus stop in the area, which then indirectly increases crime. However, it still becomes the choice of the transit management to place a bus stop in an area that may be conducive to increasing crime. Spatial models that have served to predict future criminality (see Anselin, et al., 2000; Olligschlaeger, 1997) would be helpful for transit management in making these types of decisions.

Other potential limitations or biases arose in calculating t-score comparisons to test if block group locations could be matched between bus stop and "non-bus stop" block groups. Although all three of the major latent concepts (disadvantage, immigrant concentration, and collective efficacy) were well-matched according to the insignificant t-test for similarities, other indicating variables were significant (i.e., unemployment, minority concentration, and foreign-born), thus showing that the block groups were not well-matched for these three variables. However, these variables were still controlled for within later regression analysis.

Part III: Systematic Observational Research

Objections to qualitative research methodologies argue that validity issues are questionable. That is, it is difficult to determine the truthfulness of qualitative findings. As compared to the 114 block groups analyzed in the first part of the dissertation, the qualitative methodology only took into account a sample size of five bus stop locations. This small sample size may lead to arguments that the given discussion on the findings is unrepresentative of the larger population of bus stops throughout the given city or even in other comparable cities.

Other potential limitations can occur through the actual observations. It is possible that even during multiple observations, events that confirm or deny theoretical interests do not actually occur and this could lead to assertions for future research or wrongfully pointing out theoretical discrepancies. The observers, who conducted the nonparticipatory research, could also have misinterpreted certain social interactions by transit users. Since the research was nonparticipatory no space users were engaged to

verify the interpretation of any of the observations. Even though multiple observers were

utilized at different times of the day and year, behaviors conducted at the time of these

observations may not have been typical due to new transit users or unusual events

occurring at specific bus stop locations during the time of the observations. Lastly, it is

possible that behaviors at the bus stop location that were observed could have been

impacted by the presence of the observers (i.e., Hawthorne effect) despite every effort to

train observers to be as unobtrusive as possible. Despite the potential and

acknowledgement of these limitations, every effort was made through the qualitative

research design and implementation to limit these types of bias.

APPENDIX A

BUS STOP LOCATION OBSERVATION	
Location:	
Date:	
Time:	
Street Pattern Measurements- social patterns	
Number of traffic lanes	
Number of overhead street lights	
Volume of Traffic (number of cars per minute)	
Pedestrian traffic surrounding bus stop	
Loitering youth	
Loitering adults	
Public drinking	
Illicit drug selling	
Prostitution	
Physical Attribute Measurements **(At the location or within 100 feet)**	
Commercial, Residential, or mixed	
Type of residential units or businesses	
Number of incidents of vandalism	
Extent of garbage surrounding bus stop	
Extent of condoms or drug paraphernalia	
Number of vacant/renovated buildings	
Number of businesses or houses with visible security functions (e.g., gated doors or windows)	
Surveillance of the bus stop from residential housing or surrounding businesses	
Easy escape paths for potential offenders	
Number of buildings damaged by fire	
Number of boarded up doors or windows or broken windows	
Number of vacant, unused lots	

APPENDIX B

EXTERIOR BUS TERMINAL OBSERVATION	
Date:	
Time:	
Exterior Street Pattern Measurements- social patterns	
Number of traffic lanes	
Number of overhead street lights	
Volume of Traffic (number of cars per minute)	
Pedestrian traffic surrounding exterior of the bus terminal	
Loitering youth	
Loitering adults	
Public drinking	
Illicit drug selling	
Prostitution	
Exterior Physical Attribute Measurements (At the location or within 100 feet)	
Commercial, Residential, or mixed	
Type of residential units or businesses	
Number of incidents of vandalism	
Extent of garbage surrounding the bus terminal	
Extent of condoms or drug paraphernalia	
Number of vacant/renovated buildings	
Number of businesses or houses with visible security functions (e.g., gated doors or windows)	
Surveillance of the bus terminal from residential housing or surrounding businesses	
Easy escape paths for potential offenders	
Number of buildings damaged by fire	
Number of boarded up doors or windows or broken windows	
Number of vacant, unused lots	

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