Measuring Quality of Life with Geographic Information Systems:

Moving Beyond Part One Crimes*

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by

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Abstract

In law enforcement, accurate portrayals of the quality of life in residential communities are important for police resource allocation as well as for strategic and tactical policing practices. Standard conventions used by police agencies for determining quality of life include producing tables, graphs and maps depicting Part I offenses. Through geographic analysis of incident data from the Lincoln, Nebraska Police Department, my paper shows alternative methods for determining the quality of life in a community. My research identifies Part I offenses that serve as misleading indicators of quality of life. I also identify indicators available in law enforcement datasets that serve as more accurate determinants of quality of life. I propose a Quality of Life Index that identifies crimes, events and locations that may provide a clearer indication of neighborhood health. The benefits of using these indicators are, among other things, better internal communication and more precise distribution of police resources.

Introduction

It has now become common for police agencies to assess neighborhood quality of life by producing tables, graphs and maps depicting Part I (or Index) offenses, such as murder, rape and robbery. Although many Index crimes impact community safety, all do not. Many of the crimes and events that impact a community's sense of well-being are non-Part I offenses. Type and location of incidents hold more bearing on the impact of events on surrounding communities than do corresponding Part I, II or III crime labels.

With the growing adoption of Geographic Information Systems (GIS) in law enforcement, spatio-temporal analysis of crime and incident data has become more efficient and more effective than previous, less automated means of data analysis (Canter 1998). GIS serves as a versatile tool in policing agencies, offering a high-speed approach to organizing and analyzing incident occurrence. Deployment of police resources is often directly impacted as a result of crime maps generated from GIS (Ratcliffe 1999, Canter 1998). But Part I crime is not entirely satisfactory as a measure of a residential neighborhood's quality of life. Therefore, it is important to examine what factors contribute to quality of life so that a more accurate portrayal of information can serve as a contributor to tactical and strategic decisions.

In this paper, I argue that alternative and more informative methods for determining the quality of life in a community need implementation. Further, I propose a Quality of Life Index for use in geographic analysis, which identifies crimes, events and locations that serve as clearer indicators of neighborhood health. Such indicators will allow for improved data assessment and more precise distribution of police resources.

Literature Review

Index crime serves as an excellent starting point for determining neighborhood livability from law enforcement data. Gathered as a part of the Uniform Crime Reporting (UCR) Program run by the Federal Bureau of Investigation, Part I offenses are a recognized means of compiling and comparing consistent datasets of crime occurrence over time and across jurisdictional boundaries. Part I offenses include: murder, rape, robbery, aggravated assault, burglary, larceny, larceny from auto, and arson (U.S. Department of Justice 1980). Unfortunately, if left as stand-alone determinants, a number of Index offenses can generate false perceptions of an area's social well-being. Thus, Part I offenses need to be carefully examined for varying levels of applicability when assessing quality of life.

Quality of Life Indices

The quality of life (QOL) in any community is a combination of many social and environmental conditions.[1] There have been numerous QOL studies resulting in a number of informative indices. Cities and counties such as Jacksonville, Florida, Charlotte, North Carolina, Cincinnati, Ohio, Seattle, Washington, Spartanburg County, South Carolina and many more, have developed long term studies designed to document QOL indicators.

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[1] The use of the terms community and neighborhood in this paper are used interchangeably, and represent residential areas that may or may not be defined by political boundaries.

These indicators are a compilation of many socio-economic variables, none of which exist entirely independent of one another. The indicators were established to address the questions of what variables make a community a desirable or undesirable place to live, and how these variables can be quantified. Community indicators in the above mentioned indices draw from a broad range of categories including cleanliness (i.e. litter, street sweeping), community participation, crime rates, culture and recreation, economy, education, family and youth, health, housing, infrastructure, natural/physical/social environment, pedestrian friendliness, population, resource consumption, responsive government, safety, and transportation (City of Charlotte, North Carolina 2002, City of Cincinnati, Ohio [COCO] 2002, Jacksonville Community Council Inc [JCCI] 2002, Spartanburg County Foundation [SCF] 2001, Sustainable Seattle 1998, Charlotte Department of Geography and Earth Sciences: University of North Carolina at Charlotte 2002). Most of the studies based QOL indicators on feedback received from local community organizations, civic leaders, and the general public.

There are similar developmental concepts flowing throughout all of these QOL studies. The first suggests that determining an area's well-being involves analyzing numerous socioeconomic variables over space and time. I recognize that a well-rounded portrayal of a community is crucial to an overall QOL assessment. However, QOL indicators besides those recorded by police departments are purposely left out of this study to focus solely on specific indicators found in law enforcement data. Another principal theme is that various indicators may increase or decrease in levels of significance within a community over time, and therefore should remain flexible to inclusion or exclusion from an index. The Jacksonville study notes that "shifting realities" within a community will result in changes in community goals of maintaining or increasing levels of safety (JCCI 2002). In my QOLI, one point of contention is whether or not to include school-related incidents. There are pros and cons to the school 'variable' that will be discussed in a later section of the paper. Finally, I observed that certain types of events and circumstances have a significant effect on people's perception of safety and should be included or excluded accordingly (Smith 1989). This concept is the crux of my study and will be expanded upon throughout the paper.

Each index I examined selected a number of the broader QOL categories – between 4 and 10 of those mentioned above. Every index had differing subcategory indicators for analysis, which result in different impressions of overall QOL. For concise overview and applicability to my study, I will describe crime subcategory variations of two of the indices. In Spartanburg County, there are two main subcategories of crime – juvenile and adult – that compared Spartanburg with four metro counties. Juvenile activity is assessed on rates of court cases, prosecution, probation, commitment to a correctional institution, recidivism, index offenses and school crime reports. Adults are assessed by total crime rate, index offenses, drug offenses and domestic violence. The subcategories were normalized by varying population sizes – based on population levels appropriate to the specific offense or by population census data for Index offense comparisons (juvenile – 10,000, adult – 100,000). Brief explanations and analysis were provided for each indicator as well as the source of the data. A half-page summary of QOL is assessed for the category of crime, but not for all of the categories as a collective whole (SCF 2001).

In another study conducted for Cincinnati, Ohio, the law enforcement data indicators consisted of Part I and II offenses, panhandling, noise violations, removal of abandoned vehicles, and litter and illegal dumping citations. Data were made available at the neighborhood and/or citywide levels. Indicators were compared by quarters (2001 and 2002 only) as well as whole years for datasets ranging from 1999 to 2001. The report was published in October, 2002, therefore only the first and second quarters as well as a mid-year total were calculated for 2002. Data were not normalized by another variable. A two-page summary documents the change between the first and second quarters of 2001 and 2002 for all crime data besides illegal dumping citations. An overall assessment of all QOL indicator impact was not offered (COCO 2002).

Although neither of these studies produced an overall assessment of the QOL for their respective area(s) under investigation, it is important to note that there are studies that have developed a ranking system. For instance, Charlotte, North Carolina, has devised an index that compiles statistics for each category, resulting in a ranking of stable, threatened or fragile. From the individual category rankings, an overall neighborhood ranking is determined.

Law Enforcement and the Community

My QOLI includes many of the variables found in the crime categories of the QOL indices I reviewed. However, the conceptual foundation of my index is based on the concepts that underlie the broken-windows theory and community-oriented policing strategies. The broken-windows theory, introduced by Wilson and Kelling in 1982, proposes that if a building has one broken window that is not repaired right away, soon many will follow due to the outward appearance that no one maintains or cares about the structure's upkeep. The theory is a metaphor for the broader concept that physical and social decline in a neighborhood begins with low-level public order offenses and nuisances. The broken-window is analogous to physical or social impairments within a community. According to the theory, the number and types of impairments within a neighborhood indicate the level of importance placed on maintaining the feeling and appearance of safety by the members of the community. Crimes and upsetting behavior, such as prostitution, drug offenses, disorderly youth, and panhandling, significantly affect overall perceptions of quality of life (Brantingham 1986, Smith 1989, Taylor 1986, Wilson 1982).

A major strategy in recent community-oriented policing (COP) is the application of the broken-window theory. COP strategies typically include extensive targeting of crimes that effect neighborhood well-being. The emphasis is placed on police interaction and community member involvement within a neighborhood to reduce crime and undesirable events, such that the communities as well as the police are invested in the geographic area. Ideally, while on patrol, officers build relationships with the members of a community by walking the streets and talking to residents and business owners (Thompson 1991). This approach allows officers to gain citizen trust as well as firsthand insight into neighborhood problems and concerns. Once acquainted on a more personal level, residents often inform the police of incidents that have or will occur sooner than would otherwise come to the attention of the police (Bobinsky 1994). This method of

policing leads to a decrease in crime, while increasing the feeling of safety and sense of community ownership.

If asked what the QOL problems of a neighborhood are and where they occur, a beat officer would be more apt to point out the rash of theft from automobiles, the transients that drink in the park, or the group of rowdy teenagers that intimidate residents of apartment complexes (i.e. broken windows), rather than calls to Wal-Mart for shoplifting or bad checks. With daily presence in a neighborhood, beat officers have firsthand knowledge of the trouble spots in their patrol areas, and, if motivated and supported by their department, will likely takes steps to improve upon undesirable conditions (Casady, personal correspondence, September 27, 2003, Thompson 1991).

How, then, does a department take into consideration the cumulative knowledge of its officers with readily available data? The answer is often to produce a map or chart depicting the condition of the environment. It stands to reason that when producing QOL statistics and maps, examining the same types of crimes and incidents targeted in COP strategies and community improvement efforts may provide a more accurate depiction of an area's overall QOL.

GIS and Community Crime Analysis

The purpose of GIS, regardless of specific application, is ultimately to tell a story or relay a message about a place in time. Logical applications as well as unforeseen benefits of GIS are becoming popular topics of discussion in law enforcement literature. Numerous agencies have adopted GIS for improving methods of crime forecasting, trend analysis, information sharing, QOL assessment, and decision making (Casady 2003, Heywood et al. 1992).

Graphically displayed data can persuade an audience to believe in a state of affairs that may or may not exist (Canter 1998). Due to the especially persuasive nature of GIS, the capability to rapidly generate maps and reports comes with the responsibility of understanding what is being generated and what purpose will be served by the resulting information (Piper 2002). This section will address how GIS is used in community crime analysis. I will also discuss some of the advancements GIS has contributed to in the spatial analysis of crime.

One of the ways in which crime analysts use GIS is to generate, analyze, and distribute crime statistics about neighborhood safety. The aim is keep law enforcement personnel, public administrators, and citizens abreast of the state of the environment in which they work and reside (Casady 2003, City of Beaverton, Oregon [COBO] 2003). Although the intention is to provide an informative look into what and where crime effects communities, the results too often reflect deceptive peaks of crime (Heywood et al. 1992).

The research I reviewed concerning the analysis of crime and place seem to come to a consensus that uniform crime statistics leave a lot to be desired when assessing the impact of crime within a community (Harries 1974, Heywood et al. 1992, Smith 1989). Datasets known for having consistent standards of collection and reporting serve as the basis of many analyses. The rationale behind the use of this information is that data collected with standardized methods represent the most accurate information on which conclusions may be drawn (See, e.g., Healey 1999).

As stated in the beginning of this paper, Part I offenses are commonly used to assess QOL. Agencies using Part I data for this purpose often gather more data for internal analysis and record keeping. If carefully examined, these additional data may enhance QOL assessments. For instance, incident report datasets contain non-Part I offenses such as child abuse/neglect, suicide, narcotics, vandalism, window-peekers, flashers, prostitution, and other sex offenses. Dispatch records contain disturbance calls such as noise complaints, abandoned and suspicious vehicles, wild parties, prowlers, and discharged weapons (Casady, personal correspondence, June 27, 2002, COBO 2003, St. Paul Police Department 2002). If applicable non-Part I data are examined with select Part I offenses, as attempted to some degree in all of the QOL indices I reviewed, a better method for assessing livability will likely be obtained.

With GIS' increasing popularity, it is important to consider and understand the impact of the methods frequently used for massaging UCR data. Techniques for working with UCR data often include normalizing the data by population and viewing the information at the census tract level (Harries 1974). This methodology, regardless of whether looking at a table, graph, or map, presents two inherent problems. First, the level at which crime data are viewed and manipulated is an important contributor to the amount of information that can be gleaned from crime statistics (Anselin et al. 2000). By imposing boundaries, such as census tracts or neighborhoods, on crime data that are not confined in the real world by those same boundaries results in inaccurate assessments of crime occurrence across space. The second problem lies in the denominator chosen to normalize crime data. By dividing crime data by population estimates we may not increase the level of understanding or readability of crime occurrence in an area. In fact we are increasing the fallibility of the data analysis. For instance, consider a census tract that is largely composed of retail stores, prone to larceny crimes such as shoplifting and check offenses. Now consider another census tract that is primarily composed of residential neighborhoods, one in which the number of crimes are fewer, but of greater severity or impact on a neighborhood, such as domestic violence or residential burglaries. The crimes are all Part I offenses and included in the QOL assessment of the city. The crimes are not weighted in any way to increase the significance of an assault over a petty theft. Normalizing crime data by population (i.e. crimes per 100,000 people) effectively make the retail census tract appear in greatest need of police attention, while making the neighborhood tract, with decaying communities, only appear in moderate need of attention.

GIS software offer a vast number of tools that promote the understanding of the spatial relationships that exist among data (Anselin et al. 2000). Advancing applications in GIS have greatly encouraged the development of spatial algorithms for use in data analysis, many of which are applicable in crime analysis. It is recognized that crime occurrence is not random. In fact, distribution of criminal activity and socially undesirable behavior is often found in spatially concentrated pools (Anselin et al. 2000, Brantingham 1986). As a result, contributions most applicable to this study include work done on point pattern, cluster and hotspot analysis. Point pattern analysis is largely concerned with identifying the randomness of point distribution across space. Data are often assessed by determining the presence of clusters or dispersion of points, in comparison to a random distribution of those points across the same surface (Anselin et al. 2000, McLafferty et al. 2000). Cluster analysis evolved into what is now commonly

referred to as hotspot analysis. Hotspot analysis provides a means of interpreting large amounts of point data across a surface. Hotspots are commonly assessed in one of two ways. The first is to aggregate the information into boundaries such as neighborhoods, blocks or census tracts, often resulting in the production of tables, bar charts and choropleth maps. The second method of representation diminishes the boundary issues associated with point aggregation. In this method, a grid-based surface is created to display the hotspots of crime over an uninterrupted surface. This type of hotspot analysis estimates the location and density of events with finer precision than aggregating point data (McLafferty et al. 2000).

        If used with caution, GIS may help uncover clues about why certain crime trends and hotspots occur. Nowhere in the literature have certain Part I offenses, such as shoplifting, self-service gas pump drive-offs, or check offenses, been suggested as a contributing factor in the demise of community's QOL. Yet these offenses act as major contributors to many QOL assessments.

Data & Methodology

        My data consist of geocoded incident reports, calls for service records, and city shapefiles from the Lincoln Police Department in Nebraska.[2] The incident report dataset represents incidents resulting in official reports in 2002. These data are derived from the police department's computerized records management system. The calls for service dataset consist of all requests for police assistance in 2002 that resulted in one or more officer(s) being dispatched. These data are derived from the dispatch records created in the city's computer-aided dispatch system at the 911 center.

        The methodology I used in this study focused on developing and qualitatively assessing the efficacy of neighborhood-oriented QOLI. Once the QOLI was developed, two queries were compiled that specified the parameters of my index as well as those for all Part I offenses. I used GIS to query data from the incident report and calls for service datasets. From the query results, I generated maps, graphs and tables to compare the two indices for the City of Lincoln in 2002. I used descriptive statistics to discuss the similarities and differences between the two indices. In the next section, I detail the components of the QOLI presented in this paper.

        To increase query accuracy and efficiency, I joined the calls for service records and incident report data. I merged the two datasets by performing a full outer join. A full outer join is a relational database technique that allows two tables, of matching and non-matching records, to be combined into one. The join must be based on a common attribute field that exists in each table. I based the join on the case number attribute field. Case numbers represent unique and unchanging information about all documented occurrences in Lincoln. If a call for service incident results in an incident report, the case number documenting the incident remains the same in both datasets.

        Full outer joins should not be confused with left outer joins – a more common joining technique used in GIS applications. A left outer join appends the matching records from both tables and the non-matching records from the left table, which are

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[2] Geocoded records are events that have been assigned x- and y-coordinates on a geographic surface. Shapefiles are GIS data files that depict point, line, or polygon features on a surface (i.e crime events, street networks, city boundaries).

paired with null values. Full outer joins not only append records with matching attributes, but also include non-matching records from both datasets (Forta 2000). The full outer join allowed me to assess all available data, while eliminating the possibility of case number duplication when determining hotspot concentrations.[3]

Quality of Life Index (QOLI)

I conducted my study with one major objective in mind: to assess the available indicators in law enforcement datasets that reflect the impact of crime on daily living. Developing the QOLI involved examining Casady's Neighborhood Well-Being Index, the events focused on in the broken-window theory and COP initiatives, and the indicators used in other QOL indices.

The GIS query created to implement my QOLI is a compilation of the following four rules: (1) exclusion of certain Part I offenses that contribute to misleading hotspots, (2) inclusion of non-Part I offenses that affect QOL, (3) inclusion of non-offense calls for service data, and (4) exclusion of misleading location indicators. For a complete listing of the index parameters, refer to tables 1.1-1.3.

I will explain the reasoning behind the selection or exclusion of several of the high-impact indicators and locations. Shoplifting, check offenses, and drive-offs from self-service gas pumps are excluded because they have virtually no impact on the livability of surrounding neighborhoods, but constitute almost 22 percent of the Part I offenses in the 2002 incident report data. If these crimes were included in the QOLI, misleading hotspots would be generated in retail areas. These hotspots would de-emphasize the severity of crime and disorder that effect neighborhoods in critical condition. The non-Part I offense and calls for service inclusions are a reflection of the events depicted in the broken-window theory and community-oriented policing initiatives.

I excluded locations such as government buildings, hospitals, treatment facilities, and schools. These exclusions are based on a premise that events in these places have a high level of police interaction and documentation, but exert little impact outside the walls of the facilities. There are negative side effects associated with discriminating against occurrences by location, because some incidents occurring at these locations do impact a community's QOL. For example, I am excluding the assault of a hospital staff member by a patient in the psychology ward because it is a contained incident. However, I am also excluding the assault of a staff member in the hospital parking lot, because both incidents have the same location code. Another example is the exclusion of police assistance at schools for student behavioral problems. At the same time, I am excluding the narcotic- and alcohol-related incidents that certainly impact the students and neighborhoods beyond the school's perimeter. A similar assumption to that of schools is made regarding the events that occur at residential facilities. This process of determining what to include and exclude is a balancing act. Although excluding some of these events at places like schools or hospitals is problematic, the more serious misrepresentation of community safety that would result if they were included is the greater problem.

Some of the institutions and facilities I exclude are admittedly questionable as to whether they should remain in a QOL index. However, in this study, I seek to identify the

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[3] Note that popular GIS software packages do not provide a direct method for performing full outer joins.

most fragile neighborhoods that are often less likely to generate hotspots due to their lack of places such as hospitals, treatment centers, and large retail areas that are major contributors to crime hotspots. Excluding locations that generate a lot of incidents does diminish the presence of known hotspots of crime, and in turn increases the visibility of neighborhoods in greater need of attention. Location exclusions, especially schools, should be taken under consideration by an analyst or department considering implementing a similar QOLI. A determining factor for inclusion or exclusion could be to run two QOL queries, one that includes and one that excludes schools, to better understand the impact of the events generating hotspots. Determine what types of incidents are taking place in and around the centers of hotspots. Consider how those incidents may seep into the livability of the surrounding communities. Also, ask the officers that are patrolling and living in those neighborhoods for their impressions of the impact school-related incidents have on the surrounding communities. Another location-based caution is to not exclude retail establishments from a QOLI. In 2002, 54 percent of all offenses occurring in retail establishments consisted of shoplifting and check offenses, which might mark retail stores as a candidate for exclusion by location. However, the remaining 46 percent contained crimes of more serious nature, such as robbery, assault, larceny from auto, and auto theft which are not necessarily contained in any way by the walls of the facilities, and do in fact reflect the safety or livability of the environment.

It is important to keep in mind that all GIS indices (queries) are only able to assess the information provided to them. GIS analysis should never take the place of the intuitive perceptions of officers who work within neighborhoods, but it may help to illuminate, confirm, and more accurately quantify these perceptions.

Analysis & Findings

I began my analysis by creating two hotspot maps (raster grids) based on the following queries: (1) QOLI excluding school related incidents; (2) all Part I offenses. I used the Kernel function for calculating grid-cell values. The Kernel function is an attempt to determine the impact incidents may have on a place and on the surrounding area. Kernel densities are not calculations of points per cell, but rather, the function serves to estimate the intensity of events across a surface. The contribution of an incident to a grid-cell's intensity (value) is weighted by the distance of a point to a grid-cell center. A user-specified search radius determines the distance a point must lie within in order to contribute to a cell value. Points lying outside of a cell's search radius do not contribute to that cell's value. Incidents occurring closer to a cell's center will contribute more to that cell's value, than will a point farther away. Because the grid-cell values are based on the events occurring both in and around any given cell, abrupt endings to hotspot patterns are avoided. Using the Kernel function for hotspot mapping often gives a map reader the impression of viewing a smoothed surface of peaks and valleys when viewed at a small map scale (i.e. observation of a large area). This type of hotspot mapping allows for better visual assessment of the impact of crime on an area (Anselin et al. 2000). Kernel density estimates are based on two, user-specified criteria – cell search radius and cell size. The parameters I chose for the hotspot grids included a 50 x 50 foot cell size and a 1,320-foot (quarter mile) search radius.

To prepare the hotspot maps for comparison, I reclassified the grid-cell values of each map into four breaks resulting in five equal interval classes. I used the equal interval method because the number of events extracted from the two queries ranged significantly in total number of events (Part I offenses – 18,042 events, QOLI – 55,884 events). This method offered a way to compare the peaks of incident occurrence (i.e. areas in critical need of assistance), as portrayed by each of the two indices.[4]

The first stage of my analysis compares the differences between the location and incident composition of the hotspots generated from all Part I offenses versus those generated by the QOLI. To maintain consistency while examining all hotspots, I select incident data from the highest quintile density available. The second stage compares respective point data that intersect the top 20 percent of grid values across the entire city. I chose to examine the top 20 percent as a simple means of assessing where and what each index reveals as the indicators of greatest threat to the livability of neighborhoods in Lincoln.

Initially, I focused my analysis on the entire city. By creating hotspot maps at a macro level, I was able to identify where each index (i.e. query) depicted the particularly troubled hotspots to be in Lincoln (figure 1).

Noticeable variations in hotspot intensity and location become apparent upon inspection of the maps in Figure 1. The map showing all Part I offenses (left) has a number of hotspots that illustrate the effects of potentially misleading indicators on QOL maps. For instance, 84 percent of the crime that occurs in the retail and supermarket hotspots is shoplifting. Even if recognized as non-threatening, these hotspots still serve to divert attention away from neighborhoods in need of assistance. The Part I map also exemplifies how certain locations act as incident magnets – hospitals, jails, retail establishments, and schools.

The QOLI map (right) tells a distinctly different story than the Part I map. Hotspots emphasized by the QOLI occur in the downtown area and in the Everett and Capital Avenue neighborhoods. Although the locations of these hotspots are also depicted on the Part I map, the two neighborhoods become de-emphasized by the hotspots that were reduced or removed with the QOLI. The downtown hotspot generated from the QOLI is largely attributable to the nightlife and bar scene that generate a large number of violent crimes, acts of vandalism and other disturbances. Seventy-four percent of all incidents occur in bars, on the streets/sidewalks, and in parking garages. The downtown hotspot on the Part I map tells a similar story of nighttime violence and deviant behavior, with 66 percent of all incidents occurring in the same places depicted by the QOLI. It is apparent by comparing the inset maps that the hotspot intensities are dissimilar. Simply put, this signifies the QOLI indicates that the two neighborhoods are in greater need of attention than the downtown area for neighborhood improvement efforts. The Part I index varies slightly regarding the three locations, in that it marks the downtown area in greater need of police attention than the Capital Avenue neighborhood.

The Everett and Capital Avenue neighborhood hotspots are areas that exhibit signs of a lower quality of life. These neighborhoods are inundated with acts of vandalism, assault, domestic disturbance, suspicious persons and drug-related incidents. I

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[4] Comparison based on standard deviation was not an option in this study due to the non-normal distribution of the cell values.

next compare the incident types and locations that create the hotspots in these neighborhoods for both indices.

The Everett neighborhood shows similar hotspot shape and placement on both maps. Both indices reveal that greater than 60 percent of all recorded incidents took place on the street or at residences, such as multi-dwelling buildings and single family houses. Due to query parameters, however, there are notable variations between the incident compositions of the two hotspots (table 2). The top four incident types on the Part I map, constituting 63 percent of the Everett hotspot, consist of assault, larceny from buildings, larceny from autos and larceny other. The larceny other category is comprised of gas-pump drive-offs, theft of items from porches and front yards, and small item thefts, such as cell phones and checkbooks. In contrast, the QOLI reveals that disturbances and suspicious persons also appear to be a problem in this neighborhood.

The Capital Avenue neighborhood hotspot varies considerably between the two indices in spatial concentration and indicated degree of severity. The hotspot on the QOLI map has greater intensity and appears more concentrated than the hotspot on the Part I map. At greater than 76 percent though, both indices reveal a majority of the respective incidents took place on the street or in residences. Aside from an increase in percentage of assaults, the top four Part I offenses are comprised of the same categories of crime, with similar rates of occurrence (table 3). The QOLI shows similar levels of disturbances and assaults to that of the Everett neighborhood, but pinpoints vandalism as a larger contributor to the problem than suspicious persons.

The previous comparisons show how both indices identify the same troubled areas in Lincoln. However, the map based on Part I offenses identifies other hotspots of potentially diminished QOL in Lincoln. To better understand why the two maps contrast each other in hotspot location and intensity, I compare the indicators found within the "Retail Strip" hotspot. I again base my comparison on the highest quintile available for this hotspot. The center and spatial extent of the retail hotspot peaks are very similar on both maps, although the level of intensity ranges from the second lowest quintile on the QOLI map to the highest quintile on the Part I map. Comprising 58 percent of the total, the top four events that occur within the QOLI hotspot include disturbances, trespassing, minors in possession of alcohol, and assault (table 4). Eighty-seven percent of all incidents occurred in grocery stores, followed by three percent on the street, and three percent in restaurants. In contrast, the most prominent Part I offense in this hotspot is shoplifting at 85 percent, followed by assault at four percent, larceny from buildings at four percent, and larceny from auto at three percent of the total. Eighty-one percent of all crimes took place in grocery stores, followed by 15 percent occurring in department/chain stores. Although understanding the distribution of Part I offenses is important in law enforcement, certain offenses may not be applicable to QOL studies. In regards to the retail strip, the information available from the Part I offense index may be more important to merchants in this area rather than the residents.

In the second stage of my analysis, I broaden the scope of comparison by assessing the incident and location compositions of the top 20 percent of grid-cell values for the entire city. Unlike assessing individual hotspots at the neighborhood level, this approach makes a greater distinction between the types of events and places that generate the most intense hotspots in Lincoln.

Of the Part I crimes in Figure 2.1, shoplifting, at 36 percent, is assessed as the leading indicator of disorder in the areas of greatest crime concentration.[5] Shoplifting is followed by assault, which contributes 25 percent to crime occurrence. Upon closer examination by location, the assault data show that 42 percent occurred in residences, and that 25 percent occurred on the streets or sidewalks. Larceny from buildings is the third indicator and constitutes 15 percent of the overall crime. Forty-three percent of these larcenies occurred at residences.

Evaluating Part I crime occurrence by place reveals that grocery stores serve as the leading location indicator in areas of peak crime occurrence. When examined by criminal activity, 88 percent of grocery store crime consists of shoplifting.[6] Multi-dwelling complexes (with seven or more units) and sidewalks are the second and third leading location indicators, and contribute 14 and 10 percent to crime location, respectively. Crime occurrence in multi-dwelling complexes consist of assaults at 29 percent, larceny from building at 28 percent, and auto related larcenies at 21 percent of the total. Sidewalk-related crime consists of general assaults at 69 percent, stolen bikes at 12 percent, and assault of police officers at six percent of the total.

The information revealed by the second and third indicators of crime and place depict important events occurring in the most intense hotspots in Lincoln. However, the information contributed by the first indicator for both crime and location, does not hold the impact on the QOL in residential neighborhoods that is at first suggested by the map. Conceivably, inclusion of the less applicable indicators generates noise on maps that may contribute to less accurate assessments of QOL.

In figure 2.2, I use the QOLI to conduct a similar examination of crimes, events, and locations contributing to the need for police assistance. The types and locations of incident occurrence bear great similarities to the neighborhood assessments made earlier in this section. These similarities exist because the QOLI hotspots containing the top 20 percent of grid-cell values only occur in the Everett and Capital Avenue neighborhoods. Therefore, I address the categories of crime and incidents found within the three leading location indicators. The first and third location indicators are multi-dwelling complexes. Combined, the two housing types represent 56 percent of incident location. At these locations, 56 percent of incidents involve domestic and other disturbance related calls. Assault and vandalism follow, each contributing seven percent to the total. Street-related events constitute 12 percent of incident location. At 40 percent, disturbances serve as major contributors to street problems. Suspicious person and vehicle concerns compose 24 percent of street totals. And, at nine percent, vandalism also serves as a contributor to street incidents.

Whether looking at individual neighborhoods or incidents occurring within the top 20 percent of grid-cell values for the entire city, disturbance calls are almost always amongst the leading indicators in my QOLI and merit special attention. The Lincoln Police Department categorizes disturbances into four subcategories: domestic, neighbor, wild party, and other. After extracting all disturbance call records from the top 20 percent of QOLI grid-cell values, it becomes apparent that domestic disturbances, neighbor complaints, and wild parties do not hold a candle to the number of events within the

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[5] The hotspots that represent the top 20 percent of grid-cell values determined from Part I offenses are located in the downtown, Everett neighborhood, and the retail strip.
[6] Figures showing offense distribution are available from author on request.

'other' category (table 5). At 79 percent of disturbance calls, the 'other' category consists of a broad range of events that may or may not include the caller. Examples of 'other' disturbance calls are the following: people making excessive noise on the street/sidewalks, heard gun shots, drunken behavior in public, suspicious-looking teenagers, blasting stereos, public urination, unsubstantiated fights, threats of abuse, and verbal arguments. One reason for the flux of incidents placed in the 'other' category is that there is often overlap of the type of event occurring when an officer arrives on the scene that does not fit neatly into one of the more specific disturbance categories. For instance, an officer is sent out on a party disturbance call, and finds four intoxicated people making noise on a deck. In this scenario, the call type could be classified as either a wild party disturbance or as an 'other' disturbance and is left to the discretion of officers to decide. Although disturbance data in Lincoln is not collected and maintained with the strict, categorical standards of Part I offenses, I consider the information found within the disturbance data as plausible indicators of a neighborhood's QOL. Disturbance calls offer a wide range of citizen concerns, made known to police, about what is effecting people's QOL. If examined closely, the disturbance data may provide a way to tie into the daily concerns and stresses within a community.

Conclusion

The purpose of this paper is to encourage police departments, especially crime analysts and decision makers, to move beyond Part I offenses when conducting a quality of life analysis. As shown throughout the paper, Part I offenses such as shoplifting, check offenses, drive-offs from self-service gas pumps, do not adequately reflect quality of life. There are vast amounts of available information that can contribute to a more informative look into a community's well-being, such as non-Part I offenses and calls for service records. Location of crime occurrence must also be accounted for. Certain locations act as incident magnets and if left in a quality of life analysis merely serve to pinpoint where hospitals, jails and treatment facilities exist within a city, rather than emphasizing the neighborhoods in critical condition.

In 1982, when Wilson and Kelling introduced the broken-windows theory to law enforcement, they noted that, "Most police departments do not have ways of systematically identifying such areas [neighborhoods in critical condition] and assigning officers to them." This, however, is no longer the case with the cost-effective and widespread use of GIS. A major benefit of utilizing GIS in law enforcement is the ability to perform spatial and temporal analysis (i.e. analysis across multiple shifts and neighborhoods) on large amounts of information.

Although the organization or structure of a police department's datasets may vary from that of the datasets used in this study, any agency can create a department-specific QOLI based on available data. Techniques for combining datasets exist and are beneficial to understanding an area's livability. Incident reports, calls for service records, and any other applicable police datasets, if effectively sifted for indicators of community living, can provide a glimpse into the experiences of officers on the street. My QOLI is an attempt to depict the craft knowledge street officers often know from their "on the ground" experience about the areas in greatest need of police attention. This Quality of Life Index is not meant to replace the input of community officers, but rather to

complement their efforts with a form of community-oriented crime analysis. The index serves to identify where the most fragile neighborhoods are located. If a neighborhood is observed to be in critical condition, then examination from additional perspectives (i.e. officer input) must be sought to understand how improvement efforts can be targeted with police and public resources.

The QOLI addresses and corrects some of the issues that arise when assessing the effects of crime and disorder on a community. There are, however, issues that remain untouched in the index introduced in this study and serve as avenues for continued research. For instance, incident or event types are not weighted to signify the greater impact of a murder, rape, or robbery over an act of vandalism or a yelling match between two people on the street. While constituting an area for improvement, this does not nullify the effectiveness of my index, because many have argued that "serious street crime flourishes in areas in which disorderly behavior goes unchecked" (Wilson 1982). Another consideration for analysis would be to introduce other non-police variables into the equation, following prior QOL studies. Aggregate data such as immunization rates or standardized reading test scores may be available from health departments or school districts. Census data such as income, age or family status could add to such an analysis. Many communities have found intriguing indicators of quality of life that can be added to the QOLI to enhance the analysis. By assessing other aspects of QOL, an even better portrayal of a community may be obtained. Portraying these data with GIS truly provides the picture worth a thousand words.
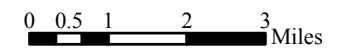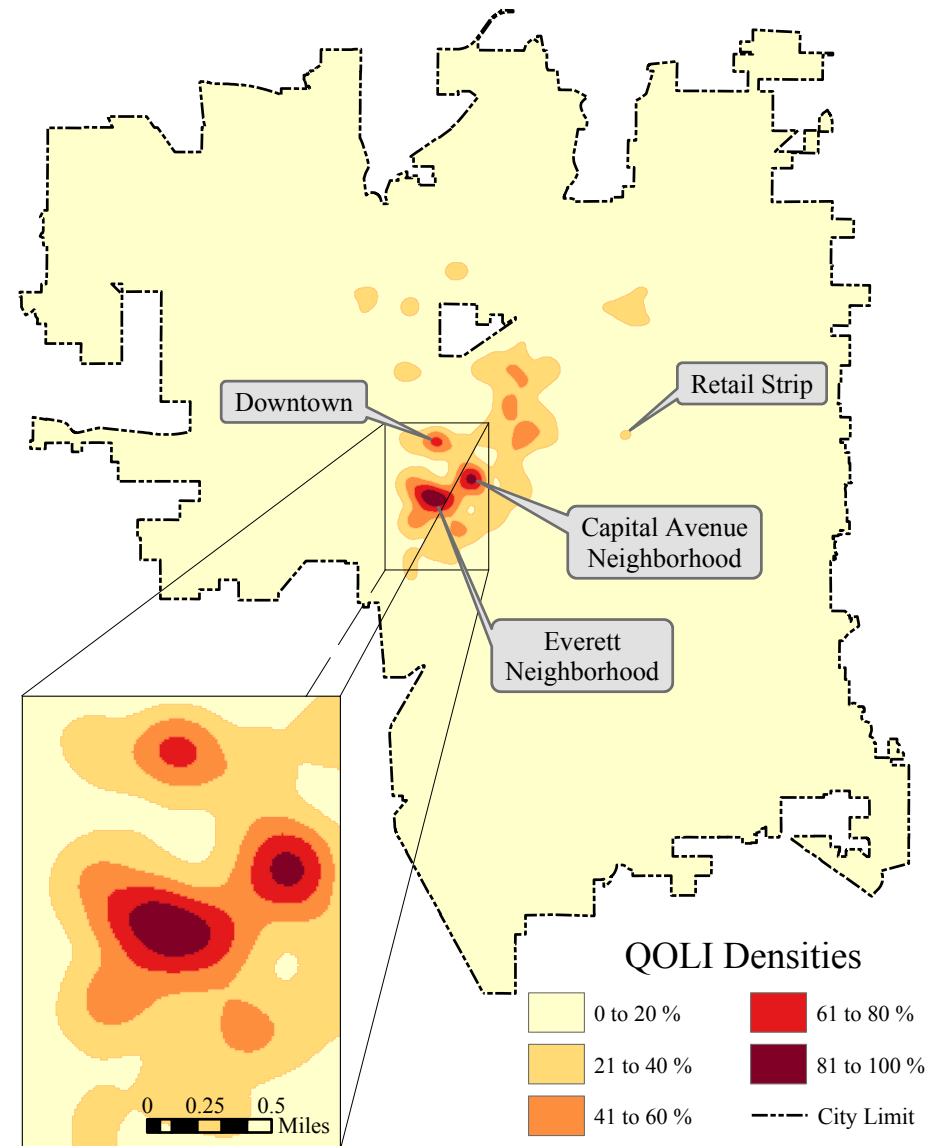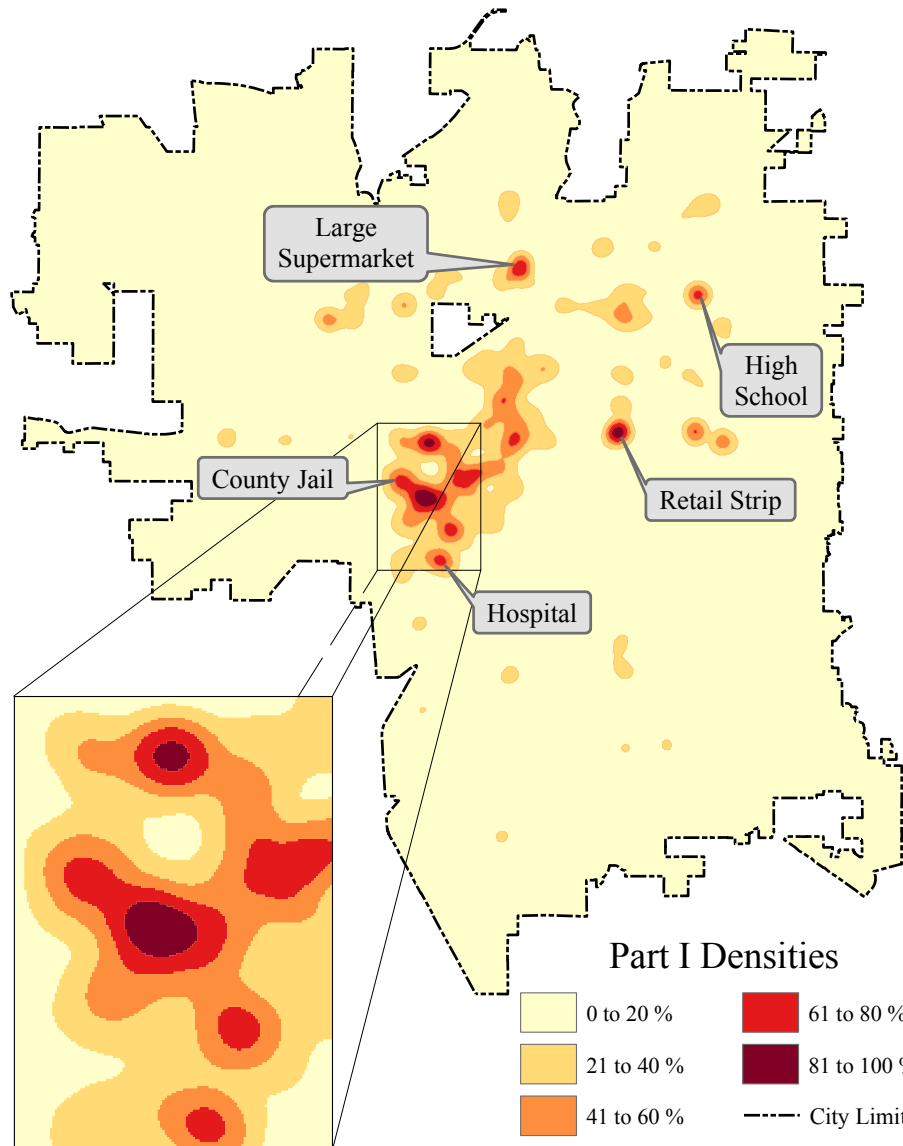
<u>Acknowledgements</u>

2002 Index Comparison
Lincoln, Nebraska

All Part I Offenses

Large Supermarket

High School

County Jail

Retail Strip

Hospital

N

Part I Densities

- 0 to 20 %
- 21 to 40 %
- 41 to 60 %
- 61 to 80 %
- 81 to 100 %
- — ·· — City Limit

Quality of Life Index

Retail Strip

Downtown

Capital Avenue Neighborhood

Everett Neighborhood

QOLI Densities

- 0 to 20 %
- 21 to 40 %
- 41 to 60 %
- 61 to 80 %
- 81 to 100 %
- — ·· — City Limit

0   0.25   0.5
Miles

0   0.5   1   2   3
Miles

Note: Densities were derived using the Kernel function. Density ranges represent grid-cell values classified into five equal intervals.

Figure 1 The maps above represent the results of two methods of determining quality of life. The city-wide maps, show where each method depicts the particularly troubled hotspots to be in Lincoln, Nebraska. The inset maps provide a closer look at Lincoln's downtown, and Everett and Capital Avenue neighborhoods.

2002 Index Comparison - Top 20 Percent
Lincoln, Nebraska

Figure 2.1

All Part I Offenses

Figure 2.2

Quality of Life Index
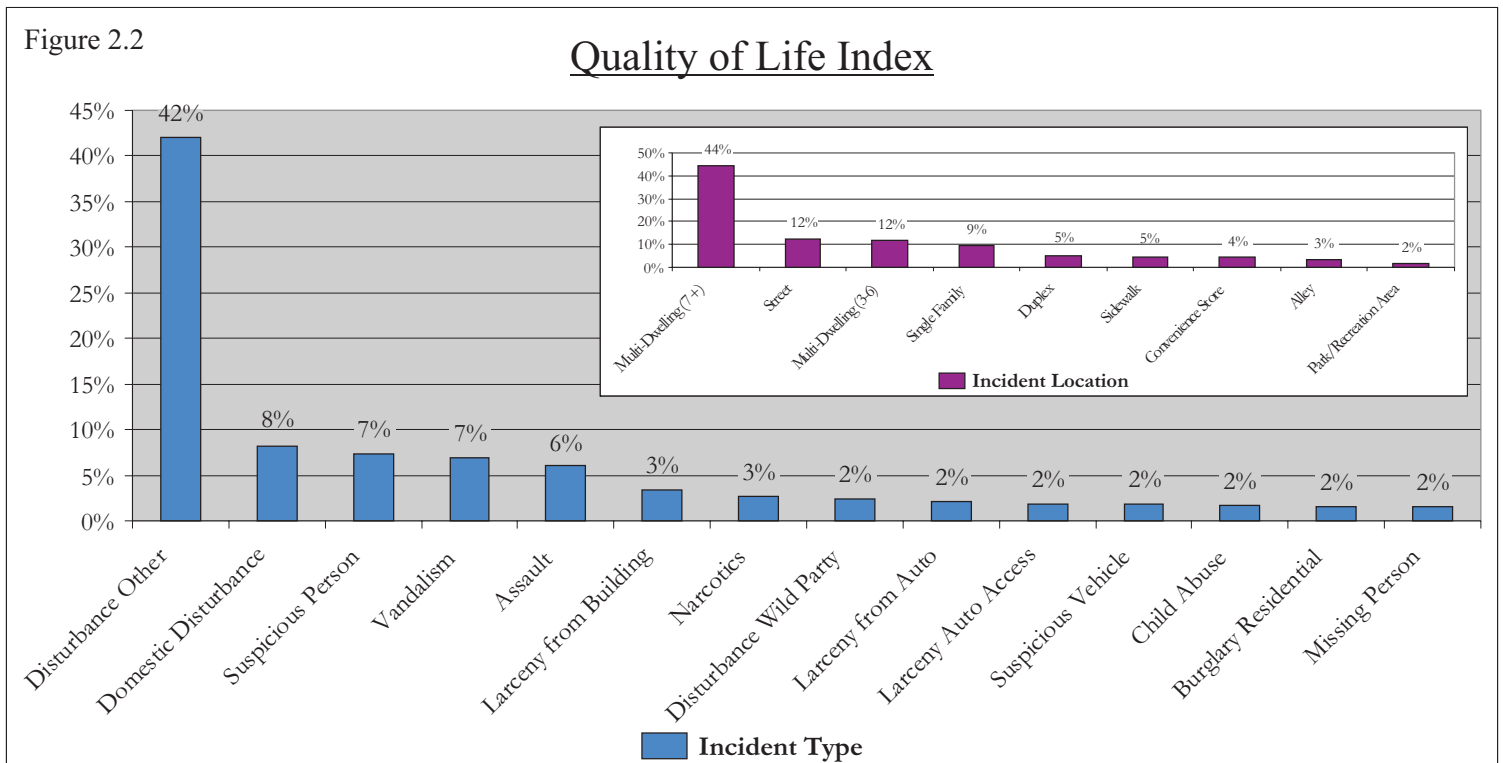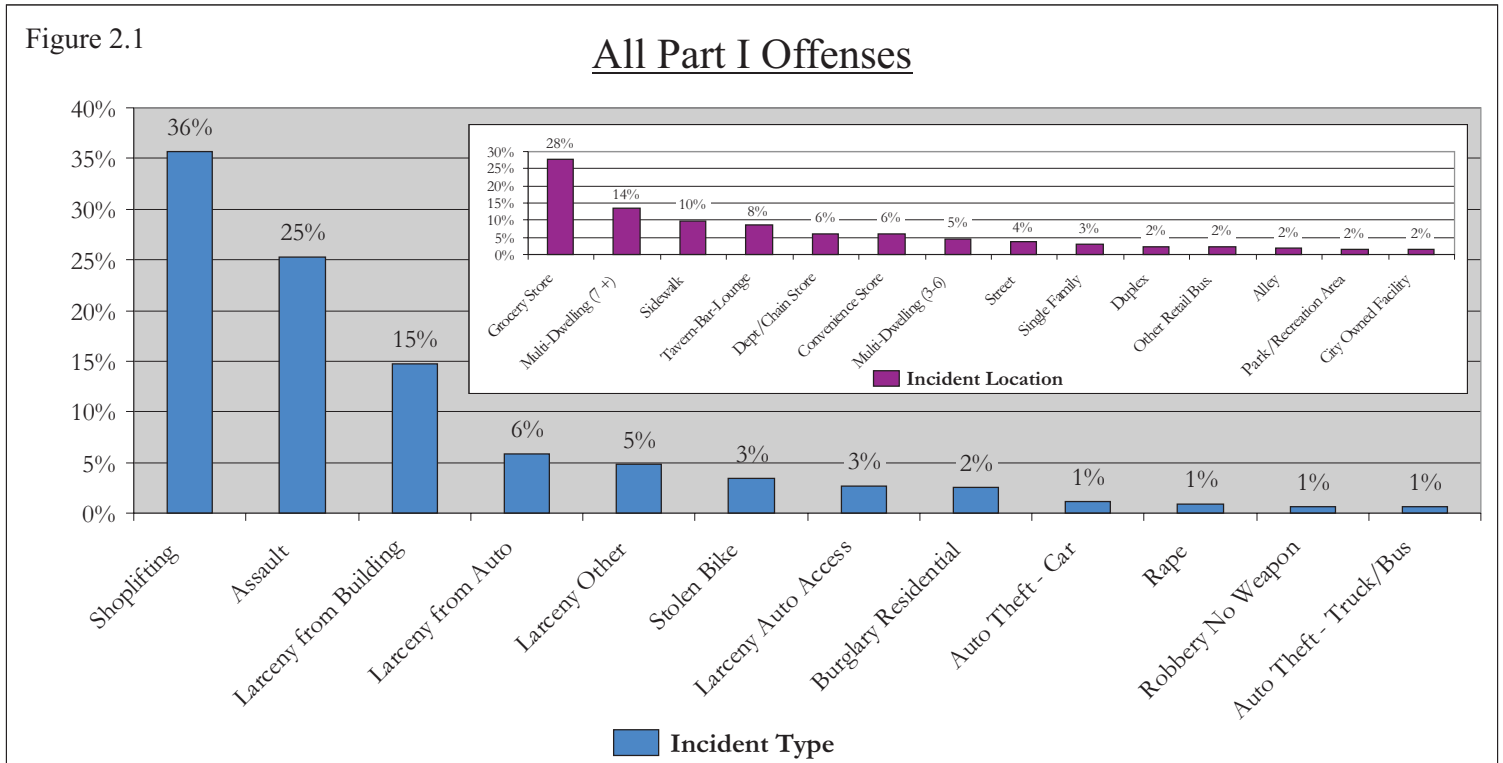
Figures 2.1-2.2 The graphs above show the distribution of incidents and locations found within the top 20 percent of grid-cell values for the entire City of Lincoln in 2002. Events and places contributing less than one percent to the total have been excluded from all graphs.

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Table 1.1 **Break-down of included and excluded Part I Offenses.**

Part I Offenses	
Included Offenses	Excluded Offenses
Murder	Burglary
Rape - Includes Attempts	Commercial
Robbery	Larceny
Aggravated Assault	Shoplifting
Burglary	Check Offenses
Residential	Gas Pump Drive-Offs
Larceny	
Auto Accessory	
From Field	
From Auto	
From Building	
Arson	

Table 1.2 **Included non-Part I Offenses and Calls for Service records.**

Non-Part I Offenses	Calls For Service
Included Offenses	Included Call Types
Adult/Child Abuse and	
Neglect	Abandoned Vehicle
Bomb - Includes Threats	Alcohol
Burglary	Disturbance
Child Abuse	Domestic
Gambling	Neighbor
Indecent Exposure	Wild Party
Missing Person	Other
Narcotics	Littering
Prostitution/Pornography/Vice	Suspicious
Sex Offense	Item/Other
Stolen Bicycle	Person
Suicide - Includes Attempts	Vehicle
Trespassing	
Vandalism	
Weapon - Includes Concealed	

Table 1.3 **Locations excluded from selected offenses and call types.**

Locations
Excluded Locations
City/County Owned Facility
State/Federal Owned Facility
Resident Institution
Treatment/Detention Facility
Private/Public Schools
University/College

Table 2 **Top four incident types and percentages contributing to the Everett Neighborhood hotspot.**

Everett Neighborhood			
QOLI	%	Part I Offenses	%
Disturbances Other	40	Assault	26
Suspicious Person	8	Larceny from Building	17
Domestic Disturbances	7	Larceny from Auto	10
Assault	6	Larceny Other	10
Total Percentages	61		63

Table 3 **Top four incident types and percentages contributing to the Capital Avenue Neighborhood hotspot.**

Capital Avenue Neighborhood			
QOLI	%	Part I Offenses	%
Disturbance Other	42	Assault	39
Vandalism	15	Larceny from Building	13
Domestic Disturbance	8	Larceny from Auto	11
Assault	8	Larceny Other	10
Total Percentages	72		73

Table 4 **Top four incident types and percentages contributing to the Retail Strip hotspot.**

Retail Strip			
QOLI	%	Part I Offenses	%
Disturbance Other	30	Shoplifting	85
Trespassing	11	Assault	4
Alcohol – Minor in Possession	9	Larceny from Building	4
Assault	8	Larceny from Auto	3
Total Percentages	58		96

Table 5 **Percentage of Disturbance calls for the top 20 percent of QOLI grid-cell values**

Disturbance Type	Percentage
Domestic	15
Neighbor	1
Wild Party	4
Other	79

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