Abstract

Title of Thesis: THE IMPACT OF FOOTBALL GAMES ON CRIME: A ROUTINE ACITIVITY APPROACH

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Routine activities theory (Cohen and Felson, 1979) suggests a change in people's routine activities can contribute to a change in crime rates. This thesis aims to apply routine activities theory to examine the impact of football games on crime by focusing on how a change of football fans' routine activities can affect a change in crime at the aggregate level. Using a quasi experimental design, the study paired the 76 game days with the 76 comparable non-game days. Two analytical strategies were applied, including a binomial test and a t test. The results of the study suggest that football games have some impact on crime. On average, there are small increases in burglary and auto theft and a moderate increase in car prowl (theft of auto) on a game day.

# THE IMPACT OF FOOTBALL GAMES ON CRIME:

# A ROUTINE ACITIVITY APPROACH

By

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# Chapter 1: Introduction

Studies of crime traditionally focus on people's criminality and why certain types of people commit crime whereas others do not. Not until fairly recently did researchers start to focus on crime and its context (Eck and Weisburd, 1995; Weisburd, Bushway, Lum and Yang, 2004). One important catalyst of this shift of focus is the routine activities theory proposed by Cohen and Felson in 1979. Central to their theory is the idea that crime happens when there is a convergence in space and time of suitable targets, motivated offenders and the absence of capable guardians (Cohen and Felson, 1979).

The current study tries to examine the relationship between a major event and crime in the routine activities theory framework. A major event refers to a single event that can attract a substantial amount of people to a single place during a specific period of time. A sporting event, a concert, and a fair are some examples that fit the definition of a major event. I chose football games as the proxy of major event for a couple of reasons. First, football is one of the most popular sports in the United States with among the highest average attendance. The average attendance for a football game outnumbers other professional sporting events, such as baseball games, basketball games and hockey games. I want the average attendance to be as large as possible because that will maximize the potential impact of a major event on crime. Second, other major events, such as music concerts by famous pop singers might attract more attendance than football games, but they are neither held in a fixed city nor on a regular basis. The sample size for those events might not be big enough to make statistically meaningful conclusion.

A football game can impact crime in several ways. Football games may cause fan riots (Falk, 2005). In addition, professional football games have been found to be positively related to violent assaults on women (White, Katz and Scarborough, 1992) and domestic violence (Sachs and Chu, 2000). One of the possible explanations for the findings is that professional football games are inherently violent and people tend to act in a like manner after viewing violence (White et al., 1992). Unlike past research on sports and crime, the current study takes the routine activity approach, focusing on how a change in people's routines by a football game can affect crime at the aggregate level.

Football fans change their routines when their favorite team is playing. If their favorite team is playing in town, they might watch the game in the stadium or they might watch the game from TV at homes, at a bar or at a friend's house. Those changes of routines will alter the frequency of the convergence of motivated offenders, suitable targets and the lack of capable guardians at the city level as well as the area surrounding the football stadium. When football fans from all over the city flock to the football stadium, more houses are left unattended at the city level, which will lead to more opportunities for burglary; on the other hand, more people and cars are around the football stadium which provide more suitable targets for robbery and automobile related crime in the area surrounding the football stadium. Crime inside the football stadium will not be included in the analyses.

Another way that a football game can impact crime is by providing opportunities for potential offenders. Some potential offenders are aware that more criminal opportunities will be available on game days; so they take advantage of the opportunities created by the football game and intentionally go to the place where more suitable targets will be available (Cromwell and Olson, 2004). In this case, motivated offenders and suitable targets both go up, crime are more like to occur. To illustrate, Felson (1987) draws an example from ecology to explain why certain event can be a good opportunity for some crime. He argues that when predators such as lions or foxes are looking for preys, they usually go to places where their preys are most likely to show up. So "similarly, professional [sporting] events sets the stage for nearby traffic jams and car breakings" (Felson, 1987: 914).

The current study is different from previous studies in a couple of ways. Little attention has been paid to the relationship between a major event and crime in the routine activity framework (Decker, Varano, and Greene, 2007). Routine activities theory has been successfully applied to explain crime trends across time in the United States (Cohen and Felson, 1979) as well as across nations (Bennett, 1991; LaFree and Kick, 1986). A good amount of studies apply routine activities theory to explain different levels of risk of victimization depending on the routine activities they engage in. For example, engaging in night time activities (Miethe, Stafford and Long, 1987), outdoor leisure time activities (Messner and Blau, 1987) and going out to work (Kennedy and Forde, 1990) have been found to be more likely to be victimized. Studies on the relationship between crime and place have usually applied routine activities theory to argue why certain places are more crime prone than other places (Sherman, Gartin and Buerger, 1989; Weisburd et al, 2004). Many studies have been done, applying routine activities theory and they generally have found support for the theory. However, little research has been done on the impact of a major event on crime in the routine activity framework.

Second, this study applies a different unit of analysis from past studies. Cohen and Felson's original thesis focused on macro level. They looked at how the changes of social structure since the 1960's increased the probability of the convergence of suitable targets and motivated offenders in the absence of capable guardians (Cohen and Felson, 1979). Later studies used a variety of units of analysis, including cross nations(Bennett, 1991; LaFree and Kick, 1986), Standard Metropolitan Statistical Areas (Messner and Blau, 1987), city block (Roncek and Maier, 1991), , street segment (Weisburd et al., 2004), place (Sherman et al., 1989), individual (Kennedy and Forde, 1990; Miethe et al., 1987) and the interaction between community and individual (Sampson, 1987; Rountree and Land, 2000). The current study applies two units of analysis depending on the dependent variables. There are four dependent variables discussed in the current study, robbery, burglary, auto theft and theft of auto.[1] For burglary, I look at the whole city level; for other three dependent variables, I create multi-distance buffer zones surrounding the football stadium which are more appropriate than other units of analysis in terms of testing the hypotheses (see methodology chapter for details).

The impact of football games on crime should be limited in time and space. In other words, when and where crime happened is crucial to determining whether it was affected by a football game or not. Thus, I apply temporal and spatial criteria for inclusion of the dependent variables. In order to rule out crime that is not affected by football games, I created multi-distance buffer zones surrounding the football stadium for three of the four dependent variables. The buffer zones are basically four concentric zones surrounding the football stadium, each with a .5 mile, 1 mile, 1.5 mile and 2 mile radius respectively. With this multi-distance buffer zone design, I can determine to what spatial extent football games can affect crime. Robbery, auto theft and theft of auto are

[1] Theft of auto was coded as car prowl in the original data. It refers to the act of taking something from inside the car illegally.

the three dependent variables that apply the buffer-zone design, because when people go to a football game, the number of people and cars within the buffer zones will increase. Burglary is the only dependent variable that does not apply to the design because spectators may come from anywhere in the study area. So, when there is a football game, there should be more houses left unattended at the city level instead of just the area surrounding the stadium.

The timing of crime is also important for the current study. Ideally, only crime happening with close temporal proximity to game hours should be considered being affected by football games. However, except for robbery, the data does not have precise crime time but estimated crime time periods marked as begin time/date and end time/date. Due to limitations of the data, only robbery will be included based on its temporal proximity to game hours while burglary, auto theft and theft of auto will apply a whole day as the time period for inclusion of the dependent variables.

The study area is the city of Seattle, Washington. The professional football team in this city is the Seattle Seahawks. Nine-year (1998-2006) police incident data from the Seattle Police Department (SPD) will be utilized. The research design of this study is a quasi experimental design. I paired each game day (when the Seahawks are playing in Seattle) with a comparable non-game day (when the Seahawks are not playing in Seattle). The purpose of the matched-pair design is to make every game day and its matched non-game day as similar as possible. Other potential confounding factors were also taken into account, including seasonal and weekly effects, temperature, and precipitation. Two analytical strategies were utilized, including a binomial test and a t-test for dependent samples (also known as paired t-test).

The purpose of this study is not to test routine activities theory but to apply the theory to explain if a football game has an impact on crime. The theory provides a good framework to examine the relationship between football games and crime—one which has not been looked at before.

The thesis is structured in the following ways. Chapter two illustrates how sports can impact crime based on two criminological theories: routine activities theory and rational choice theory. Chapter three lays out the research question of the current study as well as the four hypotheses that will be tested in the study. Chapter four explains the data, research design and analytic strategies in the current study. The results are reported in chapter five; limitations and conclusions will be discussed in chapter six.

# Chapter 2: Literature Review

This chapter is divided into two parts: the review of routine activities theory and the review of rational choice theory. Since routine activities theory is the main theoretical framework for the current study, it will be the focus of this chapter. Rational choice theory is brought up to supplement routine activities theory. Hence, the review of rational choice theory is more focused than comprehensive.

## Routine Activities Theory

Routine activities theory was first proposed by Cohen and Felson in 1979. Their original thesis tried to explain how the changes of social structure led to increased crime rates between the 1960's and the 1970's in the United State. Social structure changes are macro phenomenon while crime is inherently a micro-level phenomenon because it takes the convergence in a specific space and time of suitable targets, motivated offenders and the lack of capable guardians (Cohen and Felson, 1979). The mechanism of how social structure changes can affect crime rate is discussed below.

Cohen and Felson did not argue that social structure changes directly affect crime rate but suggested people's routine activities mediate between structure and crime. Social structure changes alter people's routine activities and the changes in routines affect the frequency of the spatial and temporal convergence of the three elements of routine activities theory at micro level and thus affect the crime rate. For example, one of the most important social structure changes discussed in Cohen and Felson's original thesis is married women's participation in the labor force. The increased proportion of married women's participation in the labor force helps create more criminal opportunities for burglary. More married women participating in the labor force leads to more unattended houses which, in turn, increase the frequency of the convergence of motivated offenders and suitable targets and the lack of capable guardians. Therefore, burglary increases as a result of women's participation in labor force.

Consistent with routine activities theory, the current study focuses on how the change of people's routine activities by a football game can have an impact on crime. Routine activities are defined as "any recurrent and prevalent activities which provide for basic population and individual needs, whatever their biological or cultural origins" and included "formalized work, as well as the provision of standard food, shelter, sexual outlet, leisure, social interaction and childrearing" (Cohen and Felson, 1979: 593).

Routine activities theory can be further broken down to four parts: spatial-temporal convergence, motivated offenders, suitable targets and guardianship. I will address these four major elements in the following paragraphs.

*Spatial-temporal Convergence:*

The spatial distribution of crime has been a central interest of criminologists since the 1920's (see Burgess, 1929 and Shaw and McKay, 1942). The temporal elements, on the other hand, drew relatively little attention from criminologists. Cohen and Felson found the temporal elements could not be ignored and quoted Hawley's Human Ecological theory to illustrate the three elements of time that may impact crime (1979: 590):

(1) *Rhythm, the regular periodicity with which events occur, as with the rhythm of travel activity.*

(2) *Tempo, the number of events per unit of time, such as the number of criminal violations per day on a given street; and*

(3) *Timing, the coordination among different activates which are more or less interdependent, such as the coordination of an offenders' rhythms with those of a victim.*

The introduction of the spatial and temporal elements was credited as the most important contribution by Sherman and his colleagues. ”The most important contribution of routine activities theory is the argument that crime rates are affected not only by the absolute size of the supply of offenders, targets, or guardianship, but also by the factors affecting the frequency of their convergence in space and time” (Sherman et al., 1989: 30-31). Spatial temporal convergence is important for the current study. A football game is held at a specific place and in a specific period of time. So, the impact of football games on crime should be subject to spatial and temporal components as well.

*Motivated Offenders:*

"A likely offender was anybody who for any reason might commit a crime" (Clarke and Felson, 1993: 2). While criminal motivation and criminality are crucial to some theories (e.g. strain theory), routine activities theory takes motivated offenders as given (Clarke and Felson, 1993). Cohen and Felson were more interested in how our routine activities "help people to translate their criminal inclination into action" rather than in criminals' motivations per se (p. 589). They shifted the focus from criminality to the criminal event itself. There are both advantages and limitations to this shift. By focusing on crime itself, the routine activity approach provides an easy and straightforward framework for crime prevention. According to routine activities theory, crime would reduce if the frequency of the convergence of the three elements in the theory reduces as well. “The lack of any one of these elements is sufficient to prevent the successful completion of a direct-contact predatory crime.” (Cohen and Felson, 1979: 589) Therefore, from the standpoint of a potential victim, who has no control over motivated offenders, he or she can lower the likelihood of victimization by making his/her property less suitable through target-hardening measures (see Clarke, 1983).

There are some arguments against taking motivated offenders as given. According to Miethe et al. (1987:193) “persons who may be more suitable as targets and generally lack guardianship are not necessarily those who are more likely to be victimized by property or violent crime.” If motivated offenders are taken as given as Cohen and Felson assume, then it follows that those who are more suitable as targets should be more likely to be victimized because there are always motivated offenders looking for suitable targets. This, then, would contradict what Miethe and his colleagues have found. Brantingham and Brantingham also argue that motivated offenders are not evenly distributed in space and time. For example, “car thefts are tied to the locations of unguarded cars, and follow a rhythm associated with commuting patterns during the week and with leisure activities on weekends” (Brantingham and Brantingham, 1993: 263). In other words, crime is more likely to happen in certain places and at certain period of time. Routine activities theory in its original formulation, thus failed to address why motivated offenders are not evenly distributed across space and time.

A football game may increase the level of motivated offenders in a couple of ways. First, if a football game attracts more teenagers to a game with the absence of their handlers[2], then the increase of potential offenders might be expected since teenagers are more likely to commit crime than people at any other age range (Hirschi and Gottfredson, 1983.) According to a Seahawks fan survey, fans at their 40s made up the largest percentage of all respondents and the average age of fans going to a Seahawks game is about 31 years old (Michael, 1998). According to this survey, it seems a football game will not increase the level of potential offenders greatly. Another way that the level of motivated offenders may increase is when potential offenders are aware that suitable targets will be numerous around the football stadium when there is a football game. In this case, motivated offenders might intentionally go to the areas and look for their targets (Felson, 1987).

The current study recognizes the limitations of routine activities theory, and supplements these weaknesses with the rational choice approach (which will be discussed later in this chapter) to better justify my hypotheses.

*Suitable Targets:*

Cohen and Felson discussed target suitability in two ways: objects and people. They argue "expensive and movable durables, such as vehicles and electronic appliances, have highest risk of illegal removal" (1979: 595). These objects are more likely to be stolen by motivated offenders because they are high in value and easy to move. With respect to people, the underlying premise of routine activities theory is people are more likely to be victimized if they spend more time outside of their home because staying away from home provides more chances of convergence of suitable targets and motivated

[2] Felson (1986) describes a handler as a controlling agent, one who restrains potential offenders. An example is a mother whose presence makes it less likely that a child will be deviant.

offenders in the absence of capable guardians. In Cohen and Felson's original thesis, they suggested the change of people's routine activities and the reduction in the weight of consumers' products all contributed to the rise of property crime rate since the 1960's. As more and more married women participated in the labor force, houses were more likely to be left unattended and hence became suitable targets for burglary. As the weight of household appliances, such as TV sets and washing machines became lighter, they were more likely to be stolen. Cohen and Felson applied aggregate data to test their hypotheses and found support for their hypotheses.

Studies applied individual level data and more sophisticated statistical models also found support for routine activities theory. Miethe and his colleagues suggest that "those who had higher nighttime activity and those whose major activity was performed outside the home have relatively greater risks" of property victimization (Miethe et al., 1987: 189). In a later study, Kennedy and Forde found that "the most vulnerable groups are young, unmarried males who frequent bars, go to movies, go out to work, or spend time out of the house walking or driving around (1990:143). Opposite to Miethe et al.'s argument, they suggest routine activities can predict both property and violent crime.

Past studies on routine activities theory have shown that if people spend more time outside their houses, both they and their households are more likely to be victimized. Spending more time away from home will leave households unattended and hence increases the likelihood of burglary; it will also increase the likelihood of violent and property victimization. Therefore, when people go to a football game, they are increasing their as well as their households' chance of victimization.

*Capable Guardians:*

Cohen and Felson did not spend much time addressing guardianship, they pointed out it was very easy to ignore guardianship since it is “usually marked by the absence of violations” (1979: 590). Guardians are “people who can protect targets” (Eck and Weisburd, 1995: 5). A guardian has to be capable; otherwise, crime is going to happen regardless of his/her presence. For instance, a bank robbery might occur at the presence of a security guard. In this case, the security guarded is not a capable guardian.

Guardians can be people or objects. Cohen and his colleagues defined guardianship as “the effectiveness of persons or objects in preventing violations from occurring” (Cohen, Kluegel, and Land, 1981: 508). According to Miethe and Meier (1994) guardianship is “usually conceptualized as having both social (interpersonal) and physicals dimensions” (p. 51). Social guardianship refers to human guardianship, such as the number of residents in the household, neighbors, friends, etc. “The availability of others (e.g., friends, neighbors, pedestrians, law enforcements officers) may prevent crime by their presence alone or through the offering of assistance to ward off an attack” (p.51). “The most significant guardians in society are ordinary citizens going about their daily routines” (Felson, 1994: 31). In other words, house owners are the best guardians of their households. A study found that ninety percent of the burglars interviewed said they would not burglarize a house that is occupied (Cromwell and Olson, 2004).

Physical guardianship refers to the measures taken to deter crime, usually known as target-hardening measures, such as deadbolt locks, alarm system, dogs, etc. While one study found that physical guardianships can deter burglary (Cromwell and Olson, 2004), Miethe and Meier (1994) found both social and physical guardianships have no statistically significant impact on robbery and burglary.

A professional football game generally attracts more than 60,000 people for attendance. These attendants and other fans can be suitable targets for potential crime and at the same time they may act as capable guardians for each other. Moreover, police officers might increase significantly on game days. Although Felson (1994) suggests that the police are usually associated with guardians but they are unlikely to appear when crime happens, in the current study, police officers might play an important role as capable guardians because there are significantly more officers deployed in the immediate area surrounding the stadium on game days. Past studies have not reached a consensus on the effect of police presence on crime. Some past studies showed that police presence had no or virtually no effect on crime (see Greenberg and Kessler, 1982; Kelling, Pate, Dieckman and Brown, 1974, Levine, 1975; Loftin and McDowall, 1982) while some studies show an inverse relationship between police presence and crime (see Kovandzic and Sloan, 2002; Levitt, 1997; Marvell and Moody, 1996; Sherman and Weisburd, 1995; Wellford, 1974). Regardless, it is still important to take police presence into account.

### *The Domain of Routine Activities Theory*

Can routine activities theory explain all types of crime? Originally, routine activities theory was only applied to “predatory crime” which was defined as “illegal acts in which someone definitely and intentionally takes or damages the person or property of another” (Cohen and Felson, 1979: 589). Felson (1983: 912) identified four types of crime: (1) “the exploitative (or predatory) (2) the mutualistic offenses, such as gambling

(3) competitive violations, such as fights and (4) individualistic offenses, such as suicide". He suggested that while the routine activity approach originally only applied to exploitative crime, its reasoning fits all four types of crime (Felson, 1983).

Miethe et al. (1987) found that routine activities theory only applied to property crime but not violent crime. Kennedy and Forde (1990), on the other hand, found that routine activities theory applied to both property and violent crime. Recently, routine activities approach has even been applied to explain cyber crime, which includes offenses undertaken on computers or the internet (Yar, 2005).

## Rational Choice Theory

While routine activities theory provides a good theoretical framework for the current study, it does not address why a football game may be a good opportunity for a potential criminal to commit crime. Thus, I bring in another theoretical perspective, rational choice theory, which is believed to be both "compatible" with and "mutually supportive" of routine activities theory (Clarke and Felson, 1993: 1). Rational choice theory draws heavily from both classical theorists and economics theory (Bentham, Nagin, etc.). Rational choice theorists believe that criminals are rational and they evaluate the potential risk and rewards of a crime and decide whether to commit a crime or not. This idea of a rational calculation can be dated back to Cesare Beccaria and Jeremy Bentham who argued that people are rational and hedonistic. Becarria in his work "On Crimes and Punishments" (1764), suggested that people are rational and in order to deter crime, punishments should be swift, certain and fit crime. Also, economists such as Becker (1968) contributed to rational choice theory. Rational choice theorists put crime in economic equations, such as demand and supply and costs and benefits (Clarke and Felson, 1993). There are three main components for rational choice theory: “the image of a reasoning offender, a crime-specific focus, and the development of separate decision models for the involvement processes and the criminal event” (Cornish and Clarke, 1986: 7). Rational choice theorists argue motivation is crime-specific and make a distinction between “criminal involvement and crime event” (p. 5). The latter addresses different decision making processes. A criminal must decide whether to commit a crime first. Once he decides to commit a crime, and he needs to choose what type of crime to commit.

Cromwell and Olson (2004) interviewed 30 active burglars and tried to find out their motivation of committing burgles and how they select their targets. They found that burglars are rational when choosing their targets. For example, they will assess whether a target is occupied, how easy the target can be observed from neighboring homes, and how accessible the targets are. The first thing that burglars take into account is whether a house is occupied or not. Ninety percent of the burglars interviewed said they would not burglarize a house which is occupied. A professional burglar revealed he not only takes advantage of victim’s routine activities as well as police officers:

> *You know when is the best time to do a burglary? Three o’clock in the afternoon. Mothers are picking up their kids at school and the police are doing shift change. Even if someone called the cops on me, they’d be in the middle of shift change and it would take longer to get here. Man! Wait until football season. I clean up then. When they are at the game, I’m at their house* (p. 51).

There might be some professional burglars like the one in this study, who consciously know there is a football game going on, and takes advantage of it. There might be still other burglars who are not aware of a football games, but who cruise through neighborhoods, searching for targets. When they find unattended households, they might break into them. Or, motivated offenders, going about their routines of everyday life, and who happen upon empty houses due to the game. In either case, a football game should increase the probability of burglary.

# Chapter 3: Research Question and Hypotheses

## Research Question

The research question for this thesis is: Can a change of people's routine activities by a major event have an impact on crime? A major event as previously mentioned, refers to an event that can attract substantial amount of people to a specific place at a specific period of time. In the current study, a major event is operationalized as NFL games. Football games can alter people's routine activities in various ways. Those changes in routines can affect the frequency of the convergence in space and time of suitable targets, motivated offenders and the lack of capable guardians and thus may have an impact on crime.

Football fans change their routines when their favorite team is playing. Football fans that have game tickets will go to the stadium a couple of hours or even several hours before the start of the game. Some of the football fans will have a tailgate party in the stadium parking lot several hours before the game starts or even the night before (Falk, 2005). In the area surrounding the stadium, more suitable targets will be available on game days which in turn, might increase the frequency of the convergence of the three crime elements of routine activities theory. When fans go to a football game, their houses are more likely to be left unattended. Unoccupied houses are more vulnerable to burglary (Cromwell and Olson, 2004; Miethe and McDowall, 1993). Therefore, by changing the routine activities of football fans, NFL games can change people's risk of being victimized.

The current study focuses on crime at the aggregate level: both the city level and the immediate areas of the stadium. Crime inside the stadium will not be discussed in this study.[3] There are four hypotheses which will be discussed below.

## Hypotheses

*Hypothesis I*

*(1)Robbery in the immediate area surrounding the football stadium [operationalized as zone one (.5 mile buffer zone around the stadium)] will decrease on game days.*

*(2)Robbery outside the immediate area [operationalized as zone two, zone three and zone four (1 mile, 1.5 mile and 2 mile buffer zone around the stadium)] will increase on game days.*

This hypothesis is two fold. It focuses on two areas surrounding the stadium. Zone one is where more than 60,000 fans will flock on game days. Those fans can be viewed as potential suitable targets. This area is also where more capable guardians can be found. On game days, this area is crowded with fans and those fans can act as capable guardians for each other. According to a Seahawks fan survey, only 18% of fans go to the game alone (Michael, 1998).[4] So, most fans who go to the game have at least one other person to watch out for each other.

Moreover, the Seattle Police Department (SPD) has developed a special strategy for officer deployment on game days. Through personal communication with an officer from the SPD, I know roughly the number of police and the location where they were deployed on game days (Vandergiessen, 2007). Outside the stadium, there are about 70

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[3] Crime happening outside of the stadium, such as stadium parking lot, might be coded as the stadium address by the SPD. This coding practice might affect robbery only since it is not possible for the rest of the dependent variables (burglary, auto theft and theft of auto) to happen inside of the stadium. Only one robbery was coded as the stadium address throughout the nine-year study period. This case was excluded from the analyses.

[4] The survey was conducted in 1997, using a randomized sampling method and the sample size was 252.

police officers and parking enforcement officers who take care of traffic control around the stadium before and after a game. During game hours, those officers become backup force that can handle problems in the immediate area of the stadium. Inside the stadium, there are about 50 officers hired by the team to take care of problems. The current study only focuses on crime occurring outside the stadium, so the officers deployed inside the stadium will not have an impact on crime outside the stadium. There are also regular on-duty patrol officers working on their own patrol districts surrounding the stadium. The number of those officers could be up to eight. Overall, there are more than 70 officers in the immediate area surrounding the stadium and those officers could act as capable guardians for the people in the area.

Zone one is where more suitable targets as well as more capable guardians will converge. Since most of the fans do not go to the game alone and there are more police officers around on game days, I hypothesize there should be less robbery in zone one on game days than that on non-game days. In zone two, zone three and zone four, there will be more suitable targets on game days because some fans might park their cars in these areas and walk to stadium. While they are walking between the stadium and where they park their cars, they are likely to become the targets of potential robbers. The level of police presence in zone two, zone three and zone four should be similar between game days and non-game days since most police officers are deployed in zone one. Therefore, I hypothesize there should be an increase in robbery in zone two, zone three, and zone four on game days because these areas are where more suitable targets and similar amount of police presence (compared to non-game days) will converge.

*Hypothesis II*

*Burglary at the city level will increase on game days.*

When fans leave for a football game, their houses are more likely to be left unattended. Unoccupied houses have been associated with higher risk of burglary victimization (Miethe and McDowall, 1993). Moreover, past research suggests that burglars are rational and take advantage of unoccupied households to commit burglaries. Some burglar even mentioned that they took advantage of a football game to commit burglary. As an active burglar in an ethnographic study said: "Man! Wait until football season. I clean up then. When they are at the game, I'm at their house." (Cromwell and Olson, 2004: 51) Thus, from a burglar's perspective, there will be more suitable targets available on game days. In addition, a football game can also lower the level of social guardianship in a community. If many people from a community go to a football game, there will be fewer people in the community to keep an eye on the potential offenders as well as their neighboring households. Thus, burglary might be more likely to happen on game days.

There are a couple of potential confounding factors that this hypothesis needs to take into account. First, not all spectators to a Seahawks game are from the city of Seattle. According to a Seahawks fan survey, only 15 percent of the spectators are from the city of Seattle (Conway and Beyers, 1996).[5] The survey indicates most of the spectators to a Seahawks game do not come from the city of Seattle. So, there will be fewer houses left unattended than there would be if most spectators were from the city of Seattle. I shall argue that football games will still have an impact on burglary even though most of the

[5] The survey was conducted at King Dome in March 1996, using a randomized sampling procedure and the sample size was 400.

spectators were from outside of Seattle. Criminals make their decision based on bounded rationality (Simon, 1983). Some burglars will expect to see more opportunities for burglary on game days regardless of how many more opportunities that a football game will actually create. Moreover, 15% of 68,681 (the average attendance to Seahawks' games) is about 10,000 people. That is still a substantial amount of people and should have an impact on burglary. Given only 15% of fans are from the city of Seattle, a small impact is expected.

Second, whether football games would make more houses unoccupied is not clear. It is clear that about 60,000 fans will go to a football game on a game day and their houses are more likely to be left unattended. It is, however, unclear whether fans that do not have tickets are more likely to watch football games on TV at home or away from home. If fans are more likely to watch games on TV at home, then, the assumption that more houses will be left unattended on a game day might not be true. Thus, it is crucial to take into account the routines of the fans that do not go to a game in person. The present study took this potential confounding factor into account by the matched-pair design and singled out the effect by the fans that go to games in person (see Methodology section for details).

### *Hypothesis III*

*The increase in burglary on game days should be more pronounced in higher Social Economic Status (SES) areas than that in lower SES areas.*

This hypothesis is based on the premise that the previous hypothesis is true. This hypothesis will only make sense when there is more burglary on game days than that on non-game days.

A game ticket ranges from 39 to 335 dollars in price (Seattle Seahawks Official Website, 2007). The price may not be affordable for people living in lower SES areas. I assume more fans in the stadium should be from higher SES areas than lower SES areas. Then, that should lead to more houses left unattended in higher SES areas than that in lower SES areas no game days. In other words, more burglary opportunities will be created due to a football game in higher SES areas than that in lower SES ones. Thus, I hypothesize that the increase in burglary should be more pronounced in higher SES areas than that in lower SES areas. The SES is operationalized as the average annual income in one census tract according to the 2000 U.S. census (Census Bureau, 2000).

Higher SES areas may have higher burglary rate because there are more valuable things to steal; higher SES areas may have lower burglary rate because richer people are more affordable to targets-hardening measures, such as private security guards, alarm system and so on. The focus of this hypothesis is not to compare burglary rates across different SES areas, but to compare the differences in burglary between game days and non-game days across different SES areas. There might be differences in the level of motivated offenders and guardianships across different SES areas. However, there should be no difference in the level of guardianships and potential offenders between game days and non-game days in the same SES areas.[6] Therefore, if the increase in suitable targets (unattended houses) on game days is more pronounced in higher SES areas, it is likely to see more increases in burglary in higher SES areas.

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[6] Actually, the level of motivated offenders might increase on game days if potential burglars take advantage of a football game to commit burglary. Theoretically, motivated offenders tend to cluster in the place where more suitable targets may be available. So, if the assumption holds true that more increases in suitable targets in higher SES areas than that in lower SES areas, I should argue that higher SES areas will also have more increases in motivated offenders.

*Hypothesis IV*

*There will be more auto theft and theft of auto in the area surrounding the stadium on game days.*

According to a Seahawks fan survey (Michael, 1998), 67% of fans used their own cars to travel to the football stadium. So, a significant increase in the number of cars in the area surrounding the football stadium is expected on game days. When more cars are around, more opportunities for auto theft and theft of auto are available according to routine activities theory. Theft of auto is less mentioned in the literature. It happens when someone takes something from inside of the car illegally. So, when there are more cars in an area, there should be more theft of auto as well.

In accord with previous hypotheses, more suitable targets do not guarantee more crime; I need to take the level of guardianships into account. A guarded parking lot can lower the risk of automobile related crime and some other target hardening measure on cars can do the same. Because the design is of the current study is to match a game day with a comparable non-game day, those target hardening measures should be controlled for by the research design (see the Research Design in the next chapter for details).

# Chapter 4: Methodology

## Data

### *Study Area*

The study area for this thesis is the city of Seattle, Washington. Seattle is an appropriate city for the study for a number of reasons. For a practical reason, the city has a NFL team. Seattle is also a good city for the study because it is a fairly large city (22nd most populous city in the United States according to the 2000 U.S. census) and is a racially-diverse city. Moreover, the Seattle Police Department (SPD) kept thorough records of crime in computerized format from late 1980's to present (see Weisburd et al. 2004 for a detailed description of the data and the study area).

The current study uses the same crime data as the study done by Weisburd et al. (2004). The time span for Weisbrud et al.'s study is from 1989 to 2002. Data from 2003 to 2006 were available from the SPD when I was working on this project. So, that made the time period of the data for the current study up to 17 years (1989 to 2006). I decided to exclude data from 1989 to 1997 because data from that time period have a substantial amount of missing values related to crime time.[7] Thus the time period of the data for the current study is from 1998 to 2006.

### *Geocoding Process*

Geocoding is the process of transferring addresses to map features (Ormsby et al., 2004). The geocoding process of the current study was done by a geographic information

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[7] Sixty-four percent of data from that time period have zero in either Begin/End Time or Begin/End Date. Those columns are estimation of when an incident/ crime occurred.

system (GIS) known as ARCGIS 9.0.[8] The GIS transferred the incident addresses recorded by the SPD to corresponding dots on the map. Throughout the process of geocoding, not every address was recognized by ARCGIS. The addresses that cannot be recognized by ARCGIS need to be geocoded manually. I used database software known as Visual FOXPRO to do data manipulation and fix the addresses to recognizable format by ARCGIS.[9] The overall geocoding rate was about 97%.[10]

*Incident Data or Calls for Service Data*

I chose incident data rather than call for service data (call data) because incident data yield more precise estimated crime time for the current study. The timing of crime is crucial to this study because the impact of football games on crime should be limited in space and time.

The argument that incident data is more suitable than call data because the former one yields more precise estimated crime time might seem contradictory to the literature (e.g. Sherman et al., 1989). According to Sherman and his colleagues (1989: 34), one of the great advantages of call data is “precision as to the time and place of the crime”. However, precision in that context means call data give researchers a precise time of when the 911 receives a call from citizens. The time when the 911 receives a call does not necessarily match the real crime time. Actually, Sherman et al. also acknowledge that “there may often be a lag of many hours between the time of the crime and the

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[8] ARCGIS 9.0 is a product of Environmental System Research Institute.
[9] Visual FOXPRO is a product of the Microsoft Cooperation.
[10]The geocoding rate for data from 1989 to 2004 is 97.3% and the geocoding rate for data from 2005 and 2006 is 94.0%. 1989 to 2004 data have been geocoded by Wesiburd and his colleagues. The parameters I used for geocoding are 1) spelling sensitivity=80 2) minimum candidate score=30 3) minimum match score=76.

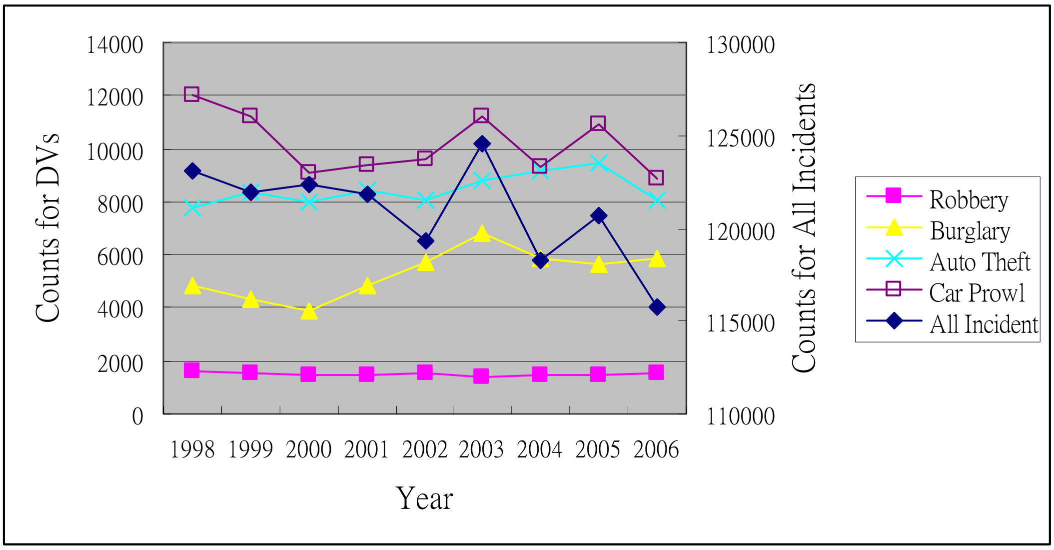
computer-recorded time of the call" (Sherman et al., 1989: 34). This limitation of call data may be a great concern for burglary, auto theft and theft of auto. People usually report their victimization to the police after they found their cars were stolen or their houses were burglarized. A house might be burglarized at two o'clock PM when people went to a football game but the case would not be reported to the police until six o'clock PM when the house owner got back. The same situation could happen with auto theft. Incident data cannot capture the exact crime time, either. However, incident data gives researchers a time period of when each crime might have happened and when it might have ended (marked as Begin/ End Time and Begin/End Date in the database). Using incident data allows me to have a better idea of when each crime happened.

There are two methodologies that past studies adopted to deal with the problem of Begin/End date and Begin/End time. A more widely used method is to take the mid point of Begin/End date and the mid point of Begin/End time as the estimated crime time (Ratcliffe and McCullagh, 1998; Townsley). Another method is called the Aoristic analysis. This method "generates a probability estimation that an event or number of events occurred within user specified temporal parameters based on the overlap between the search time frame and the time span of each incident" (Ratcliffe, 2002: 26-27). This technique basically calculates the probability of crime happening at certain time period based on the time span of begin and end time (see Ratcliffe, 2002 for details). In this study, I chose to use the mid-point method because it has been more widely used by past research (Ratcliffe, 2002). Furthermore, Aoristic analysis yields the probability of crime in a certain period of time which does not fit my analytical strategies.

## Dependent Variables

The four dependent variables of this study are robbery, residential burglary, auto theft, and theft of auto. Throughout the study period (1998 to 2006), there were a total of 1,087,784 incidents recorded by the SPD, 1.2% of which are robbery, 4.4% are burglary , 7.0% are auto theft and 8.4 % are theft of auto (see table 1). The overall incident shows a downward trend in the study period. Similar to the overall incident trend, theft of auto also shows a slightly downward trend. Robbery and auto theft remain relatively stable while burglary is the only dependent variable that shows a slightly upward trend throughout the nine-year study period (see figure 1).

**Figure 1: Crime Trend for the Four Dependent Variables from 1998 to 2006**




Not every crime from the data will be included in the analyses. I developed temporal and spatial criteria for inclusion of the four dependent variables.

### *Temporal Criteria*

Even though incident data seems to be more suitable than call data for the current study; there is a major limitation to this data. Incident data gives an estimated time period of when crime happened. The estimated time period is marked as Begin/End Date and Begin/End time. Begin/End Date is the estimation of what date each case happened. Begin/End time is the estimation of what time each case happened. Among the four dependent variables, about 97% of robbery has same begin date and end date, about 63% for burglary, 53% for auto theft and 55% for theft of auto. Less than one percent of robbery has a one day interval between begin date and end date, about 20% for burglary, 37% for both auto theft and theft of auto.[11] Point one percent of robbery has a more than one day interval between begin date and end date, 15% for burglary, 9% for auto theft and 7% for theft of auto (see table 2). I decided to exclude the cases with more than one day interval from the analyses because it is hard to determine whether those cases were affected by football games given the longer time span between begin date and end date. So, in the analyses, I will only deal with cases with less than or equal to one day interval between begin date and end date.

For those cases with same begin date and end date, about 90% of robbery, 36% of burglary, 42% of auto theft and 28% of theft of auto have identical begin time and end time. About 31% of burglary, 24% of auto theft and 19% of theft of auto have more than 6 hours time difference between begin time and end time (see table 3). For most robbery, I can pinpoint what time they happened, while for most burglary, auto theft and theft of auto, I do not actually know exactly what time they happened. Since I do not know when most of the burglary, auto theft and theft of auto happened, it is very difficult to ascertain

[11] One day interval does not necessarily mean there needs to be 24 hours interval between begin time and end time. As long as end date is one day greater than begin date; I viewed that as one day interval. So, one case might have only one hour interval between begin time and end time but still be viewed as one day interval (Begin Date=1999/10/5, Begin Time=23:30 PM; End Date=1999/10/6) End Time=01:30 AM). The same logic was applied to those with more than one day interval.

whether they were affected by football games. I decided to use a whole day (24 hours) as the time periods of inclusion for these three types of crime.[12] Robbery on the other hand, is the only dependent variable for which I have the exact time. I will only include robbery occurring in close temporal proximity to game hours in the analyses. Therefore, I applied multi-time periods as the criteria of inclusion for robbery. Robbery happening during game hours and at the time with closer proximity to game hours will be eligible for the analysis.

*Spatial Criteria*

Football games can impact crime at the city level as well as the area surrounding the football stadium. Burglary is the only dependent variable in the current study that will be discussed at the city level. On game days when fans from all over the city of Seattle flock to the football stadium, more houses at the city level will be left unattended, creating more opportunities for burglary. Robbery, auto theft and theft of auto might also be affected by a football game at the whole city level, but the magnitude of the impact might be lager and more condensed in the area surrounding the football stadium because this area creates more opportunities for the convergence of suitable targets, motivated offenders and the lack of capable guardians. For those three dependent variables, I created multi-distance buffer zones surrounding the football stadium and only those three types of crime taking place within the buffer zones will be included in the analyses. Four different buffers were created surrounding the football stadium (.5 mile, 1 mile, 1.5 mile and 2 mile respectively), and that created four concentric zones between two neighboring

[12] For example, 2006/9/17 is a game day, all the burglary, auto theft and theft of auto happening between 00 hr/00min./00sec. and 23 hr./59 min./59sec. on that date will be included in the analyses.

buffers.[13] I refer to those concentric zones as zone one to zone four [where zone one is the innermost (see figure 2)]. Zone one is the immediate area around the football stadium and should be the area that affected by a football game the most, such as significant increases in people in transition, police presence and cars on game days. Zone two, zone three and zone four should only experience modest to small increases in people in transition and cars and usually no significant increase in police presence.

I chose two mile as a cut off point because of the unique location where the current stadium (Qwest Filed) is located. Qwest Field is in the middle of three diverse neighborhoods: Chinatown International District, SODO/North Duwamish and Pioneer Square (Stadium guide, 2005). Chinatown features Asian restaurants. SODO which stands for "south of downtown" stretches "two miles south of the stadium is the largest business and industrial complex in the pacific northwest" (p. 10). Pioneer Square is a famous museum. It is likely that people might spend time in these three neighborhoods before or after a game.

The Seahawks have changed stadiums a couple of times. Qwest Field was not opened until the 2002 season. In the 2000 and the 2001 season when Qwest Field was under construction, the Seahawks games were held in Husky Stadium located in the University of Washington. Before the 2000 season, games were held in King Dome. The multi-distance buffer zones also apply to King Dome but not to Husky Stadium in that I do not have crime data from the police department of the University of Washington. So, the 2000 and the 2001 season were excluded from the analyses for all the dependent

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[13] The stadium is within one mile away from the Pacific Ocean. So some of the areas that the four concentric zones cover are actually ocean where there was no crime recorded.

variables but burglary.[14]

Table 4 reports the distribution of the three dependent variables within the buffer zones and outside of them. About 47% of robbery, 23 % of auto theft and 32% of theft of auto took place within the two mile buffer zone. While the two mile buffer zone accounts for about 1/10th of the size of the city of Seattle, it represents a disproportionately high percentage of crime.

**Table 4: The Distribution of Dependent Variables across Space**

| | Robbery | Burglary | Auto Theft | Theft of Auto |
|---|---|---|---|---|
| Zone 1 | 1,044 | N/A | 1,940 | 4,294 |
| Zone 2 | 1,329 | N/A | 3,601 | 6,622 |
| Zone 3 | 2,241 | N/A | 5,673 | 9,095 |
| Zone 4 | 1,730 | N/A | 6,560 | 9,341 |
| Within 2 mile buffer zone | 6,344 (46.9%) | N/A | 17,774 (23.3%) | 29,352 (32.2%) |
| Outside 2 mile buffer zone | 7,172 (53.1%) | N/A | 58,420 (76.7%) | 62,265 (67.8%) |
| Whole City | 13,516 (100%) | 47,795 | 76,194 (100%) | 91,617 (100%) |

## Research Design

*Quasi-Experimental Design:*

The design of this study is a quasi experiment which is defined as "experiments that have treatments, outcome measures, and experiment units, but do not use random assignment to create the comparisons from which treatment-caused change is inferred"

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[14] Because the University of Washington does not belong to the jurisdiction of the Seattle Police Department, my data does not cover crime taking place within the University campus. So, robbery, auto theft and theft of auto occurring in 2001 and 2002 will be excluded from the analysis.

(Cook and Campbell, 1963: 6). In the current study, my treatment group is game days and my control is non-game days. There are 16 games for each NFL team per year, eight home games and eight away games. From the 1998 to the 2006 season, there were a total of 72 regular-season games and four playoff games held in the city of Seattle.[15] The average attendance was 63,788.[16] Out of these 76 games, 67 games took place on Sunday; four games took place on Saturday, four games on Monday and only one game on Thursday (see Table 5). The average game duration is three hours and seven minutes with a standard deviation of about 11 minutes.[17]

To test if football games have an impact on crime, I matched each game day with a comparable non-game day. To rule out the potential weekly effect, the matched non-game day has to be on the same day of a week as the game day. To rule out the potential seasonal effect, the matched non-game day has to be a week before or a week after the game day. For example, if a game took place on Sunday, September 17th, 2006, the matched non-game day will be the Sunday a week earlier which is September 10th 2006. If both the current weekend (e.g. 09/17/2006) and the following weekend (e.g. 09/24/2006) are game days, for the former game day I can still pick up the matched non-game day a week before (09/10/2006), but for the later game day, I need to select the matched non-game a week later (10/01/2006). The overall sample size is 76 pairs (see table 6).

Among the four dependent variables, only burglary utilized all 76 pairs. Robbery,

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[15] In the 2006 Season, the Seahawks also made to the playoffs. One of the playoff games in 2006 season was held in Seattle on January 6th, 2007. Since the date is out of the range of my study period, it was excluded from the analyses.
[16] Maximum=68,681; Minimum=52,250; Standard Deviation=3,784.811.
[17] Maximum= 3 hours and 31 minutes; Minimum= 2 hours and 43 minutes.

auto theft and theft of auto only used 60 pairs (16 pairs from the year of 2000 and 2001 were excluded). Those pairs were excluded because I do not have crime data in the immediate area surrounding the football stadium in the year of 2000 and 2001.[18] Burglary was not affected because it is the only dependent variable that does not apply to the previously mentioned spatial criteria (see table 7 for a summary of the sample size utilized for each dependent variable).

As mentioned above, football games may change fans' routines in various ways. Approximately 60,000 fans will flock to the football stadium on a game day and tens of thousand of fans that do not have tickets will watch the game on TV at home, at a bar or at friends' houses. It is not clear whether those fans that do not have tickets are more likely to watch games on TV at home or away from home. If most fans that do not have tickets tend to watch football games at home, there should be fewer houses left unattended on game days. If the opposite is true, there should be more houses left unattended on game days.

I came up with a method to control for the routines of fans that do not go to football games in person by comparing the days when the Seahawks were playing in town (home-game days) with those when the Seahawks were playing out of town (away-game days).[19] Fifty out of the 76 pairs fit the criterion. I assume that on the days when the Seahawks were playing away games, football fans' routines should be roughly the same as those when the Seahawks were playing home game days, except for those

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[18] In the year of 2000 and 2001, the Seahawks changed their stadium to the Husky Stadium located at the University of Washington. The Husky Stadium does not belong to the jurisdiction of the SPD; so I do not have crime data within the university campus

[19] The away-game days are still non-game days. Among the 76 comparable non-game days I chose for the study, 50 of them are away game-days when the Seahawks are not playing in the city of Seattle but other cities in the Unites States.

who attend the games in person on game days. In other words, fans who are used to watching football games on TV at home may not change their habits when the Seahawks are playing home games or away games; fans who are used to going to a bar to watch football games will stick to their rituals. If the assumption is true, by comparing home-game days with matched away-game days, the potential confounding factor will be controlled.

Other potential confounding factors also need to be taken into account, including temperature, precipitation, police presence and other major events in the football stadium. The matched-pair design should make the weather conditions pretty similar between game days and the matched non-game days.[20] There will be more police officers deployed in the immediate area surrounding the football stadium on game days (Vandergiessen, 2007). The current study only has the information of roughly how many police officers were deployed on game days. I tried to take police presence into account by creating the multi-distance buffer zones.[21] In addition, if there are other major events held in the football stadium on non-game days, the potential impact that football games may have might be underestimated. I do not have the archived event calendars for Qwest

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[20] Consistent with my expectation, there is only a slight difference in temperature between game days and non-game days and the difference is not statistically significant ($p$=.49). Surprisingly, there is significantly more precipitation on game days than that on non-game days in three of the four measuring periods. Even during the game hours, there is more precipitation on game days and the result is close to significance ($p$=.12) (see table 11). Examination of statistical analyses allowed me to take into account of the potential confounding effect of precipitation. For every t test, I ran a multiple regression with precipitation taken into account. The regression results were similar to t test results in simple comparison. Most analyses have similar coefficients and similar $p$ values in both t test and regression analyses. Regression results are reported in tables 12, 13 and 14 in the appendices.

[21] With the design of multi-distance buffer zones, more police presence on game days is expected only in zone 1 (based on my personal communication with a Sergeant in the SPD). In the rest of the buffer zones, similar police presence is expected. Therefore, police presence should only be a confounding factor in zone 1 but not the rest of the buffer zones.

Field[22]; thus I cannot rule out the possibility that there might be other events held in Qwest Field on non-game days. So, I need to be cautious when I am explaining the results.

## Analytic Strategies

Two analytic strategies were utilized in this study. They are the binomial test and the t test. The binomial test tells whether there is more crime on game days. The t test can report the magnitude of the difference between game days and non-game days.

### *1st Analysis*

For the first analysis, I conducted a binomial test. Since it is a binomial test, the outcomes can only be binary, either a success or a failure. If there is more crime on a game day than that on the matched non-game day, that will be a success; otherwise, a failure.[23] If a football game has no effect on crime, then the probability of getting a success should be equal to that of getting a failure. So I have a binomial distribution with N=76 and P=.50. If football games have an impact on crime, then the observed probability of getting a success should be higher than .50.

### *2nd Analysis*

The binomial test simply tells us that whether there is more crime on a game day

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[22] I failed to get the archived event calendars from the Seahawks after a thorough search of the internet resources and a couple of communicating methods, including e-mailing and calling their representatives. .

[23] If a game day has the same number of crime as non-game day, this pair would be excluded from the analysis.

than non-game day. It does not tell us the magnitude of the difference. My second analysis is a t test for dependent samples. I am using dependent t test because my samples are paired (Weisburd and Britt, 2003). This test is designed to compare the mean difference between two different groups (Ritchey, 2000). The purpose of this test is to see if there is any statistical difference in the level of crime between the treatment and the control group. If my hypotheses are correct, I should see significantly more crime on game days than that on non-game days.

# Chapter 5: Results

Results for the four dependent variables are reported in the order of robbery, burglary, auto theft and theft of auto. Auto theft and theft of auto will be reported in the same section because they belong to the same hypothesis. For each hypothesis, I applied two models, the full model and the controlled model. These two models are identical except for their sample sizes. While the full model utilized all pairs in the sample, the controlled model only used pairs that included game days and away game days.

## *Robbery*

Unlike other dependent variables, robbery is a relatively rare event. Throughout the nine-year study period, there were only 13,516 robberies reported to the SPD; that is about 1,500 cases per year. I took a closer look at the distribution of robbery in my 60 pairs (2000 and 2001 were excluded). In each of the four concentric zones, there is no robbery reported on more than half of the game days or non-game days. For those days that have at least one robbery, most of them have only one robbery, and only two days have three robberies (see table 8a). Because robbery is a relatively rare event, many pairs are tied at zero. When robbery is broken down by time periods, even more pairs are tied at zero.

**Table 8a: The Frequency of Robbery in Four Concentric Zones**

| | *Zone1* | | *Zone 2* | | *Zone 3* | | *Zone 4* | |
|---|---|---|---|---|---|---|---|---|
| # of robbery | Game day | Non-Game | Game day | Non-game | Game day | Non-game | Game day | Non-game |
| 0 | 39 | 42 | 44 | 40 | 37 | 31 | 31 | 31 |
| 1 | 20 | 12 | 12 | 14 | 16 | 24 | 22 | 24 |
| 2 | 1 | 6 | 3 | 6 | 1 | 4 | 7 | 5 |
| 3 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| Total | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |

Table 8b reports the binomial test results and the t test results for robbery. There are five models in this table; each model applies a different time period for inclusion of the dependent variable. As far as I know, there is no empirical evidence on how many hours before or after the game a football game can affect robbery. So I applied multi-time periods to test this hypothesis. Model one reports results for robbery happening during game hours. Model two reports results for robbery happening two hours before and two hours after the game. Model three combine the time periods in model one and model two. Model four extends the time period in model three to four hours before and four hours after game (game hour also included). Model five applies a whole day as the time period of inclusion of the dependent variable.

The left-hand-side column reports the results of binomial test and the right-hand-side column reports the results of t test. Under the binomial test column, the observed probability of success is reported. If football games have no impact on crime, then the probability of getting a success should be equal to .50. The binomial tests show no significant findings in the four buffer zones across five different models. In zone one, all but model five report the observed probability greater than .50 which means there is more robbery on game days, but none of the results is statistically significant. That is inconsistent with my first hypothesis which suggests in the immediate area around the football stadium, less robbery should be observed on a game day than a non-game day because more police officers were deployed in zone one on a game day. In zone two, there seems to be mixed findings across different models. Model one and model four report more successes than failures while model two, model three and model five report otherwise. Again, none of the results is statistically significant. In zone three, results constantly show fewer successes than failures. Results in zone four show more successes in zone one, zone two and zone three; fewer successes in model four, and no difference in model five. None of the results in zone four is statistically significant.

The t test results were reported at the right-hand-side column of each model. Positive results stand for more crime on game days while negative results represent less crime on game days. No significant results were found in four buffer zones across different models. In zone one, four out of five models report more robbery on game days; and the differences are pretty small and not statistically significant. In zone two, there are fixed findings across different models. In zone three, less robbery is reported in every model. In zone four, more robbery is reported in all models.

**Table 8b: The Results of the Binomial Test and the T Test for Robbery (Full Model)**

| Model | Model 1 N=60 | | Model 2 N=60 | | Model 3 N=60 | | Model 4 N=60 | | Model 5 N=60 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time Period | A | | B | | A+B | | A +C | | W | |
| Test | binomial test | t test | binomial test | t test | binomial test | t test | binomial test | t test | binomial test | t test |
| Zone 1 | 1.00 (.75) | .03 (.92) | .56 (.50) | .02 (.63) | .64 (.72) | .05 (.81) | .54 (.50) | .02 (.61) | .50 (.50) | -.03 (.38) |
| Zone 2 | .63 (.37) | .03 (.24) | .33 (.74) | -.05 (.84) | .47 (.50) | -.02 (.83) | .60 (.50) | .07 (.24) | .42 (.72) | -.08 (.76) |
| Zone 3 | .33 (.85) | -.08 (.90) | .38 (.63) | -.03 (.76) | .30 (.94) | -.12 (.92) | .35 (.89) | -.10 (.88)` | .45 (.64) | -.07 (.72) |
| Zone 4 | .63 (.37) | .03 (.24) | .60 (.50) | .02 (.33) | .58 (.38) | .05 (.22) | .44 (.40) | .03 (.34) | .50 (.50) | .03 (.39) |
| Within two mile buffer zone | .50 (.50) | .02 (.22) | .46 (.57) | -.05 (.71) | .44 (.69) | -.03 (.59) | .45 (.68) | .02 (.92) | .43 (.81) | -.15 (.75) |
| Outside two mile buffer zone | .44 (.82) | -.05 (.57) | .30 (.09) | -.18* (.04) | .34 (.11) | -.22 (.09) | .32* (.04) | -.31 (.055) | .52 (.89) | -.08 (.77) |

Time period abbreviation:
A= game hour; B= 2 hours before game+ 2 hour after game; C= 4 hours before game +4 hours after game; W=whole day
* $p<.05$
*p* value for one-tailed test is reported in parentheses (except for outside two mile buffer zone).

The five models in table 8c are identical with those in table 8b except for their sample size. Table 8c is the controlled model which controls for the routines of the fans that do not have tickets. That drops the sample size to 39 as opposed to 60 in table 8b. In zone one all but model five report more robbery on game days but none of the findings in zone one is statistically significant. In zone two, all models report more robbery on game days. Notably, model nine repots a statistically significant difference between game days and non-game days in zone two. In zone three, all models report less robbery on game days and none of them is significant. In zone four, all models report more robbery on game days, especially model seven, model eight and model nine report significant findings. Within the two mile buffer zone, all but model 10 report more robbery on game days but none of the results is of statistical significance.

**Table 8c: The Results of the Binomial Test and the T Test for Robbery (Controlled Model)**

| Model | Model 6 N=39 | | Model 7 N=39 | | Model 8 N=39 | | Model 9 N=39 | | Model 10 N=39 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time Period | A | | B | | A+B | | A +C | | W | |
| Test | binomial test | t test | binomial test | t test | binomial test | t test | binomial test | t test | binomial test | t test |
| Zone 1 | N/A[24] | .03 (.84) | .57 (.50) | .03 (.64) | 63 (.63) | .05 (.75) | .50 (.50) | .00 (.50) | .42 (.33) | -.13 (.19) |
| Zone 2 | .80 (.19) | .08 (.09) | .60 (.50) | .03 (.33) | .67 (.26) | .10 (.13) | .77* (.045) | .23* (.02) | .53 (.50) | .05 (.37) |
| Zone 3 | .22 (.91) | -.13 (.95) | .33 (.65) | -.05 (.79) | .21 (.97) | -.18 (.95) | .29 (.93) | -.15 (.91) | .45 (.82) | -.05 (.74) |
| Zone 4 | .80 (.19) | .08 (.09) | 1.00 (.13) | .08* (.04) | .86 (.07) | .15* (.03) | .78 (.09) | .18* (.04) | .56 (.35) | .13 (.21) |
| Within 2 mile buffer zone | .56 (.41) | .05 (.32) | .61 (.24) | .08 (.26) | .55 (.42) | .13 (.24) | .54 (.43) | .26 (.13) | .42 (.75) | -.03 (.93) |
| Outside two mile buffer zone | .45 (1.0) | -.05 (.60) | .25 (.15) | -.21 (.06) | .33 (.24) | -.77** (.00) | .35 (.17) | .18 (.53) | .63 (.22) | .21 (.58) |

Time period abbreviation:
A= game hour; B= 2 hours before game+ 2 hour after game; C= 4 hours before game +4 hours after game; W=whole day
* *p*<.05
***p* <01
*p* =.00 means the probability is less than .01.
*p* value for one-tailed test is reported in parentheses (except for outside two mile buffer zone).

*Burglary*

Table 9a reports the results of the binomial test and the t test for burglary for the second hypothesis. There are a total of two models in this table. In model full model, the observed probability of success is .58 but it is not statistically significant (*p*=.12). The t

[24] 38 out of the 39 pairs are tied at zero; the binomial test can be applied because of insufficient sample size.

test result shows on average there is about one (.92) more burglary on a game day than a non-game day and the result is statistically significant at .05 level (*p*=.045). In the controlled model, the observed probability of success drops to .54 as opposed to .58 in the full model and is not statistically significant, either (*p*=.34). The t test result reports only .62 more burglary on a game day and the result is not statistically significant (*p*=.16).

**Table 9a: The Results for the 2nd Hypothesis**

| Model | Full Model (N=76) | | Controlled Model (N=60) | |
|---|---|---|---|---|
| Test | Binomial Test | T Test | Binomial Test | T Test |
| Whole City | 58<br>(.12) | .92*<br>(.045) | .54<br>(.34) | .62<br>(.16) |
| * *p*<.05<br>*p* value for one-tailed test is reported in parentheses. | | | | |

My third hypothesis suggests that the increase in burglary between game days and non-game days should be more pronounced in higher SES areas than that in lower SES areas. Four categories of SES level were created by ARCGIS based on the average annual income in each census tract according to the 2000 U.S. census (see figure 3 for the distribution of four SES categories in space).[25] In order to compare burglary across census tracts with different population and different number of households, I chose to standardize the unit of measurement by calculating the number of burglary per 100,000 households. Table 9b reports burglary rate across different SES categories. The

[25] The average annual income ranges from 11,265 to 101,319 dollars. I used the following parameters to group all the 124 census tracts into four categories in the ARCGIS: 1) Classification method= Natural Breaks (Jenks). 2) Classes=4. The highest SES category ranges from 71,984 to 101,319; high SES rages from 51,761 to 71,983; low SES category ranges from 34,668 to 51,760; and lowest SES ranges from 11,265 to 34,667. Seven out the 124 census tracts belong to highest SES areas, 43 belong to high SES areas, 46 belong to low SES areas and 28 belong to lowest SES areas.

descriptive statistics show more burglary in higher SES areas than that in lower SES areas. Both models show similar trend. As the SES level increases from lowest to highest, the burglary rates increase as well.

**Table 9b: Burglary Rate across SES Categories**

| | Full Model (N=76) | | Controlled Model (N=60) | |
|---|---|---|---|---|
| | Game Day | Non-game Day | Game Day | Non-game Day |
| SES-lowest | 4.42 | 4.21 | 4.65 | 4.49 |
| SES-low | 4.08 | 3.93 | 3.95 | 3.78 |
| SES-high | 3.37 | 2.81 | 3.06 | 2.76 |
| SES-highest | 2.79 | 1.97 | 1.77 | 1.77 |

.

Table 9c reports the results of binomial test and t test for the 3rd hypothesis. In the full model, binomial test results show the observed probability of success is higher than .50 in every SES category, though none of them is statistically significant. Moreover, as the SES level increases form lowest to highest, the probability of success increases as well, with the exception of the low SES area. The t test results report more burglary on game days for all SES categories, but none of them is statistically significant, either. It seems that as the SES level increases from lowest to highest, the difference in burglary between game days and non- game days increase as well, with the exception of the low SES area.

In the controlled model, the observed probability of success is pretty similar across four SES categories and none of the results is statistically significant. Moreover, there is no apparent trend as the SES level increases. The t test results show equal or more burglary on game days in all SEZS categories, though none of the differences is statistically significant. In addition, as the SES level increase from lowest to highest, the average difference in burglary between game days and non-game days increases as well, with the exception of the highest SES area.

**Table 9c: The Results for the 3rd Hypothesis**

| | Full Model (N=76) | | Controlled Model (N=60) | |
|---|---|---|---|---|
| | Binomial Test | T Test | Binomial Test | T Test |
| SES-lowest | .53 (.40) | .21 (.32) | .53 (.44) | .16 (.38) |
| SES-low | .51 (.50) | .15 (.32) | .52 (.44) | .17 (.33) |
| SES-high | .54 (.31) | .56 (.07) | .55 (.32) | .30 (.23) |
| SES-highest | .59 (.19) | .82 (.13) | .53 (.50) | .00 (.50) |
| *p* value for one-tailed test is reported in parentheses. | | | | |

*Auto Theft and Theft of Auto*

Table 10 reports the results of the binomial test and the t test for auto theft and theft of auto. The left-hand-side column for each model reports the results of the binomial test while the right-hand-side column reports the results of the t test. In the full model, the binomial test results show more successes than failures for both auto theft and theft of auto across four buffer zones. The result for theft of auto in zone three is statistically significant at .05 level ($p$=.02) for one-tailed test. In zone one and zone two, the results for theft of auto are close to the significant threshold ($p$=.06). Within the two mile buffer zone, the probability of getting a success is .61 for auto theft and .72 for theft of auto. The result for auto theft almost reaches the .05 threshold ($p$=.07) and the result for theft of auto is highly significant ($p$<.01). I also looked at the area outside the two mile buffer zone, trying to be more conservative because more successes than failures within the two mile buffer zone could simply be a reflection of the overall city trend. The results suggests otherwise. For the rest of the city outside the two mile buffer zone, the observed probability of success for auto theft and theft of auto is below .50 (.42 and .47 respectively). Though both are not statistically significant, I can rule out the likelihood that the significant results I got within the two mile buffer zone were confounded by the overall trend outside the two mile buffer zone of the city.

In the full model, the t test shows there is about .50 more auto theft in zone one on game days and the result is significant (*p*<.01). In zone two, zone three, there is more auto theft reported on game days but the results are not statistically significant. In zone four, no difference between game days and non-game days is found. With respect to theft of auto, more theft of auto is constantly reported in each of the four buffer zones and all the differences are statistically significant except for zone four. Within the two mile buffer zone, there are about one more auto theft and three more theft of auto on a game day than on a non-game day.

In the controlled model, the probability of getting a success is higher than .50 for both auto theft and theft of auto in every buffer zone. Only the result for theft of auto in zone three is statistically significant. Within the two mile buffer zone, the probability of getting a success is .66 for auto theft (*p*=.02) and .78 for theft of auto (*p*<.01) and the results are both statistically significant. Notably, outside the two mile buffer zone, the probability of getting a success for auto theft is lower than .50 (.38 and .42 respectively). With respect to the t test, more auto theft and theft of auto are reported in every buffer zone. The results for auto theft in zone one and zone two are statistically significant; the results for theft of auto in zone one, zone two and zone three are also statistically significant. Even in zone four, the result for theft of auto is close to significant threshold (*p*=.06). Overall, within the two mile buffer zone, there are about 1.4 more auto theft (*p*=.01) and 3.7 more theft of auto on a game day (*p*<.01). Interestingly, there are more statistically significant findings for the t test in the controlled model even though its sample size is smaller.

**Table 10: The Results of the Binomial Test and the T Test for Auto Theft and Theft of Auto**

| | Full Model (N=60) | | | | Controlled Model (N=39) | | | |
|---|---|---|---|---|---|---|---|---|
| | binomial test | | t test | | binomial test | | t test | |
| | Auto Theft | Theft of Auto | Auto Theft | Theft of Auto | Auto Theft | Theft of Auto | Auto Theft | Theft of Auto |
| Zone 1 | .62 (.10) | .62 (.06) | .47** (.00) | .73* (.01) | .62 (.10) | .63 (.06) | .51* (.03) | .72* (.03) |
| Zone 2 | .57 (.20) | .62 (.06) | .33 (.09) | 1.00** (.00) | .62 (.06) | .62 (.06) | .51* (.04) | .97* (.04) |
| Zone 3 | .60 (.12) | .65* (.02) | .28 (.16) | .88** (.00) | .60 (.09) | .73** (.00) | .33 (.19) | 1.38** (.00) |
| Zone 4 | .54 (.33) | .56 (.21) | .00 (.50) | .33 (.17) | .56 (.15) | .62 (.05) | .05 (.43) | .61 (.06) |
| Within 2 mile buffer zone | .61 (.07) | .72 ** (.00) | 1.05* (.02) | 2.95** (.00) | .66* (.02) | .78** (.00) | 1.36* (.01) | 3.70** (.00) |
| Outside 2 mile buffer zone | .42 (.29) | .47 (.79) | .22 (.81) | -.33 (.78) | .38 (.19) | .42 (.41) | -.21 (.85) | -1.15 (.47) |

* *p*<.05
** *p* <.01
*p*=.00 means the probability is less than .01.
*p* value for one-tailed test is reported in parentheses (except for outside two mile buffer zone).

# Chapter 6: Discussion, Limitations and Conclusions

## Discussion

The current study looked at the impact of football games on crime using the routine activity approach by focusing on how the changes of fan's routine activities contribute to changes of crime (Cohen and Felson, 1979). Using a matched-pair design that took into account potential confounding factors including fans' routine activities, weather conditions, weekly and seasonal effects, the present study found support for some of the hypotheses derived from routine activities theory. There is little support for the first hypothesis involving robbery. The differences in robbery between game days and non-game days in the immediate area of the football stadium are not only small but also not statistically significant. There is some support for the hypothesis involving burglary. As expected, there a slight increase in burglary on game days. As for my third hypothesis which was related to increases in burglary across different SES categories, I found the increase in burglary is more pronounced in the higher SES areas in the full model but not in the controlled model. My last hypothesis involving auto theft and theft of auto is mostly supported by the data. There is a small increase in auto theft and a moderate increase in theft of auto in the area surrounding the stadium on game days.

The reason that robbery was not impacted by football games may be because robbery is inherently a rare event. As I mentioned in the previous chapter, many pairs do not have any robbery on both game days and non-game days (see table 8a). This makes many pairs tied at zero which in turn, makes it hard to find significant difference between game days and non-game days. Moreover, when many pairs are tied at zero, a few cases can heavily influence the result of the analysis. Model 1 in table 8b shows there is .03

more robbery on a game day and the result would be pretty close to significant threshold ($p$=.08) if it was in the hypothesized direction. Actually, 58 out of 60 pairs are tied at zero. Only two robberies are scattered throughout the 60 game days, and those two robberies almost produce a significant difference between game days and non game days.

Because robbery is such a rare event, the difference between game days and non-game days are so small that they are generally ignorable. Most of the average difference between a game day and the matched non-game day reported in table 8b and table 8c are less than .1 robberies. In light of the small differences, even though they were statistically significant, they would not be of great importance.

The results for the second hypothesis show on average there is about one more burglary on game days than matched non-game days and the result was statistically significant. After the routine activities of the fans that do not have tickets were controlled, there was on average .62 more burglaries on game days but the result is not statistically significant. The controlled model shows the difference in burglary between game days and non-game days was small; it is consistent with my expectation given only 15% of fans to a Seahawks game are from the city of Seattle. The full model represents the overall impact of a football game on burglary before the potential confounding effect of fans' routines were taken into account, while the controlled model singles out the effect caused by the change of routines of the fans that go to a game. Given that the full model shows greater differences in burglary than the controlled model, it seems that aside from the impact caused by game-going fans, there is also a significant amount of non-game-going fans leaving their houses unattended on game days. Future studies may need to determine where those fans have gone to see if a football game will increase the crime rate in particular places, such as bars.

With respect to my third hypothesis, the full model shows the increase in burglary is more obvious in higher SES areas than that in lower SES areas. The controlled model shows a similar trend except for the highest SES category where no difference between game days and non-game days was found. The possible explanation is that in these areas, motivated offenders, suitable targets and the lack of capable guardians rarely converge to begin with. Among the four SES categories, the highest SES areas have the lowest average burglary rate on both game days and non-game days (see table 9b in the previous chapter). On non-game days, there are about 1.7 burglaries per 100,000 households in the highest SES areas, almost three burglaries less than the lowest SES areas. The low burglary rate could be a function of fewer motivated offenders, more guardianships and more targets hardening measures. Thus, even though the suitable targets in these areas might increase on game days, the lack of potential offenders and enhanced target hardening measures make it difficult for the convergence of the three crime elements in routine activities theory to occur.

With respect to the fourth hypothesis, the full model shows there are on average about one more auto theft and about three more theft of auto within the two mile buffer zone surrounding the stadium on a game day and the findings are statistically significant. The controlled model shows even greater differences; 1.4 more auto thefts and 3.7 more theft of auto within the two mile buffer zone on a game day. The t test results for auto theft show that as the distance away from the stadium increases (from zone one to zone four), the differences between game days and non-game days decrease. However, the same pattern does not apply to theft of auto whose trend shows roughly the opposite.

Both the full model and the controlled model report significant results for theft of auto in all but zone four, with zone three having the greatest magnitude. The results for auto theft are more interpretable and consistent with routine activities theory. The increase in cars should be greatest in zone one and should be smallest in zone four because fans naturally would park their cars as close to the stadium as possible. If the assumption is true, the number of suitable targets will decrease as the distance away from the stadium increases. This assumption is supported by the results of auto theft but not theft of auto.

The findings regarding the differences in auto theft and theft of auto between game days and non-game days need to be interpreted with caution because they might have been washed away if crime rates instead of crime counts were used in the analyses. I decided to use crime counts for a number of reasons. First, it is very difficult to get the exact number of how many cars there were within each buffer zone on game days and non-game days. Second, though Cohen and Felson used crime rates in their original thesis, it is consistent with routine activities theory to use crime counts. The unit of analysis of the study is much smaller than that in Cohen and Felson's piece. When a smaller unit of analysis is used, crime counts may be a better choice than crime rates because using crime rates in smaller unit of analysis might introduce more error terms. To illustrate, the number of cars within the two mile buffer zones will fluctuate a lot on a game day. By using a fixed denominator to calculate the crime rate of auto theft or theft of auto, more error terms might be introduced. Moreover, increasing the absolute size of suitable targets does not necessarily lead to more crime if the three elements of crime will not converge in space and time to begin with. For example, there might not be an increase in crime in a church regardless of more people are around. So, it is not only the number of suitable targets, motivated offenders and capable guardians that matters but also when and where the three elements converge (Sherman et al. 1989).

Central to routine activities theory is the notion that the change in the frequency of the convergence of motivated offenders, suitable targets and the lack of capable guardians will lead to the change in crime (Cohen and Felson, 1979). Following the rationale of routine activities theory, unless in the area where those three elements do not converge to begin with, the increase in the absolute size of one of the three elements should lead to an increase in crime. Therefore, that more cars lead to more auto theft and theft of auto is consistent with routine activities theory.

## Policy Implications

The findings of this thesis suggest that there are increases in auto theft and theft of auto within the two miles buffer zone surrounding the football stadium. The increases in auto theft and theft of auto are not unique to zone one only; there are also increases in zone two, zone three and zone four. These findings suggest the Seattle Police Department might want to extend the deployment of extra force to bigger areas surrounding the stadium. However, given the magnitude of the increases is small (1.4 for auto theft and 3.7 for theft of auto); at the first glimpse it is probably not worth it to put extra force to prevent a small amount of crime. However, on a non-game day, there are only about 5.2 auto thefts and 10 theft of auto within the two mile buffer zone on average. A 1.4 increase in counts for auto theft and a 3.7 increase in counts for theft of auto represent 27 % increases and more than 30% increases in rates for each type of crime respectively. It is noteworthy for the SPD when they are planning their deployment strategy.

## Limitations

There are some limitations to the data needed to be taken into consideration. First, this study may be subject to threats to internal validity. The most likely threat to internal validity that this study might suffer from is “history” which refers to the observed effect was caused by an event other than the treatment (Cook and Campbell, 1963). The observed differences in crime between game days and non-game days might result from some events other than football games. Second, the limitations of the incident data prevent me from getting precise estimates of when crime occurred. Robbery is the only dependent variable that has relatively precise estimated crime time, making, it less subject to this limitation. Burglary, auto theft and theft of auto on the other hand have less precise estimated crime time; so the results regarding these dependent variables should be interpreted with caution. Although I found differences in burglary, auto theft and theft of auto between game days and non-game days, I cannot be completely confident those differences were caused by football games.

Third, another limitation of the data is that I did not control for the potential major event on non-game days. The current football stadium, Qwest Filed, is a multi-function stadium. The stadium would host other major events when the Seahawks are not playing at home. If there are also major events held in the football stadium on non-game days, then the impact of football games may be underestimated. Fourth, it is possible that the significant findings of the present study were caused by multiple-test bias. With so many statistical test been done, there would be some statistically significant findings. Those significant finding simply occur by chance and do not suggest a real difference in population.

The final limitation to the data is specific to my third hypothesis. I created four

SES categories based on the average annual income in the census tracts according to the 2000 census data. However, the study period is form 1998 to 2006. The average income may change annually. The data I used for SES hypothesis is from the 2000 census data. My data is from 1998 to 2006. The average income may have changed, making the estimate used here inaccurate.

## Conclusions

In conclusion, there is evidence showing there is more crime on game days than non-game days in the city of Seattle throughout the nine-year study period. At the city level, there is a slight increase in burglary on game days. In the area surrounding the football stadium, there is a small increase in auto theft and a moderate increase in theft of auto on game days. However, with the limitations of data and potential threats to internal validity, it is not certain whether those differences were caused by the change of fans' routines due to football games.

Future studies can be designed in the following way to overcome the limitations that the current study is subject to and to further understand the impact on football games on crime in routine activates framework. First, future studies should try collect data with more accurate crime time and police presence; by doing so, stronger causal linkage between football games and crime may be achieved. Second, future studies should try to look at the impact of football games on crime in different major cities in the United States. The current study only focused on one city; thus the results may not be generalized to other cities. Third, future studies should also include the neighboring cities of the study area. In the current study, the increase in burglary on game days is small because most fans are not from the city of Seattle. If future research can include in the neighboring metropolitan areas of the city, then more accurate impact of football games on burglary might be measured. Finally, more control variables should be taken into account in order to make stronger conclusion. Potential confounding variables, such as other major events should be controlled in order to make stronger causal conclusion.

## Appendices

**Table 1: Number of Incidents across the Study Period (1998-2006)**

| Year/Incident Type | All Types of Incidents | Robbery | Residential Burglary | Auto Theft | Theft of Auto |
|---|---|---|---|---|---|
| 1998 | 123,087 | 1,610 | 4,868 | 7,774 | 12,006 |
| 1999 | 121,942 | 1,545 | 4,327 | 8,373 | 11,204 |
| 2000 | 122,389 | 1,481 | 3,921 | 7,996 | 9,122 |
| 2001 | 121,819 | 1,466 | 4,806 | 8,444 | 9,362 |
| 2002 | 119,356 | 1,528 | 5,713 | 8,062 | 9,606 |
| 2003 | 124,512 | 1,422 | 6,785 | 8,824 | 11,218 |
| 2004 | 118,240 | 1,482 | 5,888 | 9,181 | 9,321 |
| 2005 | 120,726 | 1,465 | 5,611 | 9,461 | 10,913 |
| 2006 | 115,713 | 1,517 | 5,876 | 8,079 | 8,865 |
| Total | 1,087,784 (100%) | 13,516 (1.2%) | 47,795 (4.4%) | 76,194 (7.0%) | 91,617 (8.4%) |

**Table 2: Missing Values for the Dependent Variables**

| | | Robbery | Burglary | Auto Theft | Theft of Auto |
|---|---|---|---|---|---|
| | | Counts (%) | Counts (%) | Counts (%) | Counts (%) |
| Number of Cases Included | I= 0 | 13,077 (96.8) | 29,881 (62.5) | 40,173 (52.7) | 49,887 (54.5) |
| | I= 1 | 89 ( .6 ) | 9,768 (20.4) | 27,969 (36.7) | 34,041 (37.2) |
| Sub-total | | 13,166 (97.4) | 39,649 (82.9) | 68,142 (89.4) | 83,928 (91.7) |
| Number of Cases Excluded | Missing Values | 236 (1.7) | 745 (1.6) | 923 (1.2) | 1,211 (1.3) |
| | Wrong time span | 7 (.0) | 12 (.0) | 29 (.0) | 56 (.0) |
| | I >1 | 107 ( .8) | 7,398 (15.5) | 7,100 (9.3) | 6,422 (7.0) |
| Sub-total | | 350 (2.6) | 8,146 (17.1) | 8,052 (10.6) | 7,689 (8.3) |
| Total | | 13,516 (100.0) | 47,795 (100.0) | 76,194 (100.0) | 91,617 (100.0) |

I= time difference between begin date and end date
Percentage reported in parentheses.

**Table 3: Time Differences between Begin Time and End Time**

| | Robbery | Burglary | Auto Theft | Theft of Auto |
|---|---|---|---|---|
| No time Difference | 11,759 (89.92) | 10,757 (36.00) | 16,794 (41.80) | 14,105 (28.27) |
| Less than 2 hrs | 1,148 (8.78) | 3,650 (12.22) | 5,788 (14.41) | 12,520 (25.10) |
| 2 to 4 hours | 61 (.47) | 3,346 (11.20) | 4,685 (11.66) | 8,652 (17.34) |
| 4 to 6 hours | 17 (.13) | 2,925 9.79) | 3,281 (8.17) | 5,279 (10.58) |
| 6 to 24 hours | 92 (.70) | 9,203 (30.79) | 9,625 (23.95) | 9,331 (18.70) |
| Total | 13,077 (100.00) | 29,881 (100.00) | 40,173 (100.00) | 4,9887 (100.00) |

* Percentage in parentheses
* This table only includes cases with same begin date and end date

**Table 5: The Weekly Distribution of the 76 Games Days**

| Season | Stadium | # of games | # of games held on Sunday | # of games held on Saturday | # of games held on Monday | Note |
|---|---|---|---|---|---|---|
| 1998 | Kingdome | 8 | 9 | 0 | 0 | |
| 1999 | Kingdome | 9 | 9 | 0 | 0 | One playoff |
| 2000 | Husky Field | 8 | 6 | 2 | 0 | |
| 2001 | Husky Field | 8 | 8 | 0 | 0 | |
| 2002 | Qwest Field | 8 | 7 | 0 | 1 | |
| 2003 | Qwest Field | 8 | 7 | 0 | 0 | |
| 2004 | Qwest Field | 9 | 7 | 1 | 1 | One playoff |
| 2005 | Qwest Field | 8 | 5 | 0 | 2 | One on Thursday |
| 2006 | Qwest Field | 10 | 9 | 1 | 0 | Two playoff |
| Total | | 76 | 67 | 4 | 4 | |

**Table 6: A list of the 76 Matched Pairs**

| Game Days | | | | | | Non Game Days | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pair | Year | Month | Date | Day | Playoff | Year | Month | Date | Day | Awy game | Note |
| 1 | 2006 | 9 | 17 | Sunday | No | 2006 | 9 | 10 | Sunday | Y | BE |
| 2 | 2006 | 9 | 24 | Sunday | No | 2006 | 10 | 1 | Sunday | Y | AF |
| 3 | 2006 | 10 | 22 | Sunday | No | 2006 | 10 | 15 | Sunday | Y | BE |
| 4 | 2006 | 11 | 6 | Monday | No | 2006 | 10 | 30 | Monday | | BE |
| 5 | 2006 | 11 | 12 | Sunday | No | 2006 | 11 | 5 | Sunday | | BE |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 2006 | 11 | 27 | Monday | No | 2006 | 11 | 20 | Monday | | BE |
| 7 | 2006 | 12 | 14 | Thursday | No | 2006 | 12 | 7 | Thursday | | BE |
| 8 | 2006 | 12 | 24 | Sunday | No | 2006 | 12 | 17 | Sunday | | BE |
| 9 | 2005 | 9 | 18 | Sunday | No | 2005 | 9 | 11 | Sunday | Y | BE |
| 10 | 2005 | 9 | 25 | Sunday | No | 2005 | 10 | 2 | Sunday | Y | AF |
| 11 | 2005 | 10 | 16 | Sunday | No | 2005 | 10 | 9 | Sunday | Y | BE |
| 12 | 2005 | 10 | 23 | Sunday | No | 2005 | 10 | 30 | Sunday | | AF |
| 13 | 2005 | 11 | 13 | Sunday | No | 2005 | 11 | 6 | Sunday | Y | BE |
| 14 | 2005 | 11 | 27 | Sunday | No | 2005 | 11 | 20 | Sunday | Y | BE |
| 15 | 2005 | 12 | 11 | Sunday | No | 2005 | 12 | 4 | Sunday | | BE |
| 16 | 2005 | 12 | 24 | Saturday | No | 2005 | 12 | 17 | Saturday | | BE |
| 17 | 2006 | 1 | 14 | Saturday | Yes | 2006 | 1 | 7 | Saturday | | BE |
| 18 | 2006 | 1 | 22 | Sunday | Yes | 2006 | 1 | 15 | Sunday | | BE |
| 19 | 2004 | 9 | 26 | Sunday | No | 2004 | 9 | 19 | Sunday | Y | BE |
| 20 | 2004 | 10 | 10 | Sunday | No | 2004 | 10 | 3 | Sunday | | BE |
| 21 | 2004 | 10 | 31 | Sunday | No | 2004 | 10 | 24 | Sunday | Y | BE |
| 22 | 2004 | 11 | 21 | Sunday | No | 2004 | 11 | 14 | Sunday | | BE |
| 23 | 2004 | 11 | 28 | Sunday | No | 2004 | 12 | 5 | Sunday | | AF |
| 24 | 2004 | 12 | 6 | Monday | No | 2004 | 11 | 29 | Monday | | BE |
| 25 | 2004 | 12 | 26 | Sunday | No | 2004 | 12 | 19 | Sunday | Y | BE |
| 26 | 2005 | 1 | 2 | Sunday | No | 2005 | 1 | 9 | Sunday | | AF |
| 27 | 2005 | 1 | 8 | Saturday | Yes | 2005 | 1 | 1 | Saturday | | BE |
| 28 | 2003 | 9 | 7 | Sunday | No | 2003 | 8 | 31 | Sunday | | BE |
| 29 | 2003 | 9 | 21 | Sunday | No | 2003 | 9 | 14 | Sunday | Y | BE |
| 30 | 2003 | 10 | 12 | Sunday | No | 2003 | 10 | 5 | Sunday | Y | BE |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | 2003 | 10 | 19 | Sunday | No | 2003 | 10 | 26 | Sunday | Y | AF |
| 32 | 2003 | 11 | 2 | Sunday | No | 2003 | 11 | 9 | Sunday | Y | AF |
| 33 | 2003 | 11 | 16 | Sunday | No | 2003 | 11 | 23 | Sunday | Y | AF |
| 34 | 2003 | 11 | 30 | Sunday | No | 2003 | 12 | 7 | Sunday | Y | AF |
| 35 | 2003 | 12 | 21 | Sunday | No | 2003 | 12 | 14 | Sunday | Y | BE |
| 36 | 2002 | 9 | 15 | Sunday | No | 2002 | 9 | 8 | Sunday | Y | BE |
| 37 | 2002 | 9 | 29 | Sunday | No | 2002 | 9 | 22 | Sunday | Y | BE |
| 38 | 2002 | 10 | 14 | Monday | No | 2002 | 10 | 7 | Monday | | BE |
| 39 | 2002 | 11 | 3 | Sunday | No | 2002 | 10 | 27 | Sunday | Y | BE |
| 40 | 2002 | 11 | 17 | Sunday | No | 2002 | 11 | 10 | Sunday | Y | BE |
| 41 | 2002 | 11 | 24 | Sunday | No | 2002 | 12 | 1 | Sunday | Y | AF |
| 42 | 2002 | 12 | 8 | Sunday | No | 2002 | 12 | 15 | Sunday | Y | AF |
| 43 | 2002 | 12 | 22 | Sunday | No | 2002 | 12 | 29 | Sunday | Y | AF |
| 44 | 2001 | 9 | 23 | Sunday | No | 2001 | 9 | 16 | Sunday | | BE |
| 45 | 2001 | 10 | 7 | Sunday | No | 2001 | 9 | 30 | Sunday | Y | BE |
| 46 | 2001 | 10 | 14 | Sunday | No | 2001 | 10 | 21 | Sunday | | AF |
| 47 | 2001 | 10 | 28 | Sunday | No | 2001 | 11 | 4 | Sunday | Y | AF |
| 48 | 2001 | 11 | 11 | Sunday | No | 2001 | 11 | 18 | Sunday | Y | AF |
| 49 | 2001 | 12 | 2 | Sunday | No | 2001 | 11 | 25 | Sunday | Y | BE |
| 50 | 2001 | 12 | 16 | Sunday | No | 2001 | 12 | 9 | Sunday | Y | BE |
| 51 | 2002 | 1 | 6 | Sunday | No | 2001 | 12 | 30 | Sunday | Y | BE |
| 52 | 2000 | 9 | 10 | Sunday | No | 2000 | 9 | 3 | Sunday | Y | BE |
| 53 | 2000 | 9 | 17 | Sunday | No | 2000 | 9 | 24 | Sunday | Y | AF |
| 54 | 2000 | 10 | 15 | Sunday | No | 2000 | 10 | 8 | Sunday | Y | BE |
| 55 | 2000 | 10 | 29 | Sunday | No | 2000 | 10 | 22 | Sunday | Y | BE |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 2000 | 11 | 5 | Sunday | No | 2000 | 11 | 12 | Sunday | Y | AF |
| 57 | 2000 | 11 | 26 | Sunday | No | 2000 | 11 | 19 | Sunday | | BE |
| 58 | 2000 | 12 | 16 | Saturday | No | 2000 | 12 | 9 | Saturday | | BE |
| 59 | 2000 | 12 | 23 | Saturday | No | 2000 | 12 | 30 | Saturday | | AF |
| 60 | 1999 | 9 | 12 | Sunday | No | 1999 | 9 | 5 | Sunday | | BE |
| 61 | 1999 | 10 | 3 | Sunday | No | 1999 | 9 | 26 | Sunday | Y | BE |
| 62 | 1999 | 10 | 24 | Sunday | No | 1999 | 10 | 17 | Sunday | Y | BE |
| 63 | 1999 | 11 | 7 | Sunday | No | 1999 | 10 | 31 | Sunday | | BE |
| 64 | 1999 | 11 | 14 | Sunday | No | 1999 | 11 | 21 | Sunday | Y | AF |
| 65 | 1999 | 11 | 28 | Sunday | No | 1999 | 12 | 5 | Sunday | Y | AF |
| 66 | 1999 | 12 | 12 | Sunday | No | 1999 | 12 | 19 | Sunday | Y | AF |
| 67 | 1999 | 12 | 26 | Sunday | No | 2000 | 1 | 2 | Sunday | Y | AF |
| 68 | 2000 | 1 | 9 | Sunday | Yes | 2000 | 1 | 16 | Sunday | | AF |
| 69 | 1998 | 9 | 13 | Sunday | No | 1998 | 9 | 6 | Sunday | Y | BE |
| 70 | 1998 | 9 | 20 | Sunday | No | 1998 | 9 | 27 | Sunday | Y | AF |
| 71 | 1998 | 10 | 11 | Sunday | No | 1998 | 10 | 4 | Sunday | Y | BE |
| 72 | 1998 | 11 | 1 | Sunday | No | 1998 | 10 | 25 | Sunday | Y | BE |
| 73 | 1998 | 11 | 8 | Sunday | No | 1998 | 11 | 15 | Sunday | Y | BE |
| 74 | 1998 | 11 | 29 | Sunday | No | 1998 | 11 | 22 | Sunday | Y | BE |
| 75 | 1998 | 12 | 13 | Sunday | No | 1998 | 12 | 6 | Sunday | Y | BE |
| 76 | 1998 | 12 | 20 | Sunday | No | 1998 | 12 | 27 | Sunday | Y | AF |

"BE" means the control is a week before game day.
"AF" means the control day is a week after game day
Y stands for the away games were held in the same time zone as the city of Seattle.

**Table 7: A Summary of the Sample Size for Each Dependent Variable**

| Dependent Variable | Data applied in the analysis | Sample Size (# of pairs) | Away games only | Note |
|---|---|---|---|---|
| Robbery | 1998-1999<br>2002-2006 | 60 | 39 | UW excluded |
| Residential Burglary | 1998-2006 | 76 | 50 | |
| Auto-theft | 1998-1999<br>2002-2006 | 60 | 39 | UW excluded |
| Theft of auto | 1998-1999<br>2002-2006 | 60 | 39 | UW excluded |

**Table 11: The T Test results for Temperature and Precipitation[26]**

| | Measuring period I | Measuring period II | Measuring period III | Measuring period IV |
|---|---|---|---|---|
| Time Period | A | B | A+B | A +C |
| Temperature | .71<br>(.49) | N/A | N/A | N/A |
| Precipitation | .67<br>(.12) | 1.11*<br>(.02) | 1.78*<br>(.03) | 2.44*<br>(.02) |

* $p$<.05
Time period abbreviation:
A= game hour; B= 2 hours before game+ 2 hour after game; C= 4 hours before game +4 hours after game; W=whole day
*p* value for two-tailed test is reported in parentheses.

[26] Temperature is measured in degree Fahrenheit and precipitation is measured in millimeter. The weather data was obtained form the National Climatic Data Center (NCDC) which is a branch under the U.S. Department of Commerce. The weather station is located in Boeing Field in the city of Seattle.

**Table 12: Regression Results for Robbery**

| Model | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time Period | A | | B | | A+B | | A +C | | W | |
| Sample Size | N=60 | N=39 | N=60 | N=39 | N=60 | N=39 | N=60 | N=39 | N=60 | N=39 |
| Zone 1 | .04 (.93) | .03 (.85) | .01 (.61) | .03 (.65) | .04 (.78) | .05 (.77) | -.001 (.49) | -.004 (.48) | -.03 (.38) | -.14 (.18) |
| Zone 2 | .03 (.24) | .07 (.11) | -.06 (.89) | .02 (.36) | -.03 (.64) | .09 (.15) | .05 (.30) | .21* (.03) | -.08 (.75) | .05 (.38) |
| Zone 3 | -.08 (.90) | -.13 (.95) | -.02 (.70) | -.05 (.78) | -.11 (.91) | -.18 (.96) | -.08 (.84) | -.15 (.91) | -.07 (.69) | -.07 (.64) |
| Zone 4 | .03 (.23) | .08 (.08) | .02 (.26) | .08* .(04) | .06 (.19) | .16* (.02) | .04 (.31) | .19* (.02) | .03 (.39) | .10 (.26) |
| Within two mile buffer zone | .02 (.40) | .05 (.32) | -.05 (.69) | .08 (.25) | -.03 (.60) | .12 (.23) | .002 (.49) | .24 (.12) | -.15 (.75) | -.06 (.59) |
| Outside two mile buffer zone | -.05 (.58) | -.04 (.72) | -.20 (.06) | -.20 (.14) | -.23 (.14) | -.21 (.29) | -.34 (.09) | -.24 (.37) | -.17 (.57) | .23 (.56) |

Time period abbreviation:
A= game hour; B= 2 hours before game+ 2 hour after game; C= 4 hours before game +4 hours after game; W=whole day
* *p*<.05
*p* value for one-tailed test is reported in parentheses (except for outside two mile buffer zone).

**Table 13: Regression Results for Burglary**

| | Results for the 2nd hypothesis | | Results for the 3rd hypothesis | |
|---|---|---|---|---|
| | Full Model (N=76) | Controlled Model (N=60) | Full Model (N=76) | Controlled Model (N=60) |
| Whole Day | 1.01 (.08) | .62 (.22) | | |
| SES-lowest | | | .40 (.22) | .22 (.37) |
| SES-low | | | .20 (.30) | .17 (.36) |
| SES-high | | | .50 (.10) | .26 (.26) |
| SES-highest | | | .77 (.17) | -.04 (.52) |

* *p*<.05
*p* value for one-tailed test is reported in parentheses.

**Table 14: Regression Results for Auto Theft and Theft of Auto**

| | Full Model (N=60) | | Controlled Model (N=39) | |
|---|---|---|---|---|
| | Auto Theft | Theft of Auto | Auto Theft | Theft of Auto |
| Zone 1 | .47** (.00) | .73* (.3) | .50* (.03) | .71 (.07) |
| Zone 2 | .33 (.08) | 1.00* (.00) | .55* (.04) | .96* (.04) |
| Zone 3 | .28 (.16) | .88* (.02) | 33 (.18) | 1.5** (.00) |
| Zone 4 | .00 (.50) | .33 (.19) | .07 (.41) | .67 (.08) |
| Within 2 mile buffer zone | 1.08* (.01) | 2.95** (.00) | 1.44** (.00) | 3.87** (.00) |
| Outside 2 mile buffer zone | 2.2 (.42) | -.333 (.790) | -.14 (.46) | -1.43 (.20) |

* *p*<.05
***p* <01
*p*=.00 means the probability is less than .01.
*p* value for one-tailed test is reported in parentheses (except for outside two mile buffer zone).

**Figure 2: Multi Distance Buffer Zones**

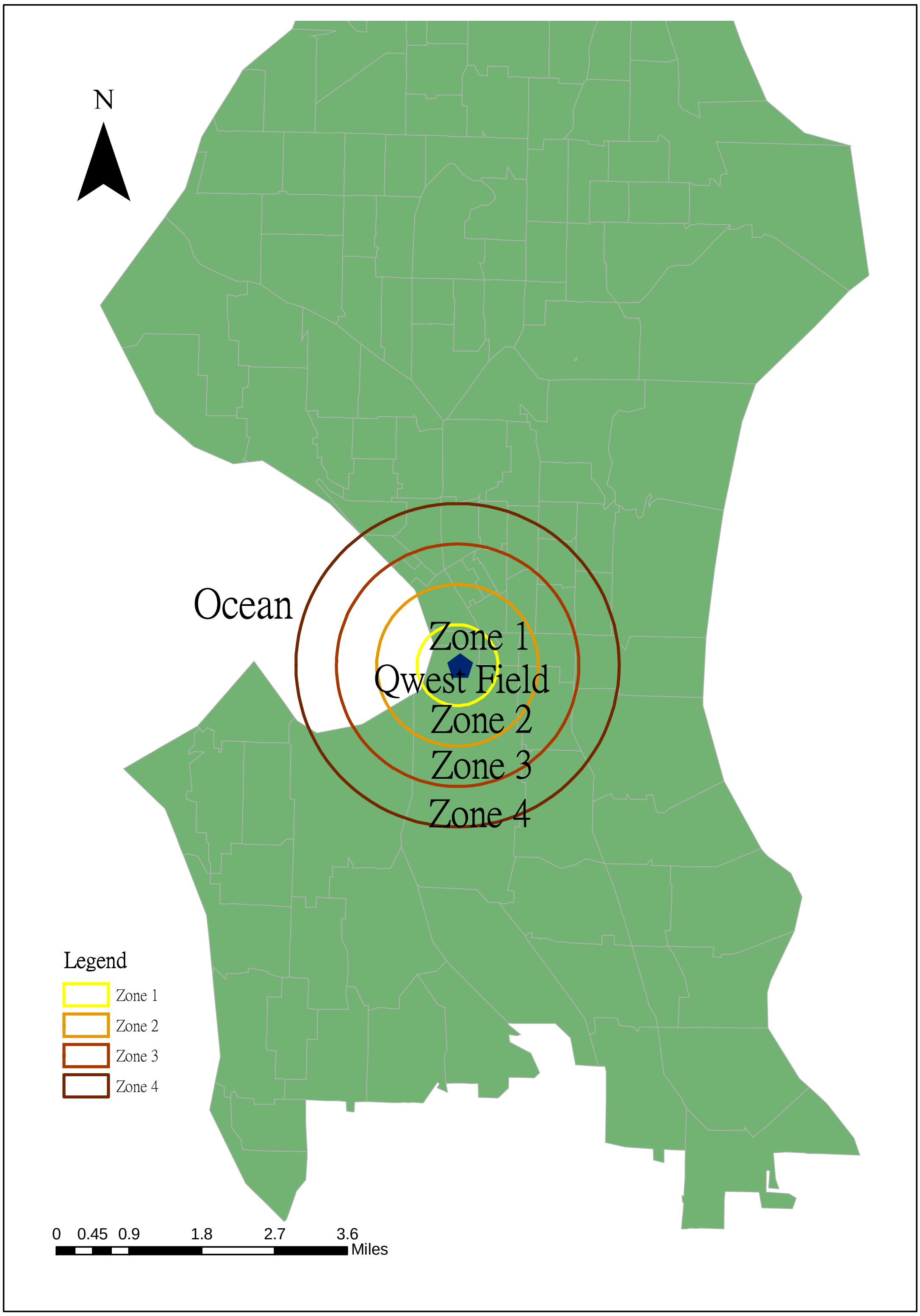
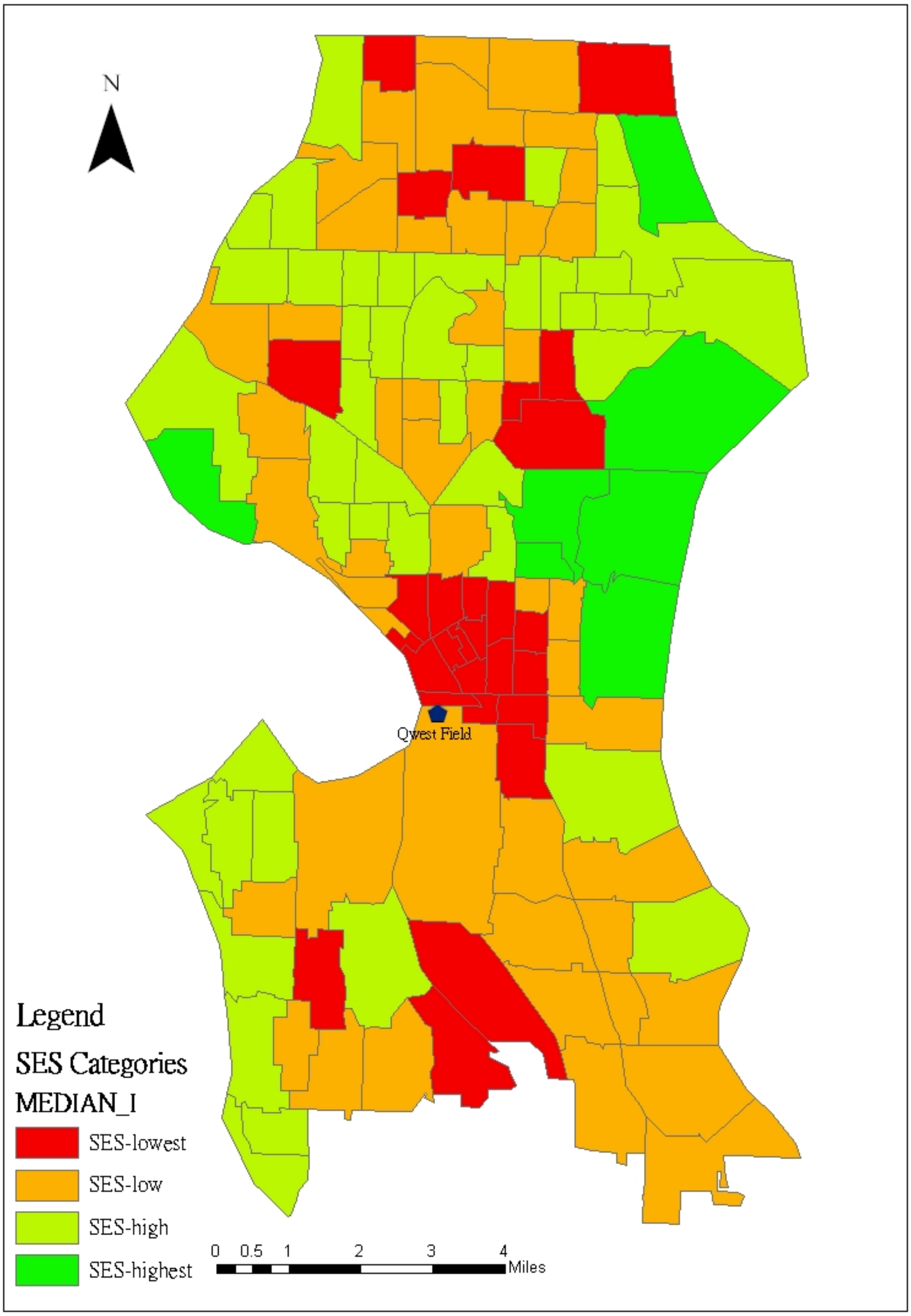


**Figure 3: The Distribution of the Four SES Categories across Space**



## Bibliography

Beccaria, C. (1764). On crimes and punishments. Trans. Caso, A. 1983. Boston, MA: International Pocket Library.

Bennett, R. (1991). Routine activities: A cross-national assessment of a criminological perspective. Social Forces 70: 147-163.

Brantingham, P. L., and Brantingham P. J. (1993). Environment, routine, and situation: toward a pattern theory of crime. In R. Clarke and M. Felson (Eds.), Routine activity and rational choice: Advances in criminological theory, Vol. 5. New Brunswick, NJ: Transaction Publishers.

Burgess, E. (1928). The growth of the city. In Park, E., Burgess, E. and McKenzie, R. (Eds.), Chicago, IL: University of Chicago Press.

Cheatwood, D. (1995). The effects of weather on homicide. Journal of Quantitative Criminology 11: 51-69.

Clarke, R. (1983). Situational crime prevention: Its theoretical basis and practical scope. Crime and Justice 4: 225-256.

Clarke, R. and Felson, M. (1993). Introduction: Criminology, routine activity, and rational choice. In R. Clarke and M. Felson (Eds.), Routine activity and rational choice: Advance in criminological theory. New Brunswick, NJ: Transaction Publishers.

Cohen, L. and Felson, M. (1979). Social change and crime rate trends: a routine activities approach. American Sociological Review 44:588-608.

Cohen, L., Felson, M. and Land, K. (1980). Property crime rates in the United States: A macro-dynamic analysis, 1947-1977; with ex ante forecasts for the mid-1980s. The American Journal of Sociology 86: 90-118.

Cohen, L., Kluegel, J. and Land, K. (1981). Social inequality and predatory criminal victimization: An exposition and test of a formal theory. American Sociological Review 46: 505-524.

Cohn, E. (1990). Weather and crime. British Journal of Criminology 30: 51-64.

Conway, R. and Beyers, W. (1996). Seattle Seahawks economic impact: prepared for HOK Sport and King County.

Cook, T. and Campbell, D. (1963). Quasi-experimentation: Design & analysis issues for field settings. Chicago, IL: Rand McNally College Publishing Company.

Cornish, D. and Clarke, R. (1986). The reasoning criminal: Rational choice perspective on offending. NY: Springer-Verlag.

Cromwell, P. and Olson, J. (2004). The reasoning burglars. In Cromwell, P. (Ed), In their own words: criminals on crime. Los Angeles, CA: Roxbury Publishing Company.

Decker, S., Varano, S. and Greene, J. (2007). Routine crime in exceptional times: The impact of the 2002 winter Olympics on citizen demand for police services. Journal of Criminal Justice.

Eck, J., Weisburd, D. (1995). Crime and place. Monsey, NY: Criminal Justice Press

Falk, G. (2005). Football and American identity. Binghamton, NY: The Haworth Press.

Felson, M. (1986). Linking criminal choices, routine activities, informal control and criminal outcomes. In D. Cornish and R. Clarke (Eds.), The reasoning criminal: rational choice perspective on offending. NY: Springer-Verlag.

Felson, M. (1987). Routine activity and crime prevention in the developing metropolis. Criminology 25: 911-931.

Felson, M. (1994). Crime and everyday life. Thousand Oaks, CA: Sage Publications.

Garland, J. and Rowe, M. (1999). The English Disease: cured or in remission? An analysis of police responses to football hooliganism in the 1990s. Crime Prevention and Community Safety: An International Journal 1: 35-47.

Greenberg, D. and Kessler, R. (1982). Model specification in dynamic analysis of crime deterrence. In John Hagan (ed.), Deterrence reconsidered: methodological innovation. Beverly Hills, CA: Sage.

Hawley, A. (1950). Human ecology: a theory of community structure. New York: Ronald.

Hirshi, T. and Gottfredson, M. (1983). Age and the explanation of crime. American Journal of Sociology 89: 552-84.

Jones, J., Ferguson, D. and Stewart, K. (1993). Blood sports and cherry pie: some economics of violence in the National Hockey League, American Journal of Economics and Sociology 52: 63-78.

Kennedy, L. and Forde, D. (1990). Routine activities and crime: An analysis of victimization in Canada. Criminology 28: 137-151.

Kelling, G., Pate, T., Dieckman, D. and Brown, C. (1974). The Kansas City preventive patrol experiment: A summary report. Washington D.C.: Police Foundation.

Kovandzic, T. and Sloan, J. (2002). Police levels and crime rates revisited: a county-level analysis from Florida (1980-1998). Journal of Criminal Justice 30: 65-76.

LaFree, G. and Kick, E. (1986). Cross-national effects of developmental distribution and demographic variables on crime: A review and analysis. International Annals of Criminology 24:213-236.

Levine, J. (1975).The ineffectiveness of adding police to prevent crime, Public Policy 23: 523-545.

Levitt, S. (1997). Using electoral cycles in policing hiring to estimate the effect of police on crime. The American Economic Review 87: 270-290.

Loftin, C. and McDowell, D. (1982). The police, crime, and economic theory: An assessment. American Sociological Review 47:393-401.

Marvell, T and Moody, C. (1996). Specification problems, police level, and crime rates. Criminology 34: 609-646.

Messner, S. and Blau, J. (1987). Routine leisure activities and rates of crime: A macro-level analysis. Social Force: 65: 1035-1052.

Miethe, T and McDowall, D. (1993). Contextual effects in models of criminal victimization. Social Forces 71: 741-59.

Miethe, T. and Meier, R. (1994). Crime and its social context: Toward an integrated theory of offenders, victims and situations. Albany, NY: State University of New York Press.

Miethe, T., Stafford, M. and Long, S. (1987). Social differentiation in criminal victimization: A test of routine activities/lifestyle theories. American Sociological Review 52: 184-194.

Michael, G. (1998). Demographic and psychographic characteristics of Seattle Seahawks and University of Washington football fans and their significance for sport marketing. Unpublished master thesis, Central Washington University, Seattle.

Ormsby, T., Napoleon, E., Burke, R. Groess, C. and Feaster, L. (2004). Getting to know ArcGIS. Redlands, CA: ESI PRESS.

Ratcliffe, J. (2002). Aoristic signature and the spatial-temporal analysis of high volume crime patterns. Journal of Quantitative Criminology 18: 23-43.

Ratcliffe, J. and McGullagh, M. (1998). Identifying repeat victimization with GIS. British Journal of Criminology 38: 651-662.

Ritchey, F. (2000). The statistical imagination: Elementary statistics for the social science. McGraw-Hill.

Roncek, D. and Maier, P. (1991). Bars, blocks and crimes revisited: Kinking the theory of routine activities to the empiricism of “hot spots”. Criminology 29: 725-753.

Russell, G. (2004). Sports riots: A social-psychological review. Aggression and Violent Behavior 9: 353-378.

Sachs C. and Chu, L. (2000). The association between professional football games and domestic violence in Los Angeles county. Journal of Interpersonal Violence 15: 1192-1201.

Shaw, C. and McKay, H. (1942). Juvenile delinquency and urban areas. Chicago, IL: University of Chicago Press.

Sherman, L., Gartin P. and Buerger, M. (1989). Hot spots of predatory crime: Routine activities and the criminology of place. Criminology 27: 27-55.

Sherman, L. and Weisburd, D. (1995). General deterrence effects of police patrol in crime “hot spots”: A randomized, control trial. Justice Quarterly 12: 625-648.

Simon, H. (1983). Reasoning in human affairs. Oxford: Blackwell.

Stadium Guide (2004). Retrieved November 18, 2006, from http://www.qwestfield.com/

Stark, R., Kent, L., and Finke, R. (1987). Sports and delinquency. In M. Gottfredson and T. Hirshi (Eds.), Positive criminology. CA: Sage Publications.

Townsely, M., Homel, R. Chaseling, J. (2000). Repeat burglary victimization: Spatial and temporal patterns. Australian and New Zealand Journal of Criminology 33: 37-63.

Trivizas, E. (1980). Offences and offenders in football crowd disorders. British Journal of Criminology 20: 276-288.

Trovato, F. (1998). The Stanley Cup of hockey and suicide in Quebec, 1951-1992. Social Forces 77:105-127.

Vandergiessen, D. (2007). Personal Communication. Seattle Police Department, W.A.

Wellford, C. (1974). Crime and the police: A multivariate analysis. Criminology 12:195-213.

Weisburd, D. and Britt, C. (2003). Statistics in criminal justice. Belmont, CA: Wadsworth.

Weisburd, D, Bushway, S., Lum, C. and Yang, S. (2004). Trajectories of crime at places: A longitudinal study of street segments in the city of Seattle. Criminology 42: 283-321.

White, G. (1989). Media and Violence: the case of professional football championship games. Aggressive Behavior 15: 423-433.

White, G., Katz, J., and Scarborough, K. (1992). The impact of professional football games upon violent assaults on women. Violence and Victims 7: 157-171.

Yar, M. (2005).The novelty of cybercrime: An assessment in light of routine activities theory. European Journal of Criminology 2: 407-427.