Exploring the Broken Windows Theory:

A Spatial Analysis of Graffiti and Crime in San Francisco

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But while I was sitting down, I saw something that drove me crazy. Somebody’s written ‘F you’ on the wall. It drove me damn near crazy. I thought how Phoebe and all the other little kids would see it, and how they’d wonder what the hell it meant, and how they’d all think about it and maybe even worry about it for a couple of days.

I went down by a different staircase, and I saw another ‘f you’ on the wall. I tried to rub it off with my hand again, but this one was scratched on, with a knife or something. It wouldn’t come off. It was hopeless, anyway. If you had a million years to do it in, you couldn’t rub out even half the ‘f you’ signs in the world. It’s impossible. – J.D. Salinger, *The Catcher in the Rye*

To my father who makes the impossible seem possible.
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Prologue:
The sheer volume and pace of urban migration today, and the challenges and opportunities urbanization represents drew me to the study of cities. Anchored with the strong belief that cities can effectively improve the lives of millions of people through exercising its economies of scale, design, and policy, the opportunity to engage in high value and mass impact absolutely fascinates and inspires me. Cities should be, and carry enormous potential to be, sources of positive externalities that improve quality of life for millions. This is what drove me to pursue this research. Addressing crime, addresses quality of urban life. Crime plagues every single city. Small cities, large cities, tall and short, crime seems to follow mass groupings of people. The first time I read about the Broken Window Theory, it struck me as one of these simple, effective solutions that can have tremendous positive ripple effects in the community. With the proliferation of smart phones that eases the process of reporting graffiti, I saw the potential for a marriage between civic engagement and graffiti abatement. As I read more about the theory, however, the argument appeared to be incomplete, subjective, and lacking of quantitative or spatial evidence. With the ambition to effectively improve quality of urban life, I began the quest of exploring the spatial relationship between graffiti and crime.
Abstract:
San Francisco spends an estimated $20 million a year on graffiti removal, believing graffiti abatement to be an effective strategy to reduce overall crime. This policing tactic is largely shaped by the widely cited broken windows theory, coined by James Q. Wilson and George L. Kelling, which states that symbols of disorder like graffiti and littering signal disorder and carelessness, inviting and fostering more serious crime to occur in the area (Wilson & Kelling, 1982). The broken windows theory is at the center of much contestation, many scholars debate its validity, linkage, and lack of acknowledgement of other influential variables. The abundant research debating the broken windows theory has largely focused on historical and observational studies conducted in New York, Los Angeles and Chicago. The present study aims to expand the geographic range of where crime and graffiti have been studied by examining the city of San Francisco. The study further fills a gap in the methodology in which the relationship of graffiti and crime are observed, by analyzing graffiti and crime through a spatial lens conducted through ArcGIS mapping technology. The study examines data from the years of 2008 to 2012, derived from the San Francisco Police Department crime reports and graffiti complaints to the government hosted 3-1-1 non-emergency hotline. The present study reveals unique spatial patterns of specific crime types, and a spatial correlation between graffiti and crime from 2008 to 2012. Narcotics, Weapons, and Prostitution sharing the greatest commonality with graffiti clusters, while Burglary, Assault, Narcotics, and Vehicle Theft share the most similar standard deviational ellipse areas with graffiti. Additionally, the study finds a discrepancy in neighborhoods that receive timely graffiti abatement and those with the highest volume of graffiti reports. A neighborhood that received timely graffiti abatement in less than twenty four hours saw graffiti drop nearly in half after two years. Lastly, income and race do not appear to be strong precursors or indicators of graffiti.

Introduction:
As the world continues to urbanize at a pace never before witnessed in human history, municipal governments are faced with great urban challenges and an opportunity to affect the lives of many by improving quality of urban life. Urban graffiti is one of these complex challenges; having gained popularity in the 1970s, the incidence of urban graffiti continues to rise, spreading from the largest cities to other locales (Gastman & Neelon, 2011). Municipal U.S governments spend an aggregate of $12 billion a year on graffiti removal, believing graffiti to influence public perception of
safety, invite crime, reduce transit ridership, deflate retail sales, and decrease property values (Weisel, 2002). The city of San Francisco spends more than $20 million annually on graffiti removal, Los Angeles, an estimated $7 million and Chicago $5.5 million (Newcombe, 2012). Despite the spending of this titanic amount of money on graffiti removal, the externalities of graffiti remain contested among scholarly circles and little research has been conducted to spatially quantify graffiti’s relationships with other components of urban life. Further, the little research conducted has been heavily concentrated in the New York, Los Angeles, and Chicago areas. The following research expands on the geography of study by investigating San Francisco. Famed for its bohemian culture, innovative industries, and tolerant policies, San Francisco has been dubbed the most Creative Class City in the United States by Richard Florida. Richard Florida, a renowned urban theorist, defines the Creative Class as the following:

I define the Creative Class to include people in science and engineering, architecture and design, education, arts, music and entertainment whose economic function is to create new ideas, new technology and new creative content

As the most Creative Class City in the, this is suggestive of a population who may possess more inclusive views on art, and may perceive graffiti more aligned with art, than a whole host of social ills. Therefore, exploring if the broken window theory holds true among a population who potentially carries a friendly bias towards graffiti makes San Francisco an exceptionally interesting site of study.

The following research attempts to address three major questions: What is the spatial relationship between graffiti and crime? What other variables that can help
explain the relationship between graffiti and crime? Does graffiti abatement lead to less graffiti and crime in the future?

The following paper is organized in five sections – Introduction, Literature Review, Methodology, Data Analysis, and Conclusion. The Introduction provides a baseline of graffiti and crime and its relevance to municipal policymakers today. The Introduction is followed by the Literature Review, which extensively covers graffiti’s definition, history, and the advocates and critics of the broken windows theory. The Research Methodology, details the sources of data, organization of data, mapping of data, and specific information on graffiti and crime in San Francisco. Next, the spatial and quantitative analysis is discussed in the Data Analysis portion. Lastly, the Conclusion discusses the implications and generalizability of the results.

**Literature Review:**

**Defining Graffiti**

The diverse types, functions, and motivations of graffiti present a challenge to policy makers and scholars attempting to define and categorize graffiti. The very term, graffiti, has been widely interpreted and plenty of literature exists debating its definition and qualifications. Even the widely respected and cited Oxford Dictionary struggles to provide a concrete definition, defining graffiti as, “writing or drawings scribbled, scratched, or sprayed illicitly on a wall or other surface in a public place,” a definition that merely suggests and encompasses the many forms of graffiti. The U.S. Department of Justice attempted to define graffiti and classified it into four major types: common tagger, conventional spontaneous graffiti, gang graffiti, and ideological graffiti (Weisel,
According to their definition, common tagger graffiti refers to graffiti “ranging from high volume simple hits to complex street art.” Common tagger graffiti is most closely associated with ‘tagging’ - signing a name or representation of the self - on public spaces. Conventional graffiti is defined as “isolated or spontaneous acts of ‘youth exuberance’ but sometimes malicious or vindictive. Gang graffiti refers to graffiti used by gangs to mark turf or convey threats of violence. Lastly, ideological graffiti is identified as political or hate graffiti, which expresses political messages and or racial, religious, ethnic slurs. At the crux, the challenge to define graffiti rests in the diversity of graffiti types, the motives behind each type of graffiti, and the subjective nature of categorizing these various types of graffiti.

Rapid urbanization and popularity of graffiti as a legitimate art form makes the challenge to define graffiti more difficult than ever. Increased urbanization carries the potential to impact urban graffiti in a number of different fashions - more canvas space, a larger audience to see the work, a form of political expression for recent migrants or natives who dislike the changing urban landscapes, leading more people to experience graffiti and view graffiti in a different lens than before. Even before urbanization took root, the challenge to define graffiti has consistently persisted.

The rise of graffiti artists as contemporary icons reflect graffiti’s evolving definition that is more inclusive of graffiti as a legitimate art form. Banksy, JR and Shepard Fairey are major icons in the campaign to claim graffiti as an art form (Atkins, 2011). Banksy’s exhibitions have drawn flocks of crowds and celebrities to clamor over his work. Angelina Jolie, Brad Pitt, Jude Law, Ashley Olson are all owners of Banksy
originals, purchasing pieces for over $600,000 each, signaling Banksy as a hip and highly recognized artist (Delana, 2011)(Wyatt, 2011). Shepard Fairey created the iconic multicolored stenciled portrait of Barack Obama in 2008, one of the most widely recognized symbols of the Obama campaign, gracing thousands of posters, flyers, coffee mugs, and other campaign paraphernalia (Pasick, 2009). The portraits recognition and wide distribution has been compared to Jim Fitzpatrick’s Che Guevara poster (Barton, 2008). Street artist, JR, fly posts immensely large black-and-white photographic portrait images in public locations all across the world, ranging from Paris to Palestine to the Chelsea high line in New York City. In 2010, he spoke at a TED conference addressing the inspiration and motivation behind his signature fly posts, a work of art he states intended to give slums a human face. His TED talk received the TED prize in 2011, an award previously given to Bill Clinton and Bono (Kennedy, 2010).

The acceptance of graffiti from notable intellectual and artistic institutions reinforces the notion that contemporary culture views certain types of graffiti as a legitimate art form. The documentary, Exit Through the Gift Shop, tracked the lives of respected graffiti artists - Banksy, Shepard Fairey, Space Invader among others – revealed the culture and process of underground street art. The documentary was nominated for an Oscar in 2011, demonstrating the interest surrounding graffiti and nod of approval from elite artistic circles that graffiti can be considered an art form. Catching the wave of interest on graffiti, The Los Angeles Museum of Contemporary Art installed a graffiti exhibition Art in the Streets, attracting record setting crowds of over 200,000 visits from April to August in 2011 (Pogrebin, 2011).
History of Graffiti

The inception of urban American graffiti began in the mid-1960s, a period of tumultuous social change, culture, politics, and technological advancements set the stage for the American graffiti movement to spark. Marked by counter culture, civil rights, and anti-war movements, American youth in the 1960s were inclined to engage in rebellious political expression. Politics largely shaped culture of this time, the string of assassinations, Vietnam War, and Watergate scandal led to civic engagement and encouraged political expression. Technologically, the new accessibility to inexpensive aerosol spray cans enabled graffiti to proliferate with great ease (Weide, 2005). Prior to the invention of the spray can, graffiti on urban landscapes was conducted with brushes, chalk, charcoal and pocketknives (Weide, 2005). Veteran and active Los Angeles graffiti artist, Chaz Bojorquez, in the book Street Writers, stated the significance of spray paint when it was introduced to the general public in the early 1960s, “Old graffiti was always done with a brush. But spray cans and felt markers have changed everything” (Cesaretti, 1975). UCLA anthropologist, Susan Phillips, supports the claim that technological advancements among aerosol cans accelerated the graffiti movement, arguing that the spray can were simply more convenient, more permanent, less conspicuous, and easier to apply to many rough and irregular surfaces (Phillips, 1999).

The first emergence of widespread graffiti in the United States developed in Philadelphia and New York City in the 1960s and 1970s. Largely considered the father of American graffiti, Darrl McCray, was a Philadelphian boy who began scribbling his
nickname ‘Cornbread’ on Philadelphia streets hoping to capture the attention of his childhood crush. Little did he know that he would capture the attention of the nation, on March 2, 1971, the Tribune ran a story announcing that ‘Cornbread’ was dead, evidence that his tag name had become an urban legend in Philadelphia (Poole, 2011). He had scribbled his name in all places he thought his crush might pass – bus routes, streets, parks – until his name was well known by many. Completely independent of graffiti’s development in Philadelphia, New York’s graffiti movement sprung at nearly the same years as Philadelphia. New York graffiti differed than Philadelphia; New York integrated color and decorative block lettering. Largely responsible for the spread of graffiti in New York City and considered one of the most influential American graffiti artists, a Greek American teenager made a name for himself by scribbling his signature, TAKI 183, throughout the five boroughs on hundreds of surfaces in New York (Phillips, 1999). In the summer of 1971, the New York Times ran an article depicting Taki 183 as a shadowy folk hero, inspiring hundreds of emulators to follow (Kennedy, 2011). Among urban historians, it is widely agreed that Taki 183 is responsible for igniting the modern graffiti movement in New York City.

The Advocates: Graffiti and The Broken Window’s Theory

The effects of graffiti on neighborhoods and social order first became discussed among scholars in 1969, in response to the abandoned car experiment conducted by Stanford psychologist, Phillip Zimbardo. Zimbardo arranged to have an automobile without license plates parked with its hood up on a street in the Bronx and similarly on a street in Palo Alto, California (Zimbardo, 1969). In both locations, untended property
became fair game for people seeking fun or plunder, even among people who normally would not participate in such acts. Due to the frequency in the Bronx with which cars are already abandoned, stolen or broken, this previous cognitive experience of “no one cares” allowed vandalism to occur even more rapidly as compared to Palo Alto (Zimbardo, 1969). Zimbardo explains,

*Here is one definition of “community,” where people care about what happens on their turf, even to the person or property of strangers. They do so perhaps making the reciprocity assumption that others in that neighborhood would similarly care about them and their possessions.*

In brief, Zimbardo found that everyday displays of neglect, disorder and low-level criminality, like abandoned cars, cause an atmosphere where even law abiding citizens engage in criminal, violent behavior.

Capitalizing on this idea, American political scientists James Q. Wilson and George L. Kelling introduced the broken window theory in 1982. This theory remains one of the most influential in shaping public policy in policing efforts to abate graffiti. A commenter on Wilson and Kelling goes so far as to state, “If there were a Hall of Fame for influential public-policy ideas, then the “broken windows” thesis would probably have its own exhibit,” (Miller, 2001). The theory claims that urban distressed signal an uncontrollable, disorderly and carelessness environment, inviting and fostering more serious crime to occur in that area (Kelling & Wilson, 1982). Wilson describes this phenomenon as follows,

*If a window is broken and is left unrepaired, all the rest of the windows will soon be broken. One unrepaired broken window is a signal that no one cares, and so breaking more windows costs nothing...* (Kelling & Wilson, 1987)
The theory illustrates how poorly maintained physical settings can lead to decreased sense of security in a neighborhood, contribute to its decline and form crime ridden locality. Today, the three most populous cities in the United States – New York, Chicago, and Los Angeles – have all adopted at least some aspect of Wilson and Kelling’s broken window theory (Harcourt & Ludwig, 2006). In San Francisco, the site of this research project, the San Francisco Board of Supervisors explicitly declares their support with the broken windows theory in their city’s ordinance:

_Graffiti is detrimental to the health, safety and welfare of the community in that it promotes a perception in the community that the laws protecting public and private property can be disregarded with impunity. This perception fosters a sense of disrespect of the law that results in an increase in crime; degrades the community and leads to urban blight; is detrimental to property values, business opportunities and the enjoyment of life; is inconsistent with the City’s property maintenance goals and aesthetic standards; and results in additional graffiti and in other properties becoming the target of graffiti unless it is quickly removed from public and private property._ (SF PW Code Sec 1301)

As shown, the work of Zimbardo (1969), and Kelling and Wilson (1982), has largely shaped public policy, and is used to infer that the effects of graffiti in a neighborhood would serve to weaken communities, embolden criminals, and accelerate criminality.

Kelling and co-author, Catherine Coles expanded on the broken window’s theory in a follow-up book entitled _Fixing Broken Windows_, which addresses tactics on how to solve the perception of disorder issue that graffiti can cause (Kelling & Coles, 1997). In the book, Kelling and Coles conducted a series of observation studies and historical analysis on municipal campaigns, formulating a strong case in support of policing by foot as a mechanism that can reduce the perception of possible crime (Kelling & Coles,
1997). This is further supported by a study published by the American Society of Criminology by Jerry Ratcliffe, Travis Taniguchi, Elizabeth Groff, and Jennifer Wood which reported the efforts of over 200 foot patrol officers working over a summer in Philadelphia (Ratcliffe, 2010). The study found that targeted foot patrols in hotbeds of violent crime served to significantly reduce violent crime levels as long as a threshold level of violence existed initially. Thus, the researches advocate for intensive foot patrol efforts in violent crime hotspots saying that the presence of foot patrols acts as a deterrence by increasing the perception that disruption will be met with apprehension and arrest (Ratcliffe, 2010).

The U.S. Department of Justice and law enforcers similarly address tactics on how to reduce graffiti from re-occurring, believing graffiti to be a precursor to crime. They find that one of the most effective responses to graffiti is regularly and promptly removing graffiti when reported. They state, “One of the most promising responses to graffiti is consistently getting rid of it, and doing so quickly....Rapid removal is key,” (Wiesel, 2002). The article does note that certain types of graffiti, depending on its surface and material used, may jeopardize the time in which it is able to be removed.

The Advocates: Graffiti and Crime

Dutch social scientists, Kees Keizer, Siegwart Lindenberg and Linda Steg from the University of Groningen, aimed to test the broken window theory empirically by running a number of different studies testing the effect of disorderly settings on an individual decision to participate in criminal activity. The researchers discovered that signs of
vandalism, litter, and low-level law breaking did change the way people behave and resulted in them being more susceptible to littering and stealing. The scientists’ state,

*The mere presence of graffiti more than doubled the number of people littering and stealing. There is a clear message for policymakers and police officers: Early disorder diagnosis and intervention are of vital importance when fighting the spread of disorder. Signs of inappropriate behavior like graffiti or broken windows lead to other inappropriate behavior (e.g. littering or stealing), which in turn results in the inhibition of other norm* (Keizer, Lindenberg, Steg, 2008)

The studies were all controlled field experiments in common spaces where disorder could be observed. There were no signs that the participants recognized or discovered they were being observed by the experimenter. The first study was conducted in an alley in Netherlands near a shopping center that is commonly used to park bikes. There were two conditions: one of order, where the walls of the alley were clean, and the other of disorder where the walls were painted with graffiti and a noticeable street sign that contained the text “Graffiti” with a disappointed look. Attached to all the bike handlebars was a paper flyer of a nonexistent shop. In order to use the bike, the flyer had to be removed. There were no trashcans in the alley, so “not littering” meant taking the flyer with them. The results revealed a strong relationship with areas of disorderly and increased littering. Out of the participants that were in the orderly (non graffiti) alley, 33% littered, in comparison to 69% who littered in the disorderly setting (Keizer, Lindenberg, Steg, 2008).

In another revealing study, the trio of Dutch researchers examined the effect of graffiti, and litter on the probability of an individual stealing. The scientists placed an envelope, containing a 5 euro note that was hanging out of a mailbox that was
extremely visible to any pedestrian passing by. The participants were all people who singly passed the mailbox on foot. The experiment contained two disorder conditions: one in which the mailbox was covered with graffiti without litter on the ground, and one where there was no graffiti on the mailbox, but there was litter surrounding the mailbox. The baseline order condition had no graffiti, nor litter around the mailbox. The circumstances of all three conditions in term of period of the day and weather were held constant. Opening the envelope or taking it was considered stealing. The subjects of the baseline order condition, 13% stole the envelope. In comparison, 27% of the graffiti disorder condition stole the envelope. Similarly, one in four participants stole the envelope in the litter disorder condition. Both studies illustrate a significant relationship between graffiti, littering, and stealing (Keizer, Lindenberg, Steg, 2008).

In response to the growing body of literature that claimed the effects of the broken windows theory, municipal implemented policies that put the broken windows theory in practice. Under the helm of William Bratton, the 38th Commissioner of the New York Police Department, and former Mayor Rudolph Giuliani, New York City applied aggressive strategies to abate graffiti with the implementation of a Quality of Life policing program in the 1990s (Keizer, Lindenberg, Steg, 2008). The policing agenda cleaned up graffiti in New York subways and aimed to deal with disorderly behavior early before more serious crime occurred. Bratton stated, “Far from trivial, fighting graffiti is the key to reducing crime overall and solving more serious offenses – from drug dealing to murder,” (Harcourt & Ludwig, 2006). In just five years, New York City saw homicide rates fall by 52% (Fagan, 2009). In a study conducted by Sousa and Kelling,
the study concluded that ‘broken windows’ policing effort from the *Quality of Life* campaign is significantly linked to the decline in violent crimes, and prevented over 60,000 violent crimes from occurring between 1990 to 1998 (Sousa & Kelling, 2001). The acclaimed success of the *Quality of Life* campaign drew worldwide attention, leading metropolitan cities worldwide to implement similar tactics to reduce crime.

**The Critics: Graffiti and Crime**

Not all researchers have found evidence to support the claim that graffiti and symbols of disorder lead to increased crime, rather, social scientists point to extraneous variables that are more indicative of an individual to participate in crime.

Public officials holstered Mayor Giuliani’s, *Quality of Life* campaign, as a successful municipal program and further evidence that validated the broken windows theory. Despite the declining crime rates in New York City during the 1990s, social scientists pointed to other variables and features that question graffiti abatement as a catalyst to declining crime rates. Popular arguments by scholars state that economic changes, changes in drug use patterns, and demographic changes were more powerful factors in influencing homicide rates than police enforcement tactics (Fagan, 2009) (Harcourt & Ludwig, 2006). Fagan argues that surges in homicide in 1972, 1979, and 1991 are paralleled with the three drug epidemics: heroin, cocaine, and crack cocaine; so, the decline of drug use in the 1990s marks a decline in crime rates as well (Fagan, 2009). According to his study, the new policing strategies had no actual effect on crime abatement.
At the heart of Wilson and Kelling’s theory of broken windows, is the role that perception of disorder plays on inviting criminal activity to occur and thrive in an area. A number of scholars have debated the validity of this theory by looking at how perceptions of communities are formed, and asking whether perceptions of disorder truly determine levels of criminality in an area.

One such argument is made by sociologists Robert J. Sampson and Stephen Raudenbush, who, while they agree that perceptions of a neighborhood can influence crime rates, argue that racial, ethnic, and socioeconomic structure of neighborhoods shapes perceptions of disorder far more greatly than graffiti, garbage or other similar things people may see on the street. In a paper published in 2001, Sampson and Raudenbush conducted extensive empirical research into 196 Chicago neighborhoods, exploring more than 23,000 streets varied by race/ethnicity and social class (Sampson & Raudenbush, 2001). To measure disorder, trained observers drove and filmed among the streets and logged the observations they made on each face block. The observers counted items such as garbage on the streets, litter, graffiti, abandoned cars, and needles and syringes as signs of physical disorder. Signs of social disorder were counted such activities as loitering, public consumption of alcohol, public intoxication, presumed drug sales, and the presence of groups of young people manifesting signs of gang membership. To measure crime, neighborhood residents were asked whether they or a member of their household had recently been victimized either by violent crime or by a burglary or theft. They were also asked separately how much of a problem they believed various social incivilities— for example, drinking in public—to be. In addition, the team
examined police reports for counts of three types of crime—homicide, robbery, and burglary. Neighborhood structural characteristics, such as the extent of poverty, the concentration of immigrants, and residential stability, were also measured.

Sampson and Raudenbush found that crime and disorder are interlinked because disorder and crime often originate from neighborhoods with concentrated poverty, not because signs of disorder lead to a downward cycle of crime, as Kelling and Wilson state. However, Sampson and Raudenbush do note that signs of disorder may potentially influence migration, investment and overall viability of a neighborhood. Disorder can serve as an incentive among residents to leave a neighborhood, those able to leave will be residents with money, therefore this leads to an increase in concentrated poverty of a neighborhood. Sampson and Raudenbush conclude that in order to reduce crime and stabilize neighborhoods, strategies should be focused on creating a sense of collective efficacy as a powerful strategy to reduce crime in distressed communities.

In 2004, researchers Sampson and Raudenbush embarked on another similar study, seeking to identify neighborhood factors that determined crime. The research team toured a set of Chicago neighborhoods in vehicles equipped with video cameras on each side capturing social activities and physical features in each locality, with trained observers simultaneously recording observations. The research found that the racial demographic of the neighborhood was a more powerful trait in shaping individual perceptions of the state of disorder in their neighborhood (Sampson & Raudenbush, 2004). For instance, the percentage of black residents in a neighborhood increased, the researchers found that so did the perception of disorder by each ethnic group, including
blacks. This correlation was also seen, though in a lesser extent, with the number of Latinos in a neighborhood. The authors write,

*Because people act on their perceptions of disorder, the consequence is a self-fulfilling prophecy whereby all actors (not only white residents) are likely to disinvest in or move away from black or mixed areas they view as at high risk of disorder. In this light, attempts to improve urban neighborhoods by reducing visible disorder—cleaning streets and sidewalks, painting over graffiti, removing abandoned cars, reducing public drinking, prostitution, or drug dealing—may produce many positive results, but may have only limited payoffs in neighborhoods inhabited by large numbers of ethnic minority and poor people.*

Sampson and Raudenbush conclude from this that race is a stronger characteristic in determining the perception of disorder in a neighborhood than things like graffiti, and warn against the self-fulfilling prophecy that can take hold as a result (Sampson & Raudenbush, 2004).

Bernard Harcourt and Jens Ludwig join the circle of contemporaries who dispute the broken windows theory by examining the results of *Moving to Opportunity*, a program produced by the Department of Housing and Urban Development that provided an opportunity for low-income families living in high crime public housing to move to less disadvantaged and disorderly communities. Contrary to what broken windows would suggest, moving to a less disadvantaged, less disorderly neighborhood did not reduce criminal behavior on net, as the tenants continued to offend at the same rates in their new, more orderly neighborhoods as they did in their former, disorderly ones. Harcourt concludes, “There’s no good evidence that disorder causes crime [or] that broken windows policing reduces serious crime in a neighborhood,” (Harcourt &
Ludwig, 2006). Their analysis finds no empirical support for the broken windows theory, and suggests that police intervention that reduces disorder may not actually reduce people’s criminal behavior (Harcourt & Ludwig, 2006).

The National Research Council, charted by Congress to advise the federal government on scientific matters, existing research does not provide strong support for the broken windows hypothesis and rather questions the validity of the results in the New York graffiti and crime study conducted by Kelling and Sousa. They state,

_There is a widespread perception among police policy makers and the public that enforcement strategies (primarily arrest) applied broadly against offenders committing minor offenses lead to reductions in serious crime. Research does not provide strong support for this proposition_ (Harcourt & Ludwig, 2006).

As demonstrated, the broken window theory remains contested in scholarly circles. However, though a significant portion of this literature has been devoted to studying and observing areas like New York, Chicago and Los Angeles, very little work has been done to quantify or even map graffiti and crimes, and none of these efforts have been set in the city of San Francisco. The present study aims to explore the spatial and quantitative relationship between graffiti and crime by utilizing ArcGIS mapping technology in the under researched site of San Francisco.

**Research Methodology**

The following research conducts an intensive spatial analysis of graffiti, graffiti abatement and crime in San Francisco from the years 2008 to 2012. In addition, the research examines other variables that may impact crime and graffiti such as income
and race. Among the thirty six types of crime that are reported, eight different crime types are analyzed - Assault, Arson, Burglary, Narcotics, Prostitution, Robbery, Vehicle Theft, and Weapons – and are observed every two years, 2008, 2010, and 2012. These eight crime types were chosen from the recommendation of a police office in the graffiti abatement division. Additional data on race, income is from the 2010 U.S Census Bureau. The mapping projects are conducted through ArcGIS 10.1 software system.

However, for the purposes of this paper, graffiti is defined in accordance to the legal system of my area of research. The San Francisco Public Works Code defines graffiti as the following:

_Graffiti means any inscription, word, figure, marking or design that is marked, etched, scratched, drawn or painted on any building, structure, fixture or other improvement, whether permanent or temporary, including by way of example only and without limitation, fencing surrounding construction sites, whether public or private, without the consent of the owner of the property or the owner’s authorized agent, and which is visible from the public right-of-way._ (SF PW Code Sec 1301)

**Data Collection**

The city of San Francisco, in an effort to improve government transparency, accessibility to city data, and empower San Francisco’s skilled workforce to build app platforms, launched a central clearinghouse website, DataSF, in 2009 that publishes a robust set of San Francisco government reports and public datasets. While the datasets on crime includes all crime incidents reported by the San Francisco Police Department from 2003 to the present, the graffiti dataset is limited and only includes information from 2008 to the present. Therefore in order to compare congruent data over the same time period, the present study only examines crime and graffiti over the period in which
information is available on both variables. The crime data is an aggregate compilation of all crime reported to the 10 police stations in San Francisco.

The original source of the graffiti data is derived from graffiti complaints made to the government hosted 3-1-1 non-emergency hotline. Since the data includes only citizen-reported graffiti incidents on public and private property, it is likely that it does not completely represent all graffiti in San Francisco; however, it does serve as a robust sample and indicate that the graffiti in which is reported is offensive or dissatisfactory to constituents.

The graffiti abatement data is generated from the graffiti dataset from the 3-1-1 complaints which contains a timestamp in which graffiti was reported and addressed. However, unlike the dataset for graffiti that looks at both graffiti on public and private property, the graffiti abatement dataset only examines graffiti removed on public property. It is the lawful obligation of the government to clean graffiti on public property, while graffiti on private property lies in the hands of private owners, accountability is likely to be significantly faultier on private property graffiti.

The datasets on income, race, came from the U.S Census data files. Income data contains both median household income and per capita income in San Francisco. Per capita income was calculated by summing all of the income within a census tract and dividing it by the number of residents. Median household income was calculated by determining the collective income of each household in a census tract and then determining the median household income for that census tract. This data is presented at the 2000 census tract level.
The dataset on race originated from the U.S Census Bureau but was adjusted to comply to San Francisco’s standards of “Latino” definitions. In its current form, the US Census places Latino and other ethnicities as non-mutually exclusive categories. To align with San Francisco’s standards, the data has been summarized so that all individuals that indicate they are Hispanic, Latino, or Spanish origin are coded as “Latino/a” and all other races are exclusive of persons of Latino/a origin. This data is presented in 2010 census tract level. The dataset on murals was compiled by the San Francisco Department of Public Health who geocoded murals that met their standards of “mural art.” There appears to be no specific text on what defines “mural art” but many photos that are indicative of bright, colorful, image based photos of “mural art.” Considering this comes from a government agency and the website has a large community following, the source appears legitimate and the only one in its kind that geocodes urban art.

The base layer where all the crime, graffiti, and graffiti abatement information are projected is a map of San Francisco produced by the San Francisco Planning Department which organizes the city by their neighborhood district lines. As San Francisco contains distinctive cultural neighborhoods, urban dwellers navigate the city according to neighborhood lines, not through census tracts and blocks, therefore utilizing the zoning map is more fitting for this type of research. In conjunction, a street map of San Francisco is integrated into the model to precisely locate and evaluate streets are major havens for graffiti and crime.
Data Mapping
The core of the maps can be divided into three major sections – crime, graffiti, and graffiti abatement. Each section is visually represented in the following three mapping methods: dot points, heat maps, and standard deviation ellipses. These three major sections – crime, graffiti, and graffiti abatement – each contain unique subsections. The crime data contains eight different crime types, each examined in the year 2008, 2010, and 2012, consisting of twenty four different map layers. Each of these twenty four maps are visually represented in two styles, dot points and heat maps, consisting of forty eight maps total of crime. Additionally for the 2012 crime data, a standard deviational ellipse test is run for each of the eight crime types, adding eight more maps to a grand total of fifty six maps on crime. These maps illustrate the location, clustering, and spatial movement and consistency of crime overtime.

Graffiti is mapped for each of the following years: 2008, 2010, and 2012. Each of these graffiti maps are visually reflected in the three styles above, totaling to nine different graffiti maps. Graffiti abatement consists of one year, 2012, and examines graffiti that has been cleaned in four different time intervals – less than twenty four hours, three to seven days, one week, and more than one week. These maps are also visually represented through dot points, heat maps, and standard deviational ellipses.

The maps are projected utilizing XY data, not geocoded addresses, for greater precision. The only exception to this is the graffiti dataset in 2008 which had incomplete XY data, and had to be compensated by geocoding the addresses that did not have XY points. The Geographic Coordinate System used is GCS_WGS_1984 and the Projected Coordinate System is NAD_1983_StatePlane_California_IIIFIPS_0403_Feet.
Results:

Crime

According to crime statistics from 2008 to 2012, San Francisco has become a safer city in the last five years, witnessing great reductions in overall citywide crime. In 2008, a total of 139,364 crime reports were filed. Three years later, this number dropped 16% (22,774) to reach 116,590 crime reports filed in 2011. Decreases in crime are seen unanimously across crime types, Figure 1 below illustrates this trend.

While the aggregate number of crime has dropped, heavy clustering of crime continues to target the same areas persistently through 2008 to 2012. While most crime disproportionately falls in the Downtown/Civic Center, and Mission district, each crime type contains its own nuanced, unique spatial pattern, largely remaining unchanged year to year. With a few exceptions, the spatial pattern either expands or decreases the existing clustering; building off or reducing crime that is already there. Rarely do new spatially independent sites of crime spring up, suggestive that crime reinforces itself in the same spatial areas. This data reflects that crime types have a spatial relationship with specific areas. The two largest clusters are

![Figure 1: San Francisco Crime by Type, 2008 - 2012](image-url)
found in Downtown/Civic Center and the Mission District. These two neighborhoods are mixed use, offering residential, office, and retail space. The districts also are home to high minority populations and low income residents. Several of the epicenters of crime clusters in Downtown/Civic Center and Mission are situated in very close proximity to the BART stations, respectively on 16th Street in the Mission and Powell Street Downtown. With the information at hand, it cannot be concluded that crime rates near BART stations reduce ridership, but it can be suggested that the perception of safety is shaped by the surrounding crime that occurs near the station.

**Assault**

Assault occurred the most frequently among the eight different crime types and displayed major clustering and tendency to re-occur in the same areas. The number of reports filed for assault decreased dramatically from 2008, where 12,668 assault reports were filed to 7,796 assault reports in 2012. Throughout the time period of study, Tenderloin, labeled Downtown/Civic Center on the maps, contained the greatest clustering of assault reports, followed by Mission and SOMA. This can be seen in Figure 2a, 2b, and 2c.
Examining the data more granularly by utilizing the precise point data in the street view map, it can be seen that certain streets are heavily lined with assault incidents, particularly Market Street, Mission Street, and San Jose Avenue. See Figure 3 below for details.
Market Street, Mission Street, and the outer Mission Street are major streets that are widely used by commuters to navigate through San Francisco. The spatial pattern of assault occurring on major streets is not isolated to 2008, but as seen in Figure 3b, this spatial trend remains consistent in the three years of study.
**Arson**

The spatial configuration of arson was the most heterogeneous of the crime types; arson was sporadic and dispersed all across the city year after year. There was a slight trend for arson to cluster and reoccur in Civic Center/Down and Bayview, but the clustering was not nearly as concentrated as any of the other crime types. The standard deviational ellipse is the widest and largest for Arson, demonstrating the great deviation and variety within the arson locations. Arson occurred the least out of the eight examined crime types, with only 192 reports filed in 2012, and like the other crimes saw a decline in incidences from 2008 to 2012.

![Figure 4: Arson in San Francisco, 2012](image)

**Key**

- Orange Dots: precise locations of graffiti
- Orange Circle: the standard deviational ellipse
- Blue Clusters: areas of clustering
Prostitution

Surprisingly, exceptionally few incidents on prostitution were reported in San Francisco, and of those reported, prostitution was by far the most concentrated out of all the crime types. The hyper-extreme concentration of prostitution reports sheds light on the substantial territorial characteristic of prostitution, an attribute that is unique to its crime. The location of these reports did not change whatsoever from year to year. In fact, the reports were often filed at the exact same street location as the year before. Prostitution in San Francisco is concentrated in the Mission and Downtown/Civic Center district. In both neighborhoods, the reports are filed in a very specific area that span no less than 4 blocks. Like assault, prostitution experienced a dramatic decrease from 2008 to 2012. In 2008, there were 1,633 prostitution reports, in 2010 there were 637, and in 2012 there were a mere 183 prostitution reports filed. The decline in prostitution reports may act as a sign that prostitution in San Francisco is in fact experiencing a decline, but it may also indicate that prostitution has taken on more sophisticated measures to escape arrest and citations. Further, due to its extreme concentration of reports, the evidence may also suggest that police officers are only focusing on areas where prostitution has
traditionally occurred and have not toured areas where prostitution may now newly exist.

*Burglary*

Quantitatively and spatially, burglary represents interesting scenarios. Quantitatively, burglary is one of the two crimes whose values remain relatively consistent from 2008 to 2012. In 2008, there were 5,678 burglary reports. In 2010, there were 4,788 burglary reports. Lastly, in 2012 there were 4,522 burglary reports. Spatially, burglary exhibits an expansionary pattern from 2008 to 2012, extending via its existing clusters, following Market Street and Mission Street.
Narcotics

The spatial configuration of Narcotics is extremely concentrated in Downtown/Civic Center area; this spatial pattern remains consistent for all the years of study. Narcotics witnessed a nearly 50% drop in reports from 2008 to 2012, plummeting from 11,63 in 2008 to 6,230 in 2012, however, as the maps demonstrate below, the locations of these reports remains unchanged. Like Prostitution, the reoccurrence of incidences in the same exact area, exposes the territorial attribute of the crime and the potential for police to be selectively inclined to search this area for Narcotics crime.

Figure 5c: Burglary in San Francisco, 2012
Robbery

The spatial configuration of robbery remains consistent from 2008 to 2012, and is most heavily concentrated in Downtown/Civic Center, SOMA, and the Mission District.
As with several other crimes, robbery crimes extend and span Market Street and appear to continue southward onto Mission Street. It does not appear to be a bias among robberies to rob wealthier neighborhoods, as the districts where heavy clustering occurs are areas with relatively lower income.

![Figure 7a: Robbery in San Francisco, 2012](image)

**Weapons**

Exhibiting a very similar spatial pattern to robbery, weapon crimes are concentrated in Downtown/Civic Center, SOMA, and the Mission District. With San Francisco’s strict gun control policy and few gun retail shops, weapons account for a small portion of crime in San Francisco. Only 1,050 weapon crimes were reported in all of 2012. Among the eight crime types observed, weapons is the second smallest in number, after Arson.
Auto Theft

Auto theft incidents exhibit the biggest percentage decrease from 2008 to 2012 and the greatest spatial movement among the different crime types. In 2008, there were 7715 reports of vehicle theft, in 2010 there were 4987, and in 2012 there were 4966. The drop is met with a different configuration of where heavy clustering of vehicle theft is occurring. The spread of auto theft is expressed in the maps below, particularly Figure 6c.
**Graffiti**

Similar to crime, overall graffiti has reduced from 2008 to 2012, and exhibits its own unique spatial patterns. In 2008 to 2009, however, there was a large spike in graffiti
incidents; this can be explained by the fact that 2009 was the year in which the 3-1-1 graffiti reporting service was launched. Suggesting prior to the 3-1-1 service, graffiti was underreported due to the more challenging process that it took to report graffiti. In the year of 2008, only 6018 graffiti complaints were made. With the launch of 3-1-1 in 2009, over 20,000 graffiti complaints were filed in 2009. Due to the new reporting system and the influx of graffiti reports provided following 2009, the graffiti map demonstrates substantial spatial movement from 2008 to 2010 and 2012. From 2008 to 2012, graffiti consistently falls in the Mission and Downtown/Civic Center, hugging Mission Street up through Market Street. This pattern is most acute in 2008. In 2010, graffiti appears to extend to the North West, spreading to Haight Ashbury, Western Addition and Inner Richmond. It is significant to note the high levels of clustering in Haight Ashbury and Western Addition in 2010, the clustering is equivalent to levels in Downtown/Civic Center. By 2012, Haight Ashbury and Western Addition experience a great drop in graffiti clustering, exhibiting much lower levels than two years ago.

![Figure 10a: Graffiti in San Francisco, 2008](image1)

![Figure 10b: Graffiti in San Francisco, 2010](image2)
Relating Graffiti and Crime

The maps display a consistent spatial correlation between graffiti and crime, the two variables perpetuate the same areas in San Francisco, heavily clustering around Downtown/Civic Center and the Mission District. Market and Mission Street are two major street corridors where crime and graffiti thrive continuously. By dissecting total crime into each specific type, the data demonstrates that each crime type possesses a nuanced, but unique spatial pattern, and that certain crimes are more closely associated with the spatial pattern of graffiti. Each crime type is visually represented in both a heat map and standard deviational ellipse layout, both of these visual representations offer insight on spatial patterns of graffiti and crime.

The heat maps expose the locations of heavy clustering of graffiti and crime. Weapons, Narcotics, and Prostitution display the most parallel clustering to graffiti. The standard deviational maps measures the distribution of incidences, capturing the area by one standard deviation of where the respected variable would likely occur. The wider
the ellipse, the greater variability there is in location of incidences. The standard
deviational ellipse applies a more aggregate view of where the incidences are falling
than the heat map, as it attempts to capture where most of the points are falling within
the map and not as focused on point density. If the crime and graffiti ellipse’s largely
overlap, this signals that a substantial portion of both datasets are occurring in the same
area.
The last three maps – Prostitution, Narcotics, Weapons – illustrate a clear spatial relationship with graffiti, with parallel clusters to graffiti. The following maps will not have as similar clustering, but continue to display comparable spatial patterns.
The following graphs display standard deviational ellipse’s, comparing graffiti and select crime types. The more similar the ellipses are in shape, angle, and location, the more evidence that the two variables act and occur in analogous fashion.

Figure 12b: Graffiti Heat Map, Robbery Points, 2012

Figure 13a: Graffiti & Assault Standard Deviational Ellipse, 2012
Red: Graffiti, Purple: Assault
Figure 13b: Graffiti & Arson, Standard Deviational Ellipse, 2012
Red: Graffiti, Orange: Arson
Figure 13c: Graffiti & Burglary, Standard Deviational Ellipse, 2012
Red: Graffiti, Navy: Burglary

Figure 14d: Graffiti & Narcotics, Standard Deviational Ellipse, 2012
Red: Graffiti, Lime: Narcotics
Figure 14e: Graffiti & Vehicle Theft, Standard Deviational Ellipse, 2012
Red: Graffiti, Forest Green: Vehicle Theft

Figure 14e: Graffiti & Weapons, Standard Deviational Ellipse, 2012
Red: Graffiti, Blue: Weapons
The standard deviational ellipse maps shed light on the average and distribution of graffiti and crime, offering a more broad view of where most of the graffiti and crime points are falling. These standard deviational ellipse maps reinforce that graffiti and crime share a spatial relationship. All the crime types, with the exception of weapons, nearly showed the same area and shape as graffiti.

**Graffiti Clean Up**

This investigation of spatial patterns of crime and graffiti offers a new method and lens to explore the broken windows theory, however, without the longitudinal data available, assuming causation is an impossible task. If the broken windows theory claims that graffiti leads to crime, it’s inferred that reduced graffiti leads to less crime. This is largely the incentive for municipal governments to invest public money in graffiti abatement programs. While the data demonstrates that San Francisco from 2008 to 2012 has overall improved the time it takes to clean up graffiti on public property, the data exposes the new commitment of San Francisco in the campaign to clean streets of graffiti. In 2008, the city of San Francisco only recorded 43 instances when they cleaned up graffiti in less than 24 hours. This number grew exponentially by 2010, where the city removed 2,150 incidences of graffiti in less than 24 hours. By the first 10 months of 2012, the city had removed 2,718 incidences of graffiti in less than 24 hours. The data demonstrates that the city has not had a long history of promptly graffiti removal, but is taking steps in order to improve.

The data on graffiti abatement exposes neighborhood discrepancies, inconsistencies exist with targeted supply of timely abatement services and
neighborhood demand. While abatement services do respond to where demand is highest – Mission and Tenderloin – it does not supply timely abatement service to fully meet demand and redirects its resources in neighborhoods with less reported graffiti. The most noticeable comparison would be Haight & Ashbury district, specifically near Kezar stadium; this area experiences the highest concentration of promptly graffiti removal of less than 24 hours. In 2010, the Haight district was responsible for 7% of all reported graffiti. In contrast, the Mission district was responsible for just over a fifth of all reported graffiti in the city. Yet, the amount of reports that were cleaned in less than 24 hours did not match the above figures. Instead, out of all the graffiti reports that were cleaned in 24 hours in 2010, 10% of those were in the Haight, while the Mission district experienced only 7% of all graffiti removal jobs conducted in less than 24 hours. In 2012, graffiti in Haight & Ashbury only made up 4% of city wide graffiti, nearly reducing graffiti reports in half. While there is not enough evidence to argue this claim, it can be suggested that timely graffiti removal in the Haight discouraged graffiti writers and led to decreased graffiti rates in the future. The largest area that received the least amount of clean up jobs performed in less than 24 hours was SOMA district, followed by the Tenderloin, and South of Mission near South Van Ness and Harrison Street.

Income

Sampson and Raudenbush argue against the broken windows theory, claiming that the relationship between graffiti and crime is better explained as a byproduct of concentrated poverty. Taking this approach, we would assume that the census tracts with the lowest per capita income and median household income would host the largest
volumes of graffiti. Both per capita income and median household income data leads to incomplete support for Sampson and Raudenbush’s concentrated poverty hypothesis, and offers room to signal that other variables at shaping the spatial configurations of graffiti and crime. While low levels of per capita income and household median income in Downtown/Civic Center can claim concentrated poverty as a precursor to crime, it cannot fully explain the spatial trends of graffiti and crime in other parts of San Francisco. All the census tracts in Bayview, Excelsior, Visitation Valley, Crocker Amazon, and Ocean View districts represent the lowest levels of per capita income. Not only is this one census tract, but the compilation of all these adjacent census tracts would make it a conglomerate of concentrated poverty. If the concentrated poverty theory held true, it would be expected that these areas would have the highest volumes of graffiti, and that simply is not the case in San Francisco.

Figure 9f: San Francisco Per Capita Income Data, 2010

Figure 9f: Graffiti in San Francisco, 2010
As the maps reflect above, there is not significant graffiti clustering in areas of concentrated poverty. If Sampson and Raudenbush’s theory held, the southern portion of San Francisco should be infested with graffiti points, but that is not the case here. Further, while the Mission District ranks fairly low on the percentile of per capita income citywide, it is contains the same levels that many census tracts have in the western portion of San Francisco. Therefore, if the theory of concentrated poverty held, we would expect that these areas would also be hit hard by graffiti, and this is completely not the case. The western portion of San Francisco, which contains the Sunset, Outer Sunset, Lakeshore, Richmond, are the districts that host the least amount of graffiti and crime. However, the complimentary argument of Sampson and Raudenbush’s concentrated poverty carries greater validity. Districts that are composed of concentrated wealth do not host graffiti. Noe Valley, Marina, Pacific Heights and any other neighborhood in the two upper crust percentiles is not a center for graffiti.
Conclusion:

My data exposes a spatial correlation between graffiti and crime in San Francisco from the years 2008 to 2012. By conducting a yearly analysis, the research shows that graffiti and crime are spatially correlated, and that specific crime types share spatial configurations and patterns with graffiti. Further, the data demonstrates that neighborhood bias exists in graffiti abatement treatments, but San Francisco’s recent commitment to timely graffiti removal disables conclusions to be made on the effectiveness of graffiti abatement practices. Lastly the data examines the role income and poverty play in shaping graffiti and crime, and the data concludes that income is an incomplete precursor to determining levels of graffiti.

The research does not attempt to assume causation between graffiti and crime. Rather, the research introduces a new method of observing graffiti and crime in a spatial lens, in a site that has not been explored by academics. While the paper cannot solve the broken windows theory, it contributes by offering a new spatial lens to view the relationship between graffiti and crime, a new site of study, dissects crime from its aggregate to specific types, and finds inconclusive evidence of income being the sole precursor to graffiti.
Work Cited Page


