



Spatial analysis of graffiti in San Francisco

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A B S T R A C T

Graffiti, as a social phenomenon, has been with us since people first began painting on cave walls. Our responses to graffiti range from recognition of artistry, to interpreting it as a sign of urban decay and disorder. Major cities respond to tax-payers with this latter response by providing graffiti abatement programs, often at substantial cost; thus, understanding and mitigating the causes of graffiti has tangible value. Using spatial analysis, we explore the combined causes of graffiti creation and the subsequent reporting of graffiti for removal in San Francisco, CA, USA. Using a combination of census data and city data, we identify five factors that have significant correlation to graffiti reports, and use them to build a regression model. We show that graffiti is created in areas with high densities of young males, and that commercial zones have the highest rate of graffiti reports. We show that a Geographically Weighted Regression model of these five factors explains over two-thirds of the variation in graffiti reports in San Francisco. Further, our findings are consistent with the dual hypotheses of graffiti as a form of communication or advertising aimed at a target market of other young males, along with the broken window thesis of graffiti interpreted as a sign of social disorder.

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Introduction

Graffiti has been with us for as long as human history; anthropologists speculate that some prehistoric cave paintings are graffiti, with the majority, according to statistical analyses, drawn by teenage males (Carey, 2006; Guthrie, 2005). According to the Oxford Dictionary, the term “graffiti” is defined as “writing or drawings scribbled, scratched or sprayed illicitly on a wall or other surface in a public place,” and certainly cave paintings fit this model. By 1868, the graffiti in Pompeii was recognized as a record of social, political and domestic life, though with a focus on what was politely described, with some disappointment, as “ordinary people” (Baird & Taylor, 2010).

More than 150 years later, our response to graffiti is multi-faceted. There is recognition of its status as art (Lachmann, 1988); graffiti as a reflection of societal customs and attitudes and their change over time (Stocker, Dutcher, Hargrove, & Cook, 1972); as a method to attain notice or fame (Halsey & Young, 2002, 2006; Lachmann, 1988); as a form of political statement (Ferrell, 1995) or as territorial markers (Ley & Cybriwsky, 1974). More recently,

there has been a recognition – or a creation of – a distinction between graffiti and street art or community art (a form of legitimized graffiti) (Mcauliffe, 2012), and the latter’s claimed role in urban renewal (Schuermans, Loopmans, & Vandenaabeele, 2012). Graffiti may even be viewed as integral to the urban character of a place and in so doing become a tourist attraction (Dovey, Wollan, & Woodcock, 2012). A single city may have a variety of responses – from tolerance to zero-tolerance – at a single time, reflecting the different stances of local government officials, and changing as new officials are elected (Mcauliffe, 2012). However, graffiti is commonly seen by local residents and municipalities as a nuisance and sign of criminality and danger (Cresswell, 1992b; Doran & Lees, 2005; Glazer, 1979; Hung, Ly, & Ngo, 2010; Mcauliffe, 2012). In this view, graffiti is perceived as a sign of public disorder, along with public intoxication, garbage and abandoned cars (Sampson & Raudenbush, 2004). The much-quoted “broken window” theory of urban decline (Kelling & Wilson, 1982) holds that a single, unfixed broken window (or graffito) can lead to breakdown of community. As such, city agencies are expected by a subset of citizens to actively control and remove graffiti. At the same time, active removal of graffiti is expensive, as is the constant surveillance required to detect graffiti. Thus, some cities including San Francisco now require removal of graffiti by property owners within an established time period (San Francisco Public Works Code Article 23, n.d.). City agencies in San Francisco spend more

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than \$20M annually for graffiti abatement (Gathright, 2010). In 2009, San Francisco initiated a program called Zero Graffiti for a Beautiful City, where they attempted to reduce graffiti through a combination of community involvement and law enforcement.

To facilitate reporting of graffiti, as well as other civic nuisances, systems have been developed for citizens to report these nuisances using smart phones or web-based applications (DeMeritt, 2011). The availability of volunteered geographic information (VGI) has increased rapidly in recent years and attracted the attention of numerous scholars (Budhathoki, Nedovic-Budic, & Bruce, 2010; Elwood, Goodchild, & Sui, 2012; Flanagan & Metzger, 2008; Goodchild, 2007) as a new form of geographic information with much potential. Cities are actively using such volunteered information in order to engage and respond to citizens (Johnson & Sieber, 2013). This approach has a number of advantages for managing graffiti as it minimizes the surveillance costs, and allows the city to focus on removal activities. In addition, it aligns city expenditures on graffiti removal from public property with the citizens most concerned about graffiti. However, in areas where citizens tolerate graffiti, presumably because they do not see it as a threat, the citizens may be less likely to report that graffiti to the city. Other areas where citizens feel empowered, such as high income areas presumed to see little graffiti, may still actively report it.

The reporting of graffiti is, however, not always consistent with the presumed reasons for creating graffiti. If graffiti artists are creating graffiti as a political statement to undermine the existing power structure, it might be expected that they make those statements in areas where the power structure is strongest – that is, high income residential and commercial areas, or in other areas of power, such as near police stations. If graffiti artists are creating graffiti to control public space, it might be expected that they make those statements in areas where the public space is most contested (Mcauliffe, 2012). On the other hand, if graffiti artists are establishing identities or communicating with other artists, predominantly young men, they may choose to do so in their own neighborhoods (Ferrell, 1995; Mcauliffe, 2012; Monto, Machalek, & Anderson, 2013). The relationship between graffiti reports and actual graffiti is a complex one; it reflects differential acceptability of graffiti by location (Cresswell, 1992a, 1992b; Haworth, Bruce, & Iveson, 2013; Shobe & Banis, 2014). We would expect these differences to be reflected as detectable spatial variation in the reporting of graffiti.

Our analyses take a mixed approach by using a quantitative/statistical approach to understanding phenomena that are most often analyzed qualitatively. The spatial distribution of graffiti is a social process for which little or no quantitative analysis has been performed. By performing quantitative analysis of spatial patterns of graffiti against available demographic data that reflects spatial variations, we seek to identify correlations that either help support existing hypotheses, or identify predictive factors that may lead to new research and new hypotheses. In particular, we may be able to see the geospatial relationship of graffiti reports to public spaces, residential or commercial zoning, and population factors such as income levels, gender and age densities.

This study, therefore, investigates the statistical support for a previously unexplored tension. Extensive interviews with graffiti artists describe the effort graffiti artists go to in selecting the locations for their graffiti (Halsey & Young, 2002) and the thrill the artists experience when their graffiti is noticed (Lachmann, 1988; Monto et al., 2013). These artists, today as in prehistory (Carey, 2006; Guthrie, 2005), tend to be young males (Austin, 2001; Castleman, 1982; Ferrell, 1995; Miller, 2002; Monto et al., 2013). We test support for the hypothesis that the most graffiti will be created where the graffiti artists' target market is located (Lachmann, 1988; Monto et al., 2013). In practical terms, this

translates to locations with a high percentage of resident young males, or locations in which young males are likely to congregate or travel through; this is similar to the relationship frequently reported between the burglary locations and offender residence, and between the relationship between major roads and burglar risk (Breetzke, 2012). We can identify locations with a high percentage of resident young males from census data. Given limited data on locations where young males may travel to or through, we assume that their travel patterns will mirror the general population, and so used commercial districts and arterials as proxies for these locations.

On the other hand, many researchers (Cresswell, 1992b; Glazer, 1979; Hung et al., 2010; Kelling & Wilson, 1982; Sampson & Raudenbush, 2004), hypothesize that another segment of the population will see graffiti as a sign of social disorder in well-to-do neighborhoods, to be discouraged; that is, parents of young males, and commercial property owners concerned that the appearance of local criminality and danger (as represented by graffiti) will impact their business. We test statistical support for this hypothesis that areas with a high proportion of young males or percentage of commercial property will be correlated with the highest number of graffiti reports.

Study area

The city of San Francisco is located at the tip of the San Francisco peninsula in California. It is the center of a larger Bay Area region of 7.5 million people that includes cities such as San Jose and Oakland. As of 2010 by the (U.S. Census Bureau, 2010), the city had a population of around 805,000 people, and a mainland area of approximately 11 km², giving it a density of around 73,180 people per km². Fig. 1 shows the study area with some key neighborhoods noted. The densely-populated city mixes numerous commercial zones along arterials with residential zoning, and has a small but increasing amount of mixed-use commercial-residential zones along arterials. Downtown and the financial district, with their cluster of commercial properties, are found in the northeast, and industrial lands are primarily located along the eastern waterfront; these areas tend to be low-lying, with little elevation change. The geographic center of the city includes gentrified neighborhoods such as Haight-Ashbury and Hayes Valley, located at higher elevations on steeper slopes, as well as the diverse and vibrant but rapidly gentrifying Mission District. The southeast part of the city is home to predominantly Hispanic and Asian neighborhoods, and both the northwest and southwest are dominated by park lands.

Data

The study period encompassed San Francisco's calendar 2009 and 2010. Table 1 lists the datasets used for this study. In this study, we used voluntary geographic information (VGI) collected by San Francisco's Department of Public Works reporting system during calendar years 2009 and 2010, just after the Zero Graffiti for a Beautiful City program began. Individuals are often in the best position to, and are much more likely to, provide current information about local conditions, and have been found to be more likely to report using digital systems (Feick & Roche, 2013; Flanagan & Metzger, 2008; Gira, Bédard, & Roche, 2010; Miller, 2010). The graffiti reports are unprompted responses reflecting visceral reactions to graffiti in the local environment, rather than artificial responses such as those solicited in periodic surveys. There are several reasons why this dataset might be skewed; for example, although the reporting system accepts both online and telephoned reports, it might be underrepresent those without access to either of these tools. However, the length (two years), coverage (the whole

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