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Does it Matter Where? Evaluating the Spatial Heterogeneity of Police Post-Stop Enforcement

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ABSTRACT AND ARTICLE INFORMATION

Scholars know relatively little about how the location of a pedestrian police stop affects the racial distribution of post-stop outcomes, including the initiation of a search or a field interview. To address this gap, this research draws on a unique data set from San Jose, California, and underutilized spatial methods to examine the extent to which conflict theory explains post-stop enforcement patterns. We consider two iterations of the theory: (1) the racial threat hypothesis, which posits that Blacks and Hispanics are more aggressively policed in minority neighborhoods, and (2) the racial incongruity hypothesis, which holds that police tend to target minorities occupying concentrated White spaces. Hierarchical linear modeling (HLM) models indicate that Blacks and Hispanics face more aggressive post-stop enforcement than Whites but that stop location is not predictive. By contrast, geographically weighted regression (GWR) analysis shows that police are more likely to initiate searches and field interviews of Blacks and Hispanics in areas with high concentrations of White and minority residents. These findings illustrate the nuanced relationship between stop location, pedestrian race, and police behavior. Conflict theory is a valuable lens through which to view post-stop enforcement, yet evidence to support the minority threat and racial incongruity hypotheses was only visible at the micro level. This research adds to existing scholarship by demonstrating the utility of GWR in teasing out the nuanced, micro-level relationship between stop location and pedestrian race not captured in more traditional models.

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This research examines the relationship between stop-question-frisk (SQF) policing, race/ethnicity, and crime by considering the extent to which the specific, micro-location of a pedestrian stop helps to explain an officer's decision to initiate a search or field interview. We use conflict theory to frame the analysis, testing the applicability of two related propositions, the *minority threat hypothesis*, which posits that non-Hispanic Blacks (henceforth Black) and Hispanics are more aggressively policed while occupying highly concentrated minority spaces, and the *racial incongruity hypothesis*, which holds that police tend to target minorities who occupy non-Hispanic White (henceforth White) spaces. In addition to both policy and theoretical relevance, this work also makes an important methodological contribution. Drawing on administrative data from the San Jose Police Department, we nest post-stop outcomes within stop location using hierarchical linear modeling (HLM) to determine how neighborhood composition shapes enforcement outcomes. This allows us to consider conflict theory in the context of San Jose's unique racial/ethnic and socioeconomic composition.

To account for inherent weaknesses in this approach, HLM models are limited by their assumption that the associations identified will be consistent across the city, overlooking that they will more likely vary within and between neighborhoods, which is known as spatial heterogeneity (Yang & Matthews, 2012). We use geographically weighted regression (GWR) to examine the spatial heterogeneity of the associations identified. GWR is an exploratory technique that allows us to generate empirically determined coefficients for each of the 22,363 pedestrian stops in the dataset. Incorporating the spatial structure of these relationships leads to a more nuanced, individualized assessment of the interaction between pedestrian race/ethnicity and post-stop enforcement context.

Our analysis, the first to examine pedestrian post-stop outcomes by comparing HLM and GWR, revealed mixed support for each theoretical proposition tested. These results enhance understanding of how racial incongruity and minority threat, operating individually and in conjunction, inform understanding of how police outcomes are distributed in an urban environment. This work also highlights the salience of analytical methods when evaluating the influence of spatial variables on officers' discretionary decisions.

Literature Review

Pedestrian Stops, Crime, and Race/Ethnicity

For decades, police in the United States have used pedestrian stops as a means of investigating suspicious circumstances (National Advisory Commission on Civil Disorders, 1968; Schwartz, 1967). In 1968, the Supreme Court clarified the law surrounding this technique, interpreting the search and seizure provision of the Fourth Amendment to allow police officers authority to detain an individual temporarily, even in the absence of probable cause, if the officer reasonably believes that the person is armed and dangerous and has or is about to engage in criminal behavior (*Terry v. Ohio*, 1968). In the years since, police departments across the United States have incorporated this type of pedestrian stop, commonly referred to as 'stop-question-frisk,' or SQF, into broader strategic efforts to control crime (White & Fradella, 2016). In many instances, police have concentrated the use of SQF in crime hot spots to maximize their efficiency as an instrument of deterrence and incapacitation (Apel, 2016).

Empirical research into the effects of pedestrian stops on crime has shown mixed results. In some cases, aggressive use of pedestrian stops has correlated with lower crime rates, though opinions vary as to the scope and durability of the effects (Ratcliffe et al., 2011; Rosenfeld & Fornango, 2017; Weisburd et al., 2016; Wooditch & Weisburd, 2016). In other instances, scholars have found little or no crime-related benefit (Fagan & Davies, 2000; Rosenfeld & Fornango, 2014). On balance, the existing SQF-crime research highlights the challenge of analyzing crime patterns across space and time and the sensitivity of these issues to changes in research design and empirical strategy (Petersen et al., 2023).

What is clear is that any benefit attributable to SQF will only be realized if the program is implemented in a lawful manner, a determination predicated in part on equitable racial distribution of both stop and post-stop outcomes (White & Fradella, 2016). In 2013, the NYPD's use of SQF was found to violate both the Fourth and Fourteenth Amendments (*Floyd v. New York*, 2013). The court held that the NYPD "adopted a policy of indirect racial profiling by targeting racially defined groups for stops based on local crime suspect data.... Both statistical and anecdotal evidence showed that minorities [were] indeed treated differently than whites" (p. 12). Judges reviewing stop-and-frisk programs in other jurisdictions, including Philadelphia (American Civil Liberties Union, 2011), Chicago (Madhani, 2015), and

Milwaukee (Choudhury, 2018) have made similar findings.

The challenge of developing a valid indication of race-based disparities in the distribution of pedestrian stops was acknowledged in the NYPD opinion and has been well-documented by scholars (see Gelman et al., 2007; Ridgeway, 2007). Central to this puzzle is the task of acquiring data that serve as an accurate benchmark against which to compare stop patterns (Walker, 2001). A rough consensus has formed around the use of statistical models that control for the racial and criminological composition of the stop context.

Using variants of this approach, several scholars have drawn on data from New York City to test the premise that in the absence of bias and net of contextual and situational factors, stop patterns should not vary by race or ethnicity. On balance, the results have nearly all supported the finding that Blacks and Hispanics are over-stopped compared to Whites, though variance exists across both effect size and scope (Coviello & Persico, 2015; Fagan et al., 2010; Ferrandino, 2015; Goel et al., 2016; Kramer & Remster, 2018; Ridgeway & MacDonald, 2009; but see Coviello & Persico, 2013). Data from other jurisdictions largely conform to the findings from New York (Ayers & Borrowovski, 2008; Hannon, 2020).

A related line of research has considered post-stop outcomes to evaluate the racial impact of pedestrian stops. As with the stop-based analysis, data show that in most circumstances, Blacks are more likely than their White counterparts to face aggressive post-stop enforcement (Coviello & Persico, 2015; Gelman et al., 2007; Hannon, 2020; Levchak, 2017). This work also indicates that despite facing greater odds of being frisked and searched, stops involving Black pedestrians are less likely to lead to either an arrest (Coviello & Persico, 2015; Gelman et al., 2007) or the discovery of illegal contraband (Hannon, 2020). Very few studies have focused explicitly on examining how police stop and post-stop enforcement affects members of Asian-Pacific Islander (API) communities. Research that has accounted for APIs have consistently found little if any disparate impact compared to similarly situated Whites (e.g., Ridgeway, 2007; M. R. Smith et al., 2019; Withrow, 2007).

Despite the continued effort to articulate the racial distribution of stop-and-frisk enforcement, there is room for a deeper analysis of how these patterns vary across space. Some scholars have compared enforcement at the precinct level (Levchak, 2017), while others have included census tract (Zhao et al., 2019) and block-level controls (Wu & Lum, 2017). A wide range of the statistical techniques have been employed to identify and isolate the effects of spatial

variables (e.g., Ferrandino, 2015; Gaston, 2019a; Hannon, 2020). In light of these inconsistencies, and given the import of the relationship between SQF and crime, between crime and geography, and the influence of race and ethnicity on all three, more careful attention to the interaction between pedestrian race/ethnicity and stop context is warranted.

Conflict Theory

Conflict theory posits that society's most powerful groups use public policy to control minority interests that they perceive as threatening in an effort to defend their economic, political, and social interests (Quinney, 1973; Turk, 1969). To that end, crime control efforts in minority communities reflect in-group fear of out-group crime and the perceived link between race and violence (Anderson, 2013). This view holds that arguments made to expand the size, scope, and aggression of pertinent legal institutions occur in accordance with the White majority's efforts to control "dangerous groups and strata, rather than the mere suppression of illegal activities" (Novak & Chamlin, 2012, p. 279). The protection of majority status and the wealth, safety, and control that define such a position are linked inextricably with the defense of White spaces through instruments of formal social control (Blalock, 1967).

Two related hypotheses articulate how these forces operate in practice. The first, known as the *minority threat hypothesis*, holds that the relative size of an area's racial and ethnic minority population is correlated with heightened threats of crime and danger among the majority (Quillian & Pager, 2001; Weitzer, 2010). Elevated fear of crime among the majority population has been buoyed by empirical evidence that crime tends to concentrate in areas with high shares of both minority residents and concentrated disadvantage (Brantingham & Brantingham, 2013; Pratt & Cullen, 2005; Sampson et al., 1997). The perceived link between race/ethnicity, poverty, and crime undergirds the deployment of police resources and aggressive enforcement tactics in these non-White neighborhoods (Kane et al., 2013; Legewie, 2016; Stults & Baumer, 2007). The sense among police that residents in these areas harbor anti-police attitudes and are more likely to engage in "dangerous and uncooperative" behavior reinforces these perceived links (Shjarback et al., 2017, p. 18; see also Petrocelli et al., 2003).

A second derivation of conflict theory, known as the *racial incongruity hypothesis*, holds that people occupying spaces where they appear to be out of context represent a heightened criminal threat and thus warrant additional scrutiny (Boyles, 2015; Gaston, 2019a). This view, motivated by the same majoritarian interests driving the minority threat hypothesis, is also predicated on the understanding

that the existing social and economic order is defined by segregated spaces (Anderson, 2013; Massey & Denton, 1993; Sampson et al., 2018). Black and Hispanic people are viewed as an unusual presence in White neighborhoods and thus are assumed to be suspicious if not dangerous (Anderson, 2013). This outlook is consistent with the working rules and everyday experiences of the police (Glover, 2007; Novak & Chamlin, 2012; Welsh et al., 2021).

Police officers train to develop the skill and understanding of relevant locations to identify individuals, behaviors, characteristics, and circumstances as suspicious and potentially criminal, or what Withrow (2004, 2007) terms *contextual attentiveness*. Meehan and Ponder (2002) note that critical to this process is coming to understand “what should typically occur in an area and who belongs as well as where they belong” (p. 402). What defines the “usual, customary, or expected” (Withrow, 2007) is a function of the various individual and structural factors that characterize an officer’s sense of the environment and the enforcement context, including, critically, the racial composition of the area, its relative level of safety, and the physical appearance of the people who occupy its public spaces (Bass, 2001; Klinger, 1997; Lynch et al., 2013; Shjarback et al., 2017; D. A. Smith, 1986; *Whren v. U.S.*, 1996).

Empirical research has shown that Blacks and Hispanics face disproportionate levels of police enforcement, a set of findings that are particularly clear in the context of both traffic-related and pedestrian encounters (e.g., Gelman et al., 2007; Pierson et al., 2020; Rojek et al., 2012). Somewhat surprisingly, given the degree to which neighborhood context shapes both crime patterns and other relevant police behavior (Gaston, 2019a; Kane, 2003; Legewie & Fagan, 2016; B. W. Smith & Holmes, 2014), scholars know much less about how stop location affects the volume and intensity of police encounters and, critically, whether the interaction between race and space influences the distribution of post-stop enforcement outcomes. The extant research has shown mixed support for both the minority threat and racial incongruity hypotheses.

Carroll and Gonzalez (2014) used a series of generalized linear models to evaluate traffic stops patterns across the state of Rhode Island. Results showed that driver race did not influence the odds that police would initiate a frisk following stops in and around Providence, the racially diverse state capital. However, when stops occurred in predominantly White cities and towns across the rest of the state, Black drivers were four times more likely to be frisked than Whites, consistent with the racial incongruity hypothesis. Shjarback and colleagues’ (2016) review of stop data from 150 jurisdictions in Illinois and

Missouri showed a similar pattern: Black and Hispanic drivers were more likely to be stopped while driving through majority-White jurisdictions compared to those with larger minority populations. Gelman and colleagues (2007) also found a pattern of racial incongruity in NYPD pedestrian stops, with data showing that Blacks were over-stopped in homogenous, predominantly White precincts.

Empirical support for the racial incongruity hypothesis has not been limited to minorities stopped in White spaces. Data from both Portland, Oregon (Renauer, 2012), and Kansas City, Missouri (Meehan & Ponder, 2002), suggest that post-stop enforcement became more aggressive as the percentage of White residents in a neighborhood increased. Gelman and colleagues (2007) also found that the NYPD disproportionately stopped White pedestrians in several majority Black precincts in the Bronx where open-air drug markets were “common” (p. 822).

Other single-jurisdiction research has shown mixed support for the minority threat hypothesis. Petrocelli and colleagues’ (2003) review of Richmond, Virginia, data showed no relationship between stop volume and census-tract level demographics, though drivers of all races were more likely to be searched following stops in locations with higher concentrations of Black residents. A more recent analysis from Houston, Texas, also found some support for the minority threat perspective: Traffic stops, consent searches, and felony arrests were each more likely in police beats with higher minority population shares. Additional post-stop outcomes, including investigatory stops and probable cause searches, did not vary by beat (Roh & Robinson, 2009).

Fagan and colleagues (2010) used a multilevel approach to evaluate pedestrian stop-and-frisk enforcement across 55 New York City “subboros.” Data showed a clear correlation between stop volume and the size of Black population in the neighborhood where the stop occurred, despite evidence that such an approach led to the discovery of contraband and subsequent arrest in less than five percent of encounters. Levchak (2017) also evaluated stop and frisk in New York City using crime and demographic data to estimate post-stop enforcement across the NYPD’s 77 precincts. A series of multilevel logistic regression models showed that Black and Hispanic pedestrians faced greater post-stop enforcement odds than Whites and that enforcement generally tended to be more aggressive in minority neighborhoods. Levchak’s analysis of the interaction between race/ethnicity and stop location demographics showed marginal and inconsistent effects.

A third study of the NYPD’s SQF regime provides further insight into the complexity of the

issue and the significant amount of work that remains. Ferrandino (2015) tracked pedestrian stops and post-stop outcome patterns across NYC's 255 neighborhoods. What differentiates this study from others is the granularity with which Ferrandino (2015) classified neighborhood demography. In addition to analyzing relatively small geographic entities, each neighborhood is described in terms of the relationship between Black, Hispanic, and White population shares. The results varied widely by race, outcome type, and neighborhood racial composition. For example, Black pedestrians were frisked disproportionately in neighborhoods with a higher concentration of White residents but were no more likely than individuals of other races to be searched or sanctioned. Though these findings offer some support for the racial incongruity hypothesis, there was also evidence to the contrary. No such disparities were evident among White or Hispanic people stopped in areas where they would have appeared to be 'out of place.' Blacks and Hispanics were also more likely to face post-stop sanctions in neighborhoods with comparatively high shares of minority residents, in support of the broader minority threat hypothesis.

In sum, this small but growing literature has generated some support for conflict theory, but the need for further research is clear. Current research is characterized by the use of divergent empirical strategies and a wide range of key variables, units of analysis, and statistical methods. Notably, none of this work utilizes GWR. This research also disproportionately relies on data from New York City, raising questions about the generalizability of its findings. Finally, analysis of the interaction between pedestrian race and stop location is rare, with meaningful implications for both conflict theory and understanding how neighborhood context affects the racial distribution of post-stop outcomes.

The Current Study

This research examines the degree to which conflict theory explains post-stop search and field interview enforcement patterns. Our inquiry is undergirded by two perspectives derived from conflict theory: (1) *racial threat*, which posits that Blacks and Hispanics are more aggressively policed in minority neighborhoods, and (2) *racial incongruity*, which holds that police tend to target minorities occupying concentrated White spaces. In line with both racial threat and racial incongruity, as well as findings from both traffic and pedestrian post-stop research, we anticipate that Black and Hispanic pedestrians will face more aggressive enforcement than Whites stopped under comparable circumstances:

H1: San Jose Police Department (SJPD) officers are more likely to subject Black and Hispanic pedestrians to post-stop enforcement (search, field interview) as compared to White pedestrians.

The minority threat hypothesis posits that majoritarian racial and socioeconomic interests align around the use of formal social control to defend White spaces from non-White interests. Because of the direct and indirect support for policing that is more frequent and more aggressive in non-White spaces, both in general and vis-à-vis Blacks and Hispanics, we expect to find the following:

H2: SJPD officers are more likely to search and field interview pedestrians of all races following stops in census tracts where Black and Hispanic residents concentrate.

H3: Black and Hispanic pedestrians stopped in neighborhoods with higher shares of Black and Hispanic residents will experience greater odds of post-stop enforcement than Whites stopped under similar circumstances.

The racial incongruity hypothesis argues that people occupying spaces where they appear to be out of racial context are inherently suspicious and represent a heightened threat. Police are trained to view neighborhoods as segregated spaces and to investigate circumstances that do not fit preconceived expectations of who and what belongs. Thus, we hypothesize that:

H4: Black and Hispanic pedestrians stopped in predominantly White neighborhoods and mixed neighborhoods with high levels of White residents will experience greater odds of being searched or field interviewed; and that

H5: White pedestrians stopped in predominantly Black and Hispanic neighborhoods and mixed neighborhoods with high levels of Black or Hispanic residents will experience greater odds of being searched or field interviewed.

Data

The primary dataset used for this analysis consists of 22,363 administrative records generated by SJPD officers following self-initiated pedestrian stops conducted between January 1, 2014 and August 28, 2017.¹ SJPD initiated the mandatory collection of pedestrian stop data on September 1, 2013 (Esquivel, 2013), requiring all sworn officers to document the date, time, and location of the stop, as well as the reason for the stop, and whether the stop resulted in one of several potential post-stop outcomes, including the

- issuance of citation or a warning,
- search,
- detention,
- field interview,
- discovery of contraband, and/or
- arrest.

influences of violent crime, property crime, and drug crime on the distribution of post-stop enforcement, we use SJPD crime records occurring during the study period.

Table 1: Neighborhood Race/Ethnicity Typology

Neighborhood type	Definition	N
Predominantly API (PA)	At least 50% is Asian/Pacific Islander; no one other racial/ethnic group represents more than 20%	53
Predominantly Hispanic (PH)	At least 50% is Hispanic; no one other racial/ethnic group represents more than 20%	65
Multiethnic (MULTI)	At least 20% White; at least 20% each is Non-Hispanic Black and Hispanic, Non-Hispanic Black and Asian/Pacific Islander, or Hispanic and Asian/Pacific Islander	73
Mixed White/Hispanic (MWH)	At least 20% non-Hispanic White; At least 20% Hispanic; no one other racial/ethnic group represents more than 20%	99
Mixed Hispanic/API (MHA)	At least 20% Hispanic; At least 20% API; no one other racial/ethnic group represents more than 20%	119
Mixed White/API (MWA)	At least 20% non-Hispanic White; At least 20% Asian/Pacific Islander; no one other racial/ethnic group represents more than 20%	109
Predominantly White (PW)	At least 60% non-Hispanic White; no one other racial/ethnic group represents more than 20%	57

Our analysis is driven by two dependent variables, measured dichotomously, including whether the stop resulted in (1) a search or (2) a field interview (FI). The field interview is an investigative technique used by the SJPD to gather information about potential criminality (SJPD, n.d.); FIs are commonly used to document gang membership and identify criminal suspects (O'Deane, & Murphy, 2010). Both search and FI follow stops that generate reasonable suspicion that a crime has or is about to be committed and thus present the most effective available measures to evaluate the aggressiveness of post-stop enforcement in the context of pedestrian race and neighborhood composition.²

We include several predictor variables, beginning with individual *race/ethnicity*. The treatment of White people serves as the reference category. Racial classifications were solely determined by the reporting officer, resulting in a low-level threat to measurement validity. Next, we identify *gender*, using males as the reference category.

In addition to these demographic variables, we also identify the justification for the detention, specifically whether it was done for the *safety* of the officer. This variable serves as a proxy for individual demeanor, which has been shown to affect officers' search decisions (Schafer et al., 2006), and allows us to account for the possible relationship between feelings of fear and the decision to initiate a search or field interview (Rojek et al., 2012).³ To control for the

To contextualize the enforcement and crime data, we employed the 2010-2014 wave of the American Community Survey (ACS), which provides a snapshot of San Jose's demography. As shown in Table 1, we grouped San Jose's 590 census tracts into seven categories based on their demographic composition. Neighborhoods that are at least 50% of one racial/ethnic group and no more than 20% of another racial/ethnic group are classified as either (1) Predominantly Asian/Pacific Islander, (2) Predominantly Hispanic, or (3) Predominantly White. Neighborhoods where two racial/ethnic groups comprise at least 20% of the population total and no other group represents more than 20% are considered mixed: (4) Mixed White-Hispanic, (5) Mixed White-API, and (6) Mixed Hispanic-API. The seventh category, Multiethnic, represents neighborhoods that consist of more than three racial/ethnic groups with at least 20% of the population share.

A typology approach is ideal because it allows us to directly measure the local racial/ethnic separation of populations, classifying tracts mixed with different groupings of Whites or non-Whites as well as singling out tracts predominately populated by one racial/ethnic group (Gibbons & Yang, 2014). This is of special importance given our focus on racially-driven motivators of police action. We also use the ACS to construct socio-economic measures of the city as part of supplemental analysis. More information on those measures is available upon request.

Note that both the ACS data and crime data are reported at the census tract scale, which serves as a proxy for local areas like neighborhoods. There is some discussion as to the best scale for which to report crime data, a debate at the heart of the modifiable unit area problem (MAUP; Hipp et al., 2012). Recent research has shown that census tracts are one of the more valid scales through which to measure the local effect of violence associated with crime (Vogel, 2016).

San Jose presents an interesting context within which to evaluate conflict theory, beginning with the nature of the city's diversity. San Jose is a majority-minority jurisdiction with a relatively even distribution of API (32.2%), Hispanic (33.2%), and White (28.7%) residents and a small Black population (3.2%). The share size and growth rate of San Jose's API population is noteworthy, as is the relatively small share of Black San Jose residents, which together distinguish the city from other large metropolitan areas (Frey, 2011; Hoeffel et al., 2012). This presents a unique opportunity to determine the particular disadvantage of Black populations when they are not a large share of a city's population. The city's relatively low level of residential segregation further distinguishes it from other more highly segregated jurisdictions like New York, Chicago, and Los Angeles, which supply the majority of data used to examine conflict theory (Frey, 2018; Silver, 2015). And yet, despite these differences, San Jose's police department continues to face allegations of racial bias against Black and Hispanic residents (Kaplan, 2015; Waller, 2020). What is more, it is one of the most expensive cities to reside in the United States.

Methods

This study draws on two analytical techniques to determine the association of local context to the presence and character of post-stop enforcement. We employ logistic HLM using the R package *lme4* to determine how specific stops relate to neighborhood context as measured by census tracts. HLM is an established method to determine how context relates to policing behavior (e.g., Reisig & Parks, 2004; Rosenfeld et al., 2007; Schafer et al., 2003). Through this method, we can nest stops within their respective census tracts to determine whether tracts explain some of the variation of stop characteristics. However, HLM is limited in that it treats local effects as spatially confined. Local phenomenon like police stops will likely vary within and between neighborhoods, a process known as spatial heterogeneity (Yang & Matthews, 2012). To better understand the spatial heterogeneity of police stops, we supplement these models with GWR.

GWR is an exploratory tool that allows us to unpack the relationships between post-stop outcomes and neighborhood context suggested in the HLM models, identifying relationships that HLM models cannot identify due to their non-spatial character. In this sense, logistic GWR explores the spatial variation of our post-stop variables across municipal San Jose (Fotheringham et al., 2003). As we have coordinates for each stop, the model below can be applied to our data:

$$\log\left(\frac{y_i}{1-y_i}\right) = \beta_{0i}(u_i, v_i) + \sum_{n=1}^k \beta_{ni}(u_i, v_i) * x_{ni}$$

Where y_i is the probability of reporting searches or field interviews, i denotes the coordinates of stop i , represents the explanatory variables ($n = 1, \dots, k$) discussed above for stop i , and represents the estimated association of variable n with search or field interview for stop i . We used the R package *spgwr* to implement the analysis. GWR is an extension of generalized regression models, and thus the interpretation of regression coefficients is largely consistent with that of HLM models (Brunsdon et al., 1998; Chen & Yang, 2012). Explicitly, the regression coefficient of a particular variable – for example, a person's race or ethnicity – at a specific location in the model indicates the change in the log-odds of experiencing a particular post-stop outcome given a one-unit change. As the model generates results for each stop in our data, we use two methods to describe our results. First, following previous studies (Brunsdon et al. 1998; Gibbons & Yang, 2018), we reported the estimates of conventional logistic results with a summary of local estimates (i.e., minimum, three quartiles, and maximum). Second, we mapped out select coefficients for each post-stop outcome analyzed. A corrected Akaike Information Criterion (AIC) was used to determine whether the logistic GWR model fit the data better than the conventional logistic model (Fotheringham et al., 2003). As a rule of thumb, when the difference in AICs between two models is larger than 4, the model with the smaller AIC is strongly preferred (Burnham & Anderson, 2002).

Results

Figure 1, which reflects the spatial distribution of our racial/ethnic typology, illustrates a combination of diversity and low levels of racial and ethnic segregation across the City of San Jose (Silver, 2015). Integrated, or mixed neighborhoods, which are reflected by Mixed White-Hispanic, Mixed White-API, and Mixed Hispanic-API tracts, are

commonplace. The pockets of racial and ethnic segregation that do exist tend to be dominated by White and API residents – Predominately API, Predominantly White, Mixed White-API, and Mixed White-Hispanic tracts. These tracts are largely found to the west of California State Route 82 (SR 82), a region of the city associated with higher socioeconomic status. By contrast, Predominantly Hispanic and Mixed Hispanic-API tracts, along with the city's few Black neighborhoods are mostly found to the east of SR 82.

end of the city, where the Predominantly White, Mixed White-Hispanic, and Mixed White-API tracts are concentrated. Hispanic stops cluster in mixed/predominant Hispanic areas and mixed/predominant API and White areas, while Black stops are clustered in select downtown areas. API stops also cluster downtown, as well as in the city's southeastern neighborhoods. It is worth noting that the correlation between stop clusters and crime is relatively weak. Also of note is the range of cluster

Figure 1: Racial and Ethnic Breakdown of San Jose

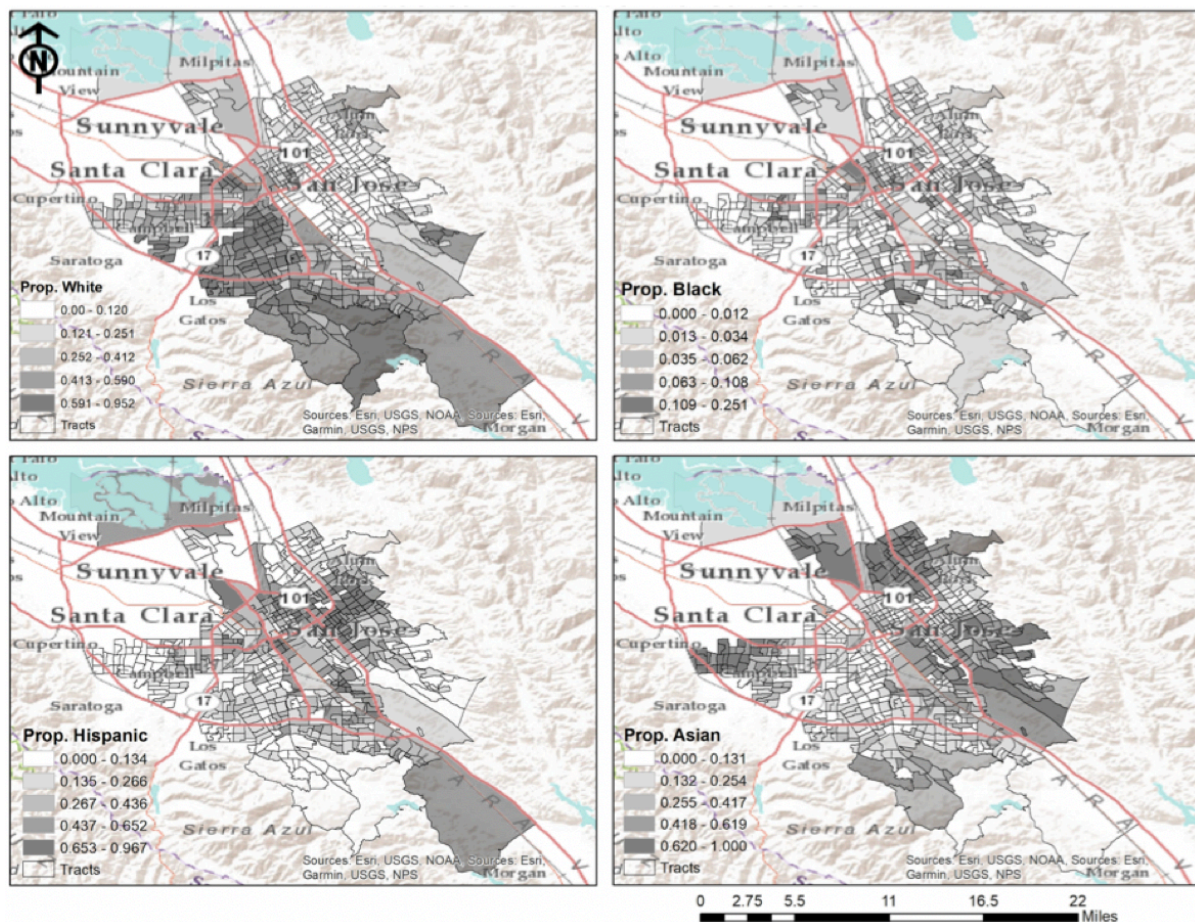
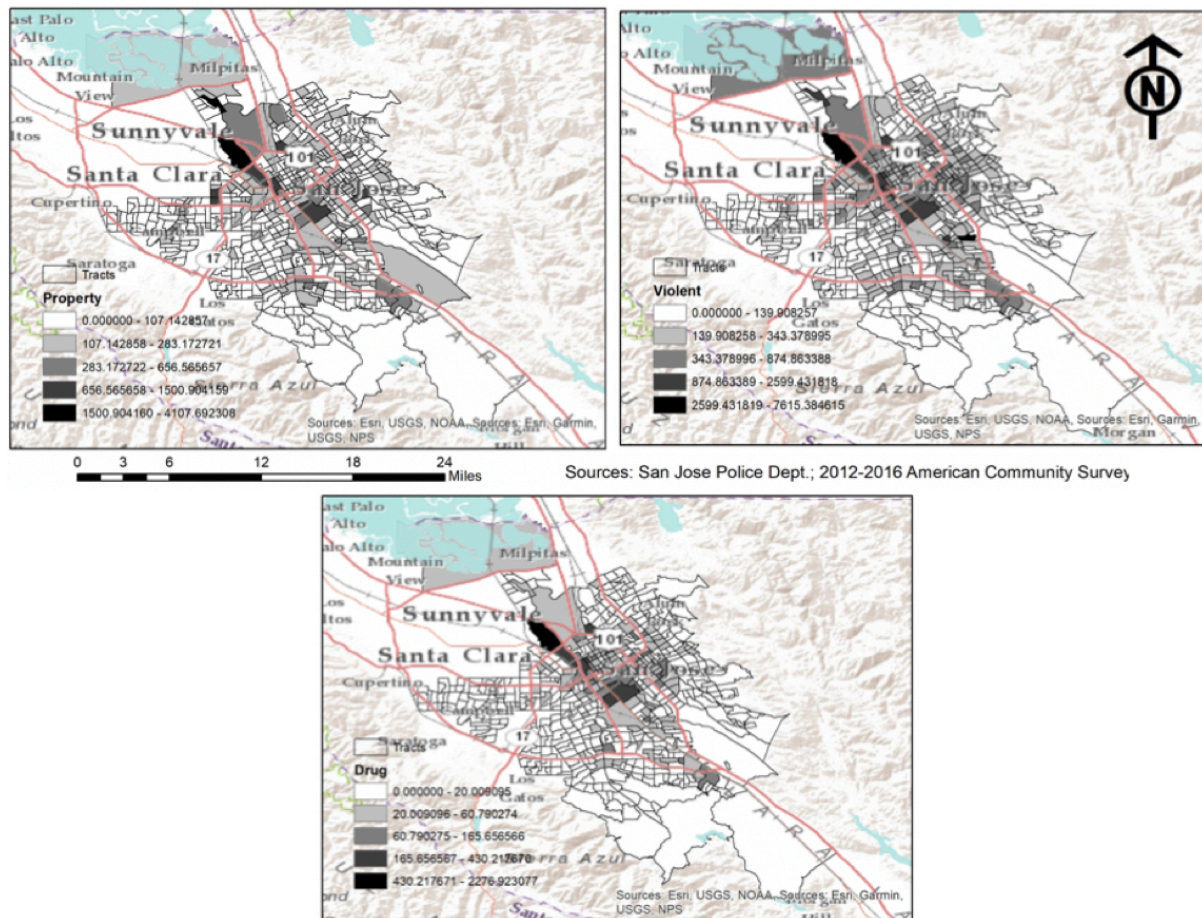


Figure 2 presents the spatial distribution of crime in San Jose by census tract, with three panels displaying property crime, violent crime, and drug crime. These visuals demonstrate that crime manifests in a consistent spatial pattern across the city, with its highest rates toward downtown locations and also appearing more likely in the city's eastern-most neighborhoods.

We evaluate the spatial distribution of police stops by race/ethnicity using Kernel Density estimation, as shown in Figure 3. The raw data show that Whites are most likely to be stopped in the western

‘intensity’; stops in White clusters max out at 4.7 stops per location, roughly 5 times less than the upper bounds of non-White stop clusters. This suggests an imbalance in terms of where stops are taking place by race/ethnicity, with non-White residents experiencing greater stop rates than Whites.

Table 2 highlights the distribution of police stops and post-stop outcomes by race/ethnicity. Nearly 47% of all stops result in a formal search. Hispanics are searched at the highest rate (48.9%), followed by Whites (41.7%). The raw data show that Black (36.8%) and API pedestrians (37.4%) experienced

Figure 2: Distribution of Crime, by Census Tract

relatively low search rates. SJPd subjects Black and Hispanic (5.5% for each group) pedestrians to field interviews at a rate slightly above the overall FI rate (5.3%) and more frequently than White (4.1%) or API (3.4%) pedestrians.

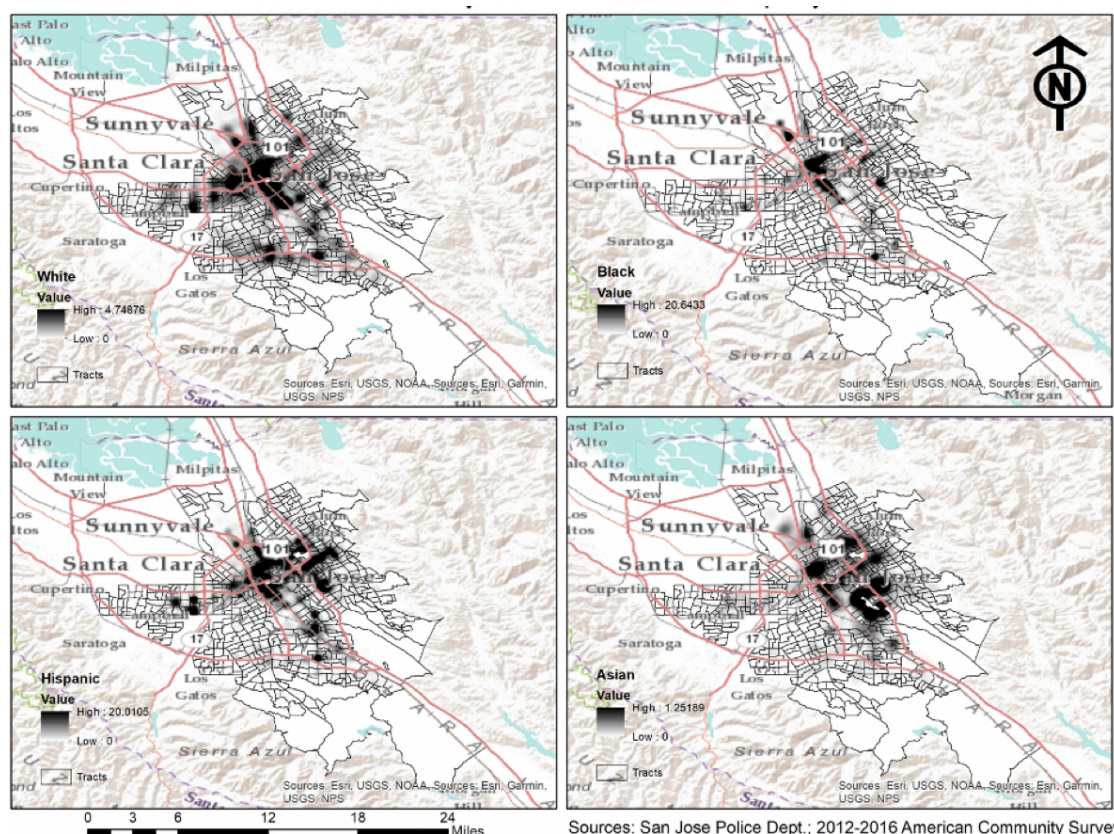
In sum, descriptive analysis of SJPd's post-stop enforcement does not conform to previous research or to our expectations, particularly in the case of Blacks and Hispanics. To determine whether these idiosyncrasies hold when accounting for contextual factors, we turn to our multivariate analysis, starting with the conventional aspatial, or 'global' analysis using logistic HLM.

HLM Analysis

In Table 3, we report the results of our global HLM analysis. Model 1 is an unconditional model that examines the presence and character of searches in San Jose. Whites and Predominantly White census tracts serve as the reference categories for the models, respectively. The data show that Hispanics are 32% more likely to be searched than Whites stopped under

similar circumstances (an Odds Ratio of 1 means the odds are the same for Whites to be searched). The Model 1 (Search Model, Level 1) results also indicate that SJPd officers are less likely to search Blacks and APIs, as compared to Whites.

In Model 2 (Search Model, Level 2), we incorporate census tract-level crime and demographic predictors. Data suggest that stop context has a moderating effect on the relationship between race and the decision to initiate a search. The associations for API, Black, and Hispanic individuals drop with the introduction of tract-level demographic data. Pedestrians stopped in several neighborhood types experienced greater search odds than those stopped in PW areas of San Jose, including Predominantly Hispanic (55.3%), Mixed Hispanic-API (50.7%), Mixed White-API (26.1%), and Multiethnic (33.8%). These findings are consistent with expectations described in *H2*. Search odds were unaffected by the inclusion of neighborhood violent, property, and drug crime rates. Notably, variables marking the interaction between race and stop context, developed to test

Figure 3: Pedestrian Stops, by Location and Subject Race

hypotheses related to minority threat (*H3*) and racial incongruity (*H4* and *H5*), showed no statistically significant effect on search outcomes and were thus omitted from Table 2.

Table 3 also shows the results of separate HLM models used to analyze how stop context affects field interview odds. Model 3 (Field Interviews, Level 1) shows that in the absence of tract-level controls, both Blacks (1.369) and Hispanics (1.419) face greater FI odds than White pedestrians. The inclusion of stop context narrows the gap somewhat, though FIs involving Black and Hispanic pedestrians remain significantly more likely than those involving Whites. Model 4 also suggests that FIs are less likely to occur in predominantly API and mixed neighborhoods. As was the case with our analysis of search data, the inclusion of interaction terms did not materially change the coefficients, and they were omitted.

To further explore the associations suggested by our HLM models, and with the hope of clarifying the nature of the interactions between race and enforcement context, which were nonexistent in the foregoing analysis, we turn to GWR. This exploratory method allows us to spatially unpack our coefficients to determine how they vary within and between San

Jose's racially concentrated neighborhoods and the city's more diverse areas.

GWR Analysis

Table 4 reports the log odds of each key post-stop outcome by race and stop context. Given that the GWR models separate results for all 22,363 stops in the data set, a five-value summary is the most efficient means of reporting the range of coefficients for each racial/ethnic group. As was the case with the HLM analysis, stops involving White people serve as the reference category.

The GWR coefficients range quite dramatically across both outcomes, suggesting that the relationship between race/ethnicity and the likelihood of post-stop enforcement may depend on where specifically a stop takes place. For example, in most stop contexts, SJPd police are less likely to search a Black person than a White one, as evidenced by the coefficients shown for Q1-Q3. However, the maximum log odds (0.981) suggests that in certain demographic conditions, Blacks are significantly more likely to be searched than Whites. The inverse is true of Hispanics, who are less likely to be searched in a small fraction of stop contexts but face substantially

Table 2: Pedestrian Stops and Post-Stop Outcomes, by Subject Race

Subject Race	Stops		Search*		Field Interview*	
White	4,693	21.8%	1,955	41.7%	190	4.1%
Black	2,945	13.7%	1,084	36.8%	162	5.5%
Hispanic	12,968	60.3%	6,340	48.9%	718	5.5%
API	908	4.2%	340	37.4%	31	3.3%
<i>Total</i>	<i>21,514</i>	<i>100%</i>	<i>10,057</i>	<i>46.8%</i>	<i>1,131</i>	<i>5.3%</i>

Note these totals omit stops, post-stop outcomes involving pedestrians characterized as ‘other’

*Rate determined with stops as denominator; +Hit rate determined using search as denominator

higher search odds in nearly all others, with the disparity reaching over 111% at the high end.

The field interview data show a different story. Blacks experience overwhelmingly disparate FI odds, ranging from 20.9% in the first quartile and 28.3 in the third, to an overwhelming 223% at the high end. The GWR analysis also shows wide FI disparities between Hispanics and Whites, ranging from 16% to 120% depending on stop location demography and crime profile. The odds that an API person will be field interviewed are also heavily dependent on stop context. In some areas, APIs are 300% less likely than Whites to face a FI; in others, APIs are 135% more likely to be field interviewed than Whites.

Though these findings are largely consistent with *H1*, they raise two critical questions in relation to our other more theoretically interesting hypotheses: Which of these coefficients are significant, and where, exactly, do they vary? To better contextualize our GWR estimates, we make use of a series of maps of San Jose, presented in Figure 3, which help to unpack the local spatial relations for Black and Hispanic coefficients based on the distribution of search and field interview incidence. In general, the more darkly an area is shaded, the stronger the magnitude of the coefficient. Areas that appear white show no statistically significant coefficients (p -value < 0.05).

When examining the distribution of coefficients for Black and Hispanic searches, which are presented in Figure 4, comparisons to the census tract-level racial demographics reported in Figure 1 are of use. Black pedestrians face disproportionately high search odds in three pockets across the city, the most pronounced of which encompasses several predominantly Hispanic and mixed Hispanic/API neighborhoods on the west side. This result is consistent with the minority threat hypothesis articulated in *H3*, which posited that Blacks and Hispanics would face greater search odds in neighborhoods with relatively higher minority population shares. Black-White disparities are also apparent, though less pronounced, in several largely

White areas toward the city center, providing some support for *H4* and the racial incongruity hypothesis. Note that violent, property, and drug crime are also concentrated in segments of this neighborhood cluster. Unlike results generated by our HLM analysis, which showed that across the city, Black pedestrians were less likely to be searched than similarly situated Whites, these data indicate that while little disparity exists in much of San Jose, Black pedestrians faced disproportionately high search odds in a small number of Predominantly Hispanic and Mixed White-Hispanic neighborhoods.

The GWR findings suggest that Hispanic pedestrians were more likely than Whites to be searched across most of San Jose, with the most pronounced disparities occurring in the Predominately White northwestern section of the city. White pedestrians experience higher search odds in several small neighborhood clusters toward the city center and a relatively large swath of heavily White neighborhoods to the south. These outcomes provide moderate support for the minority threat hypothesis (*H3*) and appear to contradict the racial incongruity view articulated in *H5*.

Black pedestrians experienced field interview disparities across several predominantly White and mixed White neighborhoods, along with certain multiethnic neighborhoods toward the city's northern and southern borders. Hispanic-White disparities are apparent across many of these same northern- and southernmost neighborhoods, in addition to several other predominantly White and mixed White/API areas to the west of SR 82. These data bring nuance to the disparities highlighted by HLM models 5 and 6, while lending support to the racial incongruity hypothesis articulated in *H4*. In sum, the GWR models suggest moderate support for the minority threat hypothesis (*H2* and *H3*) in the context of pedestrian searches and for the racial incongruity hypothesis in the context of field interviews.

Table 3: Odds Ratios of Searches and Field Interviews

	Search		Field Interview*	
	1 Level (Model 1)	2 Level (Model 2)	1 Level (Model 3)	2 Level (Model 4)
Black	0.860*** (0.051)	0.820*** (0.052)	1.369*** (0.107)	1.295** (0.113)
Hispanic	1.322*** (0.036)	1.226*** (0.038)	1.419*** (0.079)	1.347*** (0.087)
API	0.815*** (0.077)	0.798*** (0.080)	0.862 (0.195)	0.924 (0.200)
Female	0.443*** (0.070)	0.446*** (0.072)	1.298** (0.124)	1.153 (0.132)
Safety	5.271*** (0.050)	5.350*** (0.050)	1.513*** (0.082)	1.499*** (0.083)
Predominantly Hispanic		1.553*** (0.120)		0.870 (0.228)
Predominately API		1.169 (0.150)		0.360*** (0.347)
Mixed White/API		1.261* (0.133)		0.839 (0.257)
Mixed Hispanic/API		1.507*** (0.118)		0.852 (0.373)
Mixed White Hispanic		1.285** (0.121)		0.738 (0.232)
Multiethnic		1.338** (0.124)		0.656* (0.241)
Property Crime		1.000 (0.0002)		1.000 (0.0004)
Violent Crime		1.000 (0.0001)		1.000 (0.0002)
Drug Crime		1.000 (0.0005)		.999 (0.001)
Constant	0.627*** (0.031)	0.476*** (0.112)	0.038*** (0.071)	0.047*** (0.217)
Observations	21,496	21,496	21,496	21,496
Akaike Inf. Crit.	27,861.080	27,779.220	8,912.112	8,595.290
Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$				

Limitations

There are several limitations worth noting before discussing the implications of our findings. First, stop records transferred from SJPD did not include several variables known to affect the distribution of post-stop outcomes, including among others the age and demeanor of the pedestrian, the race and gender of the officer, and details about the circumstances that motivated the initial stop. And while the inclusion of these variables would enrich our analysis, the level and influence of omitted variable bias is consistent with if not much less serious than previous research in this vein.

We also cannot claim insight into SJPD's broad strategic approach to street-level enforcement or the relationship between leadership's views on the value of pedestrian stops as a crime control

mechanism and the use of the tactic by officers on the street. Further, we cannot judge the influence of several relevant contextual factors, including public accusations of racial bias on the part of SJPD officers (Kaplan, 2015) and a subsequent third-party review of the Department's traffic and pedestrian stop data (Salonga, 2016). Relatedly, our evaluation is based on a relatively small sample of pedestrian stops recorded over less than three years, which prevents meaningful longitudinal analysis of the data and may limit the generalizability of our findings.

There are some limitations with the methodologies we use. For one, a challenge with HLM is its reliance on administrative units like census tracts. It is a considerable challenge to determine the best scale to measure neighborhood effects. While census

Table 4: GWR Five-Value Summary of Log Odds

Search	Min.	Q1	Mean	Q3	Max
Black	-0.40193	-0.17916	-0.0933	-0.05116	0.98114
Hispanic	-0.6071	0.3216	0.3335	0.3584	1.1154
API	-2.09811	-0.24038	-0.15902	-0.04872	1.76884
Female	-1.4906	-0.9313	-0.8032	-0.7244	3.549
Safety	1.409	1.585	1.662	1.694	4.629
Field Interview	Min.	Q1	Mean	Q3	Max
Black	-0.1945	0.2094	0.2771	0.2828	2.2282
Hispanic	0.1605	0.2997	0.3366	0.3305	1.2023
API	-3.24788	-0.24774	-0.10692	0.03421	1.34979
Female	-1.3952	0.1137	0.2241	0.3653	1.3791
Safety	-0.02212	0.33845	0.41915	0.50099	2.06274

tracts are considered the best scale to measure crime, different scales could yield distinct results, which may be worth investigating (Vogel, 2016). While GWR allows some workaround to this problem, by unpacking the underlying spatial structure of the results, it is also a limited approach. At best, GWR is an exploratory tool. While it shows the variation of values, it does not directly explain why these variations exist (Fotheringham et al., 2003; Wheeler, 2007). Further, using GWR we cannot directly account for the fixed effects of tract-level controls like we can using HLM.

Discussion and Conclusion

This research drew on two distinct analytical methods to examine the extent to which two iterations of conflict theory help to explain patterns of police searches and field interviews conducted following pedestrian stops. Consistent with the *racial threat hypothesis*, we anticipated finding that police were more likely to search and FI Blacks and Hispanics following stops in neighborhoods with high concentrations of minority residents. We also expected to find support for the *racial incongruity hypothesis*, with data showing that police were more likely to search or FI pedestrians who were stopped in neighborhoods where they appeared to be out of place, for example, a Hispanic person stopped in a predominantly White neighborhood, or a white person stopped in a predominantly Black neighborhood.

The analysis showed mixed support for each hypothesis, with results varying by specific combination of pedestrian race, neighborhood composition, post-stop outcome, and statistical method used. These findings highlight the complex

and highly nuanced relationship between policing, race, and place. The inconsistency between our initial set of findings, generated using a relatively common empirical strategy, HLM models estimated using administrative data organized by census tract, and those derived by GWR, a technique that allowed us to determine the unique spatial characteristics of each police stop, raises several important questions about how to evaluate the racial distribution of police enforcement most effectively.

Indeed, our data suggest that the environmental variables shaping an officer's decision to initiate a search or FI may be too fine-grained to be discernable when aggregated through higher-level administrative boundaries. Census tracts are heterogeneous spaces that do not always align with neighborhood boundaries or reflect consistently those factors that inform police behavior. Tracts may include pockets of relatively high incidences of crime and others with next to none (Hipp, 2007; Lee et al., 2008); they may also incorporate areas of both concentrated disadvantage and relative prosperity, racial diversity and segregation (Masi et al., 2007; Sharkey & Faber, 2014). Working with analytical techniques like HLM that smooth out these spikes have the potential to generate spurious findings or result in a lack of analytical clarity.⁴

Evidence of an interaction between pedestrian race and stop location were not apparent when measured at the census tract level but presented clearly when considered more granularly. Indeed, our GWR analysis revealed evidence in support of both the racial threat (e.g., Black and Hispanic pedestrians stopped in select non-White communities were more likely to be searched than when they were stopped in Predominantly White areas) and racial incongruity

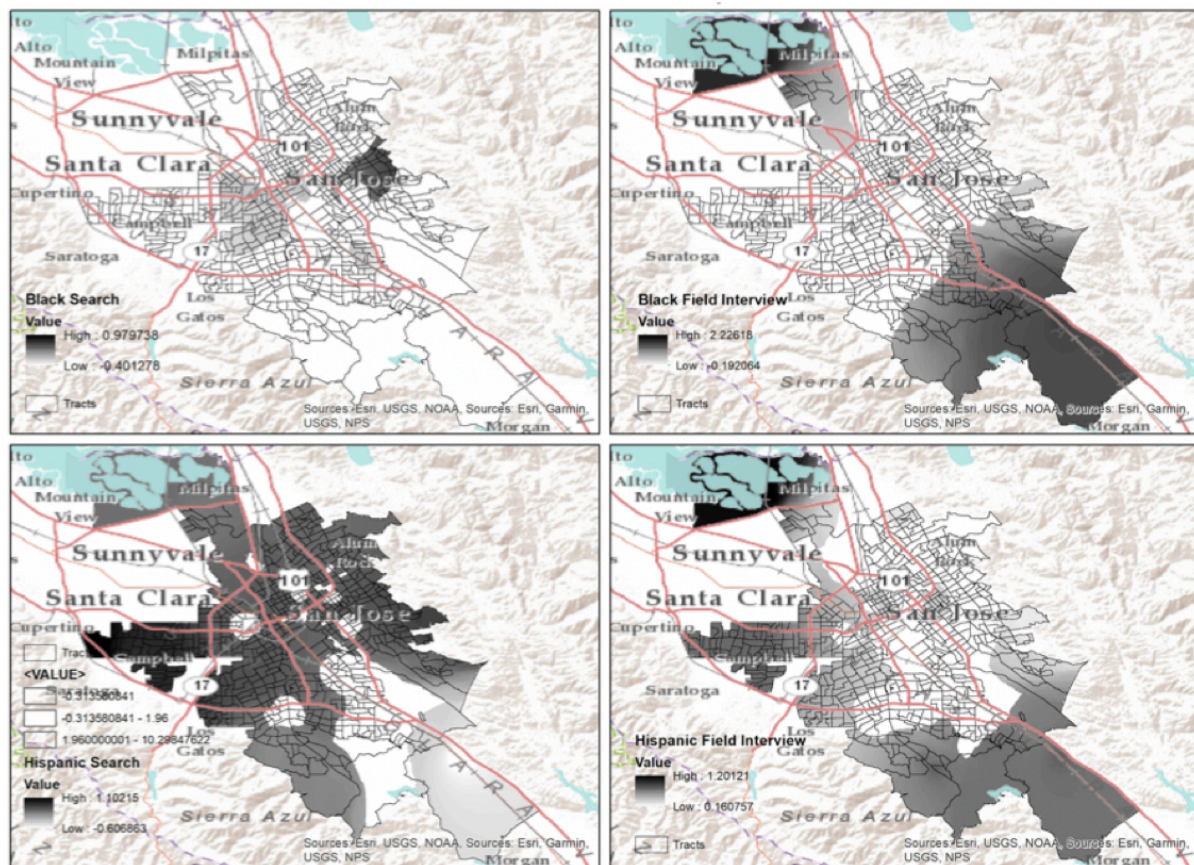
hypotheses (e.g., SJPd was more likely to conduct field interviews of Blacks and Hispanics stopped in certain White neighborhoods than when Black and Hispanic stops occurred in non-White neighborhoods). In some cases, search and FI patterns may be explained by the overt power dynamics underlying the racial threat hypothesis. In others, the appearance of a pedestrian ‘out of place’ serves as a pretext for police investigation and enforcement.

Some have argued that outcomes attributed to racial incongruity mitigate rather than reinforce the minority threat hypothesis, intimating that concerns over criminal behavior and/or maintaining preexisting racial hierarchies are unrelated to ‘out of place’ stops (e.g., Ferradino, 2015). While there is some logic to this argument, it seems at least as likely that ‘out of place’ enforcement represents a slightly different manifestation of the same motivation to police by race (e.g., Fagan & Davies, 2000; Novak & Chamlin, 2012; Rojek et al., 2012). As Gaston (2019a) notes, suspicion of non-Whites occupying predominantly White and racially mixed spaces signifies not simply racial incongruity, but the pursuit of “greater social

control in an effort to maintain the racial hierarchy, as racial conflict theories predict” (p. 517).⁵

Spatial influences on police behavior, as with crime (Weisburd, 2015), appear to be driven by forces most effectively observed at a micro level. While analytic tools like GWR do not directly explain *why* police enforcement is more aggressive following Black and Hispanic stops occurring in certain places, the ability to identify these locations with precision may provide police additional tools for maximizing the efficiency of SQF hit rates and the effectiveness of associated deterrence goals. GWR-based analysis would allow executives to marry staffing and patrol decisions at the micro-level, aligning police enforcement activity to a spatial understanding of both crime patterns and neighborhood demographics. Such an approach would also offer police and other stakeholders tools for addressing officers’ stereotyped understandings of urban contexts and use of “questionable, repeated claims of addressing episodic, local violence as a pretext for engaging in aggressive policing tactics” (Gaston et al., 2023, p. 76; see also Gaston, 2019b; Welsh et al., 2021).

Figure 4: GWR Coefficients, by Stop Location and Subject Race



Micro-level analysis of police stop and post-stop data using techniques like GWR has the potential to enhance our technical capacity to investigate established theoretical propositions like minority threat or racial incongruity. For example, by using GWR to measure spatially variable parameters, including race/ethnicity and stop location, together with more traditional methods like OLS or HLM to track fixed, or aspatial parameters, like gender, researchers may be able to develop more precise empirical assessments of how these factors interact to shape police behavior and the distribution of enforcement outcomes (Cahill & Mulligan, 2007). Increased precision in the analysis of enforcement patterns has the potential to improve scholarly understanding of conflict theory in this context and may help contribute to more effective policy development and implementation of enforcement priorities. Future research in this area should further examine the application of GWR to other aspects of police behavior and continue to utilize this and other micro-analytical tools to study conflict theory and the structural, environmental, and circumstantial factors that shape an officer's decision to initiate post-stop enforcement.

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Endnotes

- ¹ Self-initiated contacts are to be distinguished from those contacts that originate from dispatch-driven contacts that originate from a call for service. Self-initiated contacts occur at the discretion of the originating officer and are thus of particular value for racial impact research.
- ² Note that our analysis of SJPD post-stop enforcement occurs independent of officers' stop decisions. We evaluate the effects of pedestrian race and stop location on the probability of a search or FI occurring among all pedestrians stopped during the study period, as an officer's decision to initiate a search or an FI is governed by a separate legal threshold than the initial stop-and-frisk and is thus analytically severable.
- ³ Officer perceptions of their own safety during a stop is not a perfect indicator of pedestrian behavior. Indeed, police characterizations of personal safety may be affected by the same conscious or unconscious biases that we are attempting to measure in the context of search and field interview decisions. Our data show no meaningful difference in the rate that officers expressed feeling concerned for their safety by pedestrian race. Further, we used VIF scores to test for collinearity in the HLM models and that the race and safety predictors all had scores well below 10, a normal cutoff of collinearity. The results of these diagnostic tests helped to convince us that the potential benefits of accounting for citizen behavior, a metric rarely available to researchers, outweigh the downside of introducing theoretical biases into the model.
- ⁴ To investigate the possibility that SJPD searches were driven by incident-level variables, such as the suspicion of unlawful drugs or weapons, we used HLM models to examine the search 'hit rate' by both pedestrian race and stop location. The results of this inquiry (available upon request) provide very little evidence to support this argument. In fact, the data show a misalignment between search and contraband discovery: Black pedestrians face lower search odds than Whites, yet stops involving Blacks are more likely to uncover contraband. Females are less likely to be searched yet are more likely than males to be found with contraband. Predominantly API neighborhoods face low relative search odds compared to Predominantly White areas, even though hit rates in API tracts are significantly higher than in PW neighborhoods. Our GWR analysis of contraband discovery yielded no statistically significant findings, suggesting that the interaction between an individual's race and stop context is not predictive of search efficiency.
- ⁵ This presents an interesting empirical question that deserves some scholarly attention. A qualitative analysis of police officer post-stop decision-making would bring some needed clarity to the issue.