Seeing Racial Avoidance on New York City Streets

Bryce J. Dietrich[1*] and Melissa L. Sands[2*]

[1]Department of Political Science, Purdue University, West Lafayette, Indiana, USA, bjdietri@purdue.edu

[2]Department of Government, London School of Economics and Political Science, London, England, m.sands@lse.ac.uk

March 29, 2023

Abstract

Using publicly-available traffic camera feeds in combination with a real-world field experiment we examine how pedestrians of different races behave in the presence of racial out-group members. Across two different New York City neighborhoods and 3,552 pedestrians we generate an unobtrusive, large-scale measure of inter-group racial avoidance by measuring the distance individuals maintain between themselves and other racial groups. We find that, on average, pedestrians in our sample (93% of whom were phenotypically non-Black) give a wider berth to Black confederates, as compared to white non-Hispanic confederates.

Introduction

In the United States and elsewhere, race is a salient feature of everyday social interactions. Though places of residence, work, and study remain highly segregated along racial lines, with white Americans especially isolated from Black Americans, some degree of racial contact is particularly unavoidable in cities [1]. Whether they occur on the street, on public transit, or in other public spaces, these encounters need not involve conversation or verbal exchange to be significant. Social scientists have long argued that Americans behave differently in the presence of racial out-group members than they do in encounters with their in-group, and in a way that reflects a torrid history of institutionalized racism and segregation. Even as the majority of Americans now reject explicitly racist messages [2, 3], and as individuals' willingness to express racist attitudes on surveys has generally declined over time [4], white Americans' *behavior* belies persistent racial biases. This behavior need not be obviously discriminatory; racial bias may in fact be more apparent in subtle, nonverbal spontaneous behaviors than in more explicit behaviors [5–7].

One such behavior is racial avoidance. Researchers have observed nonverbal, physical manifestations of racial bias in the context of social conversations [8], seating distance [9], and shared space invasion [10]. Prior studies have, however, largely relied on laboratory or relatively small scale field studies that employ qualitative or coarse measurement techniques. This study contributes a large scale field experiment-based approach to studying racial bias in pedestrian interactions in highly naturalistic scenarios and settings. Using publicly-available, real-time video feeds from New York City Department of Transportation (NYC DOT) traffic cameras (`https://nyctmc.org//`), combined with confederates of different races, we address a central social science question: How do members of different racial groups behave toward each other in commonplace public encounters? In particular, we examine how members of different groups navigate one another on the sidewalks of a major city, one of the few places where interracial encounters regularly occur.

Experimentally, we manipulate the presence of phenotypically Black and phenotypically white young adult males on sidewalks in Manhattan, and measure the behavior of pedestrians who pass by our confederates. Our measurement technique uses NYC DOT traffic cameras to passively record pedestrian movements vis-à-vis the confederates. Our findings support our hypothesis that, on average, pedestrians will give a wider berth to phenotypically Black males than they do to phenotypically white non-Hispanic males.

This study offers several major contributions. Substantively, we document that pedestrians in the United States actively avoid Black Americans on sidewalks which likely imposes a psychological toll on a population already heavily burdened with historical and institutionalized racism. Although we are not the first to suggest such a relationship, we do so using a large field experiment in a common and important naturalistic setting. Not only do our design and measurement strategy make our findings more generalizable than previous studies, but they also allow us to uncover subtle changes in walking trajectories, which underscores one of the many ways implicit biases are physically manifested in everyday behavior. We demonstrate one way scholars could study such behavior from afar without costly surveys. Video camera feeds are available in many cities throughout the country, and researchers may even set up their own cameras to systematically measure behavior. By combining a field experiment with publicly available "big data," we demonstrate the virtue of blending careful research design with widely-available high-frequency data.

Social scientists have long described social behavior in terms of physical space [11]. People utilize space in their environment in ways that reflect their attitudes towards others [12]. A large body of research – most prominently work on construal level theory [13] – describes a powerful link between social or psychological distance and physical distance [14, 15]. Individuals tend to describe friends and in-group members as "close" and strangers and out-group members as "distant" [16] – a phenomenon so pervasive that it has even been observed in young children [17]. Physical distance is not only central to how individuals speak about others, it affects how people reason about and perceive physical distances between themselves and out-groups [18–21]. The tendency to equate out-groups with "distant" manifests in nonverbal behaviors, most notably physical avoidance. For example, white Americans put more space between themselves and Black Americans in conversation than they do when speaking with fellow whites [8, 22]. Another form of avoidance is seating distance, which has been used by social psychologists as a measure of racial bias in laboratory settings [23, 24].

Interracial encounters have been a topic of academic interrogation since at least the middle of the twentieth century [25]. Neighborhood racial composition influences individuals' behavior [26, 27]. In the now vast body of literature that includes observational and experimental studies of racial contact and threat [28–30], less attention has been paid to one of the most basic and common types of encounters – those that regularly occur on sidewalks and street corners. These experiences are significant because they are quintessentially public and nearly universal.

Here we focus on pedestrians. Early work on spatial displacement on sidewalks and in public spaces emphasizes dominance behavior [31–33] and its evolutionary roots [34], personal space [35], and "gallantry" [36, 37]. Scholars have focused on gender differences as a determinant of both power and gallantry in pedestrian encounters [31, 37–39]. Other features that determine how pedestrians are treated include group size, occupational uniform, age, physical weakness or disability, attractiveness, and cultural differences [40]. Though researchers have described various interpersonal behaviors between Black and white individuals and used physical avoidance as both an indicator of prejudice and as a measure of discrimination, studies of interracial pedestrian interaction are rare. Nearly forty years ago, researchers examined responses to breaches in spatial etiquette by studying what happens when Black confederates overtly violate social norms by blocking pedestrians' way [10]. We consciously depart from this paradigm with a more subtle and naturalistic intervention that is designed to reflect an everyday scenario: confederates conform to social norms by standing out of the way of pedestrian traffic, behaving as unimposing bystanders on public sidewalks.

Our study leverages an unobtrusive measure of individual-level behavior – live public camera feeds from the city of New York – to understand interactions that are not typically systematically observed. Images from these cameras, which allow NYC DOT staff and the public to monitor live traffic conditions throughout NYC, were recorded for later processing. The research sites are situated in two different Manhattan neighborhoods: the more residential Upper East Side and more commercial Midtown East.

Three experimental conditions were implemented and recorded at each site. In the first condition, two young phenotypically white adult male confederates stood facing each other, in conversation, in a designated spot within camera view for 15 minutes. In the second condition, a pair of young phenotypically Black adult male confederates took their place – standing in the same spots, such that the distance between them was equidistant across race conditions – for the same period of time. In the third (baseline) condition, no confederates were present for the same period of time, recorded the same way as in the first two conditions.

Confederates in each pair were dressed similarly to those in the other pair, and were similar in height, weight, and age, such that between-pair differences were minimized. Steps were taken to ensure that confederates behaved identically across conditions. They were instructed to talk about the same, non-political topic and monitored to make sure that they did not deviate from this protocol. As shown in Figure 1, confederates were positioned such that they created a slight bottleneck which funnels pedestrians into the treatment area without obstructing their movement.

Results

Figure 2 presents the average treatment effect (ATE) of the presence of Black confederates in both locations (black), on the Upper East Side (dark grey), and in Midtown (light grey), respectively. Our main outcome measure ("standardized pedestrian deviation", or SPD) reflects the deviation of a pedestrian from the confederate location as a proportion of the sidewalk width, as detailed in the Supplemental Information, Section S3.3. The leftmost panel includes all pedestrians, while the rightmost includes only those identified as non-Black. In the top panels, each ATE reflects a simple difference-in-means, calculated by estimating a bivariate OLS regression of SPD on an indicator for whether the confederates present are phenotypically Black or not. The bottom panels report covariate-adjusted average treatment effects (CTE), with controls for pedestrian race and gender, 45-minute time block, and indicators for pedestrians traveling in groups or pairs on the Upper East Side and for pedestrian race and time block in Midtown. Thicker and thinner lines reflect 90% and 95% confidence intervals, respectively, bootstrapped to account for dependence within 15-minute clusters (the unit at which randomization occurred) using a wild block bootstrap [41]. Note that this approach is highly conservative: though clustered standard errors are appropriate when clusters of units, rather than individual units, are assigned to treatment [42], in our setup it is implausible that pedestrians receiving treatment towards the end of a 15-minute time block are dependent on those treated at the beginning.

Across both locations, estimated treatment effects are generally consistent with pedestrian avoidance of Black confederates relative to white. In the left-hand panel of Figure 2, pooling across the two neighborhoods, pedestrians deviate by, on average, 3.43% of the sidewalk width ($t_{3417} = 2.403, p = 0.016, \beta = 0.032, CI_{95\%} = [0.006, 0.059]$, without controls, $t_{3322} = 5.167, p < 0.001, \beta = 0.034, CI_{95\%} = [0.021, 0.047]$ with controls), or around 4 inches, in the presence of Black confederates. On the Upper East side, estimated effects do not attain statistical significance at conventional levels; point estimates reflect that pedestrians move away between 3.19% and 3.93% of the sidewalk width ($t_{514} = 0.751, p = 0.453, \beta = 0.032, CI_{95\%} = [-0.052, 0.115]$ without controls, $t_{424} = 1.223, p = 0.222, \beta = 0.039, CI_{95\%} = [-0.024, 0.102]$ with controls), or between 3.1 and 3.8 inches, but are too noisy to reject the null hypothesis of no racial avoidance. In Midtown, pedestrians deviate between 3.24% and 3.47% of the sidewalk width ($t_{2901} = 2.620, p = 0.009, \beta = 0.032, CI_{95\%} = [0.008, 0.057]$ without controls, $t_{2895} = 5.128, p < 0.001, \beta = 0.035, CI_{95\%} = [0.021, 0.048]$ with controls), amounting to between 4.1 and 4.4 inches.

When subsetting to non-Black pedestrians, who make up 93% of our sample, our results do not meaningfully change. In the right-hand panel of Figure 2, when pooling across the two neighborhoods, point estimates reflect that non-Black pedestrians move away between 3.30% and 3.70% of the sidewalk width ($t_{3241} = 1.972, p = 0.049, \beta = 0.030, CI_{95\%} = [< 0.001, 0.059]$ without controls, $t_{3149} = 3.890, p < 0.001, \beta = 0.033, CI_{95\%} = [0.016, 0.050]$ with controls), or between 3.8 and 4.3 inches. On the Upper East side, point estimates reflect that non-Black pedestrians move away between 2.17% and 3.94% of the sidewalk width ($t_{483} = 0.473, p = 0.567, \beta = 0.022, CI_{95\%} = [-0.053, 0.096]$ without controls, $t_{396} = 1.400, p = 0.162, \beta = 0.039, CI_{95\%} = [-0.016, 0.095]$ with controls), or between 3.8 and 6.6 inches, but only the latter estimated effect attains statistical significance at conventional levels. In Midtown, non-Black pedestrians deviate between 3.20% and 3.22% of the sidewalk width ($t_{2756} = 2.015, p = 0.044, \beta = 0.031, CI_{95\%} = [0.001, 0.062]$ without controls, $t_{2751} = 3.762, p < 0.001, \beta = 0.032, CI_{95\%} = [0.015, 0.049]$ with controls), or around 4 inches, in the presence of Black confederates.

Additional preregistered hypotheses are also tested in Table 1. These include hypotheses that the wider berth predicted by the racial avoidance hypothesis will be more pronounced in predominantly white neighborhoods (Neighborhood Outgroup Salience) and among white pedestrians (Pedestrian Outgroup Salience). Comparing "All Pedestrians" to "Non-Black Pedestrians" in the "Both Locations" subsection, we find no meaningful difference in the birth given by non-black pedestrians as compared to all others. We also find essentially no difference between our Upper East Side and Midtown locations. Thus, we find very little support for our Neighborhood and Pedestrian Outgroup Salience hypotheses. Please refer to Section S5.5 for a more detailed discussion.

Finally, we expected all pedestrians would move further away from our confederates as compared to the baseline object (Obstruction Avoidance). We also expected that women would move further away from our male confederates as compared to men (Gender Heterogeneity). Section S5.5 explains each of these hypotheses more fully. In that Section, we find strong statistical support for the first, meaning pedestrians move significantly further away from our confederates ($t_{3417} = 5.710, p < 0.001, \beta = 7.549, CI_{95\%} = [4.957, 10.140]$, without controls, $t_{3322} = 5.704, p < 0.001, \beta = 7.561, CI_{95\%} = [4.962, 10.159]$). We also find support for our gender heterogeneity hypothesis, with women moving further away from our confederates as compared to men ($t_{226} = 1.713, p = 0.088, \beta = 4.883, CI_{95\%} = [-0.735, 10.501]$, without controls, $t_{226} = 3.862, p < 0.001, \beta = 11.272, CI_{95\%} = [5.510, 17.035]$). However, we were only able to test the gender heterogeneity hypothesis using our Upper East Side location, so it is unclear the extent to which this result is generalizable.

Discussion

Our findings are indicative of racial avoidance. Even in a highly-stimulating and densely populated locale pedestrians systematically change their behavior in observable ways in the presence of racial out-groups. The effects we measure may in fact represent a lower bound; if such behavior is detectable in NYC, pedestrian racial avoidance is likely even more pervasive in more racially-conservative environments. Moreover, we isolate this effect both with and without controls, suggesting our results are not dependent on specific model corrections.

These findings comport with our pre-registered hypotheses and are consistent with well-established theories of outgroup bias and threat, as well as evidence that young Black men in particular are stereotyped as threatening [43–45]. They are also consistent with evidence from across the social sciences that who and what we encounter as we move through space matters for a wide range of political and social outcomes. An experience as seemingly trivial as passing someone of another race or social class on a city sidewalk can have meaningful implications for decision-making [46].

Links between non-verbal measures of prejudice and more explicit behavioral indicators of racism are well-established. Physical avoidance in particular has been shown to track racial bias in the laboratory. For example, researchers have used immersive virtual environments to demonstrate that implicit prejudice against an ethnic out-group (as measured by an implicit attitude test, or IAT) predicts avoidance behavior [47], and that racial avoidance behavior (interpersonal distance and head orientation in a virtual encounter) predicts aggressiveness and hostility towards Black males in a subsequent virtual gunfight [48]. This body of work suggests that what is at stake is much more than a few inches of sidewalk space. One alternative interpretation of our findings is that pedestrians are "giving people space" rather than avoiding them. We reject this interpretation, and point to the literature on proxemics, which focuses on how people use space during social interactions, and demonstrates physical avoidance of stigmatized groups in a variety of contexts, linking patterns of avoidance to implicit measures of prejudice (see [49] for a review).

Our study remains subject to several limitations. As is the case in most field studies, research subjects do not represent a random sample of the population. Pedestrians on our selected Manhattan street corners are likely to be wealthier, better educated, and more politically Left-leaning than the average American. These traits may or may not make subjects less prone to racial avoidance. Technical and feasibility constraints limit our ability to estimate pedestrian race and perfectly measure actual physical distances in the camera feeds. Future research might make use of high-definition video feeds now available in other locales, or researchers might employ their own cameras.

Our study also carries important implications. First, we document systematic racial avoidance in the real world, a finding that is highly consistent with the narratives voiced by people of color, for whom stereotype threat [50] and 'micro-aggressions' carry pernicious consequences [51]. Avoidance experienced by Black individuals, day in and day out, likely imposes a psychological toll on a population that already carries the extra burden of historical and institutionalized racism, eroding mental and physical health. Moreover, pedestrian racial avoidance can be both a cause and consequence of misattributions of threat. The very public, widespread, and chronic occurrence of pedestrian racial avoidance may have spillover effects that influence others' behavior in subtle but destructive ways [52]. For example, law enforcement – even if trained to recognize their own implicit biases – may implicitly or explicitly detect bystander behavior and overestimate the level of threat posed by Black

Americans in ambiguous situations.

Second, we develop a method that allows researchers to study mass pedestrian behavior in the real world, and which can be used anywhere that cameras capture pedestrians in their feeds. Openly accessible video feeds are increasingly ubiquitous, yet under-utilized as a research tool [53]. By combining our measurement strategy with field experiments future scholars can replicate our study in different neighborhoods, and with different confederate characteristics, such as socioeconomic status, gender, ethnicity, and age.

Methods

This research complies with all relevant ethical regulations, and received approval from the University of Iowa Institutional Review Board (protocol # 201706768), with a reliance issued by the University of California, Merced Institutional Review Board. In doing so, we asked for informed consent to be waived. This was done for three reasons. First, we use publicly available camera feeds which record pedestrians every day without obtaining informed consent, meaning there is not the same expectation of privacy in this setting as opposed to in settings such as research laboratories. Second, the facial features of specific pedestrians are nearly impossible to discern from camera images. This in addition to the way the results are reported – in the aggregate – means there is limited risk for the pedestrians involved. Finally, obtaining consent would have required stopping pedestrians, which is invasive and likely infeasible.

Traffic cameras in the Upper East Side and Midtown neighborhoods were selected based on several factors: visibility of a large swath of unobstructed sidewalk, camera angle and image quality. These neighborhoods and the camera selection process are described in the Supplemental Information, Section S2.

The conditions were block randomized to control for natural fluctuations in pedestrian flow that occur throughout the day, such as lunchtime and commuting hours. That is, each day was divided into 45-minute blocks, and the order in which the three conditions were implemented within a block was randomized. The experiment took place over the course of two weekdays. On the first day, five 45-minute blocks were implemented in immediate succession at a pre-determined location in Midtown. On the second day, the same procedure was repeated – and the order re-randomized – at the Upper East Side location. Finally, all measurements were taken from distinct samples using two-sided tests.

As the experiment occurred, a research assistant (RA) on site unobtrusively identified phenotypically Black pedestrians as they passed the fixed confederate location, a task that was independently validated for one site using the recorded video, as detailed in the Supplemental Information, Section S5.1. Based on a power analysis informed by a pilot study conducted at a different intersection in Manhattan, we established and pre-registered a target sample size of $1,350$ pedestrians over 225 minutes of video. Ultimately we recorded 225 minutes at each location, capturing 776 pedestrians on the Upper East Side and $4,632$ in Midtown. Of the 776 pedestrians identified on the Upper East Side (by condition: $N_{\text{Black}} = 253; N_{\text{white}} = 263; N_{\text{control}} = 260$), 48 (by condition: $N_{\text{Black}} = 9; N_{\text{white}} = 17; N_{\text{control}} = 22$) were said to be Black or African American by our RA on the day of the experiment. This same RA identified 230 phenotypically Black pedestrians in Midtown (by condition: $N_{\text{Black}} = 57; N_{\text{white}} = 88; N_{\text{control}} = 85$), representing 4.97% of the 4,632 pedestrians tracked at that location (by condition: $N_{\text{Black}} = 1447; N_{\text{white}} = 1456; N_{\text{control}} = 1729$). In the Supplemental Information (see Section S5.2) we show balance in the proportion of Black pedestrians across experimental treatments. In the Supplemental Information (See Section S5.1.2) we also present analyses of inter-coder reliability with respect to the pedestrian race coding. All confederates and RAs were blind to the researcher hypotheses.

Recovering measurements from a photograph, or from any two-dimensional representation of a three-dimensional world, is difficult due to well-known features of perspective: objects appear smaller as distance from the observer increases, and perceived distance is distorted by the angle of vision. Thus, in a given frame of video, on the portion of sidewalk towards the top of the image (further away from the camera) a single pixel represents a greater distance than a pixel toward the bottom of an image (closer to the camera). As a pedestrian moves along the sidewalk, the relationship between pixels and actual distance on the ground changes as they progress from background to foreground. The nature of this dynamic relationship, furthermore, is dependent on the camera angle and zoom, which differs by location. Most relevant for our study, measuring the actual distance between individuals on a sidewalk is complicated by distortions due to the cameras' angled position, rather than it being located directly overhead. Although we cannot solve this problem, we take steps to show that it does not invalidate our experimental findings.

As preregistered, we consider the relationship between the pedestrian and a neutral, baseline object, located on the other edge of the sidewalk, directly adjacent and parallel to the confederates. For each frame of video, we subtract the distance (in pixels) from a given pedestrian to that object ("baseline distance") from the distance from that pedestrian to the confederate ("confederate distance"). This value is a rough proxy for how far a pedestrian is from the confederate location relative to the baseline object when the three points appear on the same visual plane.

We provide evidence of the validity of this approach in Section S3.4 of the Supplemental Information. This validation exercise is based on the idea that a camera located directly above the confederates, providing a "bird's eye view," yields the equivalent of a two-dimensional representation of the scene; from this view, one could directly measure distances from the confederates to pedestrians without distortions due to camera angle or perspective. As described in more detail in the Supplemental Information (see Section S3), we use agent-based modeling and three-dimensional models of our experimental locations to demonstrate that the SPD yields the same results regardless of whether images reflect the original camera angle or a "bird's eye view" in an animated simulation. The average treatment effects calculated using these two camera perspectives are nearly identical, suggesting that our measurement approach is appropriate in the context of a randomized experiment.

Since distortions due to perspective are minimized when a pedestrian is on the same visual plane as the confederates, we use only the measurement for each pedestrian that is closest to the confederate location in our main model specifications. We preregistered our intent to use only the closest observation, and anticipated using pixel distance to identify the closest observation. However, we discovered when implementing a validation exercise suggested by a reviewer that using pixel distance for this purpose does not always reveal the pedestrian observation that is closest in actual distance. Thus, we use "closest point" frames identified by RAs, as detailed in Section S3.5 of the Supplemental Information. The accuracy and reliability of these visual assessments is demonstrated in Section S5.1.3 of the Supplemental Information. We also show in the Supplemental Information (see Section S4) that our findings are not sensitive to the decision to use a single observation for each pedestrian; models utilizing all observations for each pedestrian yield the same substantive conclusions.

Pedestrians were manually tracked on the recorded camera images using the Fiji distribution of *ImageJ*. We consider only pedestrians who crossed between the confederates and the baseline object, and focus on those who are within close proximity to, and are not separated by a physical barrier from, the confederates. The setup, measurement strategy, and manual tracking protocol are further detailed in Section S3 of the Supplemental Information.

Our main outcome measure (SPD) is explained in greater detail in the Supplemental Information (see Section S3.3) and reflects the deviation of a pedestrian from the confederate location as a proportion of the sidewalk width. We standardize by sidewalk width – 126 and 96.5 inches wide at the Midtown and Upper East Side locations, respectively – to make results from the two sites more comparable, as pedestrian behavior is in part dependent on the amount of room one has to maneuver. To obtain estimates of pedestrian avoidance in inches, we divide the pedestrian deviation in pixels by the pixel width of the sidewalk, and then use the actual sidewalk width at the plane at which the confederates are standing to convert that percentage to inches. Note that the main specifications involve comparisons between the Black and white conditions only; data from the pure control (no confederate) condition are not used. In the Supplemental Information (see Section S5.5.1) we discuss these results, which demonstrate how pedestrian behavior changes in presence of confederate of either race relative to a baseline object. All statistical tests are two-tailed.

Protocol registration: Study design and hypotheses were registered with EGAP: http://egap.org (ID # 20170616AA) on June 16, 2017. Our preregistration plan can be found at this URL: https://osf.io/vtqez (Accessed on August 11, 2020).

Photographs on pages [XXX] used with permission of the City of New York. A copyright notice should appear in the following format: "©2017. New York City Department of Transportation. All rights reserved."

Data and Code Availability

Data availability: All data necessary to replicate the analyses and figures in this paper and supporting information are available at `https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/Y9QEUK`.

Code availability: All code necessary to replicate the analyses and figures in this paper and supporting information are available at `https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/Y9QEUK`. R (open source, version 4.1.0) was used for data analysis.

Acknowledgments

We are grateful to Jason Anastasopoulos, Dan Carpenter, Maureen Craig, Daniel de Kadt, Ryan Enos, Justin Grimmer, Matt Hibbing, Hakeem Jefferson, Gary King, Alex Theodoridis, Cara Wong, and audiences at the American Political Science Association annual meeting, the

Midwest Political Science Association annual meeting, the New York University Center for Experimental Social Science conference, Stanford University, the University of California, Riverside, the University of California, Berkeley, and the University of Iowa for helpful feedback. The authors received no specific funding for this work.

Authors Contributions Statement

B.D. and M.S. contributed equally to the authorship of this manuscript.

Competing interests Statement

The authors declare no competing interests.

Correspondence

Correspondence and requests for materials should be addressed to either B.D. (email: bjdietri@purdue.edu) or M.S. (email: m.sands@lse.ac.uk).

Tables

Figure Legends/Captions

Figure 1: Experiment Set-Up and Example Tracking Images

Note: Camera images from Midtown (panels A and C), and Upper East Side (panels B and D) locations. The original images were provided by the New York City Department of Transportation (Source: `https://www.nyc.gov/html/dot/html/home/home.shtml`). In the top row, confederates are referenced in red, pedestrians in blue, and the baseline object in green. Pedestrians in all images are numbered for the purpose of manual tracking. All markings are not on the original images.

Table 1: Treatment Effects for New York City Sidewalk Experiment

	Black Confederates Present ($\hat{\beta}$)	t-statistic	df	p-value	95% CI
Both Locations					
All Pedestrians					
With Controls	0.034	5.167	3322	<0.001	[0.021, 0.047]
Without Controls	0.032	2.403	3417	0.016	[0.006, 0.059]
Non-Black Pedestrians					
With Controls	0.033	3.890	3149	<0.001	[0.016, 0.050]
Without Controls	0.030	1.972	3241	0.049	[<0.001, 0.059]
Upper East Side					
All Pedestrians					
With Controls	0.039	1.223	424	0.222	[−0.024, 0.102]
Without Controls	0.032	0.751	514	0.453	[−0.052, 0.115]
Non-Black Pedestrians					
With Controls	0.039	1.400	396	0.162	[−0.016, 0.095]
Without Controls	0.022	0.573	483	0.567	[−0.053, 0.096]
Midtown					
All Pedestrians					
With Controls	0.035	5.128	2895	<0.001	[0.021, 0.048]
Without Controls	0.032	2.620	2901	0.009	[0.008, 0.057]
Non-Black Pedestrians					
With Controls	0.032	3.762	2751	<0.001	[0.015, 0.049]
Without Controls	0.031	2.015	2756	0.044	[0.001, 0.062]

Note: Treatment effects from OLS regressions of standardized pedestrian deviation on an indicator for whether the confederates present are Black (versus white). Positive values indicate deviation from Black confederates relative to white confederates as a proportion of total sidewalk width. Average treatment effects are shown in the rows labeled "Without Controls." In the rows labeled "With Controls," we condition the treatment effect on pedestrian characteristics and time block fixed effects. All statistical tests are two-tailed and confidence intervals are bootstrapped to account for dependence within 15-minute clusters.

Figure 2: Pedestrians Give a Wider Berth to Black Confederates

Note: Treatment effects from OLS regressions of standardized pedestrian deviation on an indicator for whether the confederates present are Black (versus white). The top panels (ATE) reflect simple differences-in-means while the bottom panels (CTE) include controls for pedestrian characteristics and time block fixed effects. Positive values indicate deviation from Black confederates relative to white confederates as a proportion of total sidewalk width. Black (■) denotes both locations ($N_{all} = 3419; N_{non-Black} = 3208$), while dark grey (■) and light grey (□) correspond to the Upper East Side ($N_{all} = 516; N_{non-Black} = 448$) and Midtown ($N_{all} = 2903; N_{non-Black} = 2758$), respectively. For the Upper East Side, all variables other than the treatment indicator were coded by a graduate research assistant at a later date (see Supplemental Information, Section S5.1). There were also six pedestrians in the Upper East Side who were identified as outliers by the same RA. Although these are excluded in this figure, their inclusion does not change our substantive results (see Supplemental Information, Section S5.4). Thicker (━) and thinner (─) lines represent 90 and 95-percent confidence intervals, bootstrapped to account for dependence within 15-minute clusters. All reported statistical tests are two-tailed. Table 1 reports the full statistical results, including all coefficients, p-values and confidence intervals.

References

[1] Qi Wang, Nolan Edward Phillips, Mario L. Small, and Robert J. Sampson. Urban mobility and neighborhood isolation in america's 50 largest cities. *Proceedings of the National Academy of Sciences*, 115(30):7735–7740, 2018. ISSN 0027-8424. doi: 10.1073/pnas.1802537115. URL `https://www.pnas.org/content/115/30/7735`.

[2] Donald R Kinder and Lynn M Sanders. *Divided by color: Racial politics and democratic ideals*. University of Chicago Press, 1996.

[3] Vincent L Hutchings, Nicholas A Valentino, Tasha S Philpot, and Ismail K White. The compassion strategy: Race and the gender gap in campaign 2000. *Public Opinion Quarterly*, 68(4):512–541, 2004.

[4] Howard Schuman, Charlotte Steeh, Lawrence Bobo, and Maria Krysan. *Racial attitudes in America: Trends and interpretations*. Harvard University Press, 1997.

[5] John F Dovidio, Kerry Kawakami, and Samuel L Gaertner. Implicit and explicit prejudice and interracial interaction. *Journal of personality and social psychology*, 82(1):62, 2002.

[6] John F Dovidio, Kerry Kawakami, Craig Johnson, Brenda Johnson, and Adaiah Howard. On the nature of prejudice: Automatic and controlled processes. *Journal of experimental social psychology*, 33(5):510–540, 1997.

[7] Carl O Word, Mark P Zanna, Joel Cooper, et al. The nonverbal mediation of self-fulfilling prophecies in interracial interaction. *Journal of experimental social psychology*, 10(2):109–120, 1974.

[8] Frank N Willis. Initial speaking distance as a function of the speakers' relationship. *Psychonomic Science*, 5(6):221–222, 1966.

[9] Michael Hendricks and Richard Bootzin. Race and sex as stimuli for negative affect and physical avoidance. *The Journal of Social Psychology*, 98(1):111–120, 1976.

[10] Clifford E Brown. Shared space invasion and race. *Personality and Social Psychology Bulletin*, 7(1):103–108, 1981.

[11] Emory Stephen Bogardus. A social distance scale. *Sociology & Social Research*, 1933.

[12] Edward Twitchell Hall and T Hall. *The silent language*, volume 948. Anchor books, 1959.

[13] Nira Liberman, Michael D Sagristano, and Yaacov Trope. The effect of temporal distance on level of mental construal. *Journal of experimental social psychology*, 38(6):523–534, 2002.

[14] Yoav Bar-Anan, Nira Liberman, Yaacov Trope, and Daniel Algom. Automatic processing of psychological distance: evidence from a stroop task. *Journal of Experimental Psychology: General*, 136(4):610, 2007.

[15] Justin L Matthews and Teenie Matlock. Understanding the link between spatial distance and social distance. *Social Psychology*, 42(3):185, 2011.

[16] A Lee Hoxter and David Lester. Social distance evaluations in white and african-american students. *Perceptual and Motor Skills*, 80(2):478, 1995.

[17] Sandra Cohen Koslin, Marianne Amarel, and Nancy Ames. A distance measure of racial attitudes in primary grade children: An exploratory study. *Psychology in the Schools*, 6(4):382–385, 1969.

[18] Anthony C Gatrell. *Distance and space: a geographical perspective*. Oxford University Press, USA, 1983.

[19] Dennis D Kerkman, David Stea, Karen Norris, and Jennifer L Rice. Social attitudes predict biases in geographic knowledge. *The Professional Geographer*, 56(2):258–269, 2004.

[20] Keith B Maddox, David N Rapp, Sebastien Brion, and Holly A Taylor. Social influences on spatial memory. *Memory & Cognition*, 36(3):479–494, 2008.

[21] Ryan D. Enos. *The Space Between Us: Social Geography and Politics*. Book Manuscript, Harvard University, 2016.

[22] John R Aiello and Stanley E Jones. Field study of the proxemic behavior of young school children in three subcultural groups. *Journal of Personality and social psychology*, 19 (3):351, 1971.

[23] Kerry Kawakami, Curtis E Phills, Jennifer R Steele, and John F Dovidio. (close) distance makes the heart grow fonder: Improving implicit racial attitudes and interracial interactions through approach behaviors. *Journal of personality and social psychology*, 92(6):957, 2007.

[24] Phillip Atiba Goff, Claude M Steele, and Paul G Davies. The space between us: stereotype threat and distance in interracial contexts. *Journal of personality and social psychology*, 94(1):91, 2008.

[25] V.O. Key, Jr. *Southern Politics in State and Nation*. Knopf, New York, 1949.

[26] Douglas S. Massey and Nancy A. Denton. *American Apartheid: Segregation and the Making of the Underclass*. Havard University Press, Cambridge, MA, 1993.

[27] Jessica Trounstine. Segregation and inequality in public goods. *American Journal of Political Science*, 60, 2015.

[28] Gordon Willard Allport. *The nature of prejudice*. Basic Books, 1979.

[29] Ryan D Enos. What the demolition of public housing teaches us about the impact of racial threat on political behavior. *American Journal of Political Science*, 60(1): 123–142, 2016.

[30] Ryan D Enos. Causal effect of intergroup contact on exclusionary attitudes. *Proceedings of the National Academy of Sciences*, 111(10):3699–3704, 2014.

[31] James M Dabbs Jr and Neil A Stokes III. Beauty is power: The use of space on the sidewalk. *Sociometry*, pages 551–557, 1975.

[32] Eric S Knowles. Boundaries around group interaction: The effect of group size and member status on boundary permeability. *Journal of Personality and Social Psychology*, 26(3):327, 1973.

[33] Nancy Henley. *Body politics: Power, sex, and nonverbal communication*. Prentice Hall, 1977.

[34] Sherwood Larned Washburn and Irven DeVore. The social life of baboons. *Scientific American*, 204(6):62–71, 1961.

[35] Gary W Evans and Roger B Howard. Personal space. *Psychological bulletin*, 80(4):334, 1973.

[36] Erving Goffman. Relations in public: Microstudies of the social order. *London: Allen Lane*, 1971.

[37] Frank N Willis, Joseph A Gier, and David E Smith. Stepping aside: Correlates of displacement in pedestrians. *Journal of communication*, 29(4):34–39, 1979.

[38] Jeanette Silveira. Thoughts on the politics of touch. *Women's Press*, 1(13):13, 1972.

[39] Robert S Sobel and Nancy Lillith. Determinants of nonstationary personal space invasion. *The Journal of Social Psychology*, 97(1):39–45, 1975.

[40] Stephen Thayer and Lewis Alban. A field experiment on the effect of political and cultural factors on the use of personal space. *The Journal of Social Psychology*, 88(2): 267–272, 1972.

[41] A Colin Cameron, Jonah B Gelbach, and Douglas L Miller. Bootstrap-based improvements for inference with clustered errors. *The Review of Economics and Statistics*, 90 (3):414–427, 2008.

[42] Alberto Abadie, Susan Athey, Guido W Imbens, and Jeffrey Wooldridge. When should you adjust standard errors for clustering? Technical report, National Bureau of Economic Research, 2017.

[43] Catherine A Cottrell and Steven L Neuberg. Different emotional reactions to different groups: a sociofunctional threat-based approach to 'prejudice'. *Journal of Personality and Social Psychology*, 88(5):770, 2005.

[44] Melissa Harris-Lacewell. No place to rest: African american political attitudes and the myth of black women's strength. *Women & Politics*, 23(3):1–33, 2001.

[45] Phillip Atiba Goff, Matthew Christian Jackson, Brooke Allison Lewis Di Leone, Carmen Marie Culotta, and Natalie Ann DiTomasso. The essence of innocence: Consequences of dehumanizing black children. *Journal of Personality and Social Psychology*, 106(4):526, 2014.

[46] Melissa L Sands. Exposure to inequality affects support for redistribution. *Proceedings of the National Academy of Sciences*, 114(4):663–668, 2017.

[47] Ron Dotsch and Daniël HJ Wigboldus. Virtual prejudice. *Journal of experimental social psychology*, 44(4):1194–1198, 2008.

[48] Cade McCall, Jim Blascovich, Ariana Young, and Susan Persky. Proxemic behaviors as predictors of aggression towards black (but not white) males in an immersive virtual environment. *Social Influence*, 2009.

[49] Cade McCall. Mapping social interactions: the science of proxemics. In *Social Behavior from Rodents to Humans*, pages 295–308. Springer, 2015.

[50] Claude M Steele. *Whistling Vivaldi: How stereotypes affect us and what we can do.* WW Norton & Company, 2011.

[51] Derald Wing Sue, Christina M Capodilupo, Gina C Torino, Jennifer M Bucceri, Aisha Holder, Kevin L Nadal, and Marta Esquilin. Racial microaggressions in everyday life: implications for clinical practice. *American psychologist*, 62(4):271, 2007.

[52] Max Weisbuch, Kristin Pauker, and Nalini Ambady. The subtle transmission of race bias via televised nonverbal behavior. *Science*, 326(5960):1711–1714, 2009.

[53] Bryce J Dietrich. If a picture is worth a thousand words, what is a video worth? In Robert X Browning, editor, *Exploring the C-SPAN Archives: Advancing the Research Agenda*. Purdue University Press, 2015.