36 Berkeley Technology Law Journal ___ (forthcoming 2022)

Racial Segregation and The Data-Driven Society: How Our Failure to Reckon with Root Causes Perpetuates Separate and Unequal Realities

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ABSTRACT:

This Essay asserts that in the United States racial segregation has and continues to play a central evolutionary role in the inequalities we see reproduced and amplified by data-driven technologies and applications. Racial segregation distorts and constrains how data-driven technologies are developed and implemented, how problems of algorithmic bias are conceptualized, and what interventions or solutions are deemed appropriate and pursued. After detailing the foundational aspects of how racial segregation has evolved over time and its less obvious social, political and epistemic implications for White Americans, the demographic group that dominates the technology sector, this Essay explores how racial segregation affects algorithmic design, analysis and outcomes. It concludes with analysis of how prevailing approaches to evaluating and mitigating algorithmic bias are insufficient and why a transformative justice framework is necessary to adequately examine and redress algorithmic bias as well as improve the development of data-driven technologies and applications. This Essay illustrates how critical analysis of racial segregation can deepen our understanding of algorithmic bias, improve evaluations of data-driven technologies for social and racial equity concerns, and broaden our imaginations about what meaningful redress of technology-mediated harms and injustices should include.

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> *"The interlocking workings of human worth, race, and space demonstrate the ways the uninhabitable still holds currency in the present and continues to organize contemporary geographic arrangements. The colonial enactment of geographic knowledge mapped 'a normal way of life' through measuring different degrees of humanness and attaching different versions of the human to different places."*
> **-Katherine McKittrick, Plantation Futures**

INTRODUCTION

Despite being one of the most racially diverse nations leading the development, use, and evaluation of data-driven technologies and methods, the diversity of the United States is not reflected in its technology sector. After several years of annual diversity reports, large technology companies, like Amazon and Facebook, have made little progress in hiring or retaining underrepresented racial minorities, and representation in leadership positions is equally bleak.[1] Academic institutions are also failing to engage and retain racially diverse faculty and students in science, technology, engineering, and mathematics (STEM) fields. Although Black, Indigenous, and other People of Color (BIPOC) make up almost 40 percent of the U.S. population,[2] underrepresented racial minorities make up only 22 percent of STEM bachelor degrees, 9 percent of STEM Doctorate degrees, and 10.1 percent of STEM Faculty at 4-year institutions.[3] This lack of racial diversity extends to technology policymaking as well, particularly in government and civil society, which both influence data-driven technology use, evaluation, and potential oversight. Recent studies have found a lack of racial diversity

[1] Kate Rooney & Yasmin Khorram, *Tech companies say they value diversity but reports show little change in last six years*, CNBC, Jun. 12, 2020, https://www.cnbc.com/2020/06/12/six-years-into-diversity-reports-big-tech-has-made-little-progress.html; U.S. Equal Emp. Opp. Comm., Diversity in High Tech (2016), https://www.eeoc.gov/special-report/diversity-high-tech.
[2] U.S. Census, United State Quick Facts (2019, https://www.census.gov/quickfacts/fact/table/US/PST045219.
[3] National Science Foundation, Women, Minorities, and Persons with Disabilities in Science and Engineering (2019), https://ncses.nsf.gov/pubs/nsf19304/digest/field-of-degree-minorities.

amongst congressional staff and within technology policy careers and institutions (e.g., think tanks and public interest non-profits).[4]

While these problems of racial homogeneity are not new, the majority of public and academic discourse about it and its impact on technology development and algorithmic bias tend to talk around or avoid discussion of a primary driver of these problems – racial segregation.[5] Segregation refers to the systematic separation and social exclusion of groups, and in the United States this has primarily and consistently occurred based on race or ethnicity. American case law posits that segregation in the United States follows two forms.[6] *De jure* segregation is the legally mandated separation and social regulation of races that was imposed through explicitly race-based laws and regulations, such as slave codes, Federal Indian policy, Black Codes, and Jim Crow laws. Though *de jure* segregation was eventually outlawed through a series of Supreme Court cases and federal civil rights laws, remnants of these laws or their intended consequences are perpetuated today through political beliefs and practices, like "local control."[7] It is also perpetuated by laws and policies that are racially neutral but were designed with only White Americans in mind or ignore "the reality of societal differences based on race", like various tax laws and policies.[8] *De facto* segregation is social exclusion and regulation of races without legal mandates and it exists through social customs, voluntary practices, private discrimination, and other prejudicial practices or behaviors. Though some scholars and practitioners contend that the distinction between *de jure*

[4] PUBLIC KNOWLEDGE, DIVERSITY IN EARLY-CAREER TECH POLICY ROLES: CHALLENGES AND OPPORTUNITIES (2021); LASHONDA BRENSON, JOINT CENTER FOR POLITICAL AND ECONOMIC STUDIES, RACIAL DIVERSITY AMONG TOP STAFF IN SENATE PERSONAL OFFICES (2020); ELSIE L. SCOTT, ET AL., JOINT CENTER FOR POLITICAL AND ECONOMIC STUDIES, RACIAL DIVERSITY AMONG TOP U.S. HOUSE STAFF (2018).

[5] *But see*, Margaret Hu, *Algorithmic Jim Crow*, 86 FORDHAM L. REV. 633 (2017) (evaluating how policies and practices that comprised the Jim Crow regime are being replicated in algorithmic tools)

[6] In *Brown v. Board of Education*, Chief Justice Earl Warren's opinion distinguished de jure and de facto segregation for determining court-mandated remedies. The Supreme Court has continued to rely on this distinction when evaluating subsequent racial segregation and discrimination cases.

[7] SUSAN E. EATON & ELIZABETH CRUTCHER, THE HARVARD PROJECT ON SCHOOL DESEGREGATION, SLIPPING TOWARDS SEGREGATION: LOCAL CONTROL AND ERODING DESEGREGATION IN MONTGOMERY COUNTY, MARYLAND (1994).

[8] DOROTHY A. BROWN, THE WHITENESS OF WEALTH: HOW THE TAX SYSTEM IMPOVERISHES BLACK AMERICANS AND HOW WE CAN FIX IT, 9-24 (2021)

and *de facto* segregation are fallacious,[9] there is general consensus that racial segregation remains one of the most persistent and pervasive features of American society and hypersegregation has become the prominent term used to describe its modern-day, multidimensional nature.[10]

When we ignore the impact of racial segregation, issues of racial inequality appear as naturally occurring phenomena, rather than byproducts of specific policies, practices, social norms, and behaviors. Such oversights also mean that historical contingencies are erroneously timebound to actors and institutions of the past, while individual or collective practices that perpetuate or even exacerbate racial inequalities remain unexamined and unchanged. This is perhaps why racial inequalities within the technology sector and racially biased outcomes produced by algorithmic technologies persist. You cannot improve racial diversity in STEM fields without critically examining the persistence of racial segregation in American public schools, particularly academic tracking, school funding, and school discipline. You cannot improve recruitment and retention of underrepresented racial minorities in the technology sector without critically examining how economic, occupational, and residential segregation may deter candidates and undermine efforts.[11] And you cannot mitigate algorithmic bias without critically examining how training datasets may be systemically biased by racial segregation or that primarily technical solutions, like audits, cannot meaningfully redress problems that stem from structural inequality. Thus, by focusing on racial segregation, we can better understand our uneven progress and in some cases, regression, on addressing this form of structural inequality as well as the unstated, and often unconscious, motivations, interests, and practices that make racial segregation and its attendant consequences so resilient in American society.

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[9] *See, e.g.*, RICHARD ROTHSTEIN, THE COLOR OF LAW: A FORGOTTEN HISTORY OF HOW OUR GOVERNMENT SEGREGATED AMERICA (2017) (describing how many historical instances of de facto segregation were, in fact, the result of public policies and political practices); DERRICK BELL, SILENT COVENANTS: BROWN V. BOARD OF EDUCATION THE UNFULFILLED HOPES FOR RACIAL REFORM (2004)((highlighting that racial policies, like racial segregation, are made through silent covenants --unspoken convergences of interest and involuntary sacrifices of rights--that ensure that policies conform to priorities set by policymakers).

[10] Douglas S. Massey & Nancy A. Denton, *Hypersegregation in the U.S. Metropolitan Areas: Black and Hispanic Segregation along Five Dimensions*, 26(3) DEMOGRAPHY 373 (1989).

[11] *See, e.g.,* Quincy Brown, et al., *Amplifying Resources for Inclusiveness in Computing: Reflections on Black in Computing*, COMMUNICATIONS OF THE ACM, April 2021, https://cra.org/amplifying-resources-for-inclusiveness-in-computing-reflections-on-black-in-computing/

In this Essay and in future scholarship, I contend that racial segregation has played a central evolutionary role in the reproduction and amplification of racial stratification in data-driven technologies and applications. Racial segregation also constrains how problems of algorithmic bias and relevant interventions are conceptualized. Throughout this essay, when I refer to racial segregation, I am not merely focused on how it reflects historical and contemporary patterns of private and public racial discrimination in various social contexts, like education, housing, employment, and public goods. These patterns and the societal inequality they produce are well-documented[12] and will be further explored in my future scholarship. For this essay I am specifically interested in the compounded effects of social exclusion and spatial isolation that is produced by racial segregation, such as concentrated wealth, distressed communities, and cognitive oversights, and how these problems impact technology development and algorithmic bias.

In Section I, I will provide a brief historical overview of racial segregation, and explore its less obvious social, political and epistemic implications for White Americans. Since White Americans dominate the technology sector, and most research suggests that they primarily benefit from racial segregation,[13] it is important to evaluate this group's relationship to the problem before examining how racial segregation affects algorithmic design, analysis and outcomes. In Section II, I will explore two aspects of how racial segregation impacts data-driven technologies and algorithmic bias. First, I will explore how racial segregation and the inequality it breeds influences algorithmic design. I am particularly interested in how specific approaches and presumptions in algorithmic design and analysis tend to replicate and maintain racial inequalities produced by racial segregation. Second, I will explore how racial segregation, or the failure to examine it, influences how some data-driven technologies are evaluated. Here, I am specifically interested in how socially contested data-driven technologies

[12] RICHARD ROTHSTEIN, THE COLOR OF LAW: A FORGOTTEN HISTORY OF HOW OUR GOVERNMENT SEGREGATED AMERICA (2017); JESSICA TROUNSTINE, SEGREGATION BY DESIGN: LOCAL POLITICS AND INEQUALITY IN AMERICAN CITIES (2018); Jennifer Roback, *Southern Labor Law in the Jim Crow Era: Exploitive or Competitive?,* U. CHI. L. REV. 1161 (1984).

[13] *See, e.g.*, IRA KATZNELSON, WHEN AFFIRMATIVE ACTION WAS WHITE (2006); JESSICA TROUNSTINE, SEGREGATION BY DESIGN: LOCAL POLITICS AND INEQUALITY IN AMERICAN CITIES (2018); EDUARDO BONILLA-SILVA, RACISM WITHOUT RACISTS: COLOR-BLIND RACISM AND THE PERSISTENCE OF RACIAL INEQUALITY IN AMERICA (2014); Daria Roithmayr, *Racial Cartels*, 16 MICH. J. RACE & L. 45 (2010).

are considered, by some, to be fair and permissible. This section is not intended to comprehensively evaluate the various ways racial segregation influences algorithmic design and bias, instead it helps illustrate how critical analysis of racial segregation can deepen our understanding of algorithmic bias, improve evaluations of data-driven technologies for social and racial equity concerns, and broaden our imaginations about what meaningful redress of algorithmic bias and racial segregation should include. I will conclude with analysis of how prevailing approaches to evaluating and mitigating algorithmic bias are insufficient and why a transformative justice framework is necessary to adequately examine and redress algorithmic bias as well as improve the development of data-driven technologies and applications.

Though data-driven technologies are developed and used globally, this Essay is explicitly focused on the United States because analysis of structural and racial inequality requires specificity. This means examining laws, customs, social practices, and other societal features that are often constrained by or limited to jurisdictional boundaries. However, my thesis and the analysis provided in this Essay can have value in other countries and contexts to interrogate local practices or forms of segregation, structural inequality, and systemic oppression (e.g. dispossession, colonization, and caste). Ignoring or masking the origins and contemporary forms of social stratification is not unique to the United States,[14] but in order to develop and hone inclusive and accurate global or multi-jurisdictional analysis of algorithmic bias and other technology-related issues, we must have clarity on the nature of the problem locally.

I. Racial Segregation in The United States and Its Implications

In this section, I will outline how racial segregation was enacted over time in the United States to contextualized the extreme social and spatial

[14] *See*, UNITED KINGDOM COMMISSION ON RACE AND ETHNIC DISPARITIES, COMMISSION ON RACE AND ETHNIC DISPARITIES: THE REPORT (March 2021), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974507/20210331_-_CRED_Report_-_FINAL_-_Web_Accessible.pdf (downplaying the role and impact of racial and ethnic discrimination and institutional racism in modern-day Britain). *Compare*, WORKING GROUP OF EXPERTS ON PEOPLE OF AFRICAN DESCENT, SPECIAL PROCEDURES OF THE UNITED NATIONS HUMAN RIGHTS COUNCIL, UN EXPERTS CONDEMN UK COMMISSION ON RACE AND ETHNIC DISPARITIES REPORT (2021), https://www.ohchr.org/EN/NewsEvents/Pages/DisplayNews.aspx?NewsID=27004&LangID=E.

isolation it produced. With this context, I will then explore the less obvious social, political and epistemic implications of racial segregation, particularly for White Americans.

a. A Brief Overview of Racial Segregation in the United States

Throughout United States history, racial segregation has been a primary mechanism for maintaining racial hierarchy. This social and racial paradigm of hierarchy, separation and exclusion has been primarily maintained through laws, policies, and actions (both by private and public institutions and individuals), though the approaches and means have evolved overtime to accommodate legal and societal changes. During the colonial and antebellum periods, racial groups were in closer proximity than later centuries due to the cruel, yet legal institution of chattel slavery, but Black American's movements, actions, liberties, and overall existence were heavily regulated and controlled through the enforcement of slave codes (laws relating to slavery and enslaved people in all colonies) and Black Codes (laws regulating the activities and behavior Black Americans during antebellum and Reconstruction). These legal restrictions segregated some public spaces, prohibited Black Americans from settling in new states or territories that were dispossessed from Indigenous Americans,[15] significantly controlled or limited interracial interactions, and subjugated Black Americans to exploitive work arrangements and conditions in states where slavery was illegal. After Emancipation and Reconstruction, racial segregation increased dramatically due to the establishment of Jim Crow laws and policies. The Jim Crow system refers to a series of laws, ordinances, informal policies, extrajudicial practices, and even social customs established by states and municipalities, predominately but not exclusively in the American South. This system legalized racial segregation across most aspects of society to serve as "public symbols and constant reminders of his [Black American's] inferior position."[16] Though the immediate purpose of these laws were to enforce physical separation based

[15] This exclusion of nonwhite groups is notable because the Homestead Acts, a series of laws granting government land to citizens by application, were the most extensive redistributive government policy and one of the greatest wealth generating entitlement programs in U.S. history. *See*, Keri Leigh Merritt, *Land and the roots of African-American Poverty*, AEON, Mar. 11, 2016, https://aeon.co/ideas/land-and-the-roots-of-african-american-poverty; ROXANNE DUNBAR-ORTIZ, AN INDIGENOUS PEOPLES' HISTORY OF THE UNITED STATES (2015).

[16] C. VANN WOODWARD, THE STRANGE CAREER OF JIM CROW, 7 (Commemorative Edition 2002).

on race, they also served to limit or exclude Black Americans from social, political, economic, and legal participation in society. As the American historian, C. Vann Woodward notes,

> "The [segregation] code lent the sanction of law to a racial ostracism that extended to churches and schools, to housing and jobs, to eating and drinking. Whether by law or custom, that ostracism extended to virtually all forms of public transportation, to sports and recreations, to hospitals, orphanages, prisons, and asylums, and ultimately to funeral homes, morgues, and cemeteries."[17]

During this same period, the United States experienced significant industrial growth, which spurred massive demographic shifts and population growth in urban areas from domestic migration and immigration.[18] Yet, the racial segregation in these urban and industrialized areas was less overt, with the exception of exclusionary zoning ordinances that prohibited or otherwise significantly restricted the presences of racial minorities.[19] Racial segregation and homogeneity were encouraged and incentivized through increased government spending on public goods, services, and infrastructure, such as public schools, fire departments, sewers and streetlights.[20] Policymakers and social welfare workers sought to assimilate and "Americanize" foreign-born populations, which were primarily European due to racially exclusionary immigration policies, through expanding their access to public goods, services, and infrastructure.[21] But the investment in and expansion of these public goods, services, and infrastructure was often dependent on and linked to community homogeneity, which also made the systemic denial of public goods and

[17] Id.
[18] JESSICA TROUNSTINE, SEGREGATION BY DESIGN: LOCAL POLITICS AND INEQUALITY IN AMERICAN CITIES (2018).
[19] CHRISTOPHER SILVER, THE RACIAL ORIGINS OF ZONING IN AMERICAN CITIES, *in* URBAN PLANNING AND THE AFRICAN AMERICAN COMMUNITY: IN THE SHADOWS (eds. June Manning Thomas & Marsha Ritzdorf 1997); Rolf Pendall, *Local Land Use Regulation and the Chain of Exclusion*, 66(2) J. OF THE AM. PLANNING ASS'N. 125 (2000).
[20] Id.; CRAIG M. BROWN & CHARLES N. HALABY, BOSSES, REFORM, AND THE SOCIOECONOMIC BASES OF URBAN EXPENDITURE, 1890-1940, *in* THE POLITICS OF URBAN FISCAL POLICY (eds. Terrance J. McDonald & Sally K. Ward 1984); CYBELLE FOX, THREE WORLDS OF RELIEF: RACE, IMMIGRATION, AND THE AMERICAN WELFARE STATE FROM THE PROGRESSIVE ERA TO THE NEW DEAL (2012).
[21] Id.

services based on race possible and inconspicuous.[22] The totalizing effect of these policies and practices not only made their racialized consequences resilient through time and demographic shifts but it made the full democratic participation or assimilation of racial minorities insuperable.

Federal public policy also contributed to racial segregation nationally. Many of the economic and social programs and reforms created during President Franklin D. Roosevelt's leadership included provisions or carve-outs that effectively excluded racial minorities and enabled racial segregation. For example, the National Labor Relations Act of 1935, which instituted various rights and protections for private sector employees, and the Fair Labor Standards Act of 1938, which boosted wages and improved working conditions, excluded domestic and agricultural workers, the majority of whom were Black Americans, and gave way to several forms of occupational and economic segregation.[23] Another way federal policy tacitly sanctioned racial segregation was through relegating implementation of federal programs, like the Servicemen's Readjustment Act of 1944 (G.I. Bill), to state and local governments, many of which upheld the Jim Crow system or other racially discriminatory policies and practices.[24] Additionally, several of the newly created federal executive agencies and institutions, like the Federal Housing Administration and the Homes Owners' Loan Corporation, enacted policies that promoted racial segregation and incentivized racially discriminatory practices and customs, such as redlining.[25] Yet, as legal and social challenges to racial segregation mounted and became increasingly successful during the Civil Rights Era, federal, state, and local government's policies and practices became more

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[22] *See, e.g.*, JESSICA TROUNSTINE, SEGREGATION BY DESIGN: LOCAL POLITICS AND INEQUALITY IN AMERICAN CITIES, 98-118 (2018); CRAIG M. BROWN & CHARLES N. HALABY, BOSSES, REFORM, AND THE SOCIOECONOMIC BASES OF URBAN EXPENDITURE, 1890-1940, *in* THE POLITICS OF URBAN FISCAL POLICY (eds. Terrance J. McDonald & Sally K. Ward 1984); Claudia Goldin & Lawrence F. Katz, *Human Capital and Social Capital: The Rise of Secondary Schooling in America*, 29(4) THE J. OF INTERDISCIPLINARY HISTORY 683 (1999).

[23] James Gilbert Cassedy, *African Americans and the American Labor Movement*, PROLOGUE MAGAZINE, Summer 1997, https://www.archives.gov/publications/prologue/1997/summer/american-labor-movement.html; PHILIP S. FONER, *ORGANIZED LABOR AND THE BLACK WORKER* (1981).

[24] IRA KATZNELSON, WHEN AFFIRMATIVE ACTION WAS WHITE (2006).

[25] *See*, Kevin E. Jason, *Dismantling the Pillars of White Supremacy: Obstacles in Eliminating Disparities and Achieving Racial Justice*, 23 CUNY L. REV. 139, 153-159 (2020) (describing policies initiated by Roosevelt administration's housing agencies and institutions that advance racial segregation, generated significant wealth in White communities, and concentrated poverty and other social ills in Black communities).

covert. For example, federal authorities used urban renewal and highway development projects to decimate BIPOC communities and create formal boundaries lines in communities that were experiencing or attempting integration.[26]

Though racial segregation was sanctioned and enforced through laws, it was equally shaped and perpetuated by the prejudicial actions and social customs of White Americans. Indeed, some scholars have argued that racial segregation and discrimination produced network effects that engendered cartel-like conduct amongst "a range of all-White groups, like homeowners' association, unions, school boards, local political parties, city councils, and other racially exclusive groups" that seek to preserve the race-based advantages that stem from exclusionary practices and policies.[27] For instance, legal scholar Daria Roithmayr observed that "[t]hese [all-white] groups gained significant social, economic and political profit – higher wages, higher property values, greater political power – from excluding on the basis of race."[28] Initially, these racially biased and socially exclusionary customs practiced by private citizens were brazen and brutal, such as lynchings, riots, and other targeted violence. But over time these practices and customs became more subtle and were framed as matters of personal preference, freedom of choice, and individual rights. So, when white parents send their children to private schools, white employers only hire from their social and professional networks, and white residents contest construction of public housing or homeless shelters in their neighborhoods, these decisions are no longer viewed as or considered acts of self-segregation. In fact, these actions and normative stances conveniently ignore the current state of American society where:

> "A typical white person lives in a neighborhood that is 75 percent white and 8 percent African American, while a typical African American person lives in a neighborhood that is only 35 percent white and 45 percent African American... In the United States, a low-income African American person is more than three times more likely to live in a neighborhood with a poverty rate of 40 percent or more than a white person is, and a low-income Latino person is more than twice as

[26] *See,.e.g.*, Johnny Miller, *Roads to nowhere: How infrastructure build American inequality*, THE GUARDIAN, Feb. 18, 2018, https://www.theguardian.com/cities/2018/feb/21/roads-nowhere-infrastructure-american-inequality.
[27] Daria Roithmayr, *Racial Cartels*, 16 MICH. J. RACE & L. 45,48 (2010).
[28] Id.

> likely to live in such a neighborhood. These statistics show that racial residential segregation and racialized concentrated poverty persist today."[29]

Together, these implicit actions, practices and policies, have become both normalized and distorted such that the current state of racial segregation in American society and contemporary racial inequality can be rationalized as isolated aberrations rather than norms that require systemic change and actions by government and society.[30]

b. A Review of the Social, Political, and Epistemic Implications of Racial Segregation

Scholarship across several disciplines have advanced our understanding of the variegated consequences of racial segregation. Though the intention is physical separation, the consequences for dominant and minority racial groups are also social, economic, political, cultural, psychological, epistemic, intergenerational, and more.[31] Yet, it is clear from the preceding section and decades of multidisciplinary scholarship[32] that the primary drivers of racial segregation are the actions and policies of federal, state, and local governments in addition to the individual and collective actions of

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[29] SOLOMON GREENE, MARGERY AUSTIN TURNER, & RUTH GOUREVITCH, US PARTNERSHIP ON MOBILITY FROM POVERTY, RACIAL RESIDENTIAL SEGREGATION AND NEIGHBORHOOD DISPARITIES (2017), https://www.mobilitypartnership.org/publications/racial-residential-segregation-and-neighborhood-disparities, *citing* PAUL JARGOWSKY, ARCHITECTURE OF SEGREGATION, THE CENTURY FOUNDATION (2015), https://tcf.org/content/report/architecture-of-segregation/; JOHN LOGAN & BRIAN STULTS, THE PERSISTENCE OF SEGREGATION IN THE METROPOLIS: NEW FINDINGS FROM THE 2010 CENSUS, PROJECT US2010 (2011).

[30] *See*, BARBARA TOMILSON, POWERBLIND INTERSECTIONALITY: FEMINIST REVANCHISM AND INCLUSION AS A ONE-WAY STREET, *in* SEEING RACE AGAIN: COUNTERING COLORBLINDNESS ACROSS THE DISCIPLINES (eds. Kimberle Williams Crenshaw et al. 2019).

[31] E.g., Patrick Sharkey, *The Intergenerational Transmission of Context*, 113 AM. J. OF SOCIOLOGY 931 (2008).

[32] *e.g.*, RICHARD ROTHSTEIN, THE COLOR OF LAW: A FORGOTTEN HISTORY OF HOW OUR GOVERNMENT SEGREGATED AMERICA (2017); JESSICA TROUNSTINE, SEGREGATION BY DESIGN: LOCAL POLITICS AND INEQUALITY IN AMERICAN CITIES (2018); ARNOLD HIRSCH, MAKING OF THE SECOND GHETTO (1993), KENNETH JACKSON, CRABGRASS FRONTIER (1985), SAMUEL ROBERTS, INFECTIOUS FEAR (2009); JUDITH R. BLAU, RACE IN THE SCHOOLS: PERPETUATING WHITE DOMINANCE (2003); MELVIN OLIVER & THOMAS M. SHAPIRO, BLACK WEALTH/WHITE WEALTH: A NEW PERSPECTIVE ON RACIAL INEQUALITY (1996); CLAUD ANDERSON, BLACK LABOR, WHITE WEALTH: THE SEARCH FOR POWER AND ECONOMIC JUSTICE (1994); LAWRENCE T. BROWN, THE BLACK BUTTERFLY: THE HARMFUL POLITICS OF RACE AND SPACE IN AMERICA (2021)

White Americans and "all-white groups." Therefore, it is important to examine some aspects of these collateral consequences of racial segregation on White Americans, to then evaluate the impact of racial segregation on technology development and outcomes. In this part, I review some of the social, political and epistemic implications because these repercussions are relevant for evaluating algorithmic design, analysis and outcomes.

Racial segregation causes social and spatial isolation of one racial group from others and over time this separation can be self-reinforcing– the distance and isolation it produces breeds differentiation of and indifference to the "other." Indeed, sociologist Eduardo Bonilla-Silva argues that because White Americans experience "high levels of social and spatial segregation and isolation from minorities" that has been sustained over several generations, it creates what he labels as "'white *habitus*,' a racialized, uninterrupted socialization process that *conditions* and *creates* whites' racial taste, perceptions, feelings, and emotions and their views on racial matters."[33] Bonilla-Silva adds that a central consequence of "white habitus" is that "it promotes a sense of group belonging (a white culture of solidarity) and negative views about nonwhites."[34] During the 18th, 19th and 20th centuries, these negative notions of racial group differences were advanced through scientific racism theories and narratives.[35] Even though these theories and narratives were ultimately challenged and discredited, notions of racial difference lived on because they were "built into the urban and suburban fabric" of American society and institutionalized in rules and laws.[36] Thus, socially constructed categories of difference that mattered in the past, in this case race, continue to matter and shapes one's world view, interests, and actions.[37]

When this happens in isolation, "whiteness is not perceived as a racial category, other categories are" and this results in the false presumption that whiteness is a norm; therefore, homogenous white neighborhoods are not viewed as products of racial segregation, instead they are considered

[33] EDUARDO BONILLA-SILVA, RACISM WITHOUT RACISTS: COLOR-BLIND RACISM AND THE PERSISTENCE OF RACIAL INEQUALITY IN AMERICA, 152 (2014).
[34] Id.
[35] *See*, DOROTHY E. ROBERTS, FATAL INVENTION: HOW SCIENCE, POLITICS, AND BIG BUSINESS RE-CREATE RACE IN THE TWENTY-FIRST CENTURY (2011); TROY DUSTER, BACKDOOR TO EUGENICS (1990).
[36] CLARISSA RILE HAYWARD, URBAN SPACE AND AMERICAN POLITICAL DEVELOPMENT: IDENTITY, INTEREST, ACTION, *in* THE CITY IN AMERICAN POLITICAL DEVELOPMENT (ed. Richardson Dilworth 2009).
[37] Id.

"normal."[38] Treating whiteness as a norm in a racially diverse yet structurally unequal society is problematic because then political, social and economic activities and outputs are designed with only White individuals and groups in mind, and those who are not white are excluded and "seem not to fit because of something in their own nature."[39] This has several repercussions but I will focus on two for brevity.

First, it "begets a politics of parochial self-interest" where all-white groups are motivated to "maximize benefits for their own community and to limit fiscal burdens by denying access to populations and land uses that they perceive as undesirable."[40] This results in a concentration of resources and benefits in white spaces (e.g. higher property values, well-funded schools, newer amenities) and a concentration of collective or societal problems in non-white spaces (e.g. poverty, over-policing, underfunded schools, higher taxes).[41] These problems are made worse because "this political division occurs in an economic system that increasingly rewards the same affluent, professional, largely suburban class, creating gaps of opportunity that are unlikely ever to be closed."[42] This investment in a winner-take-all system also makes one less interested in systemic evaluation, reform or remedies. In fact, economist Glenn C. Loury argues that this is not just a political stance but an epistemic one that he characterizes as "'biased social cognition': [i]t is a politically consequential cognitive distortion to ascribe the disadvantage to be observed among a group of people to qualities thought to be intrinsic to that group when, in fact, that disadvantage is the product of a system of social interactions."[43] And this in turn results in White American's developing "powerful explanations – which have

[38] BEVERLY DANIEL TATUM, WHY ARE ALL THE BLACK KIDS SITTING TOGETHER IN THE CAFETERIA?: AND OTHER CONVERSATIONS ABOUT RACE, 93 (1997).
[39] MARTHA MINOW, MAKING ALL THE DIFFERENCE: INCLUSION, EXCLUSION, AND AMERICAN LAW, 21 (1990). *See also*, Elijah Anderson, *"The White Space",* 1(1) SOCIOLOGY OF RACE & ETHNICITY 10 (2015).
[40] Sheryll D. Cashin, *Drifting Apart: How Wealth and Race Segregation Are Reshaping the American Dream*, 47 Vill. L. Rev. 595, 600 (2002). See also, CLARISSA RILE HAYWARD, URBAN SPACE AND AMERICAN POLITICAL DEVELOPMENT: IDENTITY, INTEREST, ACTION, *in* THE CITY IN AMERICAN POLITICAL DEVELOPMENT (ed. Richardson Dilworth 2009).
[41] CLARISSA RILE HAYWARD, URBAN SPACE AND AMERICAN POLITICAL DEVELOPMENT: IDENTITY, INTEREST, ACTION, *in* THE CITY IN AMERICAN POLITICAL DEVELOPMENT (ed. Richardson Dilworth 2009). *See also,* Sheryll D. Cashin, *Drifting Apart: How Wealth and Race Segregation Are Reshaping the American Dream*, 47 VILL. L. REV. 595 (2002).
[42] Sheryll D. Cashin, *Drifting Apart: How Wealth and Race Segregation Are Reshaping the American Dream*, 47 VILL. L. REV. 595, 596 (2002).
[43] GLENN C. LOURY, THE ANATOMY OF RACIAL INEQUALITY, 26 (2003).

ultimately become justifications – for contemporary racial inequality that exculpate them from any responsibility for the status of people of color."[44]

Second, treating whiteness as a norm stigmatizes racial difference where "problems of inequality can be exacerbated both by treating members of minority groups the same as members of the majority and by treating the two groups differently."[45] Treating racial groups the same, and therefore ignoring their structurally unequal conditions and statuses, can entrench an unfair status quo (particularly social, political, and economic arrangements) rather than acknowledging it as "part of the discriminating framework that must itself be changed."[46] Applying colorblind logics, approaches, or tactics to colorbound problems also renders white racial dominance (i.e. the dominant social, political, and economic position of White Americans) invisible and this can further entrench social inequalities across all racial groups.[47] And to be clear, acknowledging white racial dominance does not mean ignoring the deep class schisms amongst White Americans. Indeed, legal scholar Ian Haney-Lopez clarifies that:

> "Rather than belying the power of race, however, these internal rifts more likely reflect race's utility in palliating intra-group conflict among Whites. Racial ideology does not guarantee equality among Whites; it serves rather to mask and distract from gross inequalities that divide that group. That said, it remains the case that Whites as a race (though not all Whites individually) have maintained their position at the social and material apogee for centuries…[and] being

[44] EDUARDO BONILLA-SILVA, RACISM WITHOUT RACISTS: COLOR-BLIND RACISM AND THE PERSISTENCE OF RACIAL INEQUALITY IN AMERICA, 2 (2014). *See also*, CHARLES W. MILLS, WHITE IGNORANCE, at 28 *in* RACE AND EPISTEMOLOGIES OF IGNORANCE (ed. Shannan Sullivan & Nancy Tuana 2007) ("….white normativity underpins white privilege, in the first case by justifying differential treatment by race and in the second case by justifying formally equal treatment by race that—in its denial of the cumulative effect of past differential treatment—is tantamount to continuing it").

[45] MARTHA MINOW, MAKING ALL THE DIFFERENCE: INCLUSION, EXCLUSION, AND AMERICAN LAW, 20 (1990).

[46] MARTHA MINOW, MAKING ALL THE DIFFERENCE: INCLUSION, EXCLUSION, AND AMERICAN LAW, 76 (1990). *See also*, DERRICK BELL, AND WE ARE NOT SAVED: THE ELUSIVE QUEST FOR RACIAL JUSTICE (1987); GEORGE LIPSITZ, HOW RACISM TAKES PLACE (2011).

[47] *See*, BARBARA TOMILSON, POWERBLIND INTERSECTIONALITY: FEMINIST REVANCHISM AND INCLUSION AS A ONE-WAY STREET, *in* SEEING RACE AGAIN: COUNTERING COLORBLINDNESS ACROSS THE DISCIPLINES (eds. Kimberle Williams Crenshaw et al. 2019).

> White affords advantages across the range of material and status divisions that mar our society."[48]

Conversely, treating racial groups differently follows a tendency to "shoehorn the United States' racial history into a rhetorically powerful but analytically crude [and shallow] story of 'two societies'" where "particular inequalities that appear statistically as 'racial' disparities are in fact embedded in multiple social relations and…the dominant modes of approaching this topic impede the understanding of this larger picture."[49] Under this approach, people are treated as monoliths rather than individuals which not only erases other aspects of their identity (e.g. gender, ethnicity, ability, class, religion, sexual orientation) but it also flattens the complex relationships and dynamics across society to one-dimension.[50] Moreover, perpetuating racial difference both reinforces unstated norms, in this case whiteness, as well as historical or existing social arrangements (i.e., racial segregation), which in turn suggests that the status quo is neutral and natural, and again impedes systemic evaluation, reform, or remedies.[51]

The analysis provided in this section is intentionally bound and will be expounded upon in future scholarship, but what I have outlined provides sufficient context for what will be explored in the subsequent sections.

II. How Racial Segregation Shapes Data-Driven Technologies and Algorithmic Bias

In this Section I will explore two aspects of how racial segregation impacts data-driven technologies and algorithmic bias. Part A examines how racial segregation and the societal inequality it breeds influences algorithmic design and analysis and Part B considers how the failure to adequately assess the role of racial segregation and its consequences influences how

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[48] IAN HANEY LOPEZ, WHITE BY LAW: THE LEGAL CONSTRUCTION OF RACE, 148-150 (10th Ann. Ed. 2006).
[49] Adolph L. Reed & Merlin Chowkwanyun, *Race, Class, Crisis: The Discourse of Racial Disparity and its Analytical Discontents*, 48 SOCIALIST REGISTER 149, 150-151 (2012).
[50] See, PATRICIA HILL COLLINS, BLACK FEMINIST THOUGHT: KNOWLEDGE, CONSCIOUSNESS, AND THE POLITICS OF EMPOWERMENT (2000); Kimberle Crenshaw, *Demarginalizing the Intersections of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics*, 1(8) U. OF CHICAGO LEGAL FORUM 139 (1989); GRACE LEE BOGGS, THE NEXT AMERICAN REVOLUTION: SUSTAINABLE ACTIVISM FOR THE TWENTY-FIRST CENTURY (2012).
[51] MARTHA MINOW, MAKING ALL THE DIFFERENCE: INCLUSION, EXCLUSION, AND AMERICAN LAW, 53 (1990).

some data-driven technologies are implemented with minimal scrutiny and evaluated positively.

a. Racial Segregation and Algorithmic Design

There is growing recognition that data-driven techniques and technologies, like predictive analytics and actuarial assessment, can produce discriminatory outcomes.[52] But there is less consensus on what drives or causes these discriminatory outcomes, in particular what component of the algorithmic design process is at fault and whether context or the type of technology or technique matters. Within legal scholarship, there are two primary assertions. Some scholars point to human bias, error, or interventions as a source,[53] whereas others suggest that discrimination is an artifact of the data sources and data mining process.[54] Yet, these problems should not be treated as mutually exclusive. In fact, when we consider racial segregation as a root cause and source of algorithmic bias, we can recognize the aforementioned assertions as connected.

Racial segregation is both enduring and pervasive, such that it shapes most aspects of society and it is reflected in most institutional arrangements. At

[52] *See, e.g.,* EXEC.OFFICE OF THE PRESIDENT,BIG DATA: SEIZING OPPORTUNITIES,PRESERVING VALUES (May 2014), https://obamawhitehouse.archives.gov/sites/default/files/docs/20150204_Big_Data_Seizing_Opportunities_Preserving_Values_Memo.pdf; EUROPEAN COMMISSION, PROPOSAL FOR A REGULATION LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE (April 2021), https://digital-strategy.ec.europa.eu/en/library/proposal-regulation-laying-down-harmonised-rules-artificial-intelligence-artificial-intelligence.

[53] E.g., Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions,* 89 WASH.L.REV.1, 4 (2014) ("Because human beings program predictive algorithms, their biases and values are embedded into the software's instructions"); Danielle Keats Citron, *Technological Due Process*, 85 WASH.U.L.REV.1249, 1254 (2008) ("Programmers routinely change the substance of rules when translating them from human language into computer code. The resulting distorted rules effectively constitute new policy that can affect large numbers of people.").

[54] *e.g.*, Joshua A. Kroll et al., *Accountable Algorithms*, 165 U. PA. L. REV. 633, 680 (2017) ("[A]lgorithms that include some type of machine learning can lead to discriminatory results if the algorithms are trained on historical examples that reflect past prejudice or implicit bias . . . ."); Solon Barocas & Andrew D. Selbst, *Big Data's Disparate Impact*, 104 CAL. L. REV. 671, 674 (2016)("Discrimination may be an artifact of the datamining process itself, rather than a result of programmers assigning certain factors inappropriate weight"); Rashida Richardson et al., *Dirty Data, Bad Predictions: How Civil Rights Violations Impact Police Data, Predictive Policing Systems, and Justice*, 94 N.Y.U. L. Rev. 15, 41 (2019) (""...it becomes clear that any predictive policing system trained on or actively using data from jurisdictions with proven problematic conduct cannot be relied on to produce valid results...").

the same time, racial segregation is perpetuated, normalized, and often overlooked by White Americans, who dominate the technology sector and are therefore notably associated with algorithmic design and analysis. Thus, racial segregation inevitably influences and shapes data sources, the data mining process, and human biases and practices in the technology development process. To help illustrate this, I will explicate how training data can be systemically biased by racial segregation and then I will explore how the lack of understanding and evaluation of racial segregation and its consequences can influence human choices and decisions in the technology development process, and both of these problems can result in data-driven technologies replicating or amplifying inequality.

i. Training Data

Many data-driven technologies, particularly those that incorporate machine learning, rely on training data. Training data is typically composed of samples of historical observations or curated examples considered relevant to performing a particular task (e.g., prediction or matching) and it is often classified into categories by developers to train algorithms to behave in a certain way or produce specific outcomes.[55] As a result, training data can be systematically biased itself and contribute to algorithmic bias. Since training data is based on historical samples or examples, it can reflect social and structural inequalities in society, and these problems are then calcified by interventions or the lack thereof by human developers, particularly decisions that classify or surmise the validity and appropriateness of particular data points or datasets, generally.[56]

To advance this point and illustrate how racial segregation, in particular, can systematically bias training data, I will examine racial segregation and police crime data, which is a primary data source for data-driven technologies used in policing. Extant research identifies racial residential segregation and the discriminatory public policies it enabled and, in many ways, concealed (e.g. uneven funding of public goods and divestment), as prominent structural forces in the reproduction of neighborhoods and

[55] *See, e.g.,* Solon Barocas & Andrew D. Selbst, *Big Data's Disparate Impact*, 104 CAL. L. REV. 671, 680-1 (2016); BEN GREEN, THE SMART ENOUGH CITY, 66-69 (2019).
[56] Id.; Sarah Brayne, B*ig Data Surveillance: The Case of Policing*, 82(5) AM. SOCIOLOGICAL REV. 977, 996-1004 (2017).

geographies that are structurally unequal across racial and ethnic lines.[57] And as discussed the previous section, the consequence of these private and public, individual and collective actions, practices, and policies was the confinement and concentration of societal problems and disadvantage, such as poverty, unemployment, and crime, in lower-income, nonwhite neighborhoods.[58] This geographic concentration of disadvantage has been linked to higher crime rates, though there is debate about whether the causal link is criminogenic factors inherent to certain disadvantaged communities,[59] or a consequence of the lack of political power and organizing to "implement strategies to improve social and institutional structures that affect crime."[60] Yet, one fact remains true regardless of which causal explanation one adopts – sites of concentrated disadvantage and social problems are often considered sites of "disorder", which results in greater law enforcement presence, targeting and surveillance practices.[61]

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[57] Lauren J. Krivo, Ruth D. Peterson, & Danielle C. Kuhl, *Segregation, Racial Structure, and Neighborhood Violent Crime*, 114(6) AM. J. OF SOCIOLOGY 1765, 1768 (2009). *See also*, JOHN R. LOGAN & HARVEY L. MOLOTCH, URBAN FORTUNES: THE POLITICAL ECONOMY OF PLACE (1987); DOUGLASS S. MASSEY & NANCY A. DENTON, AMERICAN APARTHEID: SEGREGATION AND THE MAKING OF THE UNDERCLASS (1993); Thomas L. McNutly, *The Residential Process and the Ecological Concentration of Race, Poverty, and Violent Crime in New York City*, 32 SOCIOLOGICAL FOCUS 25 (1999); Gregory D. Squires & Charis E. Kubrin, *Privileged Places: Race, Uneven Development, and the Geography of Opportunity in Urban American*, 42 URBAN STUDIES 47 (2005); THOMAS SUGRUE, THE ORIGINS OF THE URBAN CRISIS: RACE AND INEQUALITY IN POSTWAR DETROIT (2016).

[58] Id.

[59] DOUGLASS S. MASSEY & NANCY A. DENTON, AMERICAN APARTHEID: SEGREGATION AND THE MAKING OF THE UNDERCLASS (1993); DOUGLAS S. MASSEY, SEGREGATION AND VIOLENT CRIME IN URBAN AMERICA, *IN* PROBLEMS OF THE CENTURY: RACIAL STRATIFICATION IN THE UNITED STATES (ed. Elijah Anderson & Douglass S. Massey 2001).

[60] Lauren J. Krivo, Ruth D. Peterson, & Danielle C. Kuhl, *Segregation, Racial Structure, and Neighborhood Violent Crime*, 114(6) AM. J. OF SOCIOLOGY 1765, 1771 (2009). see also, ROBERT J. SAMPSON & WILLIAM JULIUS WILSON, TOWARD A THEORY OF RACE, CRIME, AND URBAN INEQUALITY, *in* CRIME AND INEQUALITY (eds. John Hagan & Ruth D. Peterson 1995).

[61] *See*, George L. Kelling & James Q. Wilson, *Broken Windows: The police and neighborhood safety*, THE ATLANTIC, March 1982, https://www.theatlantic.com/magazine/archive/1982/03/broken-windows/304465/; ANTHONY A. BRAGA & DAVID L. WEISBURD, POLICING PROBLEM PLACES: CRIME HOT SPOTS AND EFFECTIVE PREVENTION (2010); RICHARD V. ERICSON & KEVIN D. HAGGERTY, POLICING THE RISK SOCIETY, 39-80 (1997). *Also*, BRIAN JEFFERSON, DIGITIZE AND PUNISH: RACIAL CRIMINALIZATION IN THE DIGITAL AGE, 165-182 (2020) (describing the expansion of surveillance technologies to "deviant places").

The result of this law enforcement approach, colloquially known as "broken windows" or "hot spot" policing, is that police data will reflect policing practices and policies.[62] This uneven law enforcement practice distorts crime data because even when certain types of crime occur equally across a large geographic area, it may not be accurately reflected in police crime data.[63] Instead, crime data will reflect where police concentrate their time, so crimes that take place in public places that are heavily patrolled are more visible and more likely to be recorded,[64] which means that crime datasets will reflect places and people with more law enforcement contacts, not the actual crime occurrence rates.[65]

In the context of "big data" policing, where police rely on crime data or data-driven technologies to inform policing strategies and practices, this practice of policing "disorder" not only means that neighborhoods and spaces are labeled or classified as criminogenic but the people who reside in these spaces are also subjected to negative, differential treatment and adverse categorization, e.g.– "individuals living in low-income, minority areas have a higher probability of their 'risk' being quantified than those in more advantaged neighborhoods."[66] These practices also produce feedback loop effects because the skewed crime data justifies greater police presence in lower-income, nonwhite neighborhoods and subjects the denizens of these areas to potentially less constitutional protection.[67] Moreover, since police contact is the entry point into the criminal justice system, these

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[62] Rashida Richardson et al., *Dirty Data, Bad Predictions: How Civil Rights Violations Impact Police Data, Predictive Policing Systems, and Justice*, 94 N.Y.U. L. Rev. 15 (2019).
[63] *See, e.g.*, Kristian Lum & William Isaac, *To Predict and Serve?*, 5 SIGNIFICANCE (2016).
[64] TROY DUSTER, PATTERN, PURPOSE, AND RACE IN THE DRUG WAR, *in* CRACK IN AMERICA: DEMON DRUGS AND SOCIAL JUSTICE (eds. C. Reinarman & H.G. Levine 1997).
[65] Rashida Richardson et al., *Dirty Data, Bad Predictions: How Civil Rights Violations Impact Police Data, Predictive Policing Systems, and Justice*, 94 N.Y.U. L. Rev. 15, 40-46 (2019); BEN GREEN, THE SMART ENOUGH CITY, 70-89 (2019).
[66] Sarah Brayne, B*ig Data Surveillance: The Case of Policing*, 82(5) AM. SOCIOLOGICAL REV. 977, 997(2017).
[67] *See*, Rashida Richardson et al., *Dirty Data, Bad Predictions: How Civil Rights Violations Impact Police Data, Predictive Policing Systems, and Justice*, 94 N.Y.U. L. Rev. 15, 40-28 (2019) (describing the feedback loop effects of biased crime data); Andrew Gutherie Ferguson, *Crime Mapping and the Fourth Amendment: Redrawing "High-Crime Areas",* 63 HASTINGS L.J. 179, 208-215 (2011)(detailing how fourth amendment standards and analysis can become attenuated due to high-crime area designation or other pretext); *Leaders of A Beautiful Struggle v. Baltimore Police Department*, 979 F.3d 219 (4th Cir. 2020)(finding the use of an aerial surveillance program constitutional because it served a "critical government purpose" of combatting violent crime in a high crime area).

practices can concentrate arrests and incarceration in these same locations,[68] thus making disadvantaged neighborhoods worse.[69] In fact, research suggests that the systematic effect of these self-reinforcing policing practices is a complex and sophisticated method of police enforcing racial segregation because the increased police presence and actions compound concentrated disadvantage or reinforce segregative practices (e.g. further depreciating home values or accelerating "white flight").[70]

In sum, racial segregation constrains and informs policing practices, policies, and strategies, which in turn shapes police-generated crime data that is commonly used as training data for data-driven police technologies.

ii. Problem Formulation

Most parts of the technology development process involve some form of human intervention or discretion, including decisions of what technologies to develop, identifying problems that are appropriate to address with data-driven methods, and what methods to employ. Here, I will assess a specific use case to explore how the failure to adequately understand racial segregation and its consequences in formulating data science problems ("problem formulation") can negatively skew algorithmic outcomes. But before exploring the use case, it is important to understand the role of problem formulation in the technology development process.

Problem formulation is a foundational, yet vexed part of the technology development process. It is foundational because it involves determining whether a societal or business problem can be solved by applying appropriate algorithms and it is vexed because it can influence most of the developer's design choices and decision-making.[71] Problem formulation requires developers to engage in various forms of discretionary work to

[68] Todd R. Clear, Imprisoning Communities: How Mass Incarceration Makes Disadvantaged Neighborhoods Worse (2009).
[69] E.g., Sarah Brayne, B*ig Data Surveillance: The Case of Policing*, 82(5) AM. SOCIOLOGICAL REV. 977 (2017); Rashida Richardson et al., *Dirty Data, Bad Predictions: How Civil Rights Violations Impact Police Data, Predictive Policing Systems, and Justice*, 94 N.Y.U. L. Rev. 15 (2019).
[70] GRACE ROBERTS, ET AL., THE AMERICAN SYSTEM: HOW POLICE ENFORCE SEGREGATION (2019), https://storymaps.arcgis.com/stories/ac3d72c7b1c54305937e40d2ad43d774.
[71] Samir Passi & Solon Barocas, *Problem Formulation and Fairness*, Proceedings of the ACM Conference on Fairness, Accountability, and Transparency (2019); Nicole Scott, *Defining A Data Science Problem*, TOWARDS DATA SCIENCE, Aug. 18, 2019, https://towardsdatascience.com/defining-a-data-science-problem-4cbf15a2a461.

measure and translate complex and amorphous problems into formal terms that can be parsed and solved by algorithms.[72] Such discretionary work can include, determining the nature of the problem, how to measure the problem, what it is you are trying to solve or understand, metrics for success, and what methods are best suited to solve the problem or perform a certain task (e.g. prediction or allocation).

School assignment algorithms (i.e., centralized algorithms that assign K-12 students to specific schools based on families' ranked preferences) are an instructive use case for examining how developer's presumptions, oversights, and choices in problem formulation can contribute to algorithmic bias and antithetical outcomes. When Boston Public Schools adopted a school assignment algorithm to "reengineer its school choice and assignment system, with the goal of providing parents with equitable access to good schools that are close to home", the algorithm "…largely maintained status quo, inheriting but not counteracting inequities that existed under the previous system."[73] The goals for implementing the algorithm were ambitious – to increase students' access to high-quality schools while reducing the distance they travel to get to school— but some drivers of its unsatisfactory outcomes (e.g. reducing racial and geographic integration across the school district) stemmed from the problem formulation phase. It appears the developers of the Boston school assignment algorithm had a fairly myopic understanding of racial segregation in public schools and how it relates to school quality, which constrained their problem formulation analysis and overall expectations.

While the developers of the algorithm did acknowledge that "[o]ne concern of using a correlated lottery [i.e., their mathematical approach to assigning students from particular communities to schools that are less geographically dispersed] is that it may cause racial or socio-economic segregation, because race and socio-economic status are correlated with geography,"[74] they failed to acknowledge or demonstrate a significant understanding of why this correlation exists and how these correlated factors affect school quality as well as where "good" schools are located. Racial and socioeconomic segregation in public schools is both a byproduct of

[72] Id.; Solon Barocas & Andrew D. Selbst, *Big Data's Disparate Impact*, 104 CAL. L. REV. 671, 678 (2016).
[73] BOSTON AREA RESEARCH INITIATIVE, AN EVALUATION OF EQUITY IN THE BOSTON PUBLIC SCHOOLS' HOME-BASED ASSIGNMENT POLICY, 10 & 70 (2018).
[74] ITAI ASHLAGI & PENG SHI, IMPROVING COMMUNITY COHESION IN SCHOOL CHOICE VIA CORRELATED-LOTTERY IMPLEMENTATION, OPERATIONS RESEARCH, at 38 (2014), http://web.mit.edu/iashlagi/www/papers/correlated-lottery.pdf.

residential segregation (including concentrated disadvantage) and discriminatory public policies, such as school funding and school district mapping.[75] These problems directly impact school quality and where high-quality schools are located,[76] and the failure to understand these root causes and dynamics constrained the developer's problem formulation. Indeed, an evaluation of the school assignment algorithm's implementation found that disparities in access or assignment to high quality schools reproduced by the algorithm directly reflected the uneven geographic distribution of school quality in Boston —"[t]he overarching lesson of the evaluation is that it is impossible for a choice and assignment system to provide access to 'good schools close to home' when the geographic distribution of quality schools is itself inequitable."[77] Thus, in this case study, the school assignment algorithm developer's failure to adequately evaluate and understand how racial segregation affects school quality and the geographic distribution of quality schools hindered their problem formulation analysis such that they failed to anticipate the futility of their approach.

b. Racial Segregation and Algorithmic Evaluation

In this part, I will explore how data-driven applications and technologies that are inextricably shaped by racial segregation are adopted by government officials or evaluated as neutral and socially permissible by researchers with minimal or no scrutiny of this entanglement. To illustrate this problem, I will focus on a category of data-driven applications and

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[75] *See, e.g.,* Dwyer Gunn, *Non-White School Districts Get $23 Billion Less Funding Than White Ones*, PACIFIC STANDARD MAGAZINE, Feb. 26, 2019, https://psmag.com/education/nonwhite-school-districts-get-23-billion-less-funding-than-white-ones; Alvin Chang, *We can draw school zones to make classrooms less segregated.This is how well your district does.*, VOX, Aug. 27, 2018, https://www.vox.com/2018/1/8/16822374/school-segregation-gerrymander-map; ERICA FRANKENBERG, ET AL., UCLA THE CIVIL RIGHTS PROJECT, HARMING OUR COMMON FUTURE: AMERICA'S SEGREGATED SCHOOLS 65 YEARS AFTER BROWN (2019), https://civilrightsproject.ucla.edu/research/k-12-education/integration-and-diversity/harming-our-common-future-americas-segregated-schools-65-years-after-brown/Brown-65-050919v4-final.pdf.

[76] *See*, Richard Rothstein, *The Racial Achievement Gap, Segregated Schools, and Segregated Neighborhoods: A Constitutional Insult*, 7 RACE & SOCIAL PROBLEMS 21 (2015); GARY ORFIELD & CHUNGMEI LEE, WHY SEGREGATION MATTERS: POVERTY AND EDUCATIONAL INEQUALITY, THE CIVIL RIGHTS PROJECT (2005), https://civilrightsproject.ucla.edu/research/k-12-education/integration-and-diversity/why-segregation-matters-poverty-and-educational-inequality/orfield-why-segregation-matters-2005.pdf.

[77] BOSTON AREA RESEARCH INITIATIVE, AN EVALUATION OF EQUITY IN THE BOSTON PUBLIC SCHOOLS' HOME-BASED ASSIGNMENT POLICY, 2 (2018).

technologies, crime-focused geographic information systems (GIS), which are notable for their broad adoption and acceptance, but warrant greater scrutiny.[78]

GIS are computer-based tools that capture, store, analyze, query, and visualize geospatial data and related information.[79] These tools often combine crime mapping and statistical analysis to inform law enforcement strategies and practices,[80] and commonly used examples of GIS technologies include, CompStat and predictive policing.[81] Most GIS technologies are predicated on criminology or policing theories that seek to optimize the policing of disorder by revealing spatial knowledge and

[78] *See, e.g.*, Press Release, U.S. Senator Ron Wyden, Wyden, Democrats Question DOJ Funding of Unproven Predictive Policing Technology (Apr. 15, 2021), https://www.wyden.senate.gov/news/press-releases/wyden-democrats-question-doj-funding-of-unproven-predictive-policing-technology; Joseph L. Giacalone & Alex S. Vitale, *When policing stats do more harm than good: Column*, USA TODAY, Feb. 9, 2017, https://www.usatoday.com/story/opinion/policing/spotlight/2017/02/09/compstat-computer-police-policing-the-usa-community/97568874/

[79] SPACE & NAVAL WARFARE SYSTEMS CENTER ATLANTIC, U.S. DEPT. OF HOMELAND SECURITY, GEOGRAPHIC INFORMATION SYSTEMS AND PREDICTIVE POLICING APPLICATION NOTE (2013), https://www.dhs.gov/sites/default/files/publications/GIS-Predictive-Policing-AppN_0813-508_0.pdf; Andrew Gutherie Ferguson, *Crime Mapping and the Fourth Amendment: Redrawing "High-Crime Areas",* 63 HASTINGS L.J. 179 (2011).

[80] Although GIS technologies are more prevalent within the law enforcement sector, their use for risk-based practices or strategies are becoming more common in other sectors like, child welfare. For example, the "Predict-Align-Prevent" program uses placed-based geospatial machine learning to identify and target children and communities considered at high risk of maltreatment. This system was developed using prior maltreatment incident data, and it maps maltreatment risk areas based on local child welfare, health, crime, code violations, and infrastructure data. *See, e.g*, Predict-Align-Prevent Little Rock, Arkansas Technical Report for The Arkansas Division of Children and Family Services, https://papreports.org/little-rock-ar/index.html; PREDICT ALIGN PREVENT, RICHMOND, VIRGINIA TECHNICAL REPORT (2019), https://b9157c41-5fbe-4e28-8784-ea36ffdbce2f.filesusr.com/ugd/fbb580_2f1dda2ff6b84f32856bc95d802d6629.pdf.

[81] Id. *See also*, SPACE & NAVAL WARFARE SYSTEMS CENTER ATLANTIC, U.S. DEPT. OF HOMELAND SECURITY, GEOGRAPHIC INFORMATION SYSTEMS AND PREDICTIVE POLICING APPLICATION NOTE (2013), https://www.dhs.gov/sites/default/files/publications/GIS-Predictive-Policing-AppN_0813-508_0.pdf (highlighting various predictive policing vendors and departments that used the technology); DAVID WEISBURD ET AL., NATIONAL POLICE FOUNDATION, THE GROWTH OF COMPSTAT IN AMERICAN POLICING (2004), https://www.policefoundation.org/publication/the-growth-of-compstat-in-american-policing/(finding that a third of large police departments have used CompStat-like programs and almost 30 percent of large and small police departments, respectively, expressed intentions to use the system).

patterns embedded in the data.[82] But these technologies and their underlying theories are all premised on a common fallacy that data analysis, or in this case data visualizations (i.e. crime maps), are merely revealing spatial knowledge. In reality, GIS technologies and their outputs, like crime maps or hot spot analysis, create a specific version of spatial knowledge that is shaped by normative views of social space (and its denizens), disorder and crime as well as local political priorities.[83] Indeed, Critical GIS (geographic information science) scholars emphasize that mapmaking and other GIS approaches or technologies "invariably offers distorted representations of social reality…[because] data production can only yield a small 'selection from the sum total of all possible data available [and] as such, data are inherently partial [and] selective'."[84]

For instance, the crime data most prominent GIS technologies rely on and target is "street crime" (e.g. larceny, vandalism, burglary),[85] even though the individual victimization rates and overall societal costs are greater for offenses like cybercrime, communications fraud, or corporate crimes.[86] This

[82] Andrew Gutherie Ferguson, *Crime Mapping and the Fourth Amendment: Redrawing "High-Crime Areas",* 63 HASTINGS L.J. 179,184-190 (2011); George L. Kelling, William J. Bratton, *Declining Crime Rates: Insiders' Views of the New York City Story*, 88 J. CRIM. L. & CRIMINOLOGY 1217 (Summer 1998); ANDREW GUTHRIE FERGUSON, PREDICTIVE POLICING THEORY, *in* THE CAMBRIDGE HANDBOOK OF POLICING IN THE UNITED STATES (eds. Tamara Rice Lave & Eric J. Miller 2019); ELI B. SILVERMAN, NYPD BATTLES CRIME: INNOVATIVE STRATEGIES IN POLICING (1999).

[83] *See*, Brian Jordan Jefferson, *Policing, data, and power-geometry: intersections of crime analytics and race during urban restructuring*, 39(8) URBAN GEOGRAPHY 1247 (2018); Rashida Richardson et al., *Dirty Data, Bad Predictions: How Civil Rights Violations Impact Police Data, Predictive Policing Systems, and Justice*, 94 N.Y.U. L. Rev. 15 (2019); Katherine McKittrick, *On plantations, prisons, and a black sense of place*, 12(8) SOCIAL & CULTURAL GEOGRAPHY 947 (2011).

[84] Brian Jordan Jefferson, *Policing, data, and power-geometry: intersections of crime analytics and race during urban restructuring*, 39(8) URBAN GEOGRAPHY 1247, 1249-1250 (2018). *See also*, MATTHEW W. WILSON, NEW LINES: CRITICAL GIS AND THE TROUBLE OF THE MAP (2017); Nadine Schuurman, *Formalization Matters: Critical GIS and Ontology Research* 96(4) ANNALS OF ASSOC. OF AM. GEOGRAPHERS 726 (2006); ROB KITCHIN, THE DATA REVOLUTION: BIG DATA, OPEN DATA, DATA INFRASTRUCTURES AND THEIR CONSEQUENCES (2014).

[85] *e.g.*, Andrew Gutherie Ferguson, *Crime Mapping and the Fourth Amendment: Redrawing "High-Crime Areas"*, 63 HASTINGS L.J. 179, 191 (2011); Geolitica, *Residential Burglaries: An ounce of prevention is worth a pound of prosecution*, GEOLITICA BLOG, Apr. 5, 2021, https://geolitica.com/blog/residential-burglaries-ounce-prevention-worth-pound-prosecution/.

[86] *e.g.*, RJ Reinhart, *One in Four Americans Have Experienced Cybercrime,* GALLUP, Dec. 11, 2018, https://news.gallup.com/poll/245336/one-four-americans-experienced-

distinction is significant not only because the latter category of crimes tend to lack geographic boundaries required for GIS approaches, but they also provoke a differential cultural response that is inherently shaped by racial segregation. Although these crimes may be associated with "white spaces", like financial districts or areas with greater internet or technology access,[87] the lack of geographic boundaries or specificity means that these spaces are not racialized or equated with criminality and risk.[88] Moreover, research demonstrates that the social isolation and financial advantage experienced by most White Americans as a result of racial segregation leads to crime-specific cultural frames that produces a neutralized response or justifications for white-collar crime and crimes committed by Whites, whereas the stereotype of "black criminality" is seen as a race problem that evokes punitive responses or a lack of empathy.[89] As a result, GIS technologies are understood and adopted as neutral technologies that analyze crime data to proactively "implement more efficient targeted policing practices at the precinct level…[and] monitor the effectiveness of

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cybercrime.aspx; Press Release, Federal Trade Commission, New FTC Data Shows that FTC Received Nearly 1.7 Million Fraud Reports, and FTC Lawsuits Returned $232 Million to Consumers in 2019(Jan. 23, 2020), https://www.ftc.gov/news-events/press-releases/2020/01/new-ftc-data-shows-ftc-received-nearly-17-million-fraud-reports; Giulio Saggin, *What if Street Crime Statistics Matched Those of Cybercrime*, HACKNOON, Nov. 12, 2019, https://hackernoon.com/if-street-crime-statistics-matched-those-of-cybercrime-mayhem-would-ensue-7x1d3233; Roomy Khan, *White-Collar Crimes—Motivations and Triggers*, FORBES, Feb. 22, 2018, https://www.forbes.com/sites/roomykhan/2018/02/22/white-collar-crimes-motivations-and-triggers/?sh=665ce9401219.

[87] *See*, Brian Clifton et al., *White Collar Crime Risk Zones*, NEW INQUIRY MAG.(Mar. 2017), https://whitecollar.thenewinquiry.com; S. DEREK TURNER, FREE PRESS, DIGITAL DENIED: THE IMPACT OF SYSTEMIC RACIAL DISCRIMINATION ON HOME-INTERNET ADOPTION (2016), https://www.freepress.net/sites/default/files/legacy-policy/digital_denied_free_press_report_december_2016.pdf (demonstrating a stark racial divide in home-internet access, adoption and use).

[88] *See generally*, JAMES D. UNNEVER & SHAUN L GABBIDON, A THEORY OF AFRICAN AMERICAN OFFENDING: RACE, RACISM AND CRIME (2011); KHALIL GIBRAN MUHAMMAD, THE CONDEMNATION OF BLACKNESS: RACE, CRIME, AND THE MAKING OF MODERN URBAN AMERICA (2010); Giulio Saggin, *What if Street Crime Statistics Matched Those of Cybercrime*, HACKNOON, Nov. 12, 2019, https://hackernoon.com/if-street-crime-statistics-matched-those-of-cybercrime-mayhem-would-ensue-7x1d3233 ("Over 80% of US adults believe cybercrime should be treated as a criminal act, yet nearly 25% believe stealing information online is not as bad as stealing property in real life").

[89] Tracy Sohoni & Melissa Rorie, *The whiteness of white-collar crime in the United State: Examining the role of race in a culture of elite white-collar offending*, 25 THEORETICAL CRIMINOLOGY 66 (2021); KHALIL GIBRAN MUHAMMAD, THE CONDEMNATION OF BLACKNESS: RACE, CRIME, AND THE MAKING OF MODERN URBAN AMERICA (2010).

different police practices",[90] but in practice these technologies selectively focus on only some crimes and locations and serve to mask or legitimize disproportionate policing of certain areas or communities.[91]

Despite this flawed premise, law enforcement officials, technology vendors, and even some scholars argue that GIS technologies have a positive impact on reducing crime,[92] they are less problematic than person-focused data-driven technologies,[93] and they are legally and socially permissible with reasonable safeguards or cautious design.[94] Yet, in order to hold this position one must completely ignore racial segregation and its

[90] Adam Benforado, *The Geography of Criminal Law*, 31 CARDOZO L. REV. 823 (2010).
[91] *See*, Brian Jordan Jefferson, *Policing, data, and power-geometry: intersections of crime analytics and race during urban restructuring*, 39(8) URBAN GEOGRAPHY 1247 (2018); Aaron Shapiro, *Reform Predictive Policing*, NATURE, Jan. 26, 2017; *United States v. Curry*, 965 F.3d 313, 371(4th Cir. 2020) (en banc) (Thacker, J. &Keenan, J., concurring)("Predictive policing is merely a covert effort to attempt to justify racial profiling. Over time, predictive policing has been shown to be, at best, of questionable effectiveness, and at worst, deeply flawed and infused with racial bias"); Brief of Chicago Community-Based Organizations, Brighton Park Neighborhood Council, et al. as Amici Curiae Supporting Defendant, *Illinois v. Williams*, 20 CR 0889601 (Cook Cnty. Cir. Ct. filed May 3, 2021) (arguing that the City of Chicago only deployed ShotSpotter in police districts with the largest proportion of Black and Latinx residents and the technology justifies discriminatory overpolicing).
[92] E.g., William Bratton, Turnaround: How America's top cop reverse the crime epidemic (1998); Avi Asher-Schapiro, *In a U.S. first, California city set to ban predictive policing*, REUTERS, Jun. 17, 2020, https://www.reuters.com/article/us-usa-police-tech-trfn-idUSKBN23O31A ("On its website, PredPol said that its technology helps police fight crime and that Santa Cruz police reported a 19% reduction in burglaries since implementing its programme while Los Angeles Police saw a 25% fall."); G.O. Mohler et al., *Randomized Controlled Field Trials of Predictive Policing*, J. OF THE AM. STATISTICAL ASSOCIATION (2015).
[93] *E.g.*, Andrew G. Ferguson, *Policing Predictive Policing*, 94 WASH. U. L. REV. 1109 (2017).
("Sending a police car to patrol a suspected area is less consequential than sending a police detective to interrogate a suspect"); SHOTSPOTTER, A CITIZEN'S GUIDE TO SHOTSPOTTER CONNECT (2021), https://www.shotspotter.com/wp-content/uploads/2021/03/ConnectCitizensGuide_v1_0.pdf ("The team behind Connect has carefully thought about the data used by the model to reduce potential harm to community. As part of this approach, we do not make predictions about the actions of people…").
[94] E.g., Andrew Gutherie Ferguson, *Crime Mapping and the Fourth Amendment: Redrawing "High-Crime Areas",* 63 HASTINGS L.J. 179 (2011); SHOTSPOTTER, A CITIZEN'S GUIDE TO SHOTSPOTTER CONNECT (2021), https://www.shotspotter.com/wp-content/uploads/2021/03/ConnectCitizensGuide_v1_0.pdf.

consequences, other concurrent social or policy changes,[95] and some of the aforementioned practical implications of GIS technologies.[96] To help illustrate this point and emphasize why racial segregation must be considered when evaluating GIS and other data-driven technologies, I will highlight a specific use case in Chicago, IL that was presented as a success, yet overlooked the role of racial segregation as the source of structural conditions that drove crime as well as an alternative solution to address crime.

In 2017, the Chicago Police Department (CPD) launched an $18 million project piloting several GIS technologies—ShotSpotter (location-based gun detection system), HunchLab (place-based predictive policing system now owned by ShotSpotter and called ShotSpotter Connect), and Police Observation Devices (a system of CCTV cameras).[97] These technologies were integrated into police district-based intelligence hubs known as Strategic Decision Support Centers (SDSC), where information was analyzed to inform police district practices and strategies while complimenting traditional policing.[98] The pilot was initially implemented in six police district and then expanded to six additional districts, all of which were targeted for their high gun violence and homicide rates.[99] The pilot received a positive reception with local government officials both relaying

[95] *See*, e.g., Steven D. Levitt, *Understanding Why Crime Fell in the 1990s: Four Factors that Explain the Decline and Sex that Do Not*, 18 J. OF ECON. PERSPECTIVES 163 (2004)(challenging narratives that CompStat and other geographically focused policing tactics were successful in reducing crime by highlighting other factors that contributed to crime reduction); John Eterno & Eli B. Silverman, *The NYPD's CompStat: Compare statistics or compose statistics?*, 12(3) INT'L. J. OF POLICE SCIENCE & MGMT. 426 (2010) (finding the CompStat was implemented with other problematic policing policies like quotas, which led to "unethical distortion of crime reports").

[96] *E.g.*, Beryl Lipton, *"It's Predpol, and it's going to reduce crime": Agencies take algorithmic effectiveness on faith, with few checks in place*, MUCKROCK, Nov. 5, 2019, https://www.muckrock.com/news/archives/2019/nov/05/predictive-policing-lacks-accuracy-tests/; Mitchell L. Doucette, et al., *Impact of ShotSpotter Technology on Firearm Homicides and Arrests Among Large Metropolitan Counties: a Longitudinal Analysis 1999-2016*, J. OF URBAN HEALTH (2021)(finding that implementing ShotSpotter technology has no significant impact on gun-related homicides or arrest outcomes).

[97] *See*, Michael Wasny, *The Shots Heard Round the City*, SOUTH SIDE WEEKLY, Dec. 19, 2017, https://southsideweekly.com/shots-heard-round-city-shotspotter-chicago-police/; Timothy Mclaughlin, *As shootings soar, Chicago police use technology to predict crime*, REUTERS, Aug. 5, 2017, https://www.reuters.com/article/us-chicago-police-technology-idUSKBN1AL08P.

[98] Id.

[99] Id.

satisfaction to some of the technology vendors[100] and attributing declining crime rates to the SDSCs—"the number of shootings in the 7th District [Englewood] from January through July fell 39 percent compared with the same period last year. The number of murders dropped by 33 percent to 34. Citywide, the number of murders is up 3 percent at 402."[101]

Yet, local residents and some critics questioned whether the crime reduction can simply be attributed to the technologies or even the CPD, and they feared that "the technology could prove a distraction from confronting what they say are the underlying issues driving violence in the city of 2.7 million."[102] And this doubt is warranted when one starts to consider the role of racial segregation. First, it is important to note that racial segregation cannot and should not be ignored in a city like Chicago, which is considered one of the most racially and economically segregated cities in the United States.[103] In fact, a 2016 report declared that "some 72% of black or white residents would have to move to a different census tract to even out the numbers, according to a commonly used segregation measure called the index of dissimilarity. In New York, the figure is 65% and in Philadelphia, it's 63%."[104]

Most of the neighborhoods selected for the pilot, and especially those celebrated for crime reduction (i.e., Englewood and West Garfield Park), are almost exclusively comprised of Black and Latinx residents,[105] have

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[100] Robert Cheetham, *Why we Sold HunchLab*, AZAVEA BLOG, Jan. 23, 2019, https://www.azavea.com/blog/2019/01/23/why-we-sold-hunchlab/ ("the product was gaining some traction – we had just won over our biggest customer, the Chicago Police Department, and they were seeing some success with the software").

[101] Timothy Mclaughlin, *As shootings soar, Chicago police use technology to predict crime*, REUTERS, Aug. 5, 2017, https://www.reuters.com/article/us-chicago-police-technology-idUSKBN1AL08P.

[102] Id. *also*, Michael Wasny, *The Shots Heard Round the City*, SOUTH SIDE WEEKLY, Dec. 19, 2017, https://southsideweekly.com/shots-heard-round-city-shotspotter-chicago-police/.

[103] CensusScope, US Metro Areas Ranked by White/Black Dissimilarity Index, https://www.censusscope.org/us/rank_dissimilarity_white_black.html.

[104] Tami Luhby*, Chicago: American's Most Segregated city*, CNN BUSINESS, Jan. 5, 2016, https://money.cnn.com/2016/01/05/news/economy/chicago-segregated/.

[105] *E.g.*, The population of the Englewood neighborhood, covered by the 7th CPD police district, is 94.1% Black and 4.3% Latinx. The population of West Garfield Park neighborhood, covered by the 11th CPD police district, is 93.7% Black and 2.6% Latinx. The population of the Austin neighborhood, covered by the 15th CPD police district, is 79.1% Black and 14.4% Latinx. THE CHICAGO METROPOLITAN AGENCY FOR PLANNING, COMMUNITY DATA SNAPSHOT ENGLEWOOD, CHICAGO COMMUNITY AREA JUNE 2020 RELEASE (2020), https://www.cmap.illinois.gov/documents/10180/126764/Englewood.pdf;

substantially higher poverty rates than Chicago overall,[106] and were negatively impacted by segregation practices and policies such as the construction of the Dan Ryan Expressway (I-90 and I-94), urban renewal projects (specifically the demolition or redevelopment of public housing), public and private divestment, and school closures.[107] Research on hypersegregation demonstrates that racial minorities living in hypersegregated areas are exposed to concentrated disadvantage and distress, including elevated crime and violence, [108] and research on the societal costs of segregation find that black-white segregation (not economic segregation) are significantly associated with higher homicide rates.[109] While the CPD pilot locations were selected based on gun violence and homicide rates, the role of racial segregation in these problems cannot

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THE CHICAGO METROPOLITAN AGENCY FOR PLANNING, COMMUNITY DATA SNAPSHOT WEST GARFIELD PARK, CHICAGO COMMUNITY AREA JUNE 2020 RELEASE (2020), https://www.cmap.illinois.gov/documents/10180/126764/West+Garfield+Park.pdf; THE CHICAGO METROPOLITAN AGENCY FOR PLANNING, COMMUNITY DATA SNAPSHOT AUSTIN, CHICAGO COMMUNITY AREA JUNE 2020 RELEASE (2020), https://www.cmap.illinois.gov/documents/10180/126764/Austin.pdf.

[106] *E.g.*, The Englewood neighborhood, covered by the 7th CPD police district, has a poverty rate of 44% compared to the overall Chicago poverty rate of 20%. The West Garfield Park neighborhood, covered by the 11th CPD police district, has a median household income of $24,591 compared to Chicago's median household income of $55,198. METROPOLITAN PLANNING COUNCIL, DEMOGRAPHICS (2009), https://www.metroplanning.org/uploads/cms/documents/olympicsenglewooddemographics.pdf; THE CHICAGO METROPOLITAN AGENCY FOR PLANNING, COMMUNITY DATA SNAPSHOT WEST GARFIELD PARK, CHICAGO COMMUNITY AREA JUNE 2020 RELEASE (2020), https://www.cmap.illinois.gov/documents/10180/126764/West+Garfield+Park.pdf.

[107] *See*, Dahleen Glanton, *Lingering Lines of Discrimination*, CHICAGO TRIBUNE, Mar. 1, 1998, https://www.chicagotribune.com/news/ct-xpm-1998-03-01-9803010173-story.html; Scott Smith, *The intersection of the Dan Ryan and Chicago segregation*, OUR MAN IN CHICAGO, Apr. 18, 2021, http://www.ourmaninchicago.net/2021/04/the-intersection-of-the-dan-ryan-and-chicago-segregation/; Alvin Ulido Lumbanraja, *To Kill a Neighborhood: Urban Transport Policies and the Decline of Bronzeville*, FINDING CHICAGO: GLOBAL PERSPECTIVES BLOG, Aug. 27, 2019, https://voices.uchicago.edu/findingchicago/2019/08/27/to-kill-a-neighborhood-urban-transport-policies-and-the-decline-of-bronzeville/#_ednref4; Kalyn Belsha, *Behind sale of closed schools, a legacy of segregation*, THE CHICAGO REPORTER, Jan. 13, 2017, https://www.chicagoreporter.com/behind-sale-of-closed-schools-a-legacy-of-segregation/; Alana Semuels, *Chicago's Awful Divide*, THE ATLANTIC, Mar. 28. 2018, https://www.theatlantic.com/business/archive/2018/03/chicago-segregation-poverty/556649/.

[108] *See*, Douglas S. Massey & Jonathan Tannen, *A Research Note on Trends in Black Hypersegregation*, 52(3) DEMOGRAPHY 1025 (2015).

[109] GREGORY ACS ET AL., THE URBAN INSTITUTE, THE COST OF SEGREGATION: NATIONAL TRENDS AND THE CASE OF CHICAGO 1990-2010 (2017), https://www.urban.org/sites/default/files/publication/89201/the_cost_of_segregation.pdf.

be disregarded or go unacknowledged. This is especially true when evaluating the efficacy of GIS technologies, like those used in the CPD pilot, because such assessments must also consider alternatives that were not explored or invested in and may have been better suited to address root cause issues or structural conditions that drive certain crimes.[110]

For instance, research on racial segregation in Chicago determined that reducing the levels of black-white segregation could potentially reduce the City's homicide rate by 30 percent.[111] This is important because the aforementioned crime reduction statistics cited by the CPD as attributable to the pilot noted similar homicide reduction rates in the neighborhoods piloted, but it also acknowledged the citywide homicide rate increased during this the same observed period. Thus, it is possible that some violent crimes were merely repositioned, either moving to other areas in or outside of the city that were not subjected to the same surveillance technologies and policing tactics as the neighborhoods in the CPD pilot. While this inference is merely conjecture, it demonstrates how the conclusions by CPD and researchers[112] about the efficacy of GIS technologies are specious and erroneous. Moreover, such positive yet fallacious evaluations of data-driven technologies like GIS further obscure how policing policies, practices, and tactics serve to reinforce racial segregation and its consequences, as mentioned in Section II(A)(1).[113]

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[110] *See*, JAMES FORMAN JR., LOCKING UP OUR OWN: CRIME AND PUNISHMENT IN BLACK AMERICA (2017) (detailing how law enforcement policy choices led to mass incarceration, specifically the decisions to increase criminalization instead of policies that aimed to expand social safety nets and community investment).

[111] GREGORY ACS ET AL., THE URBAN INSTITUTE, THE COST OF SEGREGATION: NATIONAL TRENDS AND THE CASE OF CHICAGO 1990-2010, 40 (2017), https://www.urban.org/sites/default/files/publication/89201/the_cost_of_segregation.pdf.

[112] University of Chicago Urban Labs, Strategic Decision Support Centers, https://urbanlabs.uchicago.edu/programs/strategic-decision-support-centers-sdscs ("In 2017, Chicago experienced 764 fewer shooting incidents (22% reduction) relative to 2016. In District 007, historically one of the most violent districts in the city, these impressive gains are promising both compared to 2016 and historically"); ANDREW GUTHRIE FERGUSON, PREDICTIVE POLICING THEORY, at 497 *in* THE CAMBRIDGE HANDBOOK OF POLICING IN THE UNITED STATES (eds. Tamara Rice Lave & Eric J. Miller 2019) ("Early testing of HunchLab has shown positive results in Chicago and Philadelphia in reducing crime, but the findings have not been published in any peer- reviewed journals").

[113] GRACE ROBERTS, ET AL., THE AMERICAN SYSTEM: HOW POLICE ENFORCE SEGREGATION (2019), https://storymaps.arcgis.com/stories/ac3d72c7b1c54305937e40d2ad43d774. *See also*, Brief of Chicago Community-Based Organizations, Brighton Park Neighborhood Council, et al. as Amici Curiae Supporting Defendant at 25, *Illinois v. Williams*, 20 CR 0889601 (Cook Cnty. Cir. Ct. filed May 3, 2021) (arguing for close judicial scrutiny of

III. Conclusion

This Essay demonstrates why there is a great need to critically examine the drivers of structural inequities and systemic disadvantage when evaluating issues related to technology and society. If we fail to understand the lack of diversity within technology and related sectors as an extension of broader societal patterns and problems, then those who design, evaluate and regulate technology and technology-mediated issues will continue to be individuals from dominant and privileged backgrounds. Similarly, if we continue to view algorithmic bias and other technology-mediated problems as technical issues, then the solutions proposed will always fall short.

Data-driven technologies cannot be apolitical, ahistorical, or considered separate and distinct from social and power structures. This is because technology, and scientific knowledge more generally, "embeds and is embedded in social practices, identities, norms, conventions, discourse, instruments and institutions."[114] Thus, interventions to improve the data-driven technology development process and to redress and prevent negative consequences produced or amplified by data-driven technologies must contend with the complexities of social life as well as the institutional and social practices that create unequal structural conditions and contribute to the differential treatment of individuals and groups, like racial segregation.

While there are several emergent academic fields that seek to grapple with and mediate technological injustices (e.g. data justice, AI ethics, and fairness, accountability and transparency studies), many scholars have questioned the adequacy of these fields and related discourse because they tend to examine discrimination, disadvantage, exclusion, misrecognition, hyper-surveillance, and other justice-related concerns primarily through technology.[115] These fields and the interventions they produce generally fail

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ShotSpotter's reliability because of its disproportionate impact on people of color in Chicago and contributory role in unconstitutional policing).

[114] SHEILA JASANOFF, THE IDIOM OF CO-PRODUCTION, at 3 *in* STATES OF KNOWLEDGE: THE CO-PRODUCTION OF SCIENCE AND SOCIAL ORDER (ed. Sheila Jasanoff 2004).

[115] *See*, MATTHEW LE BUI & SAFIYA UMOJA NOBLE, WE'RE MISSING A MORAL FRAMEWORK OF JUSTICE IN ARTIFICIAL INTELLIGENCE: ON THE LIMITS, FAILINGS, AND ETHICS OF FAIRNESS, *in* THE OXFORD HANDBOOK OF ETHIC OF AI (eds. Markus D. Dubber, Frank Pasquale & Sunit Das 2020); Seeta Peña Gangadharan & Jedrzej Niklas, *Decentering Technology in Discourse on Discrimination*, 22(7) INFO. COMM. & SOCIETY

to reckon with the disadvantages and harms that preceded and are often compounded by data-driven interventions, or they fail to decenter technology as the primary lens of analysis or modality of prevention and redress.[116] Within legal scholarship, there is a growing body of discourse that attempts to propose legal interventions that that can provide greater transparency, oversight, or mechanisms for contestation,[117] but most of these proposals are primarily procedural and fail to question or contest the role of legal institutions, systems, policies, and practices in engendering the problems they seek to mitigate. Thus, much of this existing scholarship suffers from similar cognitive and epistemic gaps or biases detailed in this Essay and risk entrenching structural inequality.

Instead, we need interventions and approaches that apply and add nuance to how algorithmic bias and systemic disadvantage is understood and remedied, as well as clarifies that "technology assists and exists alongside, as opposed to at the center of a discriminatory and unjust society."[118] Yet, to achieve this we also need to change who is a part of and centered in data-driven technology development and the creation of interventions for technology-mediated problems. To advance these goals, the data-driven technology sector (i.e. artificial intelligence and automated decision-making) needs a transformative justice framework and praxis, which I will present and expound upon in future scholarship.

Transformative justice is a holistic approach and field of practice that seeks to address the root causes of harm and injustice and develop solutions that ultimately change social systems and structural conditions that contribute to or perpetuate harm and injustice writ large.[119] Transformative justice

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882 (2019); Anna Lauren Hoffman, *Where Fairness Fails: Data, Algorithms, and The Limits of Antidiscrimination Discourse*, 22(7) INFO. COMM. & SOCIETY 900 (2019); Reuben Binns, Fairness in Machine Learning: Lessons from Political Philosophy, *Proceedings of the 1st conference on fairness, accountability, and transparency* (2018).

[116] Id.

[117] *See, e.g.*, Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions*, 89 WASH.L.REV.1, 4 (2014); Joshua A. Kroll et al., *Accountable Algorithms*, 165 U. PA. L. REV. 633, 680 (2017); Kate Crawford & Jason Schultz, *Big Data and Due Process: Toward a Framework to Redress Predictive Privacy Harms*, 55 B.C.L. REV.93 (2014); Danielle K. Citron & Ryan Calo, *The Automated Administrative State: A Crisis of Legitimacy*, Emory L.J. (forthcoming).

[118] Seeta Peña Gangadharan & Jedrzej Niklas, *Decentering Technology in Discourse on Discrimination*, 22(7) INFO. COMM. & SOCIETY 882, 886, (2019);

[119] *See,* ADRIENNE MAREE BROWN, WE WILL NOT CANCEL US: AND OTHER DREAMS OF TRANSFORMATIVE JUSTICE (2020); Anthony J. Nocella II, An Overview of the History and

employs a systems approach to analyzing problems and it incorporates principles and practices of restorative justice, like the intentional inclusion of victims and other community members. Unlike restorative justice, which seeks to restore the condition before a harm or injustice took place,[120] transformative justice requires a broader examination of collective responsibility in society for creating structural conditions and social practices that enable and perpetuate systemic harms and injustices. Such comprehensive and shrewd analysis can fashion radical social changes as well as a variety of technical and non-technical interventions that can adequately confront the intersectional and intergenerational nature of technology-mediate problems and withstand the current pace of innovation.

Though my proposal may seem idealistic or even heterodox for technology development and regulation, it is necessary in light of who dominates all relevant sectors driving technology development and technology policy interventions, in addition to the epistemic gaps, highlighted in this Essay and other critical scholarship,[121] that hinder the formation of meaningful solutions. A transformative justice framework and praxis can: force visibility of power structures and dynamics that are often opaque yet stymie necessary reforms or actions; center people and perspectives that are typically excluded from but pivotal to the problem formulation process of data-driven technology development; and lead to systemic solutions that not only address technical concerns but underlying root causes that sustain the status quo. Therefore, a transformative justice framework and praxis for data-driven technology development and policy can help us advance towards a future where technology and society are designed for collective belonging.

Theory of Transformative Justice, 6 Peace & Conflict Rev. (2011); RUTH MORRIS, STORIES OF TRANSFORMATIVE JUSTICE (2000); PAUL GREADY & SIMON ROBINS, FROM TRANSITIONAL TO TRANSFORMATIVE JUSTICE (2019).

[120] *See*, FANIA E. DAVIS, THE LITTLE BOOK OF RACE AND RESTORATIVE JUSTICE: BLACK LIVES, HEALING, AND US SOCIAL TRANSFORMATION (2019).

[121] *See supra* note 112.