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Racialized Computational Thinking: The Case for College Admissions

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My aunt and her two sons arrived at the US/Mexico border in the early 1980s. They were coming from Nicaragua, fleeing the revolution. While it was urgent, my family was playing a game of immigration tag: one sibling would arrive in the United States, figure a few things out, and send for the next sibling. One of the things they figured out: People in the United States think all Black people come from the United States. This meant the task was simple—arrive at the border and do their best impression of African Americans.[1]

The problem was that one of my cousins looked more mestizo and neither could fake an American accent. So, after weeks of hitchhiking, walking, and bribing their way out of jail, my aunt arrived at the border sitting in the front seat of an old sedan, with her two sons hidden in a compartment under the backseat, and a coyote, or paid handler, in the driver's seat. She answered questions from the border official with either a "yes" or "no" with a crisp American accent. After answering "Are you an American citizen?" in the affirmative, they were allowed to drive on, stopping at a hotel in Los Angeles for the night, and at our doorstep in the Bay Area the next night.

As far as immigration officials were concerned, three Black Latinx[2] did not cross the border that day.

Years later, my cousin was giving me advice on my college applications. He recently graduated from San Jose State University with a degree in engineering.

"Don't tell them that you're Latina," he said.

"Why?" I asked.

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[1] I use the terms "African American" and "Black" somewhat interchangeably. The main distinction is that I use "Black" for phenotypic observations, while I use "African American" (and "African-American") for those who self-identify with the African Diaspora. Much of this work is a discussion of Hemispheric/Diasporic Blackness and the politicization of those monikers. It is therefore important that I divulge my identities as Afro-Latinx, Black, and African American.

[2] I acknowledge the various identity markers for people in Latin America, including Latinos, Latinx, and Latine and the desire to demasculinize naming. At times, I revert to the term used at the time of story-telling. I also acknowledge that for indigenous, African-descended, and non-migrant communities in Latin America, all of these identities are imposed and uniquely of the United States. For example, Mayans would not call themselves, and are not called, Latino, Latinx, or Latine in Latin America. When they are, it is imposed upon them in the United States. This is also the focus of this work, but for ease of writing, I use the term "Latinx" to describe all people from the region we know as Latin Amerca.

"*Pensaran que no puedes hablar ingles"* (They will think you can't speak English), he answered.

We both laughed.

He added, "They will also think you are here illegally."

"Did you learn that during your immigration hearing?" I smiled. "Because you are here illegally."

"School doesn't know that. They think I'm Black."

I laughed about this again. My cousin's full name, like my own, read as foreign, at least to me. My mother often bemused the fact that my name did not sound like everyone else's, especially when politicians in California became decidedly anti-immigrant. But school principals, teachers, and peers never mentioned it, except for an occasional question about when the mestizo-looking lady with the accent adopted me.

Years later, I was sitting in a graduate seminar listening to a data presentation on English learners in Chicago Public Schools. The presenter pointed out standard statistics about the percentage of English learners, how they all happened to be Spanish-speaking, how they all happened to be from the same part of Mexico. She described the program they developed based on that data, how it was Spanish-only, and supported the data points from national surveys. She showed pictures of the students they were working with: all mestizo who did not look like the plethora of cultures, ethnicities, and races that encompass Latin America, let alone the vast immigrant populations in Chicago, with its rich history of European immigrants, Puerto Rican enclaves, and emerging Chinese communities.

"How do you know that statistic about language and location?" I asked. "That all the English learners in Chicago are Mexican, mestizo, and Spanish-speaking?"

"That's what everyone answered," the presenter responded.

"Was everyone asked?"[3]

[3] Pew Research Center estimates that the percentage of Afro-Latinos (their label) in the United States is largely underestimated because of how the question is asked. Pew Research has conducted alternatively surveys that also vary, from 12% of the Hispanic (used interchangeably with Latino) adult population to 24% of the Hispanic adult population.

There are two dilemmas that the above presents, the first of which is more apparent. On May 24, 2022, Linguistic Anthropologist Nelson Flores highlighted the first dilemma by summarizing the link between racialized identities, institutions, and access via Twitter:

> I use [sic] to believe that the original intent of bilingual education in the US was to meet the needs of *racialized* bilingual students [emphasis added]. But the more historical research I do the more I realize its original *institutionalized* intent was to fix these students rather than serve them [emphasis added]. Knowing this history can help to explain how once the discourse shifted from remedial to enrichment that bilingual education so quickly became gentrified. Students framed as having poorly developed language skills that need remediation have no place in enrichment programs.[4]

Flores highlights two key points in racial formation theory: that students are racialized and that they are grappling with an imperative that is systemic, or institutionalized. He does not argue the counter: that the Latinx students *are* bilingual; nor does he state that he is discussing Latinx communities. He also does not argue that schools have organic intentions. He uses the verbs "racialize" and "institutionalize" to denote on-going processes that are familiar to social scientists, especially sociologists.

That race is malleable, political, and institutional is not altogether novel. Social scientists have argued for racial formation theory[5], critical race theory, and those derived more broadly from structuralism[6] to explain how people interpret and utilize race in the everyday,[7] and how these

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According to Pew, the variations are due to when "Black" is an option in the survey and using subgroup labels such as Afro-Panamanian. The survey does not consider racial formation processes of Afro-Latinx in the United States and abroad for all subgroups such as Haitians and Brazilians. In 2020, Pew Research estimated 6 million Afro-Latinx compared to the US Census Bureau's estimate of 1.2 million. Lopez, Hugo, et al, "Who is Hispanic?", *Pew Research Center*.

[4] Flores, Nelson, Twitter post, May 2022, 9:19 am https://twitter.com/nelsonlflores.

[5] Omi, Michael and Howard Winant, *Racial Formation in the United States*.

[6] See Dubois *The Philadelphia Negro* for further discussion.

[7] Hanchard, Michael, *Party/Politics*.

interpretations shift according to imperatives of the state.[8] In this work, I refer to this interpretation of race as racial formation. Scholars of Diasporic theory argue that the shift away from understanding identity as a function of nation status occurs when Black bodies were commodified, thereby shifting identity-formation to economic value[9] and ushering in the Black Atlantic, or the context of understanding Blackness in the modern era.[10] Afro-Latinx, or Caribbean, identity formation best exemplifies these maneuverings across time and place. While I distinguish between Diasporic theories here by parceling out how Afro-Latinx and Caribbean identities are theorized, my intention is to interject temporal and spatial racial variables into theories that underscore biological, national, ethnic, and class iterations of race. I argue that these temporal and spatial variables are part of the everyday except when race is scaled, as with data and technology.

The second problem from my anecdote is a more hidden due to how racialized data is recorded and used in our everyday technologies. As humans, we interpret, record, and deploy our understandings of identity and race constantly. Technology is a mechanism to interpret, record, and deploy these understandings efficiently. For example, search tools such as Google, assume your intention when you type a few letters into the search bar, and displays what other people who typed in the same few letters selected most. With social media, there are millions of opportunities to find such mentions and the more one selects or likes the mention, the more the mention "trends" or appears at the top of one's initial search. As Safiya Nobles documents in *Algorithms of Oppression*, top searches for Black women mirror stereotypes about Black women's sexuality and promiscuity, to such an extent that beginning a search with "Why are Black women so" will autofill with terms such as "angry," "attractive," and "sassy" among other markers.[11]

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[8] Omi, Michael and Howard Winant, *Racial Formation in the United States.*
[9] Robinson, Cedric, *Black Marxism.*
[10] Gilory, Paul, *The Black Atlantic;* Puri, Shalini, *The Caribbean Postcolonial.*
[11] Noble, Safiya, *Algorithms of Oppression*, 21.

Ruha Benjamin writes that technology, as a capitalist endeavor, replicates racist systems into efficient and consumable mechanisms of the everyday. Much like economic models of supply and demand, clicking and liking rewards terms that are most desirable, not necessarily those that are most true. In other words, technology makes racism better by making it more accessible and easier to find, by recording and deploying racialized interpretations. This is a departure from how scholars in Science and Technology Studies (STS) and Human and Computer Interactions (HCI) consider race, as noted by Ron Eglash, where the focus is on production and impact of technology with the aspiration of being able to reconfigure or appropriate the technology to have more utility for racialized groups.[12] While not entirely incorrect, the STS and HCI interpretation does not address Benjamin's position because STS and HCI scholars reconfigure a technological tool *after* it has been produced. For example, in the example that I provide in the previous paragraph, should we adjust how people interact with search results or reconfigure the algorithms so that we are not rewarding interpretations of race that are harmful? I argue that in order to appropriate technology with the aim of dismantling a racist structure, scholars must begin at the point where the technology was built and employ social scientific theories of race in computational thinking. This is primarily a data collection task, demonstrated in the anecdote about the community organization using of a racialized identity that does not reflect the plethora of ways people use race in the everyday.

My project is concerned with how racial formation exists in our everyday, how these formulations are recorded as data and used in technology, and how critical race theory can be used as a predictive mechanism in those technologies to better account for how race is conceived and valued. I theorize temporal and spatial interpretations of race, via Afro-Latinx scholarship, in order to denote the aspects of race that are recordable, yet missing from current usages of race data in technology. As a predictive mechanism, I employ critical race theory in computational thinking in the abstraction

[12] Eglash, Ron, "Appropriating Technology: An Introduction," *Appropriating Technology*.

phase, the phase in which data is deemed irrelevant and removed (Figure 1). Finally, I posit that racial projects that are concerned with access, and in consideration of critical race theory's interest convergence, reproduce the racist systems that technology makes more efficient. I use the example of educational access to demonstrate how racialized computational thinking can be used to produce more relevant and equitable outcomes.

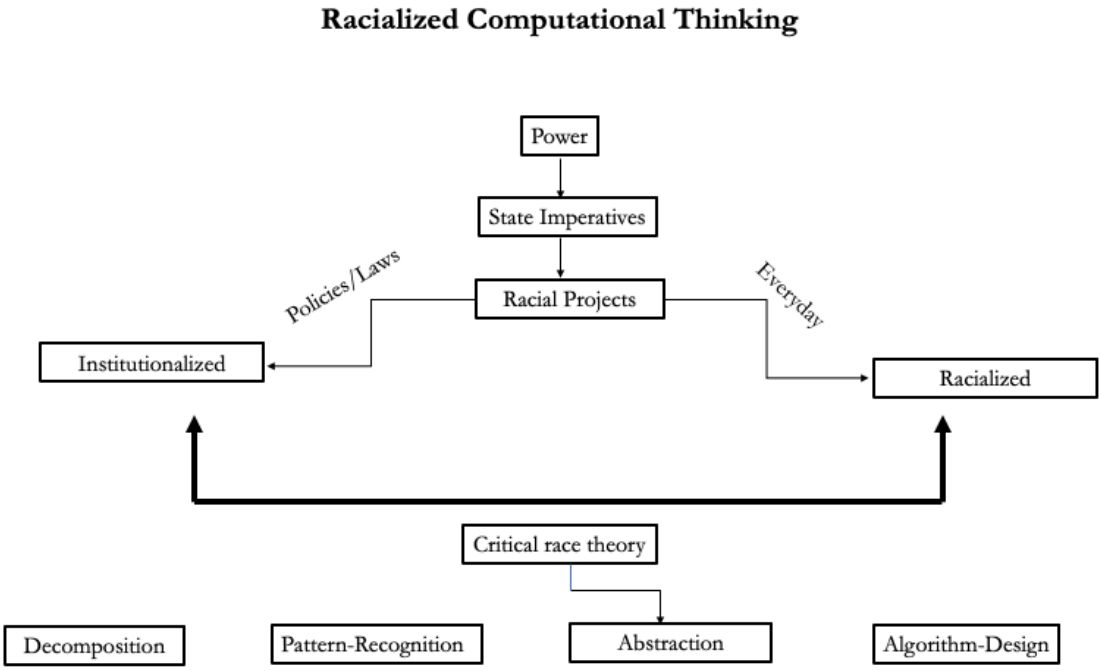

Figure 1: Author's Conceptualization

Theoretical Framework

Data and Surveillance: Racialized Everyday

The chasm between computer science including logic and mathematics, and social science reveals how we understand something to be true. Sociologists Tukufu Zuberi and Eduardo Bonilla-

Silva advance the study of this chasm by exposing the methodological assumptions that are incongruent:

> Mathematics is a system of statements that are accepted as true. Mathematical statements follow one another in a definite order according to certain principles and are accompanied by proofs. […] In mathematics, the numbers are either exact or have known or estimable error.[13]

In computer science, data is represented in logics and numbers.[14] For example, 2 + 2 = 4 is a logical statement (2 added to 2) that leads to a truth (is 4). Conceptually, the Addition Postulate describes the logic for the above as the sum of line segments with a point between endpoints. Machine learning, as a subset of computer science, is when the computer (or machine) is programmed to teach itself to apply the Addition Postulate, for example, any time it receives an input of + or sees a pattern where one would most likely provide + as an input. Computer scientists have built good models when the outcome is mostly true or the estimable error is low.[15]

While the above, especially in its current iteration, is a marvel of modern science, it exposes a dilemma when data is not true, or conceived. In the above example, writ large, people have accepted the symbol "2" to represent an amount. If one had $1 and she wanted to purchase something that is $2, logic would tell her that she does not have enough money. If one finishes a race and the timekeeper holds up a "2," we generally understand that exactly one person has finished before him. Each time that someone understands that she did not have enough money or that exactly one person finished the race before him, we affirm the accepted meaning and value of 2. I assert that computer science, among other utilities, makes the process of affirming values efficient and accessible.[16] But this presents a problem when it comes to affirming values that are not generally agreed upon. Zuberi

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[13] Zuberi, Tukufu and Eduardo Bonilla-Silva, *White Logic, White Methods*, 7.
[14] See Tukufu Zuberi and Eduardo Bonilla-Silva for more discussion of statistics and statistical methods.
[15] I am summarizing interpretations of mathematics and computer science from textbooks and coursework.
[16] See Tukufu Zuberi and Eduardo Bonilla-Silva's definition of "the consensus-making process" in statistics, *White Logic, White Methods,* 8.

argues that the error mathematics makes with regards to race is to consider race as true, rather than constructed.[17] In the following, I discuss how race becomes data, or becomes logically true.

What is observable with regards to race is biological. Linking value to biological manifestations, or phenotype, is ordinary. St. Clair Drake provides a genealogy of race theories in *Black Folk, Here and There* (1987) where he demonstrates the origins of theories based on phenotypic differences to the Chicago School of Sociology, Dr. Robert Park, and eventually Gunnar Myrdal's volume, *An American Dilemma*. Drake discusses Gustav Ichheiser's thesis regarding the importance of phenotype when discussing race relations:

> […] Ichheiser […] charged that the reigning theory of race relations was "in a state of incredible confusion because certain obvious but highly important *facts* [emphasis added] which determine the dynamics of race relations are either ignored, misinterpreted, or not taken adequately into account." He insisted that one such face was physical difference between groups.[18]

Drake later quotes Ichheiser succinctly stating, "In terms of sociopsychological reality, people who look different are different."[19] Ichheiser describes how these physical differences lead to character differences because of the way one is perceived by the other group. Regarding perception and an implied response, I discuss this in the section on surveillance and racial formation, respectively. But I return here to the notions of fact and data.

For something to be true, or a fact, and used as data, it has to be without error. Returning to Ichheiser's statement—"people who look different are different"—in order for that to be true, scholars would have needed to observe and record when physical differences lead to character and behavior difference. Drake and Zuberi and Bonilla-Silva argue that this is how the Eugenics

[17] Zuberi, Tukufu, *Thicker Than Blood*, xx.
[18] Drake, St. Clair, *Black Folk, Here and There*, 50.
[19] Drake, St. Clair, *Black Folk, Here and There,* 51.

Movement is realized. According to Eugenicists, intellectual ability is linked to physical traits, thereby leading them to urge for separation of the races. We also see this thinking as part of miscegenation laws in the New World during enslavement, from the One-Drop Rule in the colonies to forced intercourse in Latin America.[20] There are not actual inherit correlations between phenotype and character, but people create these correlations based on data that determines difference to be true. That leads me to ask: Who is Black and how do we know?

There are two parts to this response: what is observable and recorded, and what determines the error. In *Dark Matters* (2015), Simone Browne advances the application of the panopticon gaze[21] to define surveillance, and racialized surveillance, as part and parcel of our current digital and racialized era. Browne asserts that the surveilled body is tasked with participating in its own surveillance, or "surveillant assemblage," and documenting of such, from credit reporting to social media interactions to drug testing at work.[22] This is the first observation of racializing data: not all groups leave digitized footprints in the same way, especially if we consider how the panoptic gaze is a mechanism of control. Bowles and Gintis' quintessential work on schooling provides an example of how schools were designed to divide and train students for factory work.[23] If we apply that thesis to today's schools, we can see how those type of schools not only exist today, but also house a myriad of *surveillant assemblage*, most of which are tools of the judicial system such as school resources officers disseminating basic discipline to metal detectors. We also know that these schools happen to be those that are most often racialized as Black. In this example, we understand that schools provide greater opportunities to make racialized data *true* because there are more opportunities to *record* racialized data.

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[20] See Ilona Katzew's *Casta Painting* (2005) for depictions of race mixing and hybridity in Mexico, and core hybridity texts such as Jose Vasconcelos' *La Raza Cosmica* (1925) for theories on race-mixing in Latin America broadly. The premise here is counter to eugenics' conclusion, in that it urges mixing to wash out supposed inferior races. This is also why Latin American countries claim to be race-less.
[21] See Michel Foucault, *Discipline and Punish: The Birth of the Prison.*
[22] Browne, Simone, *Dark Matters,* 16.
[23] Bowles, Samuel and Herbert Gintis, *Schooling in Capitalist America.*

While this appears to parallel Foucault's usage of prisons and torture as control devices, Browne's surveillant assemblage is a type of pre-structural control device where data is racialized in order to insert data into structures. By this I mean, it is surveillance data in search of a racial project rather than a racial project with surveillance data already embedded into its functioning. Browne coins the term, "racializing surveillance" to describe this type of surveillance tool:

> Racializing surveillance is a technology of social control where surveillance practices, policies, and performances concern the production of norms pertaining to race and exercise a "power to define what is in or out of place."[24]

When it comes to what happens in schools racialized as White, we simply do not know if there are more guns, for example, because they lack the surveillance to determine if that is true. Anecdotally, this is an interesting statement because of the type of schools where mass shootings occur such as Columbine High School, Sandy Hook Elementary School, and Marjorie Stoneman Douglas High School, all schools racialized as White and lacking the surveillance tools of schools racialized as Black.

As a scholar concerned with racial formation and computer and data science, I take courses where the methodologies that I understand are in conflict. This is how I came to this work. In a graduate seminar, we were discussing the use of crime data and its impact on student behavior in schools. The principal investigator for the project stated that it was difficult, if not nearly impossible, to collect data on crime in neighborhoods racialized as Black. This was not because it was not surveilled. It was because the type of crimes that are surveilled in neighborhoods racialized as Black are also those that police officers escalate, save for homicide where the victim was already deceased. The assumption that Black neighborhoods are more violent therefore becomes true due to the surveillance. But should these neighborhoods be surveilled for crimes that police officers do not escalate, such as white collar crimes, it would be racialized differently. This is why I also argue that

[24] Browne, Simone, *Dark Matters,* 16.

racialized surveillance creates a circumstance where one is actively looking for a behavior that Browne discusses as a control tool, rather than passively waiting for it to happen.

In computer science, it is not enough to say that certain populations are surveilled. As I discuss previously, it has to be recorded as true. This is done with percentages and data points. To demonstrate this, I would like to return to my initial question—Who is Black?—and review the ways that the US Census Bureau records Blackness within Latinx identities. I use this application for two reasons: it clearly demonstrates the conflicting racial formations of the One-Drop Rule and hybridity; and it forces scholars to define racial projects within time and place.

I remember when the US Census first considered Latinx as an ethnicity with Black as a race within it. It was 2020 and I was sitting with my cousins who migrated from Limon, Costa Rica. They were born in Nicaragua but left during the war, and spent the majority of their childhood in Costa Rica. They recently became US citizens after their father declared political asylum. We argued about that census for hours. It went something like this:

"You shouldn't select 'Hispanic' because you were born here," my cousin instructed me.

"Most so-called Hispanics in this country were also born here," I clarified for her.

"But you don't speak Spanish that well."

"First, that's not true. And second, neither do Haitians and Brazilians. When they say 'Hispanic,' they mean them too."

"No," my cousin corrected me. "Haitians and Brazilians are Black."

"How are they Black, but you're not?"

"Well Costa Ricans aren't Black either. Everyone is mixed."

"You know that's not true," I said as we all laughed. "So, what are you going to put?"

"'Other,' I guess."

"Only straight white men select 'Other' or 'Decline to State,'" I said. "So, if you're putting 'Other,' shouldn't I put 'Other'?"

"No, you put 'African American.'"

"But it says, 'African American, not of Hispanic origin.'"

"But culturally, that's what you are."

"Again, not true. But second, that's not the question."

None of us completed the census that year.

As it turns out, we were not the only ones confused about these categorizations. Hugo, et al from Pew Research Center state that the US Census Bureau has adopted a policy of "You are if you say you are," when defining Hispanic groups.[25] The percentage of people who say they are versus what we think it might be is quite distant. Currently, 12% of Hispanic adults identify as Afro-Latino. If estimates of those enslaved in the British colonies are around 2% to 6%, with the remainder enslaved in what will become Latin America and Caribbean, how did we get from 98% to 94% being "Afro-Latino" to 12% or 24% a few generations later? Or is that data point of 12% less an indication of "You are if you say you are," and more "Which do you prefer to be racialized as?" As Mary Waters[26] and Percy Hintzen[27] might argue, the latter has more to do with choice, and who can opt in and out of an identity, than what a person actually is. Regarding surveillance, we should then understand that surveillance tools are catching the 12% that answered the question—"Which do you prefer to be racialized as?"—rather than an indicator of who is actually present.

Algorithms and Computational Thinking

[25] Lopez, Hugo, et al, "Who Is Hispanic?" *Pew Research Center.*
[26] Waters, Mary, *Ethnic Options.*
[27] Hintzen, Percy, *West Indian in the West.*

In the previous section, I discuss how data is recorded. In what follows, I describe how data is used in computational thinking. Computational thinking is a type of logic that sequences events. Digital Promise, a non-profit that provides access to computing tools for K-12 students, defines computational thinking as "a problem-solving approach that integrates across activities," and programming as the "set of instructions that a computer can understand and execute."[28] It is important to distinguish between computational thinking and programming because all academic disciplines theoretically problem-solve. But in computer science, scholars learn languages to program computers to problem-solve. Digital Promise enumerates computational thinking skills that include programming tasks such as debugging. Therefore, when I discuss computational thinking skills, especially their application to qualitative social sciences (non-programming), I exclude the steps that are strictly programming skills: Decomposition, Pattern Recognition, Abstraction, and Algorithm Design.[29] Digital Promise includes Data Practices as a practice within Decomposition. I use racialized surveillance in the previous section as what would be considered a data practice.

Decomposition is the process of breaking down problems into more manageable questions.[30] One likely would not begin with the question that requires additional steps to answer: Why does the Earth rotate around the sun? Instead, it would be critical to answer if the Earth rotates, how fast it rotates, and does it rotate around other stars and planets. With regards to establishing questions about race, in the previous section I first ask, who is Black and how do we know? As I describe, the answers are quite scattered, and we never quite arrive at an answer. African American Studies professor, Ruha Benjamin, employs critical race theory, namely the Cheryl Harris argument regarding Whiteness as property and George Lipsitz' "possessive investment in whiteness,"[31] to argue for visual usage of Black

[28] Digital Promise, "What is Computational Thinking?"
[29] Digital Promise uses the term Algorithmic Thinking (as a programming task). I therefore call it Algorithm Design. Digital Promise also use sub practices within each skill, namely Automation, Computational Modeling, and Data Practices. Again, these are specific to programming, although I discuss a version of data practices early in this work.
[30] Digital Promise, "Computational Thinking for Next Generation Science Toolkit."
[31] Benjamin, Ruha, *Race After Technology*, 102.

identity within technology and Omi and Winant's argument regarding the racial state to frame the system in which Blackness is given value in technological systems and technology.[32] Benjamin argues that Black identity has always been linked to technological tools, be that the slave ship or the cotton gin. In this theorization, who is Black in the New World is tied to how the Black body fits into the hull of a slave ship or how quickly one can extract seeds from the plant.[33] In the following section, I commit to a similar exercise by defining contemporary racial projects and their manifestations.

Pattern Recognition is concerned with finding relationships and correlations within the data. In the previous discussion, this can be considered determining what is true, and in some instances, reliable. Computer scientists use a tool from data science to determine the reliability of data: entropy. Entropy is a formula that determines the impurity of the data.[34] The computer will determine what amount of heterogeneity is permissible and continue to run, or loop, the algorithms as long as they are producing a measurement within the limits of entropy. This is the second obvious place for human intervention. While the computer will determine what entropy score is acceptable, programmers can manipulate entropy themselves or do a manual analysis of the data points that were most disparate, and eventually excluded. This is an important framing for three reasons: first, algorithms look at individual behaviors without paying attention to the larger systems; how algorithms interpret data can help us to understand the meaning applied to data; and, finally, we can create algorithmic interventions by designing the algorithm to predict systemic influences, rather than individual behaviors. While entropy uses numbers, we use entropy regularly. For example, a doctor might provide a diagnosis with a certain level of certainty. She is determining that based on the percentage of instances that similar circumstances occur and led to the same result. Returning to social science examples, consider

[32] Benjamin, Ruha, *Race After Technology*, 89.
[33] Benjamin, Ruha, *Race After Technology*. See also Zakiyyah Jackson's *Becoming Human: Matter and Meaning in an Antiblack World* for discussion of attaching meaning to the Black body according to material value (within Humanities and Sexuality Studies).
[34] Mitchell, *Machine Learning*.

the example of police escalating crimes in neighborhoods racialized as Black. The programmer determines how often that has to occur in order for it to be true.

Abstraction is skill that removes data points that are deemed irrelevant. Consider the previous skill, pattern recognition, where the programmer determines what is reliable. The programmer will then determine what events to remove, making guesses as to what is making the sequence or data unrealiable. Coupled with the previous skill, the abstraction skill becomes vulnerable to human bias because of one's ability to determine relevancy. While Benjamin uses critical race theory as a decomposition practice, I consider it more so in the abstraction phase to determine what systems, practices, and policies are most relevant to the outcomes that one is seeing. In the above example, this would mean looking at how crimes racialized as White are treated in other communities, and the processes by which police officers receive consequences for any escalation of those crimes. This is the correlation that the authors in *The 1619 Project*[35], and activist writers such as Ta-Nehisi Coates[36] make when discussing contemporary outcomes of historical racial projects. For example, poverty is linked to enslavement and Reconstruction rather than race. By enumerating policies, the abstraction skill directs our attention to larger systemic patterns rather than individual behaviors.

Lastly, Algorithm Design, is when the relevant steps are put together to lead to a conclusion. Computer scientists may put these steps into if/then statements: If x occurs, then y occurs. In the decomposition and abstraction phases, data is streamlined so that x and y are clear. When multiple algorithms are placed together, we call this a model. Machine learning is when models behave without human intervention, meaning the "machine" or in this case, computer, acts on its own and teaches itself, or "learns" when to do decomposition, pattern-recognition, and abstraction. Therefore, if/then statements are coded to move to a different algorithm depending on entropy. The computer moving

[35] Hannah-Jones, et al, *The 1619 Project: A New Origin Story.*
[36] Coates, Ta-Nehisi, "The Case for Reparations," *The Atlantic.*

to different algorithms is called a loop. In machine learning, the algorithms are coded to continue looping until the entropy is reliable. As the computer receives new information from the data, it continues to adapt to maintain entropy. A more recent example of machine learning and entropy comes from Zillow's use of machine learning to predict housing prices where housing prices are already inflated. Zillow's models worked for some time, resulting in Zillow purchasing houses that they had high confidence (entropy) would render in a higher sell price. The Zillow model relied on homeowners living in cities that were booming, notably tech hubs. The model collapsed during the pandemic when homeowners had more flexibility in where they lived.[37] While the model could not predict a pandemic, it also did not include if/then statements for other reasons why the housing market might cool especially when predictions such as Zillow's entered our everyday usage.

Zillow's collapse reminds us that people use the outcomes that the algorithms produce, and by using the outcomes, the algorithms become self-fulfilling. The data that is collected is already racialized and if it is used, it is considered true. This means that the outcomes of algorithms are used as truths. In the example of housing prices, Zillow was originally an application that helped people shop for homes. This means that they were able to predict house prices *and* to display them. A home-buyer would then affirm the data by purchasing it for the price that Zillow displayed. This "feedback loop" proves to be a problem when it comes to racialized data, as Mathematician, Cathy O'Neil explains:

> The math-powered applications powering the data economy were based on choices made by fallible human beings. […] Nevertheless, many of these models encoded human prejudice, misunderstandings, and bias into the software systems that increasingly managed our lives.[38]

[37] Ataee, Pedram, "Zillow Collapse Proves AI Is Not Perfect: Let Me Explain," *Towards Data Science.*
[38] Noble, Safiya, *Algorithms of Oppression*, 27.

Safiya Noble extends this argument by saying that this encoded bias is "fundamental to the operating system on the web."[39] Prejudice and bias are fundamental to the ways that algorithms function because they are making predictions for the way systems currently operate. In other words, as Ruha Benajmin also argues, the algorithms are predicting outcomes for racialized and institutionalized systems because these systems are racialized and institutionalized.[40] But the hope is that instead of reinforcing racism, these algorithms can be used to undo it.

Computational thinking includes four non-programming skills: Decomposition, Pattern Recognition, Abstraction, and Algorithm-Design. While the general public assumes that computer programming is without bias, all of the skills, and especially Decomposition and Abstraction, include human bias. Because Abstraction is concerned with removing instances that are not part of a pattern, inserting critical race theory in this skill allows the programmer to determine what is a pattern and what is indicative of a larger racial project. This is especially important since people use the outcomes of algorithms, or predictions, to make their own decisions, which are usually those that underscore the racial projects.

Racial Formation and Critical Race Theory

As Paul Gilroy writes in *The Black Atlantic: Modernity and Double Consciousness* (1993) of the constant tension between what is and what is intended,

> Modernity is apprehended through its counter-discourses and often defended solely through its counterfactual elements, yet their analyses remain substantially unaffected by the histories of barbarity which appear to be such a prominent feature of the widening gap between modern experience and modern expectation.[41]

[39] Noble, Safiya, *Algorithms of Oppression,* 10.
[40] Benjamin, Ruha, *Race After Technology.*
[41] Gilroy, Paul, *The Black Atlantic,* 49.

Race as interpretation, creation, and biology is a phenomenon within modernity. Scholars of modernity describe race as the time in which group identity was attached to their financial value, resulting in an authentic identity and another that is a product of the commodification. These dual notions, between what is authentic and what is manufactured, is known as a type of consciousness and one in which people navigate between their understandings of authentic and manufactured. This idea of consciousness was likely coined by WEB Du Bois in *The Souls of Black Folk* (1903) where the sociologist succinctly asks, "How does it feel to be a problem?"[42] and further delineates the dilemma of the Black experience:

> The history of the American Negro is the history of this strife, --this longing to attain self-conscious manhood, to merge his double self into a better and truer self. In this merging he wishes neither of the older selves to be lost. […] He simply wishes to make it possible for a man to be both a Negro and an American, without being cursed and spit upon by his fellows, without having the doors of Opportunity closed roughly in his face.[43]

DuBois distinguishes between two opposing identities, Negro, in the vernacular of the time, and American, noting that both cannot exist in harmony with each other. By making this delineation, race scholars are forced to theorize around what makes the two identities distinct and how the attempts to merge them are impossible.

In the previous sections, I discuss racialized surveillance as a way to collect racialized data. I also discuss how data is used, and the ways this usage maintains racial projects. Inherent in both arguments is the idea that race is malleable due to the value placed on races and that systems work in a way to benefit those value systems. Another critical assumption of the racialized computational thinking approach that I am describing is that the above is known and can be tracked. The following

[42] DuBois, *The Souls of Black Folks,* 7.
[43] DuBois, *The Souls of Black Folks,* 9.

describes the two theories that support these arguments and assumptions: racial formation and critical race theory.

Two tenets of critical race theory speak to the embeddedness of racism, including the ways in which it is foundational to all institutions in the United States. First, critical race theorists argue that racism is "ordinary"[44] because it is so common and even natural to the everyday functioning and experiences of people of color. George Lipsitz and Cheryl Harris argue that this is due to institutions privileging white skin, where the foundations of the institution were based in increasing the financial value of White identity.[45] Both authors introduce their arguments by discussing land grabs during the initial Native American conquests. Then, law-makers wrote policy that only permitted White-identifying people to own land, thereby creating a wealth class dependent on skin color.[46] Harris extends the argument to include enslavement and education,[47] a connection I describe in more detail later in this work.

The second tenet of critical race theory that is important for this work is interest-convergence. Law professor Derrick Bell advances interest-convergence as an implied mechanism in race-based laws—Black people acquire rights only when it is in the interest of White people.[48] In the case of education, the author argues that in *Brown v Board of Education* (1954), the supposed advances for African Americans only reached as far as it would benefit White people. The Court granted enough rights to ensure that White communities would not bear any harm. In subsequent adjudications, namely in affirmative action, the Court has maintained this interest-convergence by limiting the number of seats available to African American students, including those that exceed admissions standards for White students.[49]

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[44] Delgado, Richard and Jean Stefanic, *Critical Race Theory: An Introduction*, 8.
[45] Lipsitz, George, "The Possessive Investment in Whiteness"; Harris, Cheryl, "Whiteness as Property."
[46] ibid
[47] Harris, Cheryl, "Whiteness as Property."
[48] Bell, Derrick, "Brown v Board of Education."
[49] See *Fisher v University of Texas* (2012).

Both the ordinary of racism and its interest-convergence are predictable, meaning one can predict the outcome of law by determining how different it would be from established norms and how beneficial it will be to Whites. But it is first important to understand who is being discussed according to racial formation and how racial formation itself is a interest-convergence tool.

According to racial formation theorists, race gains meaning from biology and the interpretation of that biology within contexts of ethnicity, nation, class, and the political.[50] According to Omi and Winant, the mechanisms that are used to define race are known as racial projects:

> Racial projects connect what race *means* in a particular discursive or ideological practice and the ways in which both social structures and everyday experiences are racially *organized,* based upon that meaning. Racial projects are attempts both to shape the ways in which social structures are racially signified and the ways that racial meanings are embedded in social structures.[51]

These racial projects can differ in size and scope, from policies to personal interactions, such as enslavement to affirmative action to the placement of so-called ethnic food in a grocery store. What is important to note in this work is that they are traceable and observable. Whenever something can be identified by race, a racial project made it so.

Scholars of the African Diaspora in Latin America provide important contributions to racial formation theory: how space and time significantly determine meaning applied to race, moment to moment, rather than only within larger political moments. Hanchard argues that, in the case of Brazil, racial formation is insufficient as it does not allow for individual identity-making within collective identities, unless it is across epochs.[52] Since Afro-Latin Americans are simultaneously navigating within notions of whiteness and blackness, they are demonstrating the meanings attached to each. In

[50] Omi, Michael and Howard Winant, *Racial Formation in the United States*.
[51] Omi, Michael and Howard Winant, *Racial Formation in the United States*, 125.
[52] Hanchard, Michael, *Orpheus and Power*, 17

"Negotiating among Invisibilities: Tales of Afro-Latinidades in the United States," I argue that for Afro-Latinos, the changing meaning of nationhood, or an "American" identity as it applies to blackness and whiteness, further complicates identity-formation.[53] This notion of competing racial formations within Americanness exists within other racialized ethnic groups, such as Hmongs and Uyghers, and complicates our understanding of race within other theories such as critical race theory.

Scholars of Afro-Latinx identity also identify the prevalence of war as a racial project that makes identity in Latin America unique. In *The Black Jacobins,* CLR James writes,

> The people who made [West Indians][54], the problems and the attempts to solve them, are peculiarly West Indian, the product of a peculiar origin and a peculiar history. West Indians first became aware of themselves as a people in the Haitian Revolution. Whatever its ultimate fate, the Cuban Revolution marks the ultimate stage of a Caribbean quest for national identity.[55]

James argues that had it not be for war, namely Bolivar revolutions, Latin Americans would not be forced to create national identities. The irony in this articulation is that the revolutions that James uses to periodize this timeline, Haitian Revolution and Cuban Revolution, are Bolivar revolutions intending to remove imperialist powers. Nelson Maldonado-Torres argues that this identity-making within war is a feature of Latin American race-making in modernity and in concert with interactions with the Western world.[56] Of interest for this work is that this violence leads to emigration from Latin American countries to the United States, the source of the violence and racial projects that will maintain the modern race-making both at home and abroad. We see this conflict in disparate voting behaviors in Florida among Cuban, Venezuelan, and Nicaraguan migrants, most of whom arrived in

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[53] Hoy, Vielka, "Tales of Afro-Latinidades," *The Afro-Latin@ Reader.*
[54] James is using West Indian interchangeably with Caribbean and how we are using Afro-Latin American today. He is doing so by comparing Fidel Castro and Cuban national identity with that of Toussaint L'Overture.
[55] James, CLR, *The Black Jacobins,* 391.
[56] Maldonado-Torres, Nelson, *Against War: Views from the Underside of Modernity*, 4.

the United States after the US intervened in revolutions and civil wars at home. We also see this in the controversy regarding the lack of Black representation of Washington Heights in *In the Heights*, Washington Heights being a neighborhood established by Black Latinx migrants looking to escape racial hegemony at home.[57] This controversy also highlighted hybridity discourses and the violence created by erasure for Black Latinx. In short, war and violence serve as a racial project in Latin America and is applied differently for different groups. This causes groups to seek migration to the United States for differing reasons. In the United States, they are racialized according to racial projects in the United States and those that existed at home. This demonstrates how racial formation is also an process of place and time.

Lastly, inserting Afro-Latino identity-making as a racial formation tool provides another unit of identity-making, that of having choice. Mary Waters and Percy Hintzen argue that West Indians in the United States exemplify the ability to choose identities, especially when acquiring political power.[58] They note that phenotype and nation status provide these options. While this may seem counter to the argument that I raise in the previous paragraph, I believe it is the perception of having a choice that allows one to navigate among racial formations, not the actual choices. To return to the Pew Research Center's survey, as the number of options for Afro-descended categories increased, so did the percentage of respondents who selected "Other." The irony is that the researchers at Pew ultimately combined all of the categories, even "Other," and selected respondents they believed to be Afro-descended to answer it, meaning it did not matter what the respondents answered. But this illusion of choice is another critical intervention in racial formation theory and its application in critical race theory. I argue that critical race theory can be used as a computational predictive tool, but only as far as choice and temporality can also be measured and surveilled.

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[57] Leon, Felice, "Let's Talk About *In the Heights* and the Erasure of Dark-Skinned Afro-Latinx Folks," *The Root.*
[58] Hintzen, Percy, *West Indians in the West*; Waters, Mary, *Ethnic Options.*

Schooling, Access, and Race Formation: Institutionalized Racialization

In the previous sections, I discuss racialized data and surveillance assemblage, algorithm design, and racial projects. In this final framing, I discuss schooling as a racial project maintained by racialized data. Educational sociologists undertake this task when they grapple with the role of schools in ending or mirroring racism. As part of the Civil Rights Act of 1964, President Johnson commissioned the US Office of Education to report back on the state of education for Black children.[59] The outcome, the Coleman Report, is considered the most significant reporting on the state of education.[60] The report concludes that Black children are disadvantaged in schools because of the lack of cultural capital of their parents.[61] This creates a chicken-egg argument for educational sociologists, sometimes in questioning how much schools matter: Do schools create inequalities, reproduce them, or mirror them?[62] I argue that these are questions concerned with the interpretation, recording, and deployment of racialized data, and are most apparent when disseminating resources such as college degrees. How resources are disseminated is a type of interest-convergence. While it is not always grounded in the law, I argue that resources are allocated in a manner that benefits Whites and identities are racialized in order to do so.

In schools, behaviors are racialized with outcomes in grading, discipline, and matriculation. The research in culture and cultural capital in education ranges from claims about the advantages gained as a result of class identities,[63] to the ways that Black and other under resourced students

[59] Kiviat, Barbara, "The Social Side of Schooling," *Johns Hopkins Magazine.*
[60] ibid
[61] Text of Coleman Report. See: Pierre Bourdieu and Jean-Claude Passeron's use of "cultural capital."
[62] Downey, Douglas, *How Schools Really Matter.*
[63] Calarco, Jessica, *Negotiating Opportunities: How the Middle Class Secures Advantages in School;* Lareau, Annette, "Cultural Knowledge and Social Inequality;" Lee, Jennifer and Min Zhou, *The Asian American Paradox;* Lopez, Nancy, *Hopeful Girls, Troubled Boys.*

navigate in what Christopher Emdin identifies as cultural clashes,[64] to methods to address the aforementioned clashes in the classroom with new pedagogies such as culturally responsive, relevant, or sustaining pedagogies.[65]

Researchers have discussed the ways that awareness of advantages provided to certain groups permits groups to navigate within established social hierarchies. This is known among class structures[66] and research is also pointing to the ways ethnic groups do the same. Jennifer Lee and Min Zhou argue that this works in two ways for Asian American students: that stereotype promise and hyperselectivity make positive cultural behaviors available to Asian American students, and then Asian community organizations, specifically Chinese groups, coalesce around dispensing of the capital. In other words, Chinese organizations use the stereotype of being good at Math to be good at Math, for example. When the stereotype originates from a difference in education levels in the home country (i.e. societal perceptions of lower levels of education attained in the US compared to at home), immigrants are able to access what the authors deem, ethnic capital, "which supports the cultural institutions and practices necessary to reinforce the success frame."[67] They argue that because Asians are assumed to be highly education in Asia, they should therefore be educated in the United States. In other words, while most understand the model minority stereotype to be a myth, it does allow Asian groups to access cultural capital to support their advancement.

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[64] Carter, Prudence, *Keepin it Real: School Success Beyond Black and White:* Delpit, Lisa, *Other People's Children;* Emdin, Christopher, *For White Folks Who Teach in the Hood…and the Rest of Y'all Too.*

[65] Hollie, Sharrocky, *Culturally and Linguistically Responsive Teaching and Learning;* Ladson-Billings, Gloria, "But that's just good teaching! The case for culturally relevant pedagogy"; Alim, H. Samy and Django Paris, eds *Culturally Sustaining Pedagogies.*

[66] Lareau, Annette, "Cultural Knowledge and Social Inequality;" MacLeod, Jay, *Ain't No Makin It.*

[67] Lee, Jennifer and Min Zhou, 6. According to Lee and Zhou, "success frame" refers to "a strict definition of achievement and success" that includes grading and employment expectations, among others. Hyperselectivity creates the circumstances for the success frame to exist. Hyperselectivity is a dual process where Asians are "highly selected […] [and] more highly educated than the average American." Being highly selected also refers to the racial project at work for Asian immigrants, as Lee and Zhou describe: The Immigration and Nationality Act of 1965 only allowed for highly educated Asians to migrate to the United States, especially those skilled in particular fields. Therefore, it is not that Asians are inherently smarter; only highly educated Asians were permitted or encouraged to immigrate. I discuss later in this piece the difference with African Americans "immigration" during enslavement and the racial project being forced labor.

African Americans are not perceived in the same way. In general, African Americans did not migrate to the United States recently or voluntarily. They also are not coming from countries where there is perceived hyperselectivity. Researchers describe how the different circumstances for African Americans led to different outcomes in accessing cultural capital. Following Lee and Zhou's argument, while African Americans are not indigenous to the United States, Emdin argues that African Americans occupy a sort of neo-indigeneity due to the length of time that they have been in the United States, as a group, and the circumstances of their migration and enslavement. In *For White Folks Who Teach in the Hood…and the Rest of Y'all Too*, Emdin describes the ways that African American students in urban environments (or the neoindigenous) navigate and create identities in order to cope:

> [T]he neoindigenous in urban areas have developed ways to live within socioeconomically disadvantaged spaces while maintaining their dignity and identity. They are blamed for achievement gaps, neighborhood crime, and high incarceration rates, while the system that perpetuates these issues remains unchallenged.[68]

The process that Emdin describes here is a reminder of how schools operate under stereotype threat and hyposelectivity, or the opposite of Lee and Zhou's argument for Asian American students. By using the founding of the Carlisle Indian Industrial School[69] to describe the impact of culture, Emdin reminds us that the intention behind schooling for indigenous and urban youth, as he argues, has always been an attempt to de-culture themselves, or as he writes, "they are expected to divorce themselves from their culture in order to be academically successful."[70] Nancy Lopez similarly argues

[68] Emdin, Christopher, *For White Folks Who Teach in the Hood…and the Rest of Y'all Too,* 13.
[69] Carlisle Industrial Indian School was founded in 1879 with the goal of acculturating Native Americans. Students learned Christian education and adopted Christian names, with the intention of assimilating into the dominant culture. Richard Henry Pratt, who founded the school under the authority of the US government, famously stated, "Kill the Indian, save the man."
[70] Emdin, Christopher, *For White Folks Who Teach in the Hood…and the Rest of Y'all Too.*

that the cultural capital ascribed to non-immigrant Blacks, has similar consequences for immigrant Blacks, with variations that are also gendered.[71]

Researchers have argued that one way to address inequities in how cultural capital is distributed lies in how students are taught or increasing the cultural capital of the teacher. Researchers in culturally sustaining, relevant, and responsive pedagogy look for ways that teachers can create more inclusive environments without having to change the structure of the school system. While Linda Darling-Hammond's work in culturally responsive and relevant teaching defines "culture" in the classroom especially as a point of departure for culturally sustaining teaching, Django Paris and H. Samy Alim provide a definition of culture within culturally sustaining pedagogies that is applicable to its predecessors:

> We believe that equity and access can be best achieved by centering the dynamic practices and selves of students and communities of color in a critical, additive, and expansive vision of schooling. Instead of being oppressive, homogenizing forces, CSP asks us to reimagine schools as sites where diverse, heterogenous practices are not only valued but *sustained*.[72]

Here, the authors acknowledge the disparate ways that culture is used in the classroom and in schools, while calling for practitioners to use their agency to change it. Lisa Delpit in *Other People's Children* (1995) provides a basis for how we understand the impact of culture in schools: "It [dread] is the result of coming face-to-face with the teachers, the psychologists, the school administrators who look at "other people's children" and see damaged and dangerous caricatures of the vulnerable and impressionable beings before them."[73] This is a departure from Lee and Zhou, Emdin, and Lopez, among others, due to the amount of agency placed on the practitioner. But it is important to note how students are racialized and by whom.

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[71] Lopez, Nancy, *hopeful girls, troubled boys.*
[72] Paris, Django and H. Samy Alim, *Culturally Sustaining Pedagogies: Teaching and Learning for Justice in a Changing World,* 3.
[73] Delpit, Lisa, *Other People's Children, xxiii*

There are behaviors that are identifiable as positive when done by certain groups, while others are negative when done by others. Unlike the positive behaviors, African American students have little control over how their behaviors are interpreted and these interpretations have severe consequences even beyond the classroom. When African American students are aware of the behaviors and attempt to control them, they are met with internal struggles related to assimilation or stereotype threat. Researchers look to resolve these inequities by placing the onus on educators in increasing their own cultural capital. This perspective largely ignores what school system make possible. The following looks at how researchers look at systems in addressing these inequities.

I previously discuss how cultural capital work inside classrooms and schools. As I argue, these interactions eventually become embedded into the structures of schools. In part, this is a cultural argument, meaning the school can take on a type of human characteristic by allowing capital to be distributed in unequal ways. But schools also operate without human influence. By this I mean that cultural capital becomes so ingrained in the functioning of the school, that the most well-meaning of people can do little to change it. I also argue that this is intentional, returning back to critical race theory's framing of value. Schools are not structured to support all students. Be it district funding, city funding, or the ways institutions make money, K-12 institutions are not structured in a way to support all students. The following looks at how the literature describes school infrastructure.

Research in college access reveal the many ways that high schools limit the ways students can access resources necessary to gain admissions to college. I argue that these are sites of social reproduction according to Bourdieu, and because they are based on racial meanings, are also examples of racialized institutions. This can be in the counseling program[74], accurately identifying successful

[74] Bates, Abigail, "Underrepresented and Underserved: College Undermatch and School Counseling"; Yun, JT and JF Moreno, "College access, K-12 concentrated disadvantage, and the next 25 years of educational research."

students,[75] or providing identified students with curricula that meets changes in the economy.[76] Researchers also point to the lack of changes in admissions as demographics and populations shift. As I write this, the University of California at Berkeley was forced by the court to reduce admission by 3,000 due to the housing crisis in the Bay Area. This is a function of housing prices, not student ability. Yet, college administrators will have to drastically shift how they admit students and potentially use academic selectivity to address a lack of housing. One may assume that this will lead the university to admit students who can afford to live off-campus, rather than those who are most academically prepared.

Eve Ewing points to more perplexing ways that underresourced schools are positioned. She writes, "Two words emerged that I also read over and over: the schools, she said, were *underutilized* and *underresourced*. 'But,' I said aloud, 'that doesn't make any sense.' How could the person charged with doling out resources condemn an institution for not having resources?"[77] As Ewing points out, the reality is that underresourced schools are sometimes so underresourced that they are closed. The other reality is that most of these schools, at least in Chicago, are predominantly Black.[78]

These dilemmas in schooling are not new and represent the question that President Johnson attempted to answer by commissioning the Coleman Report in 1964. The President was interested in understanding "[…] the lack of availability of equal educational opportunities for individuals by reason of race, color, religion, or national origin in public educational institutions."[79] The result was one of the more controversial reports in education, blaming much of the inequities in schooling on families. Education reformers and researchers have since set out to demonstrate that this conclusion is wrong,

[75] Hoxby, CM and C Avery, "The missing 'one-offs': The hidden supply of high-achieving low income students"; Logan, Minca, Adar, "The geography of inequality: Why separate means unequal in American public schools."
[76] McMillan Cottom, Tressie, *Lowered: The Troubling Rise of For-Profit Colleges in the New Economy*; Scott, Richard and Michael Krist, *Higher Education and Silicon Valley: Connected but Conflicted.*
[77] Ewing, Eve, *Ghosts in the Schoolyard*, 4-5
[78] Ibid 5
[79] Civil Rights Act of 1964, Section 402

as families are also a product of the social, economic, and political contexts in which they live. Researchers who focus on the structures of education have thus focused on whether schools are a mirror or salve to the inequities found outside of the school's boundaries.

One way to approach this is to look at how successful K-12 institutions are in supporting students in accessing higher education. By looking at access to higher education, researchers can understand the functioning of schools and understand how policies that govern higher education, that are largely federal policies, impact how K-12 schools work. Much of the research related to access to higher education is centered around affirmative action policies[80] or entry into less selective colleges and Historically Black Colleges and Universities.[81] In the above research, while some attention is given to the low graduation rates of these institutions, the conclusions place little responsibility on the structures of the lower-performing institutions or why the affirmative action policies are necessary in our current environment. By doing so, this research seems to diverge from the lessons of the cultural capital research, and even the infrastructure of K-12 education arguments, by placing blame squarely on the decisions of individuals or a policy, and not on the actual institutions of higher education. This is in part a racial project as it removes agency from the structures that are actually making decisions for students.

But this trend seems to be shifting. There is some emerging research about college admissions that highlights the ways that colleges are intentionally not admitting all of the students they can, disproportionately impacting students of color. This research on the mechanics of admissions assumes that African American students did everything that they could control correctly, save for attending a college that unbeknownst to them, was not equipped to deal with changing times.[82] For

[80] Allen, Walter et al, "From Bakke to Fisher: African American Students in US Higher Education over Forty Years."
[81] ibid; McDonough, Patricia, *Choosing colleges. How social class and schools structure opportunity*.
[82] Bowen, WG et al *Crossing the finish line: Completing college at America's public universities*; McMillan Cottom, Tressie, *Lowered: The Troubling Rise of For-Profit Colleges in the New Economy*; Scott, Richard and Michael Krist, *Higher Education and Silicon Valley: Connected but Conflicted.*

example, Scott and Krist argue that even though the number of students eligible to apply to selective colleges has increased since World War 2, the number of seats at selective campuses have not. This is especially troubling since high school graduates are now much more skilled in the areas that industry is demanding but are forced to attend colleges that would not allow for entry into these high-skilled technology jobs.[83] As noted earlier, McMillan Cottom makes a similar argument by stating a similar finding to Scott and Krist and adding that the for-profit, vocational school has become an industry dependent on these higher skilled students not attending the four-year selective colleges that they are more than qualified to attend.[84] These higher skilled students are disproportionately African American.

Similar to the above, research in college infrastructure also reveals another phenomenon—undermatching. There is a vast array of four-year, degree-bearing colleges that should meet the needs of all students who are eligible, but very few students who can attend them, do. This is partly a problem of high schools where mostly students of color are given advice to attend a college that is an undermatch for everyone (e.g. low graduation rates)[85] or an undermatch for under-resourced students.[86] As Melissa Roderick, et al discuss, there are assumptions about what under-resourced high school students are capable of doing that implicitly interrupt where they are told to attend college:

> Implicit in these policy discussions is the assumption that low-income students have the information and support they need to respond to new incentives and opportunities. They presume that if students were more qualified, they would be able to navigate the college search

[83] Scott, Richard and Michael Krist, *Higher Education and Silicon Valley: Connected but Conflicted.*
[84] McMillan Cottom, Tressie, *Lowered: The Troubling Rise of For-Profit Colleges in the New Economy.*
[85] Bates, Abigail, "Undrerepresented and Underserved: College Undermatch and School Counseling"; Roderick, Melissa et al, "Potholes on the Road to College: High School Effects in Shaping Urban Students' Participation in College Application, Four-year College Enrollment, and College Match."
[86] Alon S and M Tienda, "Assessing the 'mismatch' hypothesis: Differences in college graduation rates by institutional selectivity;" Bowen, WG et al, *Crossing the finish line: Completing college at Americas public universities*; Hoxby, CM et al, "The missing one-offs: The Hidden Supply of High-Achieving Low-Income Students."

> and application process and translate those qualifications into enrollment in four-year colleges.[87]

While this may seem to be an argument better suited for the cultural capital or K-12 section, and I agree in part that it does, it is critical to note that Roderick, et al finds the problem in "college match" or a four-year college that matches the "selectivity levels that matches their qualifications."[88] This is also a dilemma of admissions since choosing to enroll is not simply a matter of choice on the part of the student; she has to be admitted first, and we can assume that colleges are aware of when a student is not truly a match.

Analysis

Abigail Fisher applied to the University of Texas in 2008. At the time, the university had a policy that automatically admitted students who were in the top 10% of the graduating seniors in Texas. Under a special policy at the University of Texas, the remaining seats could be filled using several other factors such as leadership ability, special circumstances, gender, or race, among others. Ms. Fisher, a White woman whose grades were not sufficient for admissions consideration in either policy, argued that she was not admitted to the university because race could be used as a factor in the special policy. Ms. Fisher's case eventually went to the Supreme Court. There she argued that any consideration of race, was a violation of her Fourteenth Amendment rights.[89]

By the time Ms. Fisher originally sued the University of Texas in 2012, very little of the original intention of affirmative action remained in practice. *Grutter v. Bollinger* (2003) upheld the decision from *University of California v. Bakke* (1978) that race could be used as a consideration in college admissions,

[87] Roderick, Melissa, et al, 179.
[88] Ibid
[89] The Fourteenth Amendment allows for equal protection, meaning one cannot be discriminated against on the basis of race.

but held that racial quotas, or specifying the number of students to fill the seats each year, would not be allowed. Without that racial quota, affirmative action laws mostly supported White women in admissions and in the workplace,[90] with very little impact for its intended recipients, African Americans and Latinos.[91] This is one of the more fascinating things about the race-based laws: the actual decision or text of the law is of little consequence. As critical race theorists argue, race-based laws, including the deliberations about the law, define who can complain and what is a valid complaint but they have little impact on the day-to-day functioning of African Americans or in ending racism.[92] So, even though Ms. Fisher gained admissions to and graduated from a comparable institution, and every African American and Latino student who gained admissions that year had higher grades and test scores than her, the Supreme Court allowed her to air her complaint regarding the value placed on the race. By allowing Ms. Fisher to argue a value system, the Supreme Court debated the investment in educating African Americans.

In what we know about the case thus far, African American and Latinx students are racialized as not deserving of a college education, even when they earn higher grades than their White counterparts. This is strange not only because African American and Latinx students perform better,

[90] According to critical race theory, laws related to race and education fail to support African Americans for three major reasons: interest-convergence; the goal of colorblindness; and notions of merit. Derrick Bell argues that laws related to race and education are implemented when there is a high degree of interest-convergence, or when the rights granted to African Americans have some benefit to Whites (1980). From *Brown v Board of Education* (1954), Bell argues that the Supreme Court only granted rights to African Americans because it was in the benefit of Whites to do so (ibid). In our modern-day application of affirmative action, when prosecutors and policy advocates only debate aspects of the law that relate to race. In the University of Texas case, Fisher's representatives only argued aspects of the policy that related to race, while preferences granted to gender and class, among others, were not in dispute. Kimberle Crenshaw argues that this is due to the aim of colorblindness, the second major reason why laws related to race and education are ineffective for African Americans (2006). Crenshaw argues that from the inception of affirmative action, the goal has been to reach a point when race-specific laws would not be necessary, or having a colorblind society. The court has never expressed an interest in being gender-blind or class-blind, for example. Finally, Cheryl Harris argues that this is due to how merit is allocated, namely what value is placed on racial differences compared to other differences (1993). Harris (1993) and George Lipsitz (1998) argue that Whiteness is a valued commodity within many institutions, including education. The result of interest-convergence, colorblindness, and merit has meant that White women are included in affirmative action laws when they are written or decided but not in the subsequent dismantling of those laws (e.g. removing funding to race-based college access programs in California due to the passing of Proposition 209, but not to gender-based programs).
[91] Massie, Victoria, "White women benefit most from affirmative action—and are among its fiercest opponents."
[92] Delgado, Richard and Jean Stefanic, *Critical Race Theory: An Introduction.*

but also because students racialized as African American and Latinx in a college setting, are not typically racialized in that way elsewhere. Anecdotally, Black students on college campuses bemuse the lack of US-born African Americans. In an NBC interview, Black students at Harvard talked about how their Black peers are from Nigeria, Jamaica, and Haiti.[93] While students made light of the trend, there is some truth to how this occurs, stemming from hyperselectivity for Nigerians, for example, working in the same way as it does for Asian students.[94] Like Asian students, laws exist that support the educational attainment for hyperselected immigrant groups, namely Deferred Action for Childhood Arrivals (DACA). For public institutions, we see an increase in admissions and enrollment for immigrant groups from Latin America and Africa as DACA laws become more lax and funding increases.[95] When public institutions claim DACA students as international students, they receive more funding from the federal government than if they are listed as domestic, in-state students.[96] For private institutions where in-state, out-of-state, and international tuitions are comparable, we see DACA funding being used to fund other students since DACA students also tend to participate in advocacy groups that fund them separately. In speaking to an admissions officer at a private university, he noted that since its inception, no DACA funding went to the DACA students because their tuition was paid for. But it was in their best interest to admit DACA students to fund other programs. In this circumstance, we see how it is beneficial to racialize African American and Latinx students as non-deserving, while simultaneously benefitting financially from their enrollment. In racialized computational thinking, we would use DACA funding and first-generation enrollment in the abstraction phase to remove patterns that are correlated to funding rather than aptitude.

[93] Lee, Trymaine, "Ebony & Ivy," *Into America*, podcast.
[94] In the United States, 63% of first-generation Nigerians have a college education, compared to 7% of Nigerians at home (taken from workingimmigrants.com).
[95] I am correlating admissions at the University of California with DACA funding.
[96] This is taken from admissions data for the University of California.

During Supreme Court deliberations for Fisher v University of Texas (2015), Justice Scalia stated the following:

> There are those who contend that it does not benefit African Americans to get them into the University of Texas where they do not do well, as opposed to having them go to a less-advanced school, a slower-track school, where they do well.[97]

Justice Scalia's words were shocking in that they were said aloud by a Supreme Court Justice. But his words did not surprise people who work with and around students applying to college. The statistics are abysmal but consistent: African Americans are not admitted to college, especially selective colleges, at high rates. As Scalia implies, this is because African Americans are selected out of the admissions process (or should be) because they would not perform well. Admissions practices use that data point in a way that underscores Scalia's implication: that African Americans inherently cannot perform at selective institutions. The problem, as Justice Scalia implied, is that the 9% admissions rate for African Americans is treated as the ceiling, an aspiration or limit, while the 34% or 49%[98] for White students is considered the floor, a basis in which to grow from. Implied are notions of merit, value, and capabilities that are ascribed to African Americans and White students. These implications are made into reality in the ways that K-12 education and admissions to college function.

Returning to my description of computational thinking, Scalia demonstrated a logic that first asked if African Americans are capable enough to attend the University of Texas. But the data that is currently available does not explain the 9% admissions rate; rather it creates a self-fulfilling feedback loop[99]: only 9% of students have ever been admitted to the University of Texas therefore only 9% should be admitted to the University of Texas. Every time the university maintains that percentage, the task learns that it is correct. Therefore the events that result in 9% admissions for African

[97] Supreme Court oral arguments in Fisher v University of Texas, December 9, 2015.
[98] Taken from admissions data for the University of Texas in IPEDS, US Department of Education.
[99] O'Neil, Kathy, *Weapons of Math Destruction.*

American students yield an entropy that is reliable and making the percentage true. The way that affirmative action law is applied and the use of application materials are types of surveillance that supports the racialized outcomes that we see in college admissions.

Conclusion

Racialized data is the result of racialized surveillance, or methods of recording data that support racial projects, such as college applications. Since college degrees are a scarce resource, students are racialized to ensure the resource is only provided to White students, unless there is a separate benefit to institutions, as with federal funding. By applying critical race theory and racial formation theory to this logic, we are able to see how policies and understandings of race impact outcomes. Instead of reinforcing racial projects, this application better allows social and computer scientists to solve problems.

While discussing computational thinking, I omitted skills that required programming skills. For further study, it is important to employ programming skills to fully build machine learning models. This also requires creating a way to collect and interpret racialized data according to their racial formations. This requires more attention in the Decomposition and Abstraction phases of computational thinking.

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