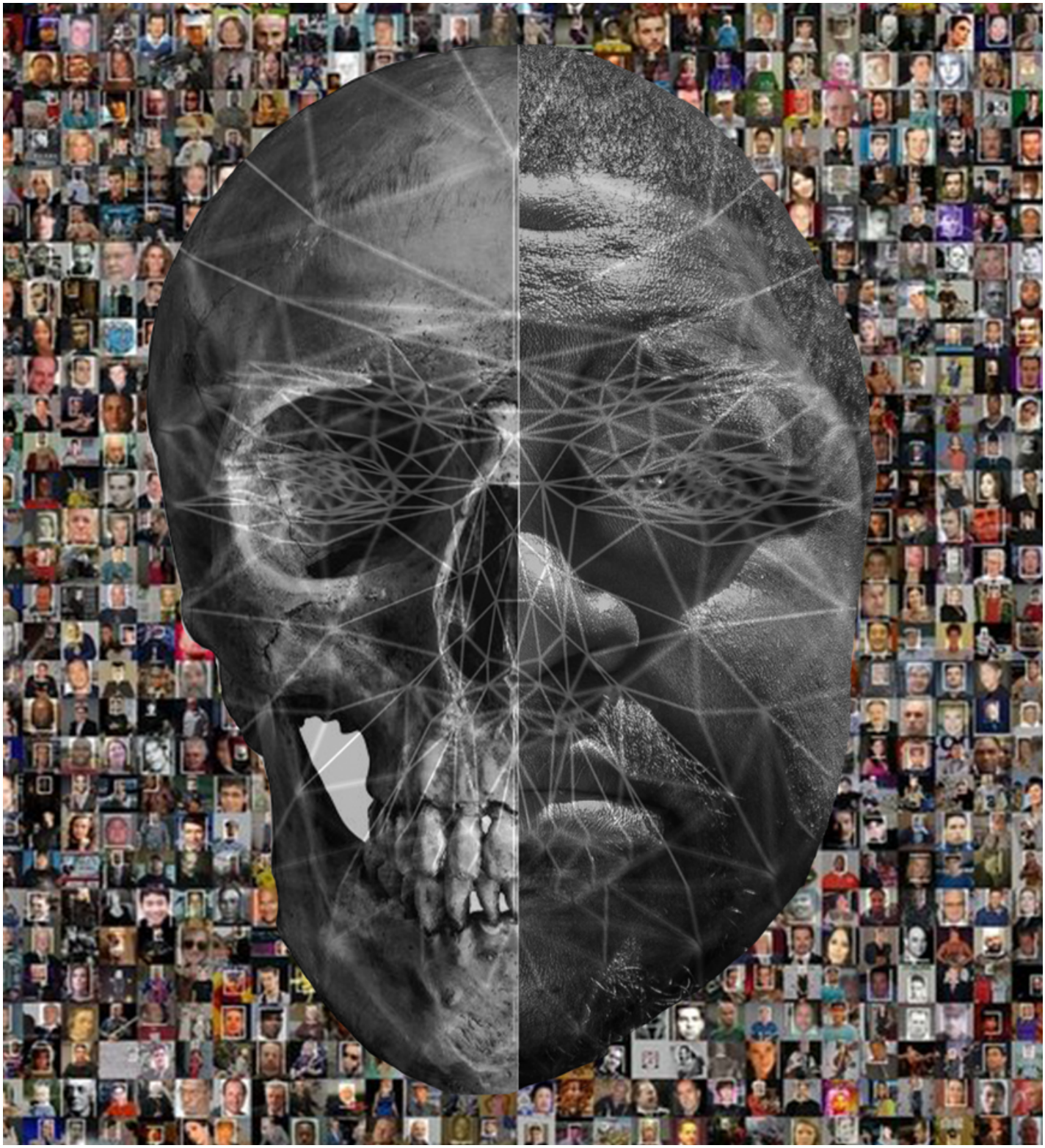
THE RACIALIZED FACE

FACIAL RECOGNITION TECHNOLOGY AND HISTORIES
OF CRIMINALIZATION



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THE STORY OF ROBERT JULIAN-BORCHAK WILLIAMS

Robert Julian-Borchak Wiliams,
American Civil Liberties Union

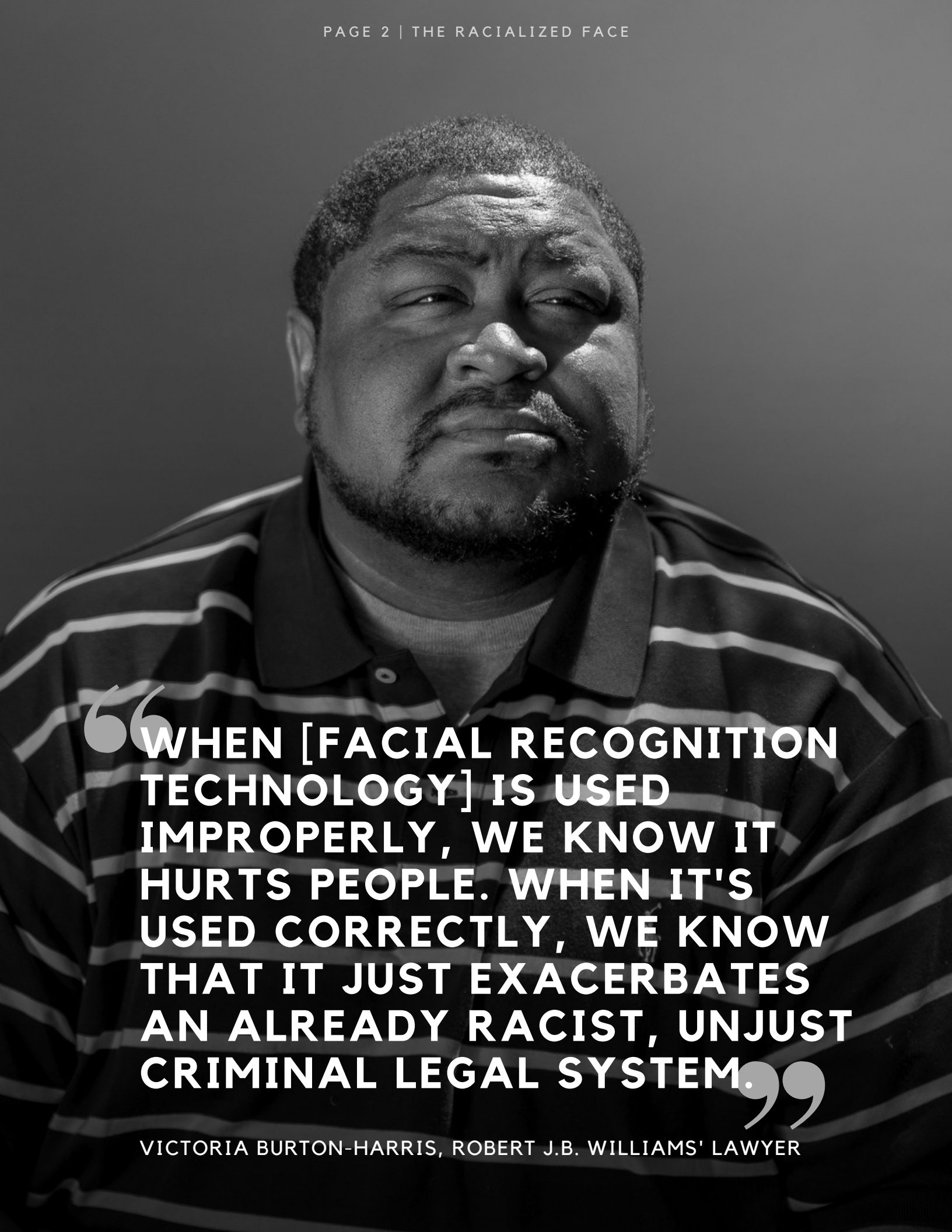
In January of 2020, a Black Detroit native named Robert Julian-Borchak Williams was wrongfully arrested by the Detroit police after being mismatched by facial recognition technology.

After receiving a call from the Detroit Police Department telling Williams to go to the station to be arrested, at first believing this to be a prank, Williams found the police showing up at his house in Farmington Hills, Michigan an hour later where they immediately handcuffed him. The police did not investigate Williams nor inform him of his crime when he was arrested, only showing him a piece of paper with his photo and the words "felony warrant" and "larceny." Williams was arrested in front of his 2 young daughters, who were distraught by the scene, and his wife, who asked the officers where he was being taken in which the response of an officer was "Google It."

Williams was taken to a Detroit Detention Center, where he was held overnight. The next day, he was taken to an investigation room where the detectives showed Williams three pieces of paper. The first two were still and blurred images of a Black man caught on surveillance who robbed $3,800 worth of merchandise from a Shinola watch store in December of 2018. "Is this you?" asked one of the detectives. Holding the picture up to his face, knowing this was not him, Williams replied, "No, no this is not me. You think all Black men look alike?" The third piece of paper was another photo of the same man next to a picture of Williams' driver's license, to which Williams pointed out again that these photos did not match. "I guess the computer got it wrong," said one of the detectives. Williams was held in custody until that evening and was released 30 hours after his arrest on a $1,000 personal bond.

Complaints of this case arose around the time of the George Floyd protests in June 2020. This is the first reported case of an American being wrongfully arrested based on a mismatch from a facial recognition algorithm (Hill, 2020). While Mr. Williams' case is one of the only cases of this on record, there are certainly many other untold stories. These stories likely include countless innocent people taking plea bargains or being incarcerated for crimes they did not commit, all because an algorithm took them for a criminal (Garvie, 2020).

Adopted from Hill, 2020.



“WHEN [FACIAL RECOGNITION TECHNOLOGY] IS USED IMPROPERLY, WE KNOW IT HURTS PEOPLE. WHEN IT'S USED CORRECTLY, WE KNOW THAT IT JUST EXACERBATES AN ALREADY RACIST, UNJUST CRIMINAL LEGAL SYSTEM.”

VICTORIA BURTON-HARRIS, ROBERT J.B. WILLIAMS' LAWYER

LETTER FROM THE EDITORS

Readers,

First and foremost, we the authors are so glad you have taken interest in this project. As we prepare to graduate, we wanted to ensure the capstone project we presented was relevant, important, and in alignment with the material we have studied over the last four years, providing an analysis of current problems of racial injustice that require change through both a scientific and cultural perspective. We hope this project compels you to think about how science and technology are not removed from the structures that hold white supremacy in place.

The unjust killings of George Floyd, Ahmaud Arbery, and Breonna Taylor in 2020 brought to light the pervasiveness of racism in our criminal justice system. It was during the Black Lives Matter Protests that Mr. Williams' story was made public and the issue of racial bias within facial recognition technology was given more attention. Thus, we decided it was necessary to further investigate and increase awareness of this previously hidden issue, and we hope it may inspire action towards social change. Though we understand that there is a need for systemic change that extends far beyond the use of facial recognition technology, we hope that this project may be useful in considering how racial biases become invisibilized and institutionalized through technologies, especially within our criminal justice system.

Sincerely,
Jessica Castro, Emily Davidson, and Sarah Isen

THE BIAS PROBLEM WITH FACIAL RECOGNITION

Faces are important to us. Our faces are connected to our social medias, passports, and driver's licenses. It is through our faces that we perceive the world around us, establish our own identities, and recognize others. With facial recognition technology, machines can identify people just as we identify one another. However, just because identification is performed by an algorithm doesn't mean facial recognition technology is devoid of bias. In fact, in its technological guise of objectivity, facial recognition technology invisibilizes bias. This is dangerous. As a result of these hidden biases, facial recognition technologies perpetuate racism and other forms of discrimination. This is especially problematic in the context of law enforcement, where institutional, implicit, and explicit racism are already present within every area of policing and criminalization.

How Facial Recognition Technology Works

Facial recognition is a type of biometric, or "a measurable biological (anatomical and physiological) and behavioral characteristic that can be used for automated recognition." ("Biometrics," 2020). Facial recognition technology involves the process of using facial signatures to identify or verify the identity of an individual. This process involves five steps (Kaur et al., 2020):

1. **Image Acquisition:** For a face to be identified by an algorithm, an image must be captured by a 2D image, 3D depth image, or video.
2. **Face Detection:** The face(s) in a given image are detected. This process is similar to the Viola Jones detection algorithm, a way to distinguish faces from other non-face parts of the image.
3. **Feature Extraction:** This step involves the extraction of unique facial features from the image to make a facial signature composed of a vector of values.
4. **Database Matching:** The facial signature extracted in the previous step is matched with facial data points from a database consisting of many images. It is important to note that an individual's facial signature can differ greatly between pictures, and no technology is capable of generating a unique facial signature for each individual. This leaves room for error.
5. **Person Identification:** From the matches, identifications or verifications are made based on the system's similarity score threshold. Sometimes multiple potential matches are produced.

In order for this process to work, artificial intelligence (AI) systems are provided with training datasets. These datasets consist of thousands of pictures of human faces which are used to develop a statistical model for what a face is supposed to look like (Hanson et al., 2020). In turn, the system develops predictive capabilities that enable it to extract facial features and make matches based off of these signatures. These training sets vary in the degree to which they represent the diversity of human faces. This has implications for their accuracy in identifying faces of different demographics.

Different law enforcement matching databases exist at the local, state, and national levels. Most of these databases contain mugshot images of arrested persons. A number of law enforcement agencies at the state level have databases consisting of DMV drivers license photos. Furthermore, the FBI system includes an extensive database of non-criminal images, with access to state driver's license photos as well as passport and U.S. visa pictures from the State Department (Face Recognition, 2017). Under recent scrutiny is the face recognition company Clearview AI. The company took images from sites like YouTube, Venmo, and Facebook, allowing the more than 600 law enforcement agencies that use the app to match people's faces to their social media profiles, uncovering identities through people's online profiles (Hill, 2020). As a result of the widespread inclusion of various forms of images in these law enforcement databases, it has been estimated that half of all Americans are included in a face recognition database (Face Recognition, 2017). What is perhaps even more alarming is the fact that most Americans are not aware that their faces are included in these databases. Our faces are being used in ways that we are not informed of, have not consented to, and likely don't understand the risks of.

Bias within the machine

As a result of various technological inputs, facial recognition algorithms have been found to be much less accurate for women, younger people, and Black individuals. Testing the accuracy of these algorithms involves finding the rates of false positives and false negatives across different demographic groups.

THE VARIOUS USES OF FACIAL RECOGNITION TECHNOLOGY

Shopping: Many stores are experimenting with facial recognition technology in order to speed-up transactions, understand the demographics of their customers, and protect against theft.

Security & access control: At workplaces and other locations, facial recognition technology is being implemented as a means of access control. Usually, this involves a verification test to ensure that the person entering a building matches the identity of an employee.

Consumer technology: Many people use Face ID to unlock their phones. Social media websites like Facebook and Google Photos automatically identify people in pictures.

Schools: Some schools are using facial recognition technology to protect campuses from known criminals such as sexual predators. It is also being used to track attendance and attentiveness.

Law Enforcement: While most commonly used to identify suspects, facial recognition is used by law enforcement in a variety of different ways. It can be used in real-time to identify "hot lists" of people in a crowd or to identify individuals at airports and border crossings.

False positives occur when the wrong person is indicated to be a match, and false negatives occur when the correct person is not indicated as a match. The Gender Shades project compared the identification accuracy between darker and lighter skinned males and females for facial recognition technologies built by three major companies. It was found that each of the three companies performed better for males than females and that error rates for dark skinned faces were 11.8%-19.2% higher than for light skinned faces. IBM's face recognition software had the most striking disparity, with a difference in the error rate of darker females and lighter males of 34.4% (Buolamwini and Gebru 2018).

Another audit known as the Face Recognition Vendor Test (FRVT) was run by the National Institute of Standards and Technology. Using datasets consisting of domestic mugshots, immigrant application photographs, visa photographs, and border crossing photographs, they tested 189 facial recognition algorithms. To test the accuracy of these algorithms, they compared images from the same person to get a "mate" score and images of different people to get a "nonmate" score. The goal is to have low nonmate scores and high mate scores. From the database of immigrant application photos, they found the highest false positive rates in West and East African and East Asian people. In fact, many of the algorithms were 10 to 100 times more likely to inaccurately identify a black or East Asian face compared with a white one. Perhaps not surprisingly, the lowest false positive rates were in Eastern European individuals. Using the domestic law enforcement images, the highest false positives were found in American Indians, with African Americans and Asians having high false positive rates as well. In accordance with the results of the Gender Shades project, women also had higher rates of false positives than men (Grother et al., 2019).

Another study analyzed the performance of six facial recognition algorithms for different racial/ethnic, age, and gender demographics. The algorithms had the lowest performance for females, the 18-30 age group, and Black individuals (Klare et al., 2012). An additional study found that skin reflectance, a measurement of skin pigmentation by the amount of light reflected from the skin, had the strongest effect on the performance of facial recognition algorithms out of a number of demographic covariates. Lower skin reflectance, which corresponds with darker skin pigmentation, was associated with lower efficiency and accuracy (Cook et al., 2019).These studies consistently show that facial recognition technology is less accurate for Black individuals.

Facial recognition technologies are dangerously calibrated to whiteness. One way that bias becomes embedded within the technology is through a lack of diversity in the databases used to train algorithms. These training sets are largely made up of images of white males (Najibi 2020). For example, a dataset known as Labeled Faces in the Wild (LFW), a collection of faces from the web that is often used as training data for facial recognition algorithms and research, has been estimated to consist of faces that are 77.5% male and 83.5% White (Buolamwini and Gebru, 2018). Thus, algorithms trained on LFW data are trained to identify a population that is more white and more male than the population of the United States as a whole. When even a "neutral" algorithm is trained on a nonrepresentative set of data, this can produce a strong bias in which the outcome deviates from the

population data. Training data bias is often very hidden, as the data used to train these algorithms is usually not disclosed and is treated as separate from the technology and the institutions that use it (Danks & London, 2017). When the training data is disproportionately made up of white males, the predictive capabilities of the machine are unsurprisingly better at identifying white males. Furthermore, as programmers and researchers attempt to create more equitable databases, there is still a lack of engagement with critical and social theories of race and gender. Data gathering and annotation have historically relied on visible markers of difference to make assumptions about race and gender. This failure to reckon with the sociopolitical natures of these intersectional identities leaves face recognition databases unclear and untrustworthy (Scheuerman et al., 2020)

Another way that bias becomes built into the machine is through the camera settings used to capture images such that

“whiteness is configured as the universal gauge that determines the technical settings and parameters for the visual imaging and capture of a subject” (Pugliese, 2007).

The cameras used to capture facial images are optimized for lighter-skinned users and thus do not produce high quality images of darker skinned individuals (Najibi 2020). As a result of these settings, the extraction of facial features is not favorable for darker skinned individuals. This creates problems both in training set photos and the photos captured for identification. Thus, facial recognition technologies are not neutral. They are calibrated to a whiteness that is representative of a complex racial worldview. Though seemingly objective pieces of technology, they in fact serve to maintain hierarchical notions of race, with whiteness at the apex as the norm and template (Pugliese, 2007).

Beyond the Machine

Not only is bias built into the machine, it is also perpetuated through the implementation of facial recognition technology by law enforcement. For example, in local police departments that use facial recognition technology on cameras, these cameras are often more densely located in areas with large non-white populations. This is the case in Detroit, Michigan where cameras have been positioned all over the city as part of Project Green Light. The police department uses facial recognition on real-time footage from the cameras, accessible through a mobile device (Urban et al. 2019). The Project Green Light camera stations are highly concentrated in areas with large populations of Black individuals, with less stations in areas with high White and Asian populations. Thus, Black individuals in Detroit are surveilled through facial recognition technology at much higher rates than White and Asian individuals (Najibi 2020).

Furthering this cycle is the fact that many police departments use facial recognition to compare images with mugshot databases. Since Black people are overrepresented in many of these mugshot databases as a result of a historical racial disproportion in investigation and arrest rates, this racialized pattern of criminal enforcement continues, and Black individuals are even more likely to be investigated and arrested (Bacchini and Lorusso 2019).

Additionally, individual implicit bias and racial prejudice are involved when a police officer or witness is tasked with deciding between multiple matches produced by the technology. Facial recognition algorithms do not return definitive “yes” or “no” answers about whether there is a match (Garvie et al., 2016). They require decision-making on the part of an individual to determine which of the potential matches to pursue. This makes interpretation bias possible and is furthered by the fact that many law enforcement agencies are not trained on how to interpret the results of facial recognition technology and do not have a deep understanding of how the algorithm functions. This creates room for additional implicit biases to enter the process. Discriminatory outcomes are not uncommon in policing, partly as a result of the hyper-criminalization of Black people and the long history of policing as an institution to maintain racial power hierarchies. When tasked with determining which of the returned matches is the suspect, witnesses and officers may unknowingly make decisions based on implicit biases, such as a stereotype that links Black individuals with crime (Spencer et al. 2016).

Facial recognition technologies are not neutral. They are molded by the sociocultural influences of their designers, users, and societies. Under the guise of objectivity and technological neutrality, facial recognition technology perpetuates existing biases. Facial recognition algorithms are dramatically less accurate for Black individuals and women, which has a number of harmful consequences. The biases in facial recognition technology exist both within and beyond the machine, upholding a racial worldview and sociocultural notions of racial essentialism and hierarchy.

"CODE4RIGHTS, CODE4ALL"

A TED TALK ABOUT *CODED GAZE*, AKA *ALGORITHMIC BIAS*

[Viewing as PDF] Link to video: tinyurl.com/codedgazetedtalk
[Viewing as Canva link] Click below to view the video

While working on a project that could project a digital mask onto one's relfection, Ghanaian-American MIT graduate student Joy Buolamwini found that the facial recognition software she was using had difficulty detecting her face unless she wore a white mask. Though this was nothing new for her, for she had encountered other instances where facial recognition technology failed to recognize her face. Buolamwini describes this phenomenon as **algorithmic bias**, which "creates exculsionary experiences and discriminatory practices." Buolamwini describes how, "algorithms, like viruses, can spread bias on a massive scale at a rapid pace."

In this TedTalk, Buolamwini introduces the hidden disease of algorithmic bias, which she refers to as "the coded gaze" and the dangers it brings to society. Buolamwini provides viewers with methods of action they can take to make coding more inclusive and urges them to join the fight for social change.

JOY BUOLAMWINI

Joy Buolamwini is the founder of Code4Rights and a graduate researcher with the Civic Media group at the MIT Media Lab. Buolamwini is an advocate for inclusion and equality in the world of technology and aims to promote social change through her work.

THE OTHER- RACE EFFECT

INVESTIGATING THE MECHANISM OF ALGORITHMIC BIAS IN FACIAL RECOGNITION TECHNOLOGY

It has long been known that people of color report a higher rate of false face matches from the use of facial recognition. The higher rates of algorithmic inaccuracy among people of color exacerbate the racial bias and hierarchies within the greater American society. But how is this bias encoded into the algorithms of facial recognition technologies and what is the mechanism behind this bias? The other-race effect may provide the answers to these questions.

Retrieved from Pittsburg Magazine

Retrieved from European Scientist

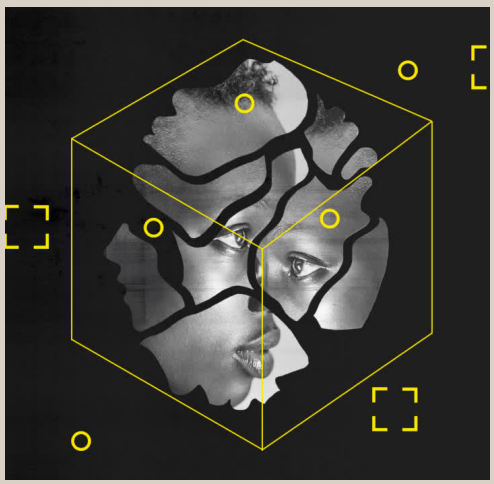
The way we see and interpret the outside world is greatly impacted by our environment and surroundings. This concept of environmental impact on human functioning holds true with the recognition of human faces. Humans encounter different faces throughout their entire lifetime. The increasing frequency of encounters with specific faces gets integrated into a person's memory, making that face easier or quicker to recognize. But what about with new faces? Do human experiences and the environment affect the rate of recognition of new faces? Researchers have applied this query to the knowledge of race, describing a phenomenon in which people are subject to higher rates of error when recognizing faces of people from a race different from their own (Goldstein, 1979). This phenomenon is most commonly known as the other-race effect (ORE), but it is also regarded as the cross-race recognition deficit or own-race bias (ORB) (Meissner and Brigham, 2001).

Without direct knowledge of the ORE in the lay community, the ORE can be translated to the expression "they all look alike." This common phrase has not only spurred convictions of racism by the expressor, but it has also shown to lead to problematic consequences in facial identification. As will be discussed later in this article, many psychological studies have confirmed the ORE in which human faces more accurately recognize faces of their own race (Meissner and Brigham, 2001). However, with the rise of FRT, studies have also revealed the presence of the ORE encoded within facial recognition algorithms.

THE PROBLEM OF THE ORE IN FRT

As mentioned in "The Bias Problem with Facial Recognition," the Face Recognition Vendor Test (FVRT) was used to assess the accuracy of facial recognition algorithms, ultimately showing higher rates of false positive scores in identifying women and people of color. The database of false rates from the FVRT in 2006 was subsequently used in a study to analyze and compare the performance of East Asian and Western facial recognition algorithms to East Asian and Caucasian humans. Jonathan P. Phillips, a researcher from the National Institute of Standards and Technology who conducted this study, argued for this study to be carried out due to the concern that the "underlying causes of the ORE in humans might apply to algorithms as well" as a result of the demographic origin of the algorithm and the demographic structure of the training set (Phillips, 2009).

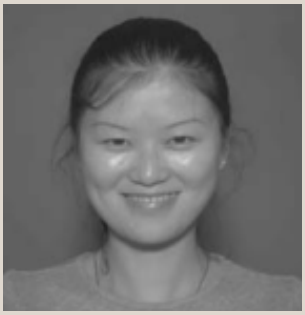
The study consisted of two experiments. The first tested the hypothesis of the effect of demographic origin on the accuracy of the algorithms by measuring the ORE in Western and East Asian



algorithms. Using datasets from the FVRT 2006, the algorithms were prompted to match facial identity with Caucasian and East Asian faces in a controlled setting and an uncontrolled setting, as shown to the right. Consistent with the hypothesis that demographic origin matters, both algorithms showed higher match rates for faces of their respective origins, confirming the presence of the ORE.

Retrieved from Phillips, 2009

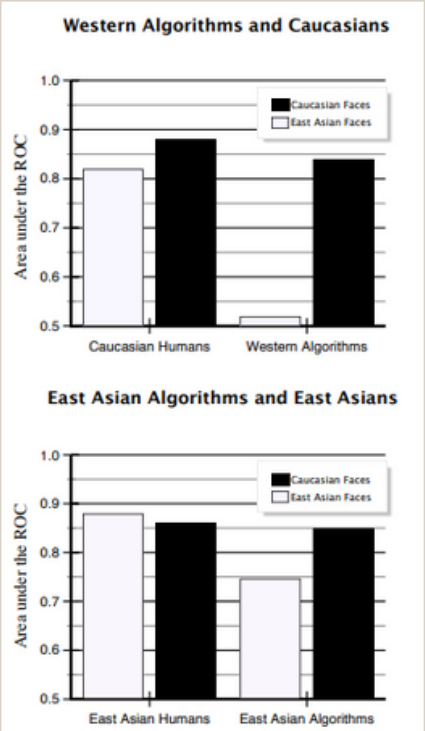
controlled setting (close up and studio lighting)



uncontrolled setting (distance and corridor lighting)

The second experiment tested the hypothesis of the impact of the population demographics by comparing the performances of East Asian and Caucasian humans and East Asian and Western algorithms. The humans and the algorithms were asked to match the identities of faces from the FVRT 2006 database. The results for the human test showed no significant differences in accuracy between East Asian and Caucasian faces. In contrast, there was a significant difference in accuracy between the different algorithms. Both the East Asian and Western algorithms more accurately identified Caucasian faces, with the Western algorithm having a larger accuracy advantage. Thus, algorithm accuracy is heavily influenced by the population demographic.

In both experiments, a "classic ORE" was observed for the algorithms, in which the algorithms showed an equal advantage for their country of origin (i.e. the East Asian algorithms more accurately identified East Asian faces). However, in experiment 2, there is evidence for a slight advantage in recognizing Caucasian faces which was supported by the difference as depicted in the graphs below.



Graphs retrieved from Phillips, 2009

Phillips states that some of the datasets from the FVRT 2006 were first collected at the Face Recognition Grand Challenge (FRGC) dataset which was composed of 70% Caucasian faces and 22% East Asian faces (2011). While the coders of the East Asian algorithms integrated more East Asian faces for training, the East Asian algorithms were still exposed to both Caucasian and East Asian faces, emphasizing the impact of experience and population demographics. The mechanisms of this impact will be discussed in further detail later in this article. Nonetheless, the findings from this study are consistent with other studies that measure the ORE in facial recognition algorithms (Furl et al., 2010) in supporting the presence of the ORE in facial recognition algorithms, thus providing one explanation for algorithmic bias.

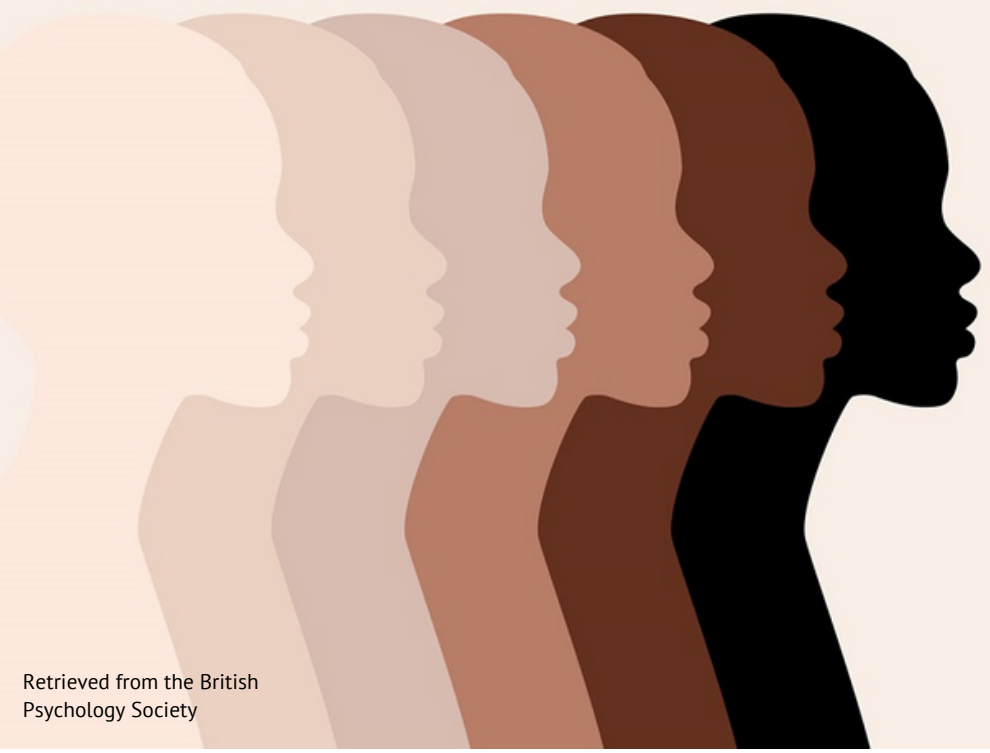
The presence of the ORE in facial recognition has been deemed problematic. But how valid is the ORE and how exactly does it create bias within facial recognition algorithms?

VALIDATING THE ORE

The ORE was first detected by Gustave A. Feingold in 1914. Feingold, a Harvard psychology professor, was interested in the justice of criminalization by natural recognition and recognized the discrepancies and biases that can occur in psychological recognition. His studies investigated the role of the environment on the relationship between recognition and discrimination based on degrees of similarity. His findings suggested higher rates of identification errors in new environments compared to familiar or old environments. He found that recognition doesn't depend on memory or imagery, rather, it is primarily affected by consciousness, and consciousness is related to attitude which is nurtured by the quality and quantity of contact (Feingold, 1914). With his studies on human and object identification, he concluded that environment and contact have an impact on recognition, recognizing this phenomenon in regards to facial recognition as the ORE.

Since then, many studies regarding human facial perception have shown evidence for the ORE. To confirm and analyze the existence of the other-race effect, or in this case the presence of own-race bias (ORB) in facial recognition, researchers Dr. Christian A. Meissner and John C. Brigham conducted a meta-analysis of 39 research articles from a span of 30 years that report measures of discrimination in facial memory (2001). Among the studies they analyzed, they observed a "mirror effect" pattern, in which there were higher identification accuracy rates in own-race faces than in other-race faces. The presence of this pattern among many studies of facial perception has established this phenomenon as an integral part of facial perception.

Studies have assigned the ORE as an account of memory, implying that one has a better memory of own-race faces and poorer memory of other-race faces. Thus, memory tests, most commonly simple old-new recognition tasks, have been used to measure facial recognition and thus the ORE. Most recent studies have indicated that the Cambridge Face Memory Test (CFMT) provides the most accurate measures of face memory and is thus the most commonly used method of measuring the ORE. Unlike simple old-new recognition tests, the CFMT provides specific stimuli to test facial memory such as lighting, various facial angles, and time sensitivity. The CMFT exists in different versions based on race, allowing for the comparison of results across races. Lastly, the CFMT has reported high rates of internal reliability, giving it "good power for detecting the [ORE]" (McKone et al., 2012).



Retrieved from the British Psychology Society

CAMBRIDGE FACE MEMORY TEST (CFMT)

TAKE THE TEST (CAUCASIAN FACES): HTTPS://TINYURL.COM/CFMTCAUCASIAN

The Cambridge Face Memory Test (CFMT) is an online memory test that assesses short-term, unfamiliar face memory, and facial recognition (Murray and Bate, 2020). The CFMT was first developed to diagnose various developmental brain disorders such as developmental prosopagnosia. The CFMT was initially released with only Caucasian faces, but eventually versions with additional races were released. As a result of its ability to detect facial recognition across different races, the CFMT is one of the leading tests to assess the presence of the other-race effect.

Visit the link above to take the test to measure your facial recognition abilities. The test takes about 20 minutes. Note: only the Caucasian version is currently available.

STAGE 1: LEARN STAGE

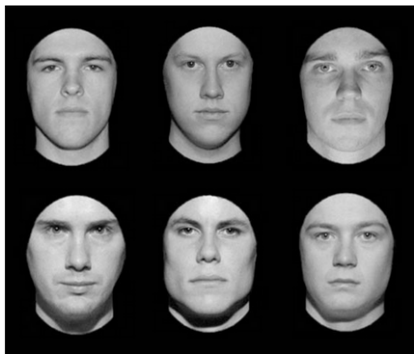
Stage 1a: Study
First you are introduced to a target face with 3 different angles. You are given 5 seconds to memorize each angle of the face.

Stage 1b: Test
You will then be shown 3 different faces and are asked to identify which face is the target face. The image is identical to the study image.

This stage will repeat for 5 more rounds.

STAGE 2: NOVEL STAGE

Stage 2a: Study
You will be shown the same 6 faces from the Learn Stage. You will be given 20 seconds to memorize the 6 faces.



Stage 2b: Test
You will be shown a series of three faces and are asked to identify which face is a target face. The face can be any of the 6 faces. However, the images used in this stage are different from the study stage.

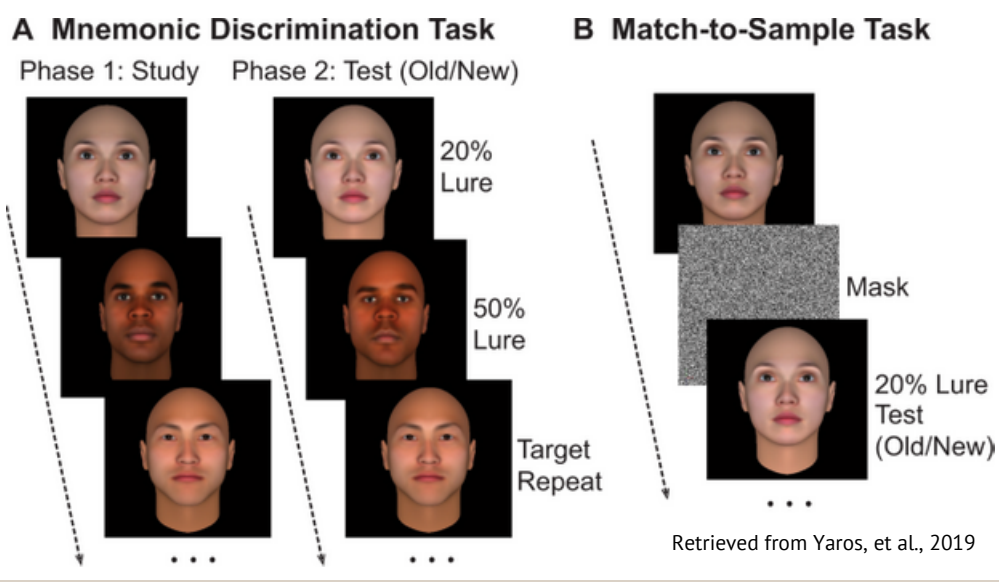
STAGE 3: NOISE STAGE

Stage 3a: Study
You will be shown the same 6 faces from the Learn Stage. You will be given 20 seconds to memorize the 6 faces.

Stage 3b: Test
You will be shown a series of three faces with noise (blurred, spots) and are asked to identify which face is a target face. The face can be any of the 6 faces. However, the images used in this stage are different from the study stage.

Pictures retrieved from the Cambridge Face Memory Test

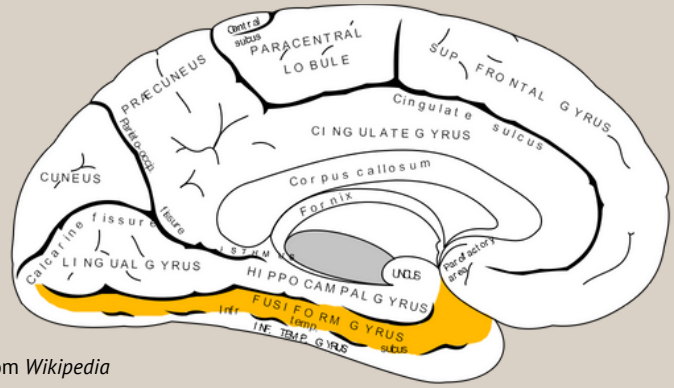
Many studies including the ones mentioned above have established the ORE as a fundamental part of facial recognition. Thus, to understand the biological and psychological mechanisms of the ORE, it is imperative to also understand the mechanisms of facial recognition as a whole.



Retrieved from Yaros, et al., 2019

MECHANISMS OF FACIAL RECOGNITION AND THE ORE

Facial recognition at its core is a process of memory and discrimination. During the first year of life, the face-processing system of the brain undergoes a period of refinement and a prototype for face-space dimensions is established based on the face-space dimensions the infant is exposed to (Kelly et al., 2001). Facial recognition is characterized by stimulus responses that appear in the fusiform (occipitotemporal) gyrus, the area of the brain responsible for recognition and information-processing (Lopatina, 2018). The fusiform gyrus invokes face-selective responses and holistic processing of faces.



Retrieved From *Wikipedia*

Familiar face stimuli experience more activation in this area as well (Walker et al., 2008). Evidence has shown that activation in the fusiform gyrus "is modulated by racial bias in response to other-race faces" (Richeson et al., 2003). Thus, recognition of same-race faces shows greater activity in the fusiform gyrus. The other-race effect has also shown greater activity response in the posterior cingulate cortex (PCC), an area of the brain linked to emotion and memory functioning. Similar to the fusiform gyrus, PCC activity is enhanced with the recognition of same-race faces (Ito and Bartholow, 2009), showing that experience plays an important role in recognition.

This can also be seen through the ORE's memory computational basis of mnemonic discrimination, the ability to distinguish new and old stimuli of similar subjects. One study uses mnemonic discrimination tasks to show that the ORE may function from processing differences between same-race (SR) and other-race (OR) faces as a result of social categorization (Yaros et al., 2019). This study aims to replicate episodic memory to analyze pattern separation in the context of race. The system of pattern separation is characterized by a nonlinear input-output transfer, with the input being similar faces and the output being recognition ability, that can both discriminate between faces (pattern separate) and allow for input variability (pattern complete). The study compares discriminations of SR and OR faces,

hypothesizing better mnemonic discriminations of same-race faces than other-race faces. The results showed a significant difference in SR and OR performance for mnemonic discrimination, indicating the detection of the ORE in this method of memory computation (Yaros et al., 2019). The findings, along with the brain activations, show the important role experience has in generating the ORE.

QUESTIONING THE ORE

Despite the substantial evidence for the existence of the ORE, one scientist has questioned the validity of this phenomenon as an individual effect. With memory as the computational basis for the ORE, Dr. Joanna K. Malinowska argues that the ORE is not an individual effect but rather an example of the unfamiliarity homogeneity effect (2016).

The unfamiliarity homogeneity effect (UHE) is the phenomenon in which anything unfamiliar (faces, objects, places, etc.) will be recognized less accurately than anything familiar. The UHE is a result of perceptual narrowing, another term for prototype-building based on experience (Nelson, 2001). The UHE encompasses all types of recognition based on experience, including the ORE, leading Malinowska to argue that the ORE alone does not exist (2016).

Malinowska makes a valid point that the ORE at its core is a function of recognition heavily influenced by memory and that similar phenomena occur with unfamiliar subjects. However, the problem with Malinowska's argument is that it denotes recognition of faces to the same level as the recognition of objects. It disregards the prejudice, social training, and motivation that also have an impact on the ORE. The ORE is an example of the UHE as a function of memory. However, the ORE functions from both experience and social motivations, thus it can also exist as a distinguished effect.

MOTIVATION AND THE ORE

Researchers Ito and Bartholow also suggest that motivation and group identification play crucial roles in facial processing. "Motivational factors that make race more or less salient to perceivers modulate this neural response" in the fusiform gyrus and the PCC (Ito and Bartholow, 2009). As a case of ingroup vs. out-group favoritism, one's identification to a particular racial group influences how one will process specific faces. Researcher Daniel T. Levin

Retrieved from Wrongful Convictions Blog

argues that the problem is not that we can't code the details of cross-race faces; it's that **we don't**. Instead, we substitute group information, or information about the race, for information about the features that help us tell individual people apart (2000, p. 571). **"Face categories are based on the social cognitions associated with person classification that cause facial features to be selected using a perceptual schema or frame"** (Levin, 2000, p. 572). Association to a specific racial group leads to the distinction of individual characteristics of same-race faces in contrast to a focus on a "prototype" or certain features of other-race faces. Thus, there is a hidden intention behind recognition that is beyond simple memory. The contact hypothesis, a common psychological explanation for the ORE, takes into account both the roles of experience and motivation in producing the ORE.

THE CONTACT HYPOTHESIS

The contact hypothesis suggests that more contact with other-race individuals increases recognition accuracy of other-race faces by reducing prejudice and influencing motivation to accurately recognize other-race faces (Walker et al., 2018). Those who have had early exposure to racially diverse faces and integrated neighborhoods are proposed to have better other-race recognition. While this phenomenon is not the sole explanation for the ORE, it plays a significant role in its development.

One study looks specifically at the impact of social contact on other-race face processing overtime as a necessary component to understanding the ORE at both the neural and psychosocial levels. This study measures face-related neural activity, the effect of the stimulus race, and the relationship between eventr-related potential (ERP), which is an electrochemical measure of a stimulus response, and other-race social contact. The findings report larger ERP rates for same-race faces in relation to individuating experience and social contact respectively (Walker et al., 2008). Such findings "demonstrate the malleability of our internal neural and cognitive functioning by external social influences."

The processing of race-related information is "heavily impacted by social learning, and that personal experience with members of these groups can modulate race-of-face processing" (Walker et al., 2008). Thus, the correlation between social contact and race-based facial processing as indicated from this study show support for the role of the contact hypothesis in the ORE.

THE CONTACT HYPOTHESIS AND ALGORITHMIC BIAS

The contact hypothesis suggests that social learning and exposure greatly impact one's accuracy of facial recognition among same-race and other-race faces, leading to the ORE in humans. However, with humans responsible for encoding algorithms that mimic the human process of facial recognition, the contact hypothesis also provides an explanation for the presence of racial bias in FRT.

Bias and preference integrated into our minds are translated through the minds of the coders and the training sets that are chosen and developed by humans. Values and prejudices are embedded into algorithms as a result of a bias towards one's environmental exposures to SR and OR faces. Thus the motivations of the (often white) coders are encoded into facial recognition algorithms. Additionally, the diversity of the training sets for the algorithms gives rise to the effects of the contact hypothesis.

A study conducted at the University of Texas, Dallas analyzed variations of the contact hypothesis in computational facial algorithms and their susceptibility to the ORE (Furl et al., 2010). The stimulus sets and algorithms used in the study came from the Face

Recognition Technology (FERET) program, which includes the most diverse set of algorithms, despite being composed of mostly Caucasian faces. This lack of diversity reveals the controversy of FRT and the need for more diverse data sets. Three different contact hypothesis algorithms (general, developmental, and non-contact) were assessed using a human psychological study of facial recognition as the foundation. The results of the algorithm tests were consistent with the human psychological studies in which Caucasian faces were more accurately recognized due to their high proportion in the training sets, suggesting the validity of the contact hypothesis (Furl et al., 2010). As discussed above in Phillips' similar study, the accuracy of the algorithms is heavily dependent on the demographic origin of the algorithm (the coders) and the demographics of the population to be recognized (the subjects). The ORE may also play a significant role in witness and officer identification of matches.

This study shows the fundamental role motivation and exposure play in FRT. It is important to understand the presence of the ORE in face recognition algorithms because these algorithms undergo machine learning with racially diverse training sets, an analogous process to the psychological processes of creating, storing, and retrieving facial images from human memory (Furl et al., 2010). Thus, both the diversity of the training sets and the diversity of the coding team must be considered to reduce or avoid the consequences of the ORE in FRT. However, it is important to note that the contact hypothesis is a significant explanation but not the sole explanation for the ORE in both human and algorithmic facial recognition. When unpacking algorithmic bias, it is crucial to consider the efficacy of the ORE and what inputs are being integrated into facial recognition algorithms.

Today, technology is produced in an environment that maintains implicit racial biases and thus will further perpetuate racial bias and existing human values. It is critical to analyze the origins and effects of racism in society to see how it has created a foundation for both experience and motivation to produce the ORE in facial recognition algorithms.

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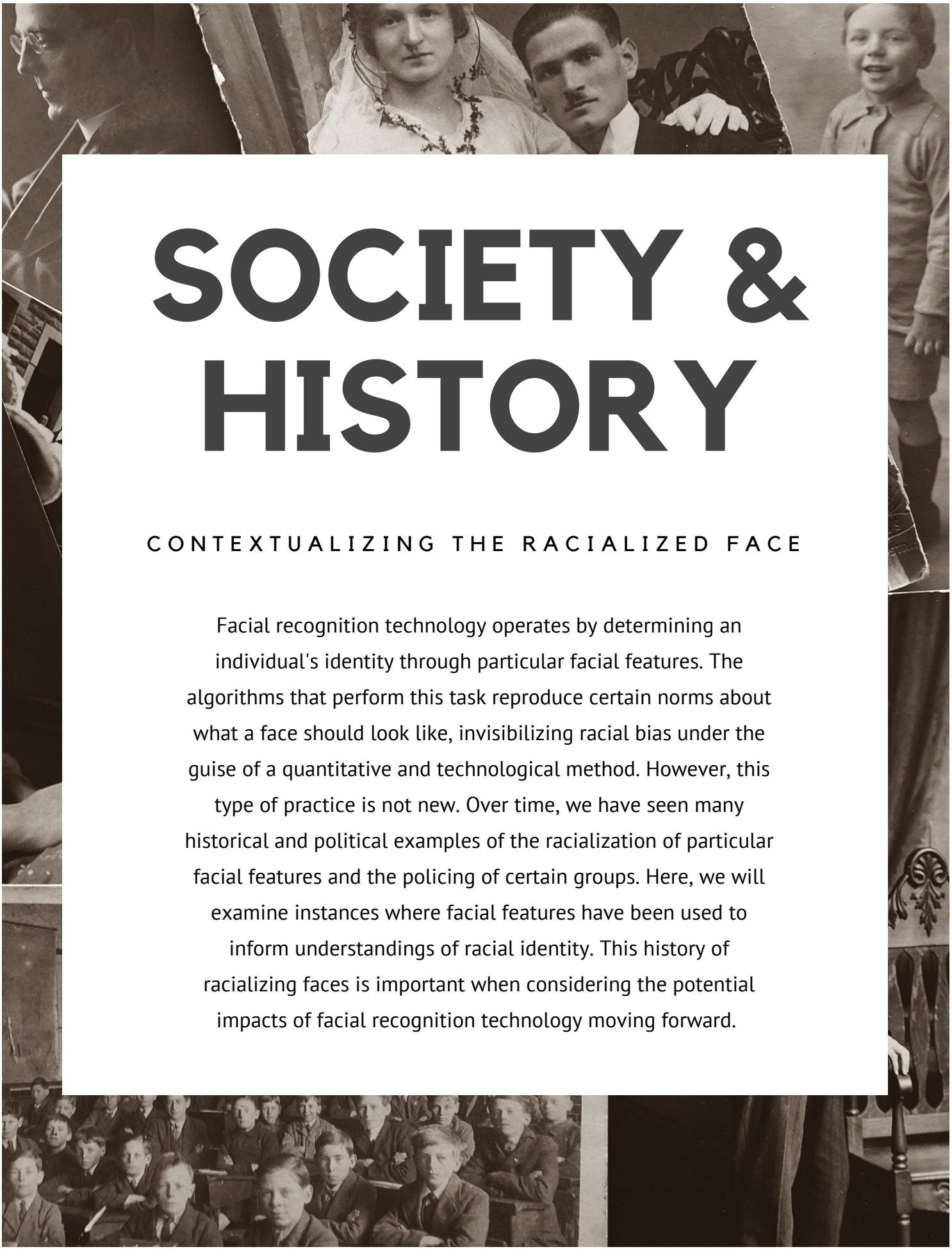

SOCIETY & HISTORY

CONTEXTUALIZING THE RACIALIZED FACE

Facial recognition technology operates by determining an individual's identity through particular facial features. The algorithms that perform this task reproduce certain norms about what a face should look like, invisibilizing racial bias under the guise of a quantitative and technological method. However, this type of practice is not new. Over time, we have seen many historical and political examples of the racialization of particular facial features and the policing of certain groups. Here, we will examine instances where facial features have been used to inform understandings of racial identity. This history of racializing faces is important when considering the potential impacts of facial recognition technology moving forward.

POLICING


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HISTORIES OF RACIAL BIAS AND CRIMINALIZATION

The racial bias we see embedded within facial recognition technologies warrants discussions about the ethics of its use, particularly within policing. Policing and incarceration within the United States were created to maintain the usage of Black unpaid labor and white supremacy. An understanding of the origins and timeline of racism within policing is essential to evaluating facial recognition technologies if they are to be used within the police state.

ORIGINS IN SLAVE PATROLS

The first formal establishment of a policing system in the United States was seen in the southern colonies in the early eighteenth century (Dulaney, 1996). African slavery was the backbone of the southern and rural economies of the time, consequently making it a system that white land owners had interests in protecting. As such, American colonies began to enact strict laws as to how African slaves could behave, including the prohibition of assembly, leaving the plantation, violence against white persons, and more. These laws also included the establishment of "slave patrols", who were tasked with stopping, searching, and punishing African slaves that were found off the plantation without a pass. Highly organized slave patrols were found in every southern colony of the United States, and over time they only continued to gain political strength. Their organization and vigilance was only heightened by the potential for slave insurrections, such as the 1831 Virginia insurrection by Nat Turner. The institution of policing in the US found its origins here, and made with it the sole intention of preserving and heightening the system of African enslavement.

RECONSTRUCTION ERA AND PRISON LABOR

In 1865, the 13th Amendment was enacted, abolishing enslavement for all except those convicted of a crime. Because of this clause, the post-civil war strategy became to increase policing heavily so as to create the mass criminalization of the emancipated and continue to exploit their labor as the imprisoned. Strategic laws called the Black Codes were enacted as a means of criminalizing emancipated Africans. These codes were punitive and senseless, including crimes such as loitering, breaking curfew, and vagrancy laws, which made it illegal to be unemployed (Browne, 2007).

Crimes such as these were regarded as felonies, ensuring long sentences and increased prison populations.

The existence of these laws caused the presence of Black people imprisoned to skyrocket. The South quickly began the building of an extensive prison system, sometimes converting former plantations into prisons (Goodman, 1912). Additionally, policing systems were increased, so as to arrest and imprison as many Black people as possible to perform labor. With so many Black prisoners working, a system of convict leasing gained popularity; white plantation owners were allowed to purchase prisoners to work on their property. In many ways, the banning of slavery did not actually prevent Black enslavement; it merely shifted the legal structure in which slavery could operate.

Moving into the 20th and 21st centuries, police brutality against Black Americans has been a consistent and pervasive issue. Violence perpetrated by the police against Black men has been well documented, from the age of the Civil Rights Era, all the way until current day.

RODNEY KING, O.J. SIMPSON, & THE LAPD

In 1991, A Black man by the name of Rodney King was stopped by four LAPD police officers (three of them white). A videotape taken of the incident showed these cops beating King with batons for approximately 15 minutes while multiple other cops stood by and watched. The four officers were indicted and charged with excessive force, yet found not guilty. This decision sparked massive riots across Los Angeles, causing major civil unrest and close to $1 billion worth of damage. These protests were the result of mounting distrust of the LAPD, which had been at the center of racial tensions in Los Angeles for years (Sastry et al., 2017).

In 1995, the murder trial of football star O.J. Simpson was underway. This trial had huge amounts of public attention, but not just because of Simpson's celebrity status- the trial was largely centered around investigating claims of racism and corruption within the LAPD. During this trial, audio tapes of an officer named Mark Fuhrman were released to the public. These tapes included the repeated derogatory use of slurs targeting Black people, despite his testimony that he had never before used those words. This sparked even more outrage, and solidified to the jury and the public that extreme racism was present within the LAPD. This was the strategy of Simpson's defense team, and many believe that he was found not-guilty due to the rising racial tensions of the time and the Black distrust of police (Gaines, 1995).

MODERN DAY

Issues of racism within policing systems are very much present today. When considering the histories of policing, it is clear that the system was created and maintained with the primary purposes of maintaining white supremacy and using Black bodies for labor. As such, allowing the use of facial recognition technologies may be premature. Before allowing the use of these technologies within the criminal justice system, they must be subjected to racial bias testing to ensure that their use is anti-racist and does not contribute to the historical and pervasive hyper-criminalization of Black people.

RESEARCH SPOTLIGHT: POLICING AND RACE

89%

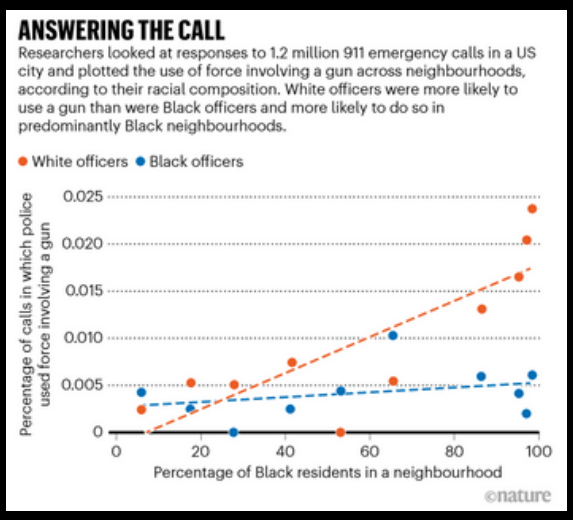
of Black Americans believe that the criminal justice system is biased against Black people, while only 38% of White Americans think the same thing (Tonry 2011).

Black men are

2.5x

more likely to be killed by police than white men (Edwards et al 2019).

Those with Afrocentric facial features are perceived as being more "deviant", and may receive longer sentences than those with less Afrocentric features (Eberhardt et al. 2006).



SOCIETY & HISTORY

MY BLUE WINDOW

AMERICAN ARTIST

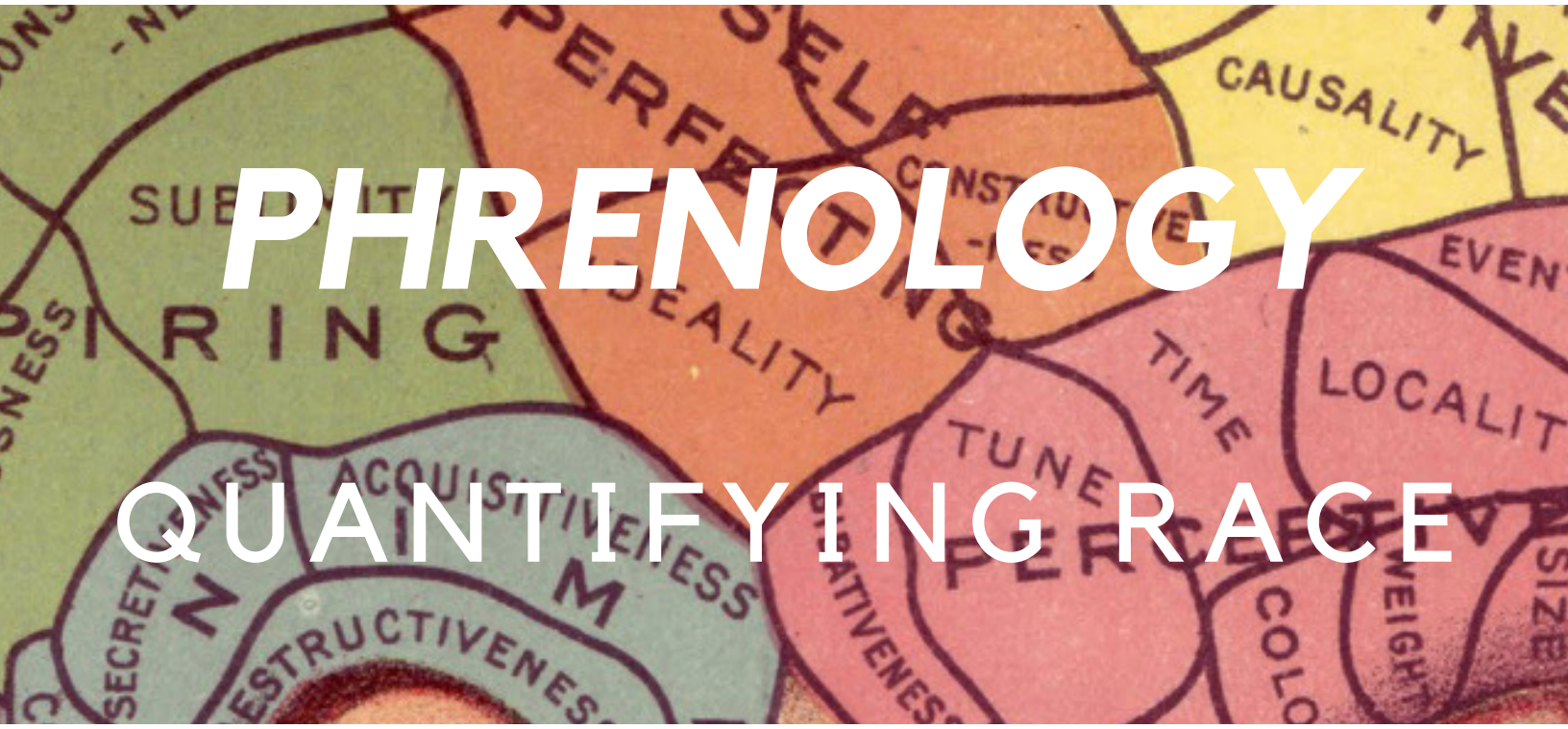
Sirens blaring, neon maps flashing, the words "rape, robbery, and murder" appearing in bright letters, and a voice announcing "crime deterred."
Look behind the eyes and ears of law enforcement in the streets of Brooklyn in this art exhibit.

American Artist's exhibit "My Blue Window," previously located at the Queens Museum, showcases the psychic life of law enforcement and the anti-Blackness embedded within the algorithms of policing systems. The exhibit provides a 21-minute video, *2015,* that replicates what the police see in the streets of Brooklyn. Various crimes "robbery", "rape", "murder," etc., and their incident rates are displayed in the bottom right-hand corner of the screen but without the sight of criminal activity. The police car simulation uses predictive policing (PredPol) algorithms to analyze a criminal landscape based on past criminal data. The video puts users in the driver's seat to provide them a perspective behind the lenses of police officers.

Also a part of the exhibit is an app and a one-minute animation, *1956/2054,* displayed outside of the blue curtain that allows users to read more information about predictive policing, surveillance legislation, and private investment in civic technologies. *1956* is a call to Philip K. Dick's short story "The Minority Report", which is set in the year 2054 and details mutants who can predict crime before it happens.

American Artist, installation shot of 2015, 2019.
Single-channel HD video, sound, 21:38 minutes.
Photo by Hai Zhang

Together, 2015 and 1956/2054 shine a light on the past, present, and future of technologic policing and issues of racism embedded within technological systems and the political system of the U.S. My Blue Window traces the themes of anti-Blackness and racist algorithms to the conventional view of a police car, reminding us that modern policing still acts on America's foundation of anti-blackness from the aftermath of slavery (Reid 2019).



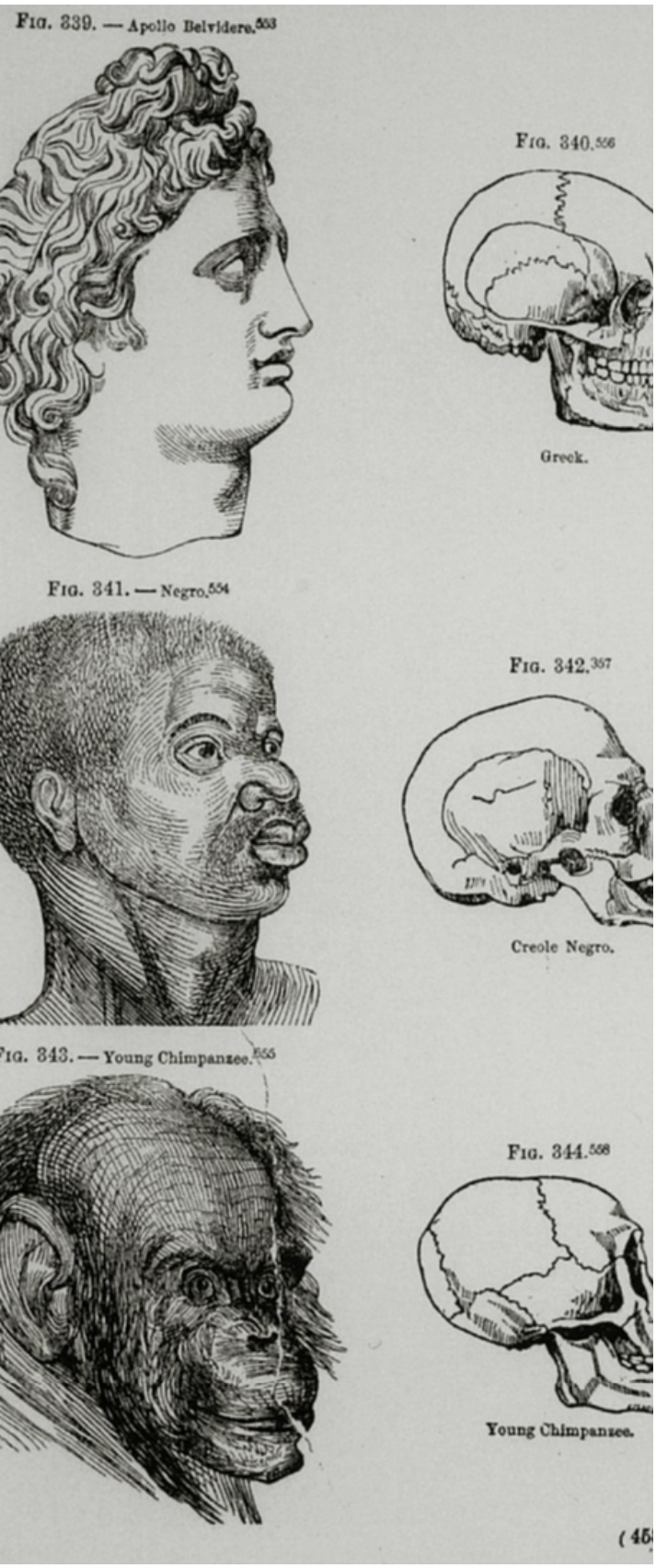
PHRENOLOGY

QUANTIFYING RACE

The measurement of facial and cranial structures as a scientific practice is not new; these types of facial measurements were the basis of a hugely influential pseudoscience of the 1800's called phrenology.

Originally developed by Franz Joseph Gall in 1796, the core philosophy of phrenology was that mental features and abilities could be predicted through measurements of the face and head. Phrenologists believed that traits like benevolence, secretiveness, wit, and more could be determined by the facial and cranial structures of the individual. Despite phrenology being discredited now as a pseudoscience, it gave way to our current understanding of how certain mental and emotional processes are located in specific areas of the brain.

During the 19th century, phrenology was well respected and influential amongst scientists, and was commonly used to protect white supremacy and further notions of genetic determinism. Amongst others, Gall and his student Broussais argued that Caucasians were superior to other races, as measurements of their skulls were indicative of greater creativity, intelligence, beauty, and more (Branson 2014). Dutch phrenologist Petrus Camper originated the phrenological concept of facial angles, which was deeply rooted in racial hierarchies and functioned to uphold white supremacy. In drawing comparisons between the facial angles of Africans and those of chimpanzees, Camper argued that Africans were more prone to “brute” behavior, with low brain mass and intelligence. Caucasians, however, were considered to be the "most beautiful" and most evolved, with the highest potential for intelligent thought. The comparison of Africans to monkeys as a racist trope is thought to have originated here, and has persisted from historical phrenological thought into modern day.



Depictions comparing the skulls of Caucasians, Africans, and Chimpanzees. These types of comparisons suggested a monkey-like, less evolved nature of Africans.

Much like facial recognition technology, phrenology was used not just to measure facial structures for the purpose of scientific discovery, but also to assist in policing and criminalization efforts. Phrenologists believed that they could determine the characteristics of criminals based on their head shape and tailor incarceration efforts to the individual person. Determinations of their intelligence, brutality, insanity, morality, and more would help the state determine if the criminal was capable and worthy of rehabilitation efforts. Decisions regarding method of incarceration, length of sentencing, and profession upon release were all impacted by the phrenological analysis of their mental traits (Staum 2014). This history of determining criminality based on a "scientific" analysis of facial features highlights the reality that facial recognition technology may not be as empirical as we assume.

Scientific understanding is inherently created out of culture, and understanding the ways in which systemic oppression is embedded in the knowledge we believe to be purely factual is key to dismantling white supremacy and implicit bias.

NAZI GERMANY & THE JEWISH NOSE

The racialized stereotype of the “Jewish nose” is one that has persisted through many periods of history and has been heavily tied to sentiments of anti-semitism. During the reign of Nazism in WW2 Germany, racializing the Jewish people played a crucial role in justifying the attempt to eliminate them. In doing so, it was argued that those not of Aryan descent were less advanced and should be eliminated from the gene pool to create a stronger “super race.” Along with measuring features like coloring and stature, the Nazi party attempted to identify and define Jewish people through the shape of their noses.

SOCIETY & HISTORY

One of the most notable pieces of Nazi Jewish studies was *Racial Characteristics of the Jewish People*, by Hans F. K. Günther. Published in 1930, this academic book aimed to define the race of the Jewish people scientifically, and support the notion of their racial inferiority. Günther discussed at length the characteristics of an Ashkenazi Jewish nose and how it was indicative of Near Eastern racial descent. He defines it not as being distinctively long, but rather with "fleshy outer nostrils set conspicuously high on the face" (Steinweis, 2006). This definition of a Jewish nose was just one of many. Another example of Jewish identification efforts comes from a Nazi propaganda children's story entitled The Poisonous Mushroom, by Ernst Hiemer. This story includes a moment where a young boy named Karl is describing to his teacher how to recognize a Jew:

"A Jew is usually recognized by his nose. The Jewish nose is crooked at the end. It looks like the figure 6. So it is called the "Jewish Six." Many non-Jews have crooked noses too. But their noses are bent, not at the end, but further up. Such a nose is called a hook nose or eagles beak. It has nothing to do with a Jewish nose"

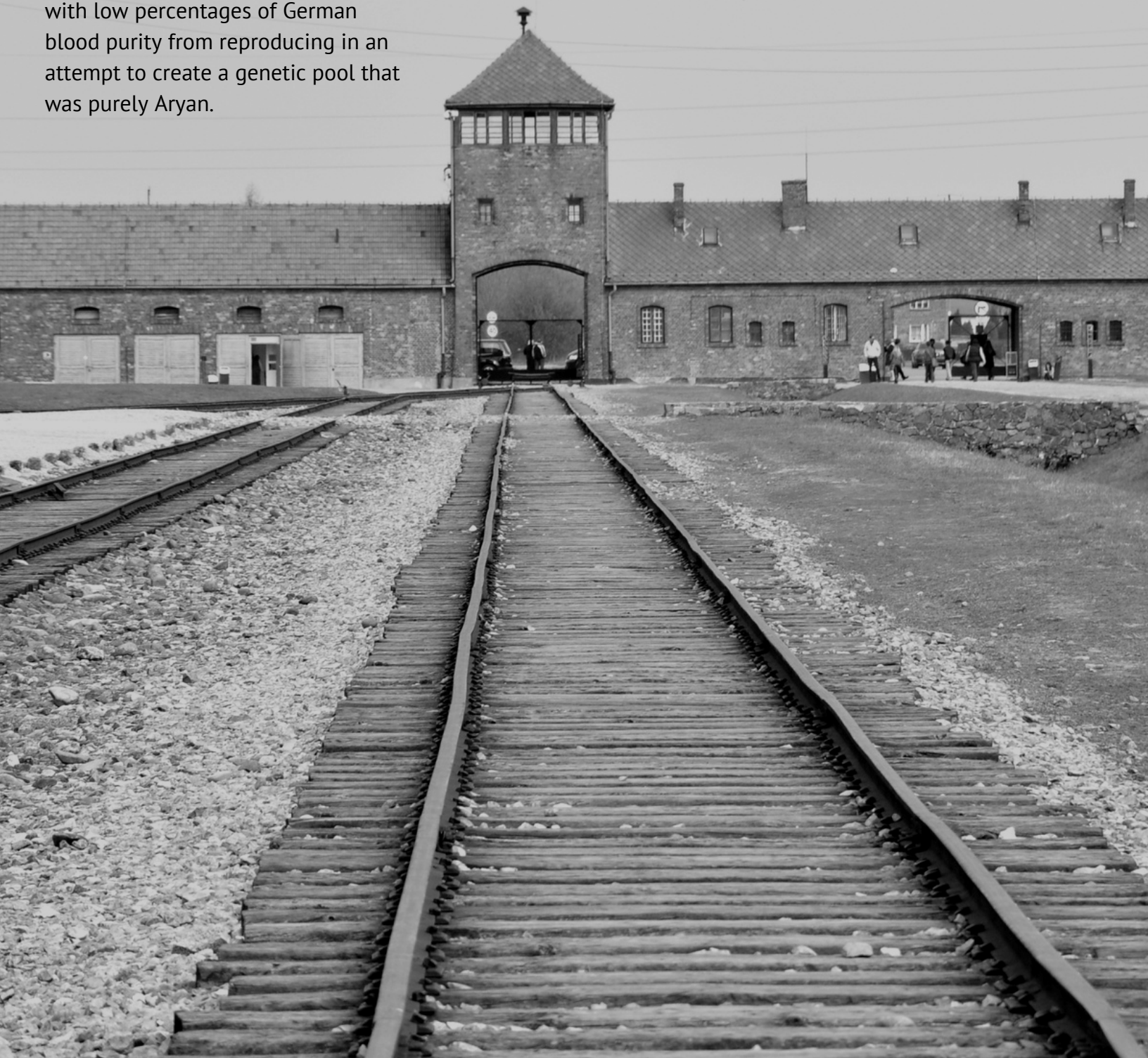
(Noakes et al 1975).

Retrieved from https://www.bbc.co.uk

Pictured above: A man having his nose measured during an Aryan race test. Facial measurements, particularly measurements of the nose, were methods commonly employed by the Nazi party to help determine an individuals status as a 'Jew'.

Stereotypes like these, along with quantitative measurements of the nose, were used as some of many data points in the practice of racial testing. Nazi racial scientists of the 1930's would calculate "Germanic blood purities" through analysis of an individual's hair color, eye placement, nose size, and more (Goossen, 2016). In doing so, they could prevent those with low percentages of German blood purity from reproducing in an attempt to create a genetic pool that was purely Aryan.

Nazis were able to use the premise of scientific measurement and rationalism to legitimize and accelerate systems of white supremacy, relying largely on the universal notion that science is the practice of pure logic and reason. This is just one historical example of science, particularly "Racialized Face" science, being deeply embedded in and reflective of culture. Understanding that science is not purely empirical, but is also comprised of values and world-views, is essential in understanding the issues that facial recognition technologies present in current day.



CARICATURE

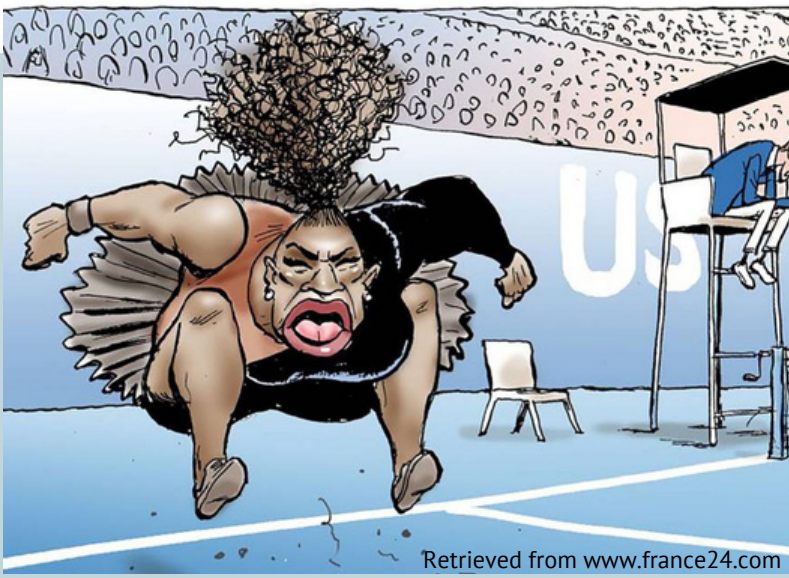
A VEHICLE FOR RACISM

Caricature art is a staple of culture today; these exaggerated cartoons with comically proportioned facial features are used in many places in the modern world, including entertainment, politics, and more. By exaggerating certain striking characteristics or facial features of a person, a caricature can inform the viewer of not just who the individual person is, but also their race.

With the exaggeration of race-associated facial features often comes the intent to mock or stereotype, making caricature art a common medium for those aiming to perpetuate racist agendas.

SERENA WILLIAMS: The Melbourne Herald Sun

In 2018, Mark Night, a cartoonist at The Herald Sun newspaper, published a highly criticized caricature of Serena Williams, an athlete largely considered to be the greatest female tennis player of all time. This cartoon was published in response to Williams' match against Naomi Osaka at the 2018 US Open, where she threw her racquet on the ground and called the umpire a "thief" and "liar", amongst other things (Held 2019). This caricature depicts Williams "throwing a temper tantrum," prominently featuring a set of comically large lips. This cartoon came under fire for its racist tropes, with many saying that the depiction of her shared similarities with racist Jim Crow era caricatures. Not only did this depiction of her visually mock her Blackness through the size of her lips, but also played into the stereotype of the "angry Black woman" that is so commonly a product of cultural misogynoir.



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Night claims this cartoon was simply a response to Williams' bad behavior, and not a commentary on her Blackness. However, this claim clearly ignores the pervasiveness of white supremacy and the culture and history surrounding Black women, particularly in regard to their anger. The intentional enlargement of her lips functions to draw attention to her Blackness, helping to center her race within the commentary it is attempting to make.

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AUDREY II:
Little Shop of Horrors (1982)

A musical-turned-movie from the 1980's, Little Shop of Horrors tells the story of Audrey II, a sentient plant from outer-space that eats humans and eventually takes over the world. Typically portrayed on stage by a large puppet, Audrey II has a deep, soulful voice, and has a face entirely composed of a giant set of lips. In theory, Audrey II *should* be a genderless, raceless being, as the character is quite literally an alien from outer space. However, it is made clear that Audrey II is intended to be a representation of a Black man. His voice, large lips, and manner of speaking are all clearly based in common stereotypes of Black men. The voice actor, Levi Stubbs, was chosen for the role specifically because of his "streetwise", Black-sounding voice, further supporting the idea that Audrey II's comically large lips were intended to create a sense of "Blackness" in the character (Jensen 2008).

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GEORGE FLOYD:
Politicizing Blackness

On May 25, 2020, George Floyd was pinned to the ground by a police officer's knee for over 8 minutes after allegedly buying cigarettes with a counterfeit bill. His unjust murder sparked Black Lives Matter protests across the world, and his image was heavily depicted in the media, by both those in support of the BLM movement and those against it. Those who were in support of the Black Lives Matter movements typically depicted him with proportionately sized lips, as seen on this mural painted at a BLM protest (bottom). This is in contrast to the image above, which depicts him with overly large lips as a way of commenting on his race. This difference is inherently political, and choosing to depict Floyd with a racially stereotyped facial feature effectively weaponizes his race in the attempt to further the pro-policing agenda and perpetuate the stereotype of Black criminality.

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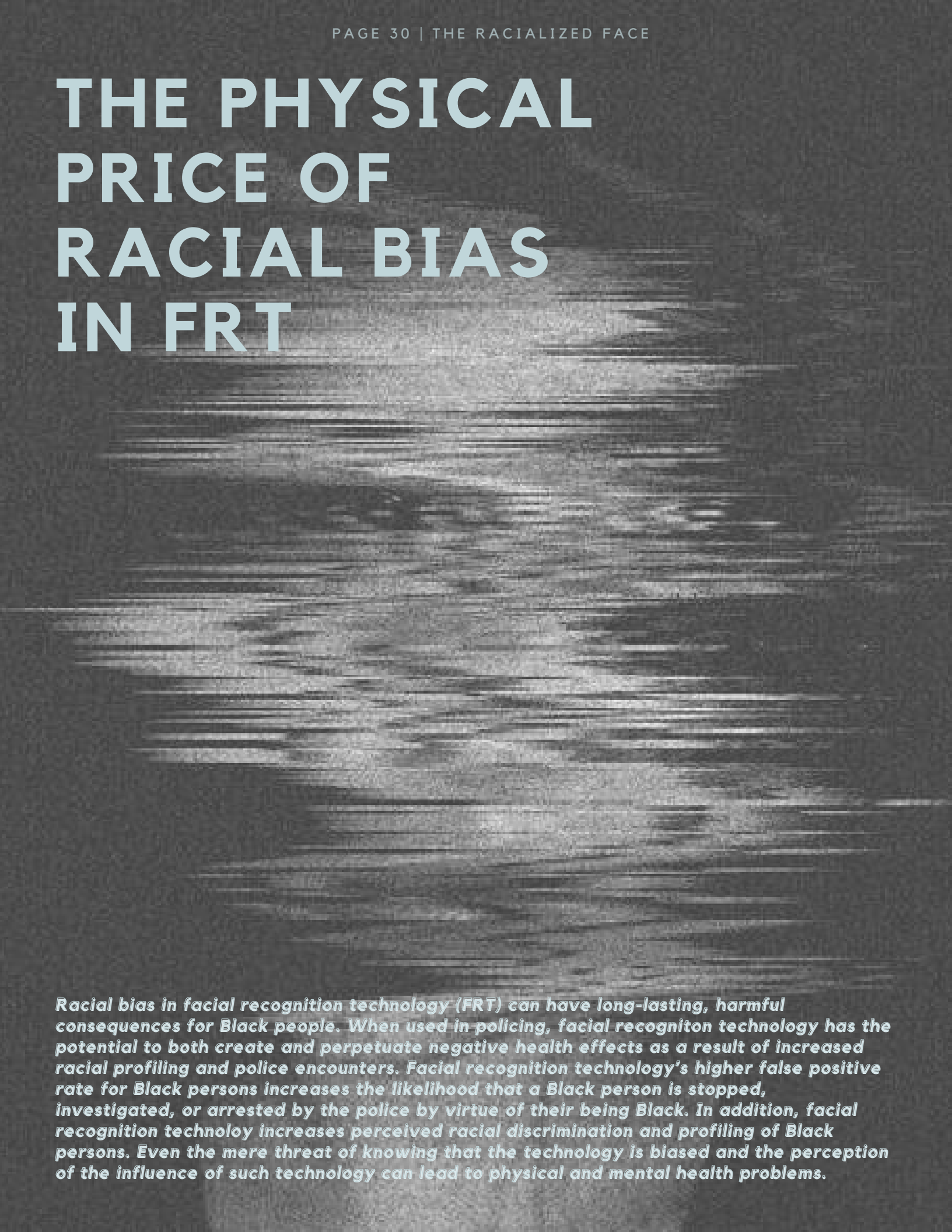
THE PHYSICAL PRICE OF RACIAL BIAS IN FRT



Racial bias in facial recognition technology (FRT) can have long-lasting, harmful consequences for Black people. When used in policing, facial recogniton technology has the potential to both create and perpetuate negative health effects as a result of increased racial profiling and police encounters. Facial recognition technology's higher false positive rate for Black persons increases the likelihood that a Black person is stopped, investigated, or arrested by the police by virtue of their being Black. In addition, facial recognition technoloy increases perceived racial discrimination and profiling of Black persons. Even the mere threat of knowing that the technology is biased and the perception of the influence of such technology can lead to physical and mental health problems.

Laurencin and Walker argue that racial profiling is a health disparities issue (Laurencin and Walker 2020). Health disparities are defined as "preventable differences in the burden of disease, injury, violence, or opportunities to achieve optimal health that are experienced by socially disadvantaged populations" ("Health Disparities Among Youth," 2020). Black Americans face police encounters and police violence at a rate that is dramatically higher than their representation in the population. For example in the last 6 months of 2018, 28% of all persons stopped by LA police officers were Black, despite the fact that Black people make up only 9% of the Los Angeles population. Black people are also more likely to have firearms pointed at them by police officers and to be detained, handcuffed or searched (BondGraham, 2020). As a result of these disproportionately high encounters with police, Black people may experience increased stress, trauma, and anxiety. Police confrontations, perceived threat of police, and knowledge of racial profiling have been found to be associated with poor mental health, PTSD, and even decreases in the birth weights of Black infants (Laurencin and Walker 2020). The consequences of racial profiling are very real. Facial recognition, when used in policing, serves to legitimize and invisible racial profiling, thereby perpetuating the health disparities that already exist as a result of police discrimination, encounters, and violence.

Some of the public health problems of racial profiling and discrimination may be explained by the biological stress response. Stress can be described as "the effects of anything that seriously threatens homeostasis of the body," and anything that causes stress is a stressor (Schneiderman et al. 2005). When a stressor is encountered, the Sympathetic-Adreno-Medullar (SAM) axis and the Hypothalamus-Pituitary-Adrenal (HPA) axis are activated (Godoy et al. 2018). Upon receiving a signal of distress from an area of the brain called the amygdala, the hypothalamus activates the SAM axis, leading to the fight-or-flight response. The hormone epinephrine is released into the bloodstream, causing various physiological responses, such as a quickening heartbeat and heightening of the senses. After an initial rush of epinephrine, the hypothalamus activates the HPA axis. This results in the release of corticotropin-releasing hormone (CRH) from the hypothalamus which leads to the subsequent release of adrenocorticotropic hormone (ACTH) from the pituitary gland and then glucocorticoids, or cortisol, from the adrenal glands, keeping the body in a state of distress (Understanding the Stress Response, 2011).

When chronic stress, or long term exposure to stressors is experienced, the HPA axis stays activated, leading to overcompensation of biological systems that eventually break down, causing adverse impacts on the body (Juster et al. 2010). Frequent activation of the stress response can lead to increased blood pressure and weight gain. Chronic stress can also result in a number of diseases ranging from digestive problems to circulatory problems to suppression of the immune system, among other consequences.

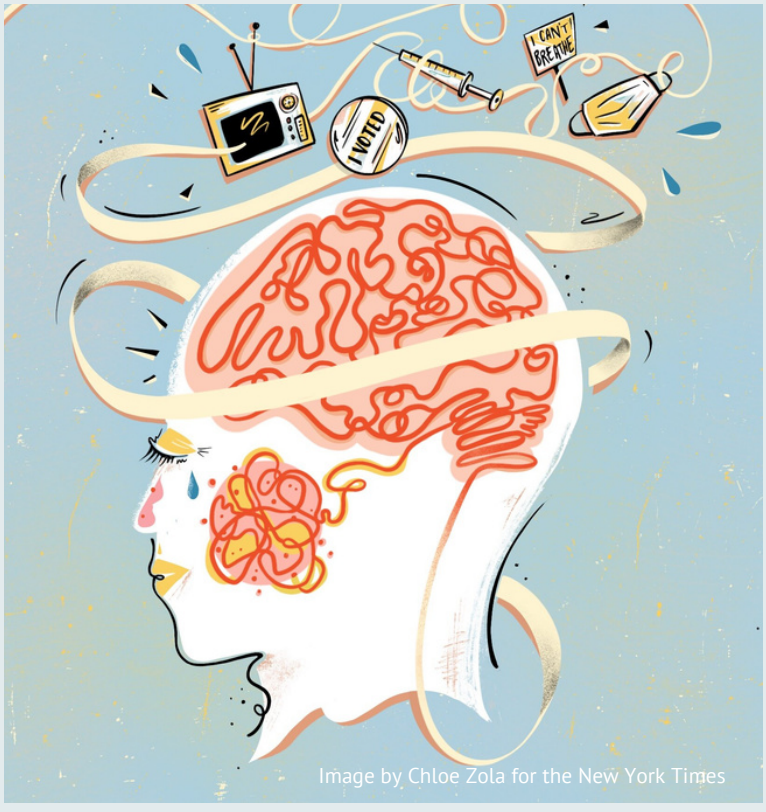


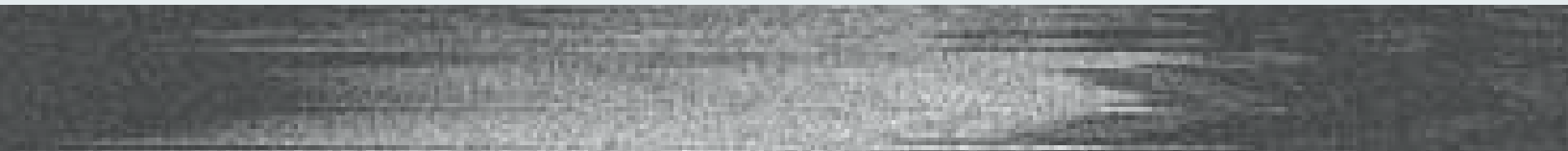
Image by Chloe Zola for the New York Times

Instances of racism and racial bias serve as stressors. Furthermore, institutional racism can shape exposure to stressors and give rise to stress proliferation processes, leading to the exacerbation of other stressors. Additionally, incarceration, death, aggressive policing, and other events resulting from institutional racism may contribute to the stress of individuals and communities (Williams, 2018).

In fact, as shown by Sawyer et al., the mere anticipation of prejudice or discrimination leads to both psychological and cardiovascular stress responses (Sawyer et al., 2012). Another study examined the allostatic load, a measure of the physiological burden imposed by stress, between Black and White Americans. The researchers found that Black Americans had higher allostatic load scores and a greater probability of a high score at all ages when compared to White Americans. They attributed these findings to the "weathering effect," or the idea that Black persons experience early health deterioration as a result of the summative impact of repeated stressful experiences of social, economic, and political adversity (Geronimus et al., 2006). Thus, racism is deeply intertwined in the occurrence of stress, including stress resulting from police encounters and the perception of discriminatory policing. Facial recognition technology, in its contribution to discriminatory policing practices, may lead to the increased stress of Black people and others who do not fall within the technological calibration to the white male face.

Racism-related stress has many health consequences. One study in low-income communities of color in Chicago found that men with a high number of lifetime police stops had three times greater odds of current PTSD symptoms and women reporting a high number of lifetime police stops had two times greater odds of current PTSD symptoms, likely as a result of a perpetual stress response stemming from constant police exposure (Hirschtick et al., 2019). A review of 138 studies on the health effects of self-reported racism found strong associations between self-reported racism and negative mental health outcomes including depression, psychological distress, stress, and anxiety as well as self-reported racism and health-related behaviors such as cigarette use, alcohol misuse, and substance misuse (Paradies, 2006). Another review found significant associations between police interactions and mental health outcomes including psychotic experiences, psychological distress, depression, PTSD, anxiety, and suicidal ideation and attempts. In all three of the included studies that limited the population to Black Americans, it was found that those who experienced police interactions had a higher prevalence of poor mental health compared to those who did not report a police interaction (McLeod et al., 2020).

From these studies, it is clear that racism and police-related stress has very harmful consequences for public health. Facial recognition technology discreetly increases instances of racial bias and therefore contributes to health consequences resulting from discrimination. The mere knowledge that police technologies, including facial recognition algorithms in ubiquitous use, are racially biased might perpetuate health disparities. The use of facial recognition technology in policing has more at stake than meets the eye. In its harmful involvement in already discriminatory systems, facial recognition technology does not just convert biologies into innocent data points, rather it alters the very biologies of its subjects.



ASK THE EXPERT

AN INTERVIEW WITH CLARE GARVIE

Clare Garvie is a senior associate with the Center on Privacy & Technology at Georgetown Law. She has authored three reports about face recognition in policing. She has also testified before the House Oversight Committee about the police use of face recognition and serves as an expert resource on the topic for members of Congress.

ED: What do you think is most dangerous about facial recognition technology?

CG: To me, it is the lack of understanding around how reliable it is as an investigative tool. Face recognition has been used as a forensic investigative tool in this country for over 20 years now, but we don't have an understanding of how reliable the tool, the human plus the machine process, actually is. In my mind this is very irresponsible at best. It is a forensic technique, and without an understanding of how reliable it is, the science behind it as a forensic technique is completely questionable. And at worst, it is a violation of defendants' due process rights to information about their guilt or innocence. Under the Fifth Amendment right to a fair trial, defendants are entitled to information that speaks to their guilt or innocence, potentially exculpatory evidence. This is under the doctrine that the Supreme Court established in a case called Brady v. Maryland. Face recognition produces a lot of evidence about whether or not the defendant is in fact the person who committed the crime, and given the fact that we don't know how reliable it is, in my view, this is information that must be turned over to the defense. Historically, this has not happened which in my mind means that over the last 20 years there have been an unknown number, but likely tens of thousands of cases, where face recognition was used in violation of an individual's right to a fair trial.

ED: Wow. So how do you estimate that number [of people whose right to a fair trial has been violated by face recognition]?

CG: It's almost impossible to determine. Not only is it not public information, law enforcement agencies themselves don't tend to keep track of which cases face recognition is used in and what the final position of that case was. Let's use the Pinellas County Sheriff's Office as an example. They run a face recognition system for Florida. It's been in operation since 2001. At the time that I was talking to them about their system back in 2016, it was used about 8000 times a month, and yet, there were no audits ever conducted. We can extrapolate one of two things from that. Either the system was used very often and was never successful, in which case it raises a fundamental question of why the system would be 15 or so years old. Why would they consider paying for this service if it wasn't successful? Or it is useful, but law enforcement agencies aren't keeping track of its efficacy and aren't disclosing that.

ED: I understand that you work with members of Congress and other politicians and legislators. What do you tell policy-makers about facial recognition technology? What are the most important things to know in drafting legislation?

CG: The most important thing to know is that when regulating or legislating around face recognition, we should focus on the rights and liberties that are at risk as opposed to the technology itself. This is because the technology is subject to change. If we regulated too specifically around a technology, it could be that 2 years from now there is a new technology that is somehow completely unregulated even though the risks and problems with that technology are exactly the same. The key thing is to regulate with a goal of protecting rights and liberties as opposed to restricting a technology specifically.
What this might look like is looking at the concern around the risk to First Amendment activities

(the right to free speech, association, and assembly) and the risk that biometric surveillance poses to that. Then we would make sure that legislation protects the right to anonymity while engaging in First Amendment protected activity as opposed to just saying face recognition can't be used on First Amendment protected activity.

ED: Do you think that there is a way for facial recognition technology to be implemented ethically?

CG: I think there is a world in which we can craft a very strong set of rules around how the technology can, and more importantly, cannot be used. We can also regulate, or at least put ethical principles in place, in the development of the technology. We are pretty far from that at this point in time which is why the Center on Privacy & Technology advocates for a moratorium. It's going to take some time to figure out exactly what these rules are, and until that point, we should not continue allowing the technology to be used in violation of peoples' rights and liberties.

ED: So, do you think we need to put a moratorium on the entire use of face recognition before we continue with maybe using it in the future?

CG: Yes, unless we are actively working on regulation or get comprehensive regulation in place now, I believe a moratorium is appropriate purely given the due process risks of continued violation of somebody's Fifth Amendment rights. To be clear, this is talking about law enforcement use of the technology. I think there are other uses of the technology that are a little less objectionable. For example, an employer with the consent of his employees might decide to use some sort of access control system that scans faces, or there's the continued use of face ID on a phone or tagging on Facebook. That might not be inherently objectionable. Face recognition is not a monolith. It's a tool that has a broad range of applications, and some of those applications are more benign than others.

ED: In your report *The Perpetual Line-Up*, you have a long list of different recommendations. What needs to be done to put these in place?

CG: A fair number of the recommendations that we have made in that report have actually been implemented. For example, the National Institute of Standards and Technology now runs ongoing face recognition vendor tests and has run a demographics-specific analysis particularly focused on the racial bias with the technology. We've seen a lot of movement in the research community to fill that research gap that we identified. And we've seen some jurisdictions around the country take steps to regulate the technology, particularly to ban the technology or to put a moratorium on its use. That being said, we are still waiting on any sort of universal regulation on the part of the federal government. But there has been a lot of increased transparency and testing for accuracy and bias, which is very positive. However, I think we're still falling short of ideal degrees of transparency and democratic control over the use of the technology.

ED: How would you recommend communities get involved?

CG: Law enforcement is there to protect and serve communities which means communities should be the ones deciding whether and how face recognition is used. The mechanisms available are certainly power of information: public records requests required of law enforcement for transparency, particularly around contracting for these tools. City councils and state legislators should be available to communities to respond to their requests for democratic oversight. We've seen pretty successful efforts by communities. Certainly in the jurisdictions where the technology has been banned, that often has been community-led. Even in other jurisdictions where the technology still persists, there are still community-led movements. Like in Detroit, community members have been very active in asking city council to review contracts, push the law enforcement agency to implement a policy around its use, to be more public and transparent around its use. So ultimately, I believe it should be up to communities to decide whether and how this technology is being used and our public representatives are the ones to effectuate that for us.

IN DEFENSE OF CIVIL LIBERTIES

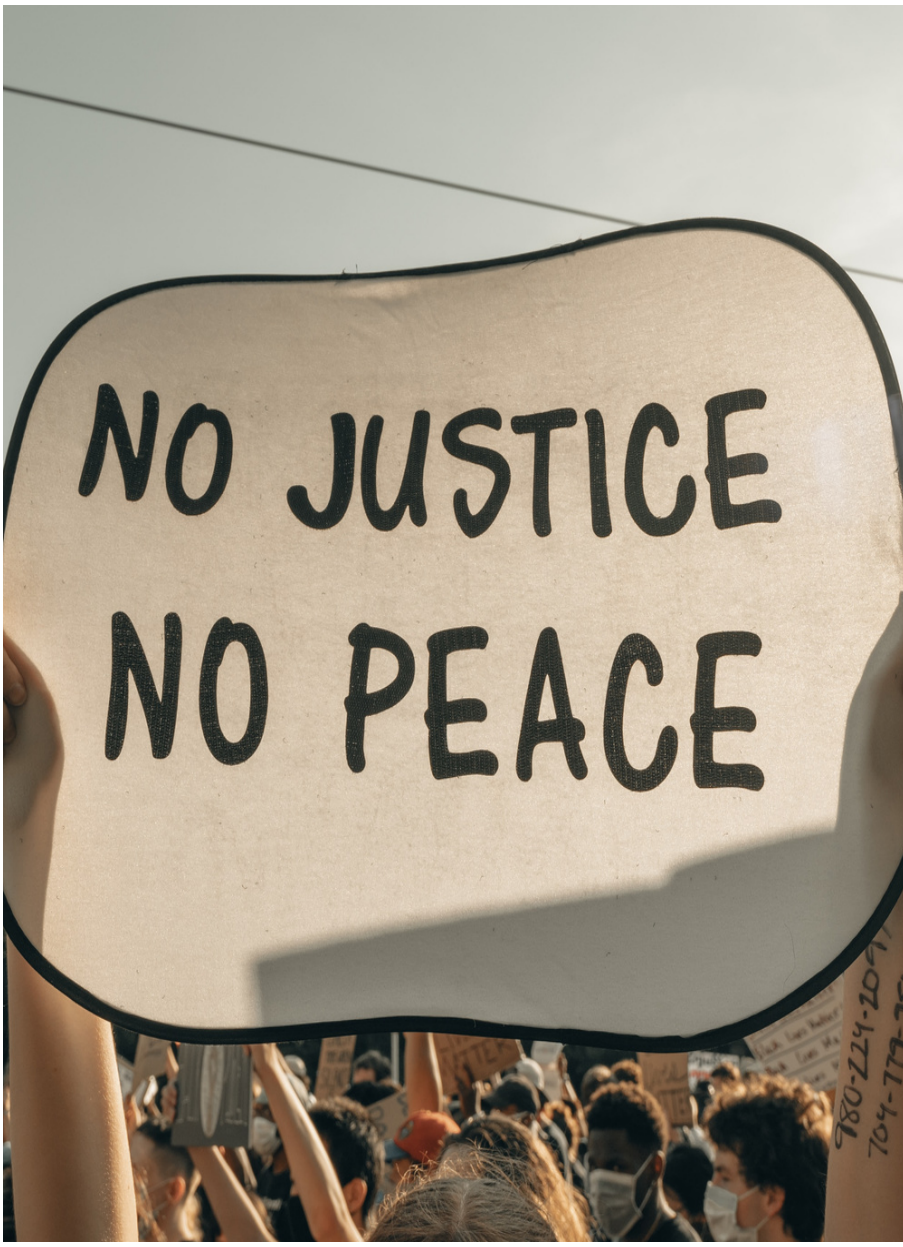
Concerns about privacy, autonomy, and freedom are inextricably linked to the use of facial recognition technology. What is unique about facial recognition is that it has the ability to identify someone from a distance, within a crowd, and without their knowing. Indeed, autonomy and consent are central to the use of facial recognition technology. Many individuals are unaware that their images are included in law enforcement face databases or that their images are being captured for the purpose of identification. Additionally, different uses of facial recognition technology raise different concerns. Principles of civil liberties can be used to determine how facial recognition should be used, if at all.

As described in the Universal Declaration of Human Rights, the right to privacy is a fundamental human right. Privacy is therefore a necessity for democracy and freedom (Naker and Greenbaum, 2017). While the right to privacy is not explicitly described in the United States Constitution, it has been interpreted in some cases to be an extension of the Constitution's Amendments. In Katz v. United States, it was established that there is a reasonable expectation of privacy arising from the requirements that an individual has exhibited an actual (subjective) expectation of privacy, and the expectation is one that society is prepared to recognize as reasonable ("Expectation of Privacy"). This case resulted from a violation of the Fourth Amendment's protection against unreasonable searches and seizures. This begs the question of whether the use of facial recognition technology and video surveillance constitutes a search under the Fourth Amendment and therefore whether facial recognition technology violates a reasonable expectation of privacy. While most people recognize that photos and videos may be taken in public, facial recognition may push the boundaries of an expectation of public anonymity (Milligan, 1999). Furthermore, facial recognition technology threatens what sociologist Erving Goffman termed "civil inattention," the social norm of showing a proper amount of indifference towards others, contributing to the respect of privacy in public by creating recognizability and recognition in situations where one does not expect to be paid attention to (Sharon and Koops, 2021). Additional concerns involve the manner in

which information collected for facial recognition may be kept secure. It is clear that the covert use of facial recognition technology removes some level of privacy.

Issues of freedom and autonomy are also of concern. Facial recognition technology may inhibit individual agency and the ability to make decisions according to one's own beliefs (Introna and Nissenbaum, 2010). For example, if face recognition is used at a protest, an individual may be deterred from expressing themself, producing a chilling effect on freedoms of speech and association protected by the First Amendment as well as the right to remain anonymous while engaging in those rights (Garvie et al., 2016). In a free society that relies on foundations of a presumption of innocence and meaningful consent, the morality of facial recognition in public uses becomes blurred (Introna and Nissenbaum, 2010). Indeed, if people fear being "watched" by the use of facial recognition technology, they may filter their actions and words.

There are additional concerns about the growth of mass surveillance as a means to monitor individuals. While face recognition technology is not currently being used in the United States in this way, it has the potential to be used in this manner. Some scholars have cited mass surveillance as a method of social control and conformity, as people are less likely to take risks or deviate from the norm when they are being surveilled (Milligan, 1999). Especially for the use of



facial recognition technology by law enforcement, there is fear of a police state involving repressive control by law enforcement.

Along with these issues, the use of facial recognition technology in policing puts constitutional rights at risk. Under the Fifth Amendment right to due process, information that might be favorable to a defendant must be disclosed to the defendant. However, prosecutors have not been providing defendants with information about the algorithms used against them. Given that the technology is not always accurate, this is evidence that must be turned over to the defendant. Without this information, defendants who have been identified through facial recognition are not being given a fair trial (Trivedi & Wessler, 2019).

Facial recognition also presents risks to the Sixth Amendment right of a defendant to confront witnesses testifying against them. Facial recognition technology acts very similarly to the lineup identifications in which a witness is tasked with picking a suspect out of a line of people, as it involves both an algorithm picking people out from a database and a person picking the suspect out from the matches returned by the algorithm (C. Garvie, personal communication, March 2, 2021). Thus, under the Sixth Amendment's Confrontation Clause, it is argued that defendants should be entitled to know how facial recognition technology was used against them. It is likely that facial recognition technology has already been used in violation of these constitutional rights many thousands of times (C. Garvie, personal communication, March 2, 2021).

As a result of the biases within facial recognition technology, violations of civil liberties disproportionately affect some groups more than others. Values and politics become inscribed within the technology. When tied to policing practices, surveillance is unevenly distributed across populations, leading to differing privacy implications (Introna and Wood 2004). As cameras and captures are focused on Black neighborhoods, Black people experience higher intrusions of privacy. Furthermore, as a result of biases within the technology and its implementation, individuals with darker skin are more often incorrectly and unjustifiably investigated (Bacchini and Lorusso 2019). This leads to further violations of privacy, anonymity, autonomy, and constitutional rights.

Such abuses as discrimination through practices like predictive policing or wrongful arrest might present constitutional challenges in the future under the equal protection of the law guaranteed by the Fourteenth Amendment (Nakar and Greenbaum 2017). The fact that a criminal investigative tool which is part of our criminal legal system has different accuracy rates depending on the race, age, and gender of a person contradicts the goal of our justice system to treat everyone equally under the law. A technology that breaches civil liberties, especially in a manner that is racially disproportionate, is hazardous. The ways in which facial recognition technology threatens individual rights must be scrutinized before it can be implemented both legally and morally.

The fact that facial recognition technology is differentially accurate for different groups of people is dangerous. It has severe consequences for health, criminalization, privacy, and autonomy. However, facial recognition technology, despite its downfalls, has proven useful in some situations. Thus, we pose the question: ***What do we do from here?***

One way to improve the use of facial recognition technology so that it does not perpetuate racist policing practices and violate human rights is through regulation and policy changes. To protect the autonomy of individuals, a consent process could be instituted for the inclusion of driver's license photos and other images in law enforcement databases. Along with other awareness campaigns, this would help to improve the public's understanding and expectation of privacy when it comes to facial recognition captures and surveillance. Furthermore, the standard of use of facial recognition technology could be changed to reflect a requirement of probable cause and individual suspicion. This would lessen the threat of a police state and mass surveillance (Garvie et al., 2016). It would also require that sufficient evidence is produced to make arrests using facial recognition technology. Defendants should also be made aware of when and how facial recognition technology is used against them. Any future regulation should focus on protecting the rights of individuals in the face of a rapidly changing technological landscape

Aside from these policy changes, there must be improvements in the technology as well. It has been shown that training facial recognition algorithms with diverse datasets leads to improved matching accuracy (Klare et al., 2012). Therefore, we should ensure that all algorithms are trained on highly diverse datasets that are representative of the populations they are to be used on. Additionally, the programmers themselves should consist of a diverse cohort of people who aim to collectively make design decisions that are not biased towards any particular group. Furthermore, law enforcement agencies should be required to audit the use of their facial recognition technology and to provide transparent information about its accuracy and shortcomings (Garvie et al., 2016).

Another option is to place a moratorium on police use of the technology. After all, facial recognition technology poses a threat to civil liberties. It can be used to covertly surveil the public, holding the potential to track our movements and activities on an unprecedented level. Furthermore, it is biased. Justice is in order for people like Robert Julian-Borchak Williams who have been wrongfully accused of a crime they did not commit as a result of facial recognition technology. As technology advances, it has become increasingly clear that science cannot and does not exist outside of established racial hierarchies. Facial recognition technology, just like all scientific advancements, must be interrogated for how it perpetuates the criminalization of marginalized groups before it can be ethically employed.

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