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The 1980s War on Drugs, the FERET Database, and Building Future Infrastructure for Facial Recognition Technologies

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Abstract:
By the late-1980s, human-centric facial recognition technologies (FRTs) were fast becoming obsolete; the increase in the global mobility of goods and populations put increasingly greater stress on human-centric identification systems. The accompanying biopolitics of flow and control, grounded in securitization, demanded monitoring of continuous movement and the idea of stopping each face for sustained human observation quickly grew outmoded. This paper examines the shift from human-centric FRTs to automated FRTs, encompassed by the establishment of the Facial Recognition Technology (FERET) database (1993-96) and the later Face Recognition Vender Tests (2000-present). This trajectory is defined by the aforementioned shift from technologies rooted in disciplinary biopolitics to those based in interdiction that is further paralleled by the turn from Cold War ideological battles towards the War on Drugs as the central truth regime justifying the establishments and improvement of FRTs into the turn of the millennium.Sponsored by the American Counter Drug Technology Program, in partnership with DARPA, construction of the FERET began in 1993. Not only was this database essential to the later Face Recognition Vendor Tests (FRVTs), but it also provided incredibly influential and expansive documentation and methodologies for the creation and deployment of future FRTs. Such infrastructure remains deeply relevant in a post-9/11 world, in particular during the ongoing crisis of the global Covid-19 pandemic and the near future of climate catastrophe and mass migration.

Keywords: Face recognition technologies, War on Drugs, computer vision, media infrastructure.

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The late-1980s move away from human-centric facial recognition technologies (FRTs) to automated and decentralized FRTs coincided with the increase in global mobility of goods and populations that gave rise to biopolitics of flow and control, grounded in securitization, that demanded monitoring of the continuous movement of resources and populations. Stopping each face for sustained human observation grew increasingly outmoded, and, as such, FRTs moved to strategies based in interdiction.[1] The primary strategy of interdiction speaks directly to American desires for control of their national borders: interdiction involves 5 phases, central to which is "the sorting of legitimate traffic from that which might be illegal" (Joint Counterdrug operations, 1998, p 1-13). This meant a rise in so called non-intrusive forms of vision technologies that could enable the quick and efficient sorting of illegal from legal traffic without disrupting the general flow of goods and populations (Office of National Drug Control Policy Counterdrug Technology Assessment Center (ONDCP-CTAC), 1995; Pennella, 1997).

Accompanying this rise in interdiction was a shift in the vigilance within the FRT observer from detecting opposing ideological forces arising from the Cold War to the monitoring of the movement of goods and populations named as illegal in reaction to the War on Drugs. As Isacson writes, the War on Drugs replaced the containment of communism as the main rationales for American desires for global securitization (2005). As the 1980s finished, the War on Drugs demanded that notions of health and security turn from protecting citizens from invasive and harmful ideas to protecting citizens from the crime and death that rampant drug use promised. While past scholars typically point to President Richard Nixon as initiating The War of Drugs, there are many American precedents, ranging back into the late-19th century.[2] However, President Ronald Regan and the First Lady Nancy Regan are

[1] There were, of course, other forces at work compounding such developments. There was a concurrent widespread adoption of personal and work computers, with a growing incorporation of the machines into an increasingly larger portion of governmental, educational, and corporate infrastructure; while the Internet, as a networked technology, was still relatively nascent, it was growing and poised for an explosion in the early to mid-1990s. This concurrence of a proliferation of corporate and personal hardware, an increased public comfort and knowledge about computational systems, and the emergence of a globally networked form of information sharing and transferring in the Internet, provided the grounds on which to expand FRTs into an effective mass technology

[2] See: Manning, P. (2013). The Mediated Regulation of Intoxication in the Age of 'Old' Media. *Drugs and Popular Culture in the Age of New Media*, Routledge, 61-87; Whiteford, A., and Yates, J. (2009). *Presidential Rhetoric and the Public Agenda: Constructing the War on Drugs.* The John Hopkins University Press.

seen as bringing the War of Drugs to the forefront of public discourse, with the 1980s producing both policy and rhetoric that enhanced internal and international drug enforcement. These policies and discourses formed what Michel Foucault called truth regimes, which he defined as "a system of ordered procedures for the production, regulation, distribution, circulation and functioning of statements"; truth regimes act under diffuse systems of power to form constellations of practices, norms, laws, and scientific knowledge, functioning to regulate what is accepted as a truth (1977 p 14). Unlike the Cold War's truth regimes, which tethered enmity to nation states, drug smugglers' non-national affiliation short circuited almost any hope that disciplinary strategies, such as border walls and/or human-centric FRTs, would have any real effect. In solution, the War on Drugs produced and circulated truths justifying the need for technologies of interdiction, which, in turn, began to drive the desires for increasingly automated and decentralized versions of FRTs.

This paper outlines the larger context for the production of 1980s and early-1990s truth regimes emerging from the War on Drugs, linking these to the developments of the Facial Recognition Technology (FERET) database and the Face Recognition Vender Tests (FRVTs) in order to establish how both FERET and the FRVTs acted as core infrastructure for the explosive growth of the technology post-9/11. Initially funded by the U.S. Defence Counterdrug Development Program, the establishment of the FERET database and the FRVTs owe a great deal to the desires to better police America's borders and disrupt the transnational chain of drug commodities. Though a full genealogy of FERET and the initial FRVTs is outside the scope of this paper, a partial tracing of the developments of both by way of their internal documentation reveals how resonate they remain. Doing so activates Lisa Gitelman's understanding of media archeology, which leverages the protocols captured within the internal and external documentation of a media in order to recreate "the vast clutter of normative rules and default conditions, which gather and adhere like a nebulous array around a technological nucleus"; following from this, tracing documents' sprawling and low level bureaucratic functioning makes clear the tactics and strategies of governance saturated into the media's everyday functions (Gitelman, 2006 p. 7; 2014). While my current book-length work takes a larger three-pronged approach to media archeology in order to best recreate the constellations of technical, representational, and political protocols throughout the histories of FRTs, focusing here on Gitelman's media archeology allows a more fulsome understanding how both FERET and the FRVTs have been incredibly impactful on contemporary

versions of the FRTs.[3] This paper then draws further from Critical Infrastructure Studies scholars such as Douglas-Jones, Walford and Seaver who argue that focusing on the social life of documentation and data practices, and the assemblages they are deployed within, link directly to their larger infrastructural import, simultaneously making visible both top-down and bottom-up forms of power.[4] Taken together, the bureaucratic documents and protocols gathered via undertaking Gitelman's approach to media archeology gives the critical evidence necessary to support work done within the perspectives of Critical Infrastructure Studies, in turn showing how crises, whether the American War on Drugs or the latter events of 9/11, have been essential to FRTs' future entrenchment within the functioning of everyday life.

Kelly Gates's *Our Biometric Future* (2013) and the more recent "Seeing Infrastructure" by Stevens and Keyes (2021) look at FERET, both arguing that the sheer size of the standardized database was an important step in the development of the state of the art of FRTs; Gates goes further in linking FERET to the FRVTs, but glosses quickly through its impacts (p. 71; p. 76). This paper, in contrast, examines the internal documentation of FERET and the FRVTs in order to trace how both shaped the representational, technical, and political protocols that coalesced into the large-scale building and testing infrastructure that would be amplified further in the 21st century. Doing so makes clear how 1990s FRTs began as tactics serving largely top-down forms of power guided by national security, then transitioned, post-9/11, to the current moment where the technology is a normalized and ubiquitous presence, expanding algorithmic governance from sites of border security and law enforcement to malls, job interviews, test-taking environments, cruise ships, and beyond.

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[3] In order to best reconstruct the historical constellations of representational, political and technical protocols within FRTs, my larger-scale research builds a three-pronged media archeological methodology that utilizes Gitelman's work alongside Wolfgang Ernst's understanding of the the operative moment (*Digital Memory and the Archive.* Minneapolis: University of Minnesota Press, 2013) and scholars like Anna Munster's work on how the body is represented within digital media (*Materializing New Media.* Hanover: Dartmouth College Press, 2006).

[4] My larger arguments on FRTs and infrastructure draw heavily from the decades of work Bruno Latour has undertaken, but also includes *Thinking Infrastructures* (edited by Martin Kornberger, Geoffrey C. Bowker, Julia Elyachar, Andrea Mennicken, Peter Miller, Joanne Randa Nucho, and Neil Pollock, 62. Research in the Sociology of Organizations. Emerald Publishing Limited, 2019), Paul Edwards's The Mechanics of Invisibility: On Habit and Routine as Elements of Infrastructure" (*Infrastructure Space*, 2017. Berlin: Ruby Press, 2017), and many others.

The War on Drugs and Technologies of Interdiction

In general, the United States Department of Defence, via entities like DARPA and the CIA, has been central to the history of biometrics.[5] Drawing from Cole's work in *Suspect Identities* (2001), Magnat further details the increased use by governmental entities like the FBI, who leveraged rationales of securitization into widespread surveillant practices that engrained the use of punchcards and fingerprints beginning in the 1960s (2011, p. 54). At the same time, the National Institute of Technology (NIST), as well as the U.S. National Bureau of Standards, were deployed as testing and standardizing forces beginning in the 1960s through the present, continuing to provide much needed infrastructure for fingerprint identification and face recognition (Wayman, 2007, p. 266).

The American infrastructure for contemporary FRTs grew directly from the Office of National Drug Control Policy (ONDCP), which was formed from the 1988 Anti-Drug Abuse Act and the appointment of Bill Bennet as the first Drug Czar of the United States; by 1989, the U.S. Congress had named illicit drug trafficking a clear and immediate threat to the stabilization of the nation's economy and security. Soon after, the responsibility for enforcing counter-drug trafficking was given to the American military, with special attention being given to disrupting the source of drug supplies from countries mostly in Central and South America. Doing so meant relying on a variety of new and developing technologies, each of which was increasingly automated and decentralized; the 1990 establishment of the Counterdrug Technology Assessment Center (CTAC) was used to fund research and development technological projects under the strategy of interdiction (Manning, 2013; Corva, 2008; Stemen, 2017).

Under such strategies, face recognition was seen as a key potential technology: by working with the Immigration and Naturalization Service, the technology was proposed as a viable way to potentially match faces with known drug traffickers at border crossings (ONDCP-CTAC, 1995, p. 18). Aided by the previous decades' gradual

[5] Gates, K. (2011). *Our Biometric Future: Facial Recognition Technology and the Culture of Surveillance.* New York University Press. Gates writes thoroughly and extensively about the American government and its military and intelligence infrastructures have been a central part of the development of FRTs throughout its history, with the first key example being Bledose s team s company, Panoramic Research Inc, and its funding by the U.S. Department of Defence and the CIA.

improvement of technical protocols, the FRTs were pitched as an effective governing tactic by way of transforming the face into a digital identity document. From this, the imagined future of FRTs was clear: "advanced algorithms will be developed to improve the use of facial recognition technology at ports-of- entry and 'detention' facilities. These improvements will assist in correlating people being detained with known drug traffickers, terrorists and criminals" (Ibid., p. 23)

Doing so meant strengthening the abilities to build, improve, and spread the use of FRTs. Prior to 1990, the growth of FRTs was hamstrung by the scattered development of the technology across different corporate, university, and government sites, as well as by the small and varied datasets used in such research. In order for FRTs to progress to a mass scale and automated field of vision, there needed to be a more centralized and standardized infrastructure put in place to improve, evaluate, and discuss the developments of FRTs.

FERET (1993-996)

As previously mentioned, the FERET database (The National Institute of Standards and Technology, 1993) was sponsored by the Defence Counterdrug Development Program under the ONDCP and in partnership with CTAC, with many of the early tests taking place at the U.S. Army Research Laboratory (ARL) in cooperation with a number of other academic labs from across the United States (Phillips, Rauss and Der, 1996). The FERET database was initially rationalized primarily as a transnational technology in order to gain increased control of mobility, in particular the monitoring and control of the flow of goods and people across its borders; strategies of interdiction, grounded in heightened vigilance, assured that the technology's field of vision was intended to cover ever good and/or individual that passed, guilty or not.

Following from Gitelman, downloading the FERET database and exploring its internal documentation and file structuring logics showcases how both elements work to build truth regimes that justify the expansion of FRTs while also building a replicable and digitally-mobile version of the database that would ensure large-scale adoption of the FERET database itself, its discourses, and its technical protocols. With control of mobility and the flow of people and goods at its core, the description of FRTs within the FERET documentation gestures to the technology's potential, ranging from the searching of mugshots; the monitoring of sensitive security areas; verifying identities at ATMs; verifying identities for the automated issue of driver's licences; and controlling access to different facilities (Ibid., p. 9). Within this list, there is a sense of the multiple strategies that FRTs could serve as effective tactics for, in

turn centralizing desires for the monitoring and management of mobility within specialized and everyday environments alike. It is clear then that FRTs were being envisioned as technology for which its mechanics of interdiction and non-invasive vision could be an effective and crucial infrastructure for both the top-down surveillance of sensitive security sites and bottom-up forms of power, where citizens make themselves legible to such systems in order to receive access to some form of resource.

The authors of the earliest publications detailing the work of FERET lay out three major goals for the project: to discuss and develop the state-of-the-art of FRTs; to produce a large database of facial images that could be used by the FERET program and other FRT researchers; and to build a government-monitored testing and evaluation infrastructure that would utilize standardized tests and test procedures (Ibid., p. 7). From its inception, the FERET program was built to be both a producer of bureaucratic facial materials as well as an infrastructure to test and improve the work being done outside its immediate research. The steady and methodical nature of the database's construction is shown in how the project grew: in 1996, 1109 sets of images were in the database totalling 8525 images of 884 individuals; by the project's final stages the database had expanded to include 14126 images of 1199 individuals (Ibid., 14). While FERET began by testing 5 algorithms, by its end the testing had expanded to include 12 algorithms, including 2 fully automatic algorithms (Phillips, Moon, Rizvi and Rauss, 1999, p. 1).

As the first large-scale and centralized facial database, FERET set the protocols for future FRTs, most notably in its image-making. As clearly outlined within the database's internal documentation and later public reports, the technical protocols were made very clear, as a standardized database of facial imagery was essential: there is detailed description of the type of camera and film used; the retrieval, storage, and translating of the files into the digital; the file-naming conventions; the specific size and resolution of the images; the optimal standardized interocular distance; and the stressing of the need for the same physical picture-capturing sessions, that included the plain background and the semi-controlled multiple positions of the head. Importantly, the database detailed that images were to be taken of the same face from different angles in order to potentially best translate into less controlled environments: this includes further instructions on capturing frontal images, the specific angles of profiles, the use of 5 irregularly placed positions, and the mixing in of glasses and hairstyles (Phillips, Rauss and Der, 1996, p 11). These technical protocols homogenized the image-making within FERET and beyond, effectively producing reproducible best practices that still echo through contemporary FRTs.

Looking within FERET reveals the sprawl of the digital automated FRT as machine ensemble and the ways in which the data-driven practices built from the infrastructuralism within FERET would become engrained in later versions of the technology. The CDs and DVDs that contained FERET do not hold the image themselves, but rather folders and subfolders within which mostly various compressed files sit in orderly fashion. Folders contain the tools needed to view the images, such as the compression program bzip2 and libbzip2, and manuals for their use; other folders include zipped files that must be decompressed to reveal the images, encoded as .ppm files. The metadata for the ground truth images is associated with accompanying images by way of their head position, with the files mapping the x-y coordinates coordinates of the eyes, nose and mouth. Internal files like "documentation.txt" give more detailed descriptions of the database than the public reports, with further statistics on how many pictures are within as well as detailing any changes between different versions of the dataset; it also lays out the particular subsets, or partitions, within the dataset which hold labelled ground truth images that are recommended for use in future testing of FRTs.

As discussed in the introduction, the move from human-centric to automated FRTs, spurred by developments in late twentieth-century digital computing, was an essential point in the media archeology of the technology as it engrained biometrics in core truth regimes around securitization while also solidifying its bureaucratic treatment of faces as digital data-objects while simultaneously constructing a centralized, governmentally-minded production and evaluation infrastructure whole technical protocols and data practices would become the standard for the technology. Knowing this, FERET should be seen not only as the first large-scale FRT database but a whole apparatus that was built to be digital, with the images and metadata attached interlocking in a series of digital mechanics and organizations that would ultimately aid in the increasingly automated versions of the technology that were being deployed outside of laboratory settings. Further, not only were the faces within FERET digitally compressed informational objects, but so were the data practices and distribution of the database, effectively providing the tools to aid in its own replication so as to provide the digital infrastructure, the documentation, and software technology to allow different actors to undertake what FERET itself had done. This allowed for FERET's influence to spread further, reinforcing the proliferation of its technical, representational and political protocols.

As importantly, the FERET database was also used to create and deploy an early version of what would eventually grow into the FRVT. The report "The FERET Verification Testing Protocol for Face Recognition Algorithms" details the 1996 series of tests undertaken and also clearly outlines the methodology for its evaluation,

scoring procedure, and performance statistics, arguing that "for face recognition systems to successfully meet the demands of verification applications, it is necessary to develop testing and scoring procedures that specifically address these applications" (Rizvi, Phillips and Moon, 1998, p. 2). The widespread adoption of the FERET database by the FRT research community, also meant the adoption of their evaluation methodologies. This allowed a doubling of FERET's influence: first, the facial images and associated data granted a massive database to use to improve future versions of the technology, and the database would continue to be used for generations of the technology afterwards; second, the evaluation infrastructure would allow for the comparison of algorithms, with the resulting benchmarks forming the truth regimes for what a "successful" FRT is and does, including the tolerable levels of inaccuracy and biases. While the FERET tests were done on a relatively small scale, the testing methodology that the FERET database generated would be scaled to increasingly larger and more wide-ranging databases and instances of use while at the same time remaining very adaptable to, as the conclusion to this paper will address, the oncoming crises and technical developments that would define the 21st century. On the strengths of such infrastructure, the future envisioned in initial FERET documents have been realized, whether the technology is a key tactic within larger top-down and bottom-up circulations of power.

It must not be forgotten that underneath the development of these technical protocols and infrastructure is the desires for non-intrusive interdiction and the accompanying suspicion that rationalizes the expanded field of automated vision that interrogated everyone and everything under its observation. That civilian faces were used in the creation of FERET and within FRT testing does not hide the fact that the technology was being developed by the American military in order to target populations deemed threats; reiterating, the gaze produced by such apparatuses were built to look at every single person as if they were guilty, then use the technology to prove their innocence. This undercurrent runs through the following 25-plus years of the development of FRTs, although most directly within the relationship between FERET and the FRVT.

The Face Recognition Vender Tests (FRVTs)

The third goal of FERET, to create a standardized and independent set of testing protocols for FRTs, was realized in 2000 with the first FRVT. Within the FRVT's first report there is an acknowledgement that the technology had already greatly progressed since the inception of FERET less than a decade earlier (Blackburn, Bone and Phillips, 2000, p. ii). However, the FRVT would build on the infrastructure laid out in the 1998 report and would be the first to evaluate and rank

commercial FRTs, providing a centralized authority on which of those systems perform best. Many of the same entities were involved, including the American Department of Defence Counterdrug Technology Development Program Office and DARPA, with additional co-sponsorship from the National Institute of Justice.

P. Jonathan Phillips was a DARPA computer scientist who runs through the history of FERET and the FRVTs: he was one of original architects of FERET and is the lead or co-author on numerous papers related to the building of the database and the transition into the FRVTs. His paper "Meta-Analysis of Face Recognition Algorithms," co-authored with Laine M. Newton (2002), echoes one the central argument of this paper: the technical progression of the technology not only depends upon stable modes of evaluating and benchmarking the technology itself, but also evaluating research into and experimental results using FRTs. Using 24 papers as their corpus, each of which used either the FERET or ORL databases, the authors outline the key elements to look for when evaluating FRT research, in effect attempting provide an increasingly homogenized framework for building the technologies: their 10 criteria are built from Phillips's work establishing the aforementioned FERET methodologies, arguing that "to establish a sound foundation for the incorporation of standard control algorithms into an experimental method, it is necessary to establish accompanying standard evaluation protocols and image sets" (Ibid., p. 5). Phillips and Newton's article showcases the logics for the subsequent 2002 FRVT that built from the core of FERET, contending that there must be an infrastructure in place that can both define the evaluation protocols and then carry out those protocols in order to advance the state of the art of the technologies.

Imbued with such logics, the FRVTs set out to be the gold standard of FRT evaluators, buttressed by the fact that "everyone cited the FERET program because it is the de facto standard for evaluating facial recognition systems" (Blackburn, Bone and Phillips, 2000, p. 5). Within the first FRVT in 2000, co-authored by Phillips, the initial goals of the FRVT were established as two-fold: to make "a technical assessment of the capabilities of commercially available facial recognition systems"; and "to educate the biometrics community and the general public on how to present and analyze results [from evaluations of FRTs]" (Ibid., p. ii). Immediately, the importance put on technical improvements of the technology are placed alongside controlling the discourses surrounding the technology itself. The FRVT has been a key step in not only expanding the technical capabilities of FRTs, but also a way of framing which versions of the technology were "the best" and therefore the most effective. The rationales and logics for using FRTs worked symbiotically with such framings: the situations in which FRTs might be used dictated what systems were best at the same time while the best systems also delineated how FRTs might be best used.

Based on the legitimacy granted by the FERET program, the FRVT grew steadily: the first FRVT included five submitted vender algorithms that underwent the three step evaluation protocol, with each using the same 13, 872 images from the FERET database as well as the HumanID database (Ibid., p. iii)[6]; the first three reports would show incremental growth as 10 algorithms were submitted in 2002, using a database of 121,589 images of 37, 437 individuals (Phillips et al, 2003, p. 1), with the number growing to 14 algorithms in 2006 (Phillips et al, 2007, p. 9). Recalling the introduction to this chapter, in order to announce the death knell of human-centric FRTs, the FRVT definitively compared automated systems to human systems, with the results overwhelmingly favouring automated versions of the technology (Ibid., p. 3).

The FRVTs did not abandon interdiction nor the vigilance and suspicion that had produced the FERET database in the first place, instead rerouting such desires into expanding the FRTs to greater and greater fields of automated vision. Importantly then, the tests each took on increasingly more difficult and "real-world" problems that encouraged the migration of the technology outside of more restrained and cooperative environments, such as laboratories, into non-cooperative such as airports.

Comparing the first two FRVTs with Gitelman's media archeology front-of-mind makes transparent how the most urgent uses of FRTs were driven by a changing landscape of crises and vigilance while also cementing truth regimes and the production of power centred around the value of decentralized and automated interdiction, as well as the need for infrastructure that would continue to improve upon and expand the use of FRTs. As such, the initial FRVTs show the evolution of the types of problems that FRTs were being asked to solve and the truth regimes that

[6] The establishment of the HumanID program by DARPA and methodology in the early 2000s is indicative of the ways in which FRTs, and evaluations of the technology, were changing: spurred by Phillips and Newton's conclusion that researchers should take up the more difficult of FRTs, HumanID aimed to improve the technological abilities to identify people at a distance. With Philipps again at the centre, the HumanID program mixed biometric measurements, such as iris scanning, gait measurement, and face recognition, in order to improve the abilities to identify those in less structured and non-cooperative environments, doing so meant building methodologies to combine these different biometrics, but also the establishment of a series of biometric databases. Phillips, P. (2002). Human identification technical challenges. *Proceedings. International Conference on Image Processing;* DARPA. (2000). Human ID at a Distance. http://dtsn.darpa.mil/iso/programtemp.asp?mode=349 [URL broken, accessed through Wayback Machine]

accompanied such problems. In 2000, the two tests undertaken included one in a more controlled environment and one with a scenario of controlling access to a building in real-time. However, in 2002, the databases and tests change in the wake of 9/11: 2002 introduces expanded tests for environments and instances with high variability, including within moving images; it also included a "watch list" test, wherein a non-cooperative environment is monitored in order to identify any potential peoples of interest, such as known terrorists and drug traffickers. Doing so meant expanding the datasets involved from FERET to include Mexican non-immigrant border crossers as well as VISA application materials; further materials where provided by the HCInt dataset, MCINT data set as well as the HumanID dataset (Phillips et al, 2002, p. 15).

The inclusion of border crossing and VISA materials is a key shift away from the laboratory-driven, more consensual data practices present in FERET, and should be put alongside the FRVT use of mugshot databases in its testing. In both cases the databases utilized in the tests that the FRVT undertook dictated the use of the technology: when the FRVT tested algorithms for their effectiveness on mugshots, immigrant, or VISA materials, it was endorsing and promoting the use of the technology for that use. While the FRVTs frame such actions as based almost entirely in technical protocols, that technical performance is intertwined with the representational and political protocols that are embedded within that infrastructure and those facial images. In this way, truth regimes around the technologies' usage meld to the technologies' operations: if the monitoring of the mobility of terrorists and drug traffickers is the rationale for the technology's use, the technology would likely rely heavily on logics of difference, most obviously aligned along racial identifiers, that would justify its expanded field of vision so that it covers anywhere a potential terrorist or drug trafficker may be; at the same time, any citizens captured within that field of vision are subject to the same circulations of power. While such an expansion was justified by 9/11, the progress in FRTs' state of the art made in the early 2000s would become the bedrock infrastructure for its future use, not disappearing after the War on Terrorism had subsided but instead made normal to the point of near-invisibility within the monitoring and sorting of citizens' everyday lives.

It is undeniable that the FRVTs were essential in expanding FRTs' field of vision. The rationales tied to the improvement and deployment of FRTs were focused on monitoring and controlling the increased mobility that would come with the circulations demanded of global capitalism and the free movement and immigration of individuals and populations; within these apparatuses, each face was looked upon

with suspicion first, then proven innocent by FRTs' acts of identification and verification.

Conclusion

The FERET database and the FRVTs shows how the benchmarking and improving of media like FRT is very often centralized within infrastructural bodies with large amounts of resources at their disposal. Such centralizing, in turn, creates a monopoly of legitimating the technology while homogenizing the technology by way of its testing standards and technical protocols. Initially driven by desires for interdiction brought about by the War on Drugs, the legitimacy and technological bedrock that FERET and the first FRVTs provided granted the technology the flexibility and adaptability to become an effective tactic in the War on Terror after 9/11. The vigilance enacted within these examples of FRT usage created the foundation for the post-9/11 proliferation of internal and external borders, with the technology enacting further control over citizenship and the resources of citizenship under the guise of new forms of societal security and health. The technology's adaptability to different datasets and different tasks made, and continue to make, FRTs nimble enough to work alongside nationalistic rationales during moments of crisis, such as 9/11. This nimbleness, however, is aided greatly by infrastructures, like the still-ongoing FRVTs, so that within moments of societal instability FRTs have a sturdy set of protocols to fall back on in order to improve and address the problems arising from a crisis. As I have expanded in "Solving the Conflict Between Breathability and Masked Faces within Facial Recognition Technologies," producing an infrastructure for technical evaluation of FRTs that can produce statistical comparisons of different versions of the technologies' performances then provides a framework of knowledge to then evaluate and adjust the technology in moments of crises while also addressing new and/or expanded uses of the technology (2021).

Further, as the last two decades' consistent expansion of FRTs into more and more daily activities demonstrates, protocols within entities like FERET and the FRVTs are normalized and spread into further applications of FRTs. Some of such practices link to strategies and tactics based in deterritorialization and incarceration as well as the physical and social mobility which are often amplified by compounding intersectional forces based in logics of precarity and debility as well as life and death. While outside the scope of this paper, there are strong connections to be made between the continued used of mugshots within the development of FRTs and truth regimes such as the War on Drugs that disproportionately target racialized

populations.[7] When this automated field of vision, defined by the political and representational protocols captured within mugshots, expands to observe the whole of citizenry, the inscriptions of bias form what Ruja Benjamin calls the New Jim Code, which she defines as the use of new technologies and discriminatory design practices that amplify hierarchies, replicate social divisions, and trigger narratives about what kind of person is behind their data (2019). Such thinking is expanded by texts like Safiya Noble's *Algorithms of Oppression* (2018) and Virginia Eubanks's *Automating Inequality* (2018), both of which detail how algorithms based in difference produce technological redlining, consistently red-flagging populations so as to create a feedback loop of injustice resulting in those populations being relocated to digital poorhouses.

The use of media archaeologies, such as Gitelman's exploration of bureaucratic protocols and documentation, are essential in reconstructing how mass technological infrastructures are built, expanded, and maintained. Not only can the past be traced, unveiling the vectors and actors that brought about key changes in FRTs, but such information can be used to project into the future so as to anticipate both the use of such technologies, but also how they may be further cemented into the melding of large-scale corporate and governmental infrastructures. Looking forward, the near-future crises of climate catastrophe and resulting mass migration show how important FERET and the FRVTs work on national border security was. Both entities worked alongside the more general adoption of biometrics into the spaces of immigration and refugee control, such as legislation like the Immigration Reform and Immigrant Responsibility Act implemented an Alien Border Crossing Card (Wayman,

[7] Under the 1980s and 90s War on Drugs, new forms of control, which included expanded police presences in minority neighbourhoods and mandatory sentences for drug possession, fit within long-standing truth regimes that associated racialized bodies with illicit activity and the need for their reform for the safety of society at large; such control connected with previous forms of biopolitics, where the War on Drugs became a way, as Manning (2013) states, to legitimate the deepening strategies of formal regulation and surveillance" (Cited in Note 2, p. 83). As a result, as Dominic Corva (2008) and Michael Tonry (1994) clearly argue, the War on Drugs disproportionately affected young black men through the accompanying practices of punishment and incarceration; the appropriation of mugshots within automated FRTs demonstrates how the rationales for domestic law enforcement use of FRTs collide with over-policing and the resultant over-representation of liminal populations within its databases that have roots in the War on Drugs.

Corva, D. (2008). Neoliberal globalization and the war on drugs: Transnationalizing illiberal governance in the Americas. Political Geography, 27, 176-193. Tonry, M. (1994). Race and the War on Drugs. University of Chicago Legal Forum. 25-82.

p. 271). The sorting of illegal from legal forms of citizenship drove a number of the truth regimes that expanded and improved FRTs in the 1990s; this form of political recognition was enforced at national borders but also internally, as exemplified by the expansion of the powers of immigration officers and employees in 1996 that allowed for the abilities to arrest and interrogate suspected "alien" non-citizens ("Powers of immigration officers and employees," 1996).

Much like the War on Drugs, FRTs in this instance are not just technical acts, but acts of political recognition driven by vigilance and suspicion. Already, this location of political recognition within automated technologies like FRTs has only increased as the 21st century has progressed. Petra Molnar and Alex Gill's "Bots at the Gate" illustrates the ways in which biometrics like FRTs "will have life-and-death ramifications for ordinary people, many of whom are fleeing for their lives" (2018, p. 1); nation states are attempting to "introduce algorithms to help determine 'risk' and 'fraud' in refugee status applications. However, it is not clear what these terms mean and what exactly an algorithm is supposed to be looking for during the application process for protection and permanent residence" (Ibid., p. 27). Molnar goes further in "Technological Testing Grounds," contending that under current biosurveillance practices "refugees and people crossing borders will be disproportionately targeted and negatively affected" (2020, p. 1); most damagingly, nations states then develop power and knowledge monopolies which "are allowed to exist because there is no unified global regulatory regime governing the use of new technologies, creating laboratories for high risk experiments with profound impacts on peoples' lives" (Ibid., p. 3).

Knowing this, it is essential to scrutinize the current and future use of technologies like FRTs while also scrutinizing their past and the vectors of power that formed the current constellation of forces and truth regimes that operate today. From this perspective, FERET and FRVT greatly advanced the technological progress of FRTs while simultaneously providing the groundwork to build the effective and mass-scale contemporary versions of the technology that are extremely dangerous for many populations.

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