THE FLEXIBLE FACE:
UNIFYING THE PROTOCOLS OF
FACIAL RECOGNITION TECHNOLOGIES

AARON TUCKER

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ABSTRACT

"The Flexible Face: Unifying the Protocols of Facial Recognition Technologies" reconstructs the key historical constellations of technical, representational, and political protocols that have resulted in contemporary facial recognition technologies' (FRTs) ubiquitous field of automated vision. This dissertation excavates the past 200 years including case studies such as the Nippon Electric Company's work on the first public demonstration of FRTs in 1970, the 1990s establishment of the massive dataset FERET, and the contemporary solving of masked faces within FRTs during COVID, while also involving unique archival work from The Francis Galton Papers (London U.K.) and the papers of Woodrow "Woody" Bledsoe (University of Texas at Austin). From this historical scholarship, this dissertation argues that FRTs' effectiveness as a biopolitical tactic is rooted in an incredible adaptability and flexibility brought about by the technology's entwined technical, representational, and political protocols.

Utilizing a three-pronged media archeological methodology, this dissertation presents a unified understanding of FRTs' three sets of protocols working symbiotically: the technical protocols draw from vision science rooted in 19th century experimental psychology which have been expanded into deterministic and linear models of vision, powered by advancements in the science of vision, computer science, and computer vision; representational protocols, most overtly present in the facial databases used in machine learning training and operationalizing of the technology, act under predictive logics to categorize and hierarchize the faces under observation into stable data defined by difference; political protocols, in combinations of state and corporate actors under globalized capitalism, manage and control individuals and populations through the gathering and circulation of facial data and by use of the technology, often in service of a self-perpetuating hegemonic power powered by asymmetrical control of

political recognition. This dissertation's historical approach surfaces how the various formations of protocols within FRTs have depended upon, and continue to depend upon, the circulations of both top-down and bottom-up forms of power united with performances of citizenship that collapse consent and coercion within the behaviour of citizens and non-citizens in ways that manage and gatekeep resources related to citizenship, in particular during moments of crisis.

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INTRODUCTION

In September 2020, Moria, Europe's largest refugee camp located on the Greek island of Lesbos was burned to the ground by residents protesting the COVID-19 quarantine, leaving nearly 12,000 people without food, shelter, and asylum-processing infrastructure. Initially, the camp itself was only designed to hold 3,000 people and conditions quickly became squalid. COVID-19 amplified these issues, which further heightened the tensions between residents and refugees while also surfacing other economic vectors related to quarantine and lockdowns.[1]

When new camps were opened to shelter the displaced people, various enhanced surveillance apparatuses were installed, headed by a combination of cameras, drones, and biometrics named Centaur. Justified by the dual crises of a global pandemic and mass migration, Centaur not only utilized technologies like face recognition technologies (FRTs) in order to manage and monitor the refugee population, but to also collect, store, and share the data gathered from such populations. Petra Molnar, a lawyer formerly at York University's Refugee Law Lab, spent extended time in Moria and has written powerfully on the effect of programs like Centaur: not only are refugee, immigrant, and border-crossing populations disproportionally targeted by increasingly invasive technologies with little to no oversight, but the precarious populations become experimental testing grounds to extract data and improve existing automated and centralized systems of control.[2] With these populations as fodder, technologies like FRTs can be normalized in ways that can then be extended outward to include further use as tools to aid

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[1] Niki Kitsantonis and Patrick Kingsley, "Pandemic Collides With Europe's Migrant Crisis to Set Off a Calamity in Greece," *The New York Times,* September 10, 2020, https://www.nytimes.com/2020/09/10/world/europe/lesbos-fires-coronavirus.html?searchResultPosition=1.

[2] Petra Molnar, *Technological Testing Grounds: Migration Management Experiments and Reflections from the Ground Up,* European Digital Rights Initiative and Refugee Law Lab, November 2020, https://edri.org/wp-content/uploads/2020/11/Technological-Testing-Grounds.pdf

oppressive actors who aim to track those named as protestors, dissidents, and/or radicals; beyond this, the unregulated data collected can be repurposed for any number of uses, including training any number of unrelated artificial intelligence (AI) systems while also being utilized as materials for biometric apparatuses, such as facial databases. Leveraging entwined crises, the destruction then reconstruction of refugee camps in Greece is an example of technologies like FRTs being directly deployed on precarious population while simultaneously using those same groups of people to improve the technology, thereby executing more diffuse forms of future-facing control.[3]

Drawing from the example of Centaur, much of the popular discourses around FRTs are particularly concerned with the technology as an oppressive and surveillant technology used by state and corporate apparatuses. As scholars such as Joy Buolamwini and Timnit Gerbu, as well as the American government's National Institute for Standards and Technology (NIST), have demonstrated, there is strong evidence for the racialized and gendered biases inscribed into FRTs that are then further exacerbated by top-down forms of power in politically-sensitive areas, such as border securitization and law enforcement.[4]

Such argumentation is undoubtedly true while also incompletely describing the ways in which technologies like FRTs are a powerful aid to the creation and management of populations

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[3] Further sources include: Petra Molnar, "Surveillance is at the heart of the EU's migration control agenda," *Euractiv,* September 28, 2021, https://www.euractiv.com/section/justice-home-affairs/opinion/surveillance-is-at-the-heart-of-the-eus-migration-control-agenda/; Corina Petridi, "Greek camps for asylum seekers to introduce partly automated surveillance systems," *Algorithm Watch,* April 27, 2021, https://algorithmwatch.org/en/greek-camps-surveillance/; Raphael Tsavkko Garcia, "Invasive, automated surveillance systems to be introduced within refugee camps in Greece," *The Globe and Mail*, June 7, 2021, https://www.theglobeandmail.com/world/article-invasive-automated-surveillance-systems-to-be-introduced-within/

[4] Joy Buolamwini and Timnit Gerbu, "Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification," Proceedings of Machine Learning Research, 2018, http://proceedings.mlr.press/v81/buolamwini18a/buolamwini18a.pdf; "NIST Study Evaluates Effects of Race, Age, Sex on Face Recognition Software," National Institute for Standards and Technology, December 19, 2019, https://www.nist.gov/news-events/news/2019/12/nist-study-evaluates-effects-race-age-sex-face-recognition-software

defined by racial and gendered difference across the everyday lives of citizens and non-citizens alike.

Consider Apple's Face ID program, begun in 2017: users can utilize FRTs to unlock their phones, an advancement framed by the company as one rooted in convenience and personalized security. Much of the critique of this instance of the technology superficially centred on the technology's ineffectiveness as a functional tool and/or the abilities to "fool" the technology in ways that lessen its effectiveness as a security measure.[5] More importantly, however, the daily act of using one's face to unlock their phone is an example of the ways in which FRTs have crept, stealthy and overtly, into daily life in ways that leverage a user's own participation in the technology to better facilitate activities and/or access to resources in their lives. This normalization of the technology allows greater space for bottom-up forms of power to take hold, wherein citizens become invested in the use, production, and improvement of FRTs. It is increasingly easier to move from the use of FRTs in Face ID to the technology's use in signing into the American Internal Revenue Service's website, unlocking rental cars, and controlling movements on cruise ships, then to more problematic spaces such as the use of FRTs in academic test-taking environments, job interviews, and public housing access.

It is the conflation between consent and coercion in the circulations of both top-down and bottom-up power throughout the whole of FRTs where the concerns of those at refugee camps collides with citizens being asked to participate in the technology to gain access to citizenship resources in their everyday lives. For the refugees in the camps in Greece, they have very little recourse to opt out of participation in biometrics and the collection of their data; in fact,

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[5] As examples: Shubham Agarwal, "Five years later, Face ID is still the iPhone's worst feature," *Laptop Magazine,* June 4th, 2022, https://www.laptopmag.com/features/five-years-later-face-id-is-still-the-iphones-worst-feature; Jason Aten, "If You Really Want to Protect Your iPhone, Stop Using Face ID Now," *INC,* https://www.inc.com/jason-aten/if-you-really-want-to-protect-your-iphone-stop-using-face-id-now.html

consenting to such systems is part of the performance of citizenship that hopeful refugees and immigrants must undertake. Similarly, making one's face recognizable to state apparatuses by way of personal IDs and identity checkpoints is also a performance of citizenship, wherein the visibility of one's face unlocks social and physical mobility, health care, and shelter. Citizens, likewise, are consenting to such facial capturing and use of FRTs with very little alternatives if they wish to receive the resources of citizenship. The normalization of FRT through seemingly innocuous instances like the posting of selfies or the unlocking of one's phone using their face is essential to normalizing such practices such that a citizen not only expects FRTs in certain instances, but desires them for their convenience and efficiency. Importantly, at the same time, the use of FRTs on non-citizens and citizens across a myriad of use-cases provides the potential infrastructure for future crises, wherein the technological capabilities and robust and flexible data practices needed to target nearly any type of individual and population is already in place, waiting.

While the specifics of the Moira Camp and Centaur and the iPhone's FRT capabilities are very different, the underlying vectors of power remain strongly similar: FRTs are a flexible and effective tactic within the large-scale, automated, and decentralized management, monitoring, and control of individuals and populations via the leveraging of acts of political recognition and control of citizenship resources.

FRTs' Three Symbiotic Protocols: Thesis and Original Contribution

This dissertation argues that the collapse of consent and coercion at the core of FRTs is essential to its effectiveness as a political tactic, enabling an incredible adaptability and flexibility brought about by the technology's entwined technical, representational, and political

protocols that target and shape forms of citizenship in order to act as a gatekeeping device for citizenship resources; such guarding becomes heightened during crises, where states of emergency rationalize expansion of technologies like FRTs so as to maintain the health and security of those deploying the technologies. This dissertation presents a unified understanding of the technical, representational, and political protocols with FRTs working symbiotically: the technical protocols draw from vision science rooted in 19th century experimental psychology which have been expanded into deterministic and linear models of vision, powered by advancements in the science of vision, computer science, and computer vision; representational protocols, most overtly present in the facial databases used in machine learning training and operationalizing of the technology, act under predictive logics to categorize and hierarchize the faces under observation into stable data defined by difference; political protocols, in combinations of state and corporate actors under global capitalism, manage and control individuals and populations through the gathering and circulation of facial data and by use of the technology, often in service of a self-perpetuating hegemonic power powered by asymmetrical control of political recognition. Utilizing a variety of archival research, this dissertation's historical focus reconstructs the key constellations of the three protocols within FRTs across the past 200 years. Surfacing the various formations of FRTs show how the technology depends on the circulations of both top-down and bottom-up forms of power: such circuits ensured that the performances of citizenship, in particular those during crisis, are tied directly to forms of facial data enrolment and identification, wherein asymmetrical and algorithmic authority over political recognition are leveraged in ways that collapse forms of consent and coercion within the behaviour of citizens and non-citizens.

Key research questions that this dissertation answers include: What specific forces and histories have produced FRTs' technological and political flexibility and adaptability? In what ways has citizenship and the management of citizenship resources been central to the historical and contemporary development of FRTs? How has past, present and future understandings of mobility as a citizenship resources shaped FRT as a media technology? What role have crises, and the accompanying desires for societal security and health, played in the construction of contemporary FRTs? How have representational, technical, and political protocols worked symbiotically, across two centuries, to produce the current moment of FRTs' tactical use within biopolitical strategies? What are the specific constellations of protocols that enable FRTs to grow into a mass technology with a ubiquitous field of decentralized and automated vision? What resistant practices and theorizing might be most effective in short-circuiting and/or regulating FRTs in near future?

Defining "Protocols"

This dissertation's definition of protocols weaves together the work of Jonathan Crary, Alex Galloway, and Lisa Gitelman. I utilize Crary's understanding of protocols as "rules, codes, regulations and practices…a prescribed set of possibilities…embedded in a system of conventions and limitations."[6] Such a definition must be expanded to digital technologies with Galloway's use of protocols in his text *Protocol* where the operation of such technologies are structured by their protocols, or the rules of possibilities within the programming, software and

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[6] Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge: MIT Press, 1990), 6.

hardware, of the technology.[7] Gitelman then bridges the two thinkers together in arguing that protocols are "the vast clutter of normative rules and default conditions, which gather and adhere like a nebulous array around a technological nucleus"[8]; further, in *Sign, Storage, Transmission*, she pairs her analysis of protocols with documents 'sprawling and low level bureaucratic functioning amongst everyday functions.[9] Taken together, "protocols"encompasses the technical functioning and logics of an assemblage like a FRT (technical protocols) while also capturing the norms it produces via its visualities and image-making (representational protocols) as well as the vectors of power enacted by normative rules and default conditions to produce, improve, and deploy that technology (political protocols).

Facial Recognition is a Vision Problem Before it is a Face Problem

      This dissertation makes novel contributions to the field by taking the historical developments of biology, human vision, and computer vision as one of its central through lines. Doing so explains how FRTs operate as an observer that is a combination of hauntings from 19th century biology and psychology; post-WWII positivistic and cybernetic understandings of human vision; and AI-influenced models of computer vision based on linear and modular understandings of technological observation. This dissertation is unique in providing a history in which thinkers such as 19th century psychologists like Gustav Fechner and Herman von Helmholtz combine with under-examined 20th century thinkers like J.J. Gibson and David Marr to show the ways that truth regimes about vision and, later, computer vision were instrumental to the previous scholarship on mediated vision, scientific discourses, and photographic practices.

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[7] Alexander R. Galloway, *Protocols* (Cambridge: The MIT Press, 2006).

[8] Lisa Gitelman, *Always Already New* (Cambridge: The MIT Press, 2006), 7.

[9] Lisa Gitelman. *Sign, Storage, Transmission.* (Durham: Duke University Press, 2014).

From this, the constellation of political, technical, and representational protocols that construct the history of FRTs should be understood as a history of the ways in which the truth regimes surrounding the science of vision and computer vision has been about quantifying observation such that the relationship between sensation and perceptual processing is isolatable, reconstructable, imperialistic, and stable. Apparatuses based in these preconditions, such as FRTs, are then susceptible to circulations of predictive power and tactical biopolitical deployment that are often in service of self-preserving governmentality, in particular in environments where automated and decentralized control has been rationalized. This dissertation then insists that such technological capture depends upon an understanding of vision, emerging from the 19th century, that enables the sense to be isolated and disembodied in ways that remains core to the technical protocols within contemporary FRTs. It is vision that powers the melding of the protocols within FRTs and vision that grants the technology its wide, adaptable automated field of observation and its powerful gatekeeping capabilities.

The Making of a Mass Automated Field of Vision

Importantly, in order to operate at a mass scale, FRTs oscillate between close-up and zoomed-out forms of observation: this is done by targeting individuals along lines of difference within single facial images, and expanding such vision to applications of automated, decentralized vision at the level of populations; targeting individuals is central to building large-scale vision infrastructures and improving the technology to the point where it can be applied to whole populations. This oscillation fits tightly within contemporary desires for technological scalability: it is a common practice in computer science development to build a prototype, or a small version of a system, in order to test its base functionality. However, the ultimate goal is to

build the ability to scale into that prototype, such that the technology could easily be adapted and adjusted to accommodate an increasingly larger numbers of users. In the case of FRTs, the initial techniques and improvements are often done in small, contained instances, which, once established as effective, are expanded to population-level observation.

It is too simple, however, to say that whatever biases are inscribed at the scale of individual observation are then expanded and deployed at a mass scale. While it is widely accepted that FRTs struggle to identify darker-skinned faces, in particular darker-skinned women, this dissertation explains how such racialized and gendered logics, enhanced by linear and deterministic models of computer vision, are inscribed and perpetuated across generations of the technology such that the history of FRTs are marked by both influential versions that are very poor at identifying darker skinned faces as well as versions that are built in ways that are very effective at identifying non-white faces.

In the first instances, the initial prototypes are, consciously and unconsciously, coded, trained, and operationalized with the white (male) face in mind, most often utilizing technical protocols that produces vision that is better suited to lighter skins; such versions of the technology struggle to identify darker skinned faces because of the absence or dearth of such faces in the system.

However, just as importantly, there are versions of FRTs where marginalized individuals, including those on the fringes of citizenship (such as those labelled criminals and immigrants), become the experimental materials to develop the initial forms of the technology; in these cases, FRTs are actually quite effective at identifying and sorting non-white faces, with the biases of such systems emerging not as much from the technical protocols, but from the representational and political protocols. Drawing from Michel Foucault in his *The Birth of Biopolitics*, these are

examples of the use of liminal populations, those whose human capital is defined by their abilities to aid the life of populations that the State deems worth maintaining/expanding. Liminal populations, such as criminals and immigrants, are deliberately produced by a variety of biopolitical strategies aimed at maintaining precarity for certain populations who are then constantly kept in reserve for experimentation and resource extraction.[10] Within the history of FRTs, liminal populations have been essential to the expansion of the technology's automated field of vision.

In the contemporary moment, FRTs operate at a mass scale, with the entwining of their three symbiotic sets of protocols installed at an incredibly wide array of spaces, where they undertake a stunning variety of tasks. This fact, in combination with the technology's ability to "shift" its biases to value certain faces and devalue others, makes FRTs especially adept at monitoring and managing citizenship resources related to physical and social mobility, wherein the face is targeted as an ever-present identification document, in particular in contested spaces where citizenship is being determined and enforced.

As this dissertation will detail, moments of crisis have been leveraged throughout the development of FRTs to scale up the field of vision of the technology, resulting in the current moment where FRTs act as automated decision makers in an alarming diverse set of instances, ranging from law enforcement and border patrol to monitoring demographic information at mall kiosks and the tagging of friends 'faces on social media.

While prior critiques of the technologies tend to focus on only one of FRTs' three protocols, with the most attention applied to problems of bias, diversity, privacy, and surveillance, this dissertation is unique in its demonstration of how understanding the inseparable

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[10] Michel Foucault, *The Birth of Biopolitics* (New York: Palgrave Macmillan, 2004).

combination of political, technical and representational protocols is essential to producing an informed knowledge of the technology and, in turn, producing a varied and critical toolkit in resistance to FRTs' operationalizing. Doing so makes clear that solutions to the problematics of FRTs must be based in equity, affect, and indeterminacy, acting in ways that are multiple and simultaneous in order to match the technology's adaptive nature. This argument requires treating FRTs as a media technology and interrogating its histories, operations, and deployments, and thus uniting scholarship around computer vision, political science, image-making, visualities, and visual cultures at once.

Summary of Literature Review

Power, Biopolitics and Governmentality

Understanding observation and vision in this way requires this dissertation to explore and define how power circulates within apparatuses like FRTs. As such, this dissertation relies initially on Michel Foucault's understandings of power, and how, with the advent of the nation state in the 19th century, biopolitics were based in discipline that acted to manage individuals and populations through statistical methods of confinement and categorization. Such tactics and strategies acted in accordance with new forms of power based in governmentality, a self-perpetuating principle wherein power, in particular in the form of nation states, acts to remain in power.[11] My Literature Review builds upon this thinking, pulling from thinkers such as Michael Hardt and Antonio Negri, to address how expansion of globalized capitalism in the late 20th

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[11] Michel Foucault, *Security, Territory, Population: Lectures at the Collège De France, 1977-1978* (New York: Palgrave Macmillan, 2007); Michel Foucault, *Society Must be Defended: Lectures at the Collège De France, 1975-1976* (New York: Picador Press, 1997); Michel Foucault, *The History of Sexuality, Volume 1: An Introduction* (New York: Pantheon Books, 1978); Michel Foucault "Governmental Rationality: An Introduction," in *The Foucault Effect: Studies in Governmentality* (Chicago: University of Chicago Press, 1991).

century shifted biopolitics from those based in discipline to those based in control and flow[12]; acting under Mitchell Dean's understanding of international governmentality, such a change depends on the abilities to manage the mobility of individuals and populations, so as to facilitate the movement of resources and people that global capitalism demands.[13] The isolated and linear forms of vision that FRTs provide then become extremely effective tactics within larger biopolitical strategies that are based in what Jasbir Puar calls debility and Judith Butler names as precarity.[14]

The 21st century's expansion of FRTs has been fuelled primarily by crisis and Giorgio Agamben's notion of states of emergency, which in practice have taken the form of the American War on Drugs, 9/11, and, most recently, the COVID-19 pandemic.[15] Drawing from Brian Massumi's work on the predictive logics within ontopower, this dissertation describes how individual instances of crisis allowed FRTs to be installed under rationales of preemptive securitization and societal health, only to be normalized and left in place after the crisis has passed.[16] While early-21st century FRTs were primarily focused on top-down power centred on national borders and security post-9/11, the following two decades has seen the vision and observation enabled by the technologies develop into an extremely widespread tactic used to monitor the mobility of citizens within nation states, relying instead on bottom-up power wherein citizens take on the responsibilities of making themselves legible in exchange for citizenship resources across their everyday activities.

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[12] Michael Hardt and Antonio Negri, *Empire* (Cambridge: Harvard University Press, 2001).

[13] Mitchell Dean, *Governmentality: Power and Rule in Modern Society* (Los Angeles: Sage Publishing, 2010).

[14] Jasbir Puar, *The Right to Maim* (Durham: Duke University Press, 2017); Judith Butler, *Precarious Life.* (New York: Verso Books, 2006)

[15] Giorgio Agamben, *State of Exception* (Chicago: University of Chicago Press, 2005)

[16] Brian Massumi, *Ontopower* (Durham, N.C.: Duke University Press, 2015)

The Rise and Intrenchment of Algorithmic Governance

Addressing contemporary forms of FRTs demands grappling with the construction and deployment of AI and its inclusion into the technologies, in particular with the rise of Big Data practices within the past decade. The current wealth of powerful thinkers on AI, such as Kate Crawford and Tanya Butcher, can be combined with scholars focused on histories of biopolitical statistical management, like Simone Browne and Jacqueline Wernimont, and those writing effectively on race and gender within algorithmic governance, such as Safiya Noble and Virginia Eubanks, to form robust and flexible critical tools.[17] Such Critical Algorithm scholars are essential to understanding how AI and machine learning has come to structure the vision within FRTs. Such thinking is furthered strengthened by those like Kelly Gates, who writes on FRTs directly, and others like Wendy Hui Kyong Chun and Joseph Pugliese who critique the data structures and practices within biometrics.[18]

This dissertation deepens the work done in Critical Algorithm Studies by insisting that FRTs are a media assemblage based in images and image-making. From this, focusing on the representational protocols within FRTs allows for a unified understanding of the three protocols within the technologies that holds its histories in photographic and cinematic practices as core to its contemporary functioning. These histories demonstrate the importance of Nicholas Mirzoeff's

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[17] Kate Crawford, *The Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence* (New Haven: Yale University Press, 2021); Taina Bucher, *If then: Algorithmic Power and Politics* (Oxford: Oxford University Press, 2018); Simone Browne, *Dark Matters: On the Surveillance of Blackness* (Durham, N.C.: Duke University Press, 2015); Jacqueline Wernimont, *Numbered Lives* (Cambridge: The MIT Press, 2018); Safiya Noble, *Algorithms of Oppression* (New York: NYU Press, 2018); Virginia Eubanks, *Automating Inequality.* (New York: St. Martins Press, 2018).

[18] Kelly Gates, *Our Biometric Future: Facial Recognition Technology and the Culture of Surveillance* (New York: NYU Press, 2011); Wendy Hui Kyong Chun, *Programmed Visions: Software and Memory* (Cambridge: MIT Press, 2011); Wendy Hui Kyong Chun, *Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition* (Cambridge: MIT Press, 2021); Joseph Pugliese, *Biometrics: Bodies, Technologies, Biopolitics* (New York: Routledge, 2010)

concept of the right to look within FRTs, where his exploring of the in-built predictive authority within unidirectional biopolitical vision acts alongside Donna Haraway's concept of The God Trick. Thinking alongside these concepts explain the ways in which FRTs generate complexes of visuality where the face is a site of objective indexicality that can then be manipulated, categorized, and sorted, often along lines of racialized and gendered difference targeting liminal populations and in service of governmentality.[19] From this, identity documents, such as driver's licences, VISA materials, and passports, work alongside social media posts and CCTV footage of public spaces to reinforce the normalcy of the technological capture and processing of the face in service of both top-down and bottom-up circulations of power.

Intervening with Critical Posthumanism

Interventions into FRTs must return to Emmanuel Lévinas's writings on the face and to advocating for observation as an exchange that demands the ethical recognition and treatment of those observed.[20] Doing so makes the right to look, the visualities, and the networks of power within biometrics understandable and transparent. These ideas are established in the Literature Review and then are more fully explained in Chapter 6 in relation to the theorizing of Karan Barad and Rosi Bradiotti's critical posthumanism.[21]

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[19] Nicholas Mirzoeff, *The Right to Look: A Counterhistory of Visuality* (Durham, N.C.: Duke University Press, 2011); Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14, no. 3 (Autumn 1988): 575-599.

[20] Emmanuel Lévinas, *Ethics and Infinity* (Pittsburgh: Duquesne University Press, 1985)

[21] Rosi Braidotti, *The Posthuman.* (New York: Polity, 2013). A further explanation of critical posthumanism can be found in the Chapter 6 summary in this introduction and in Chapter 6 itself.

A Three-Pronged Media Archeology as Methodology

Understanding how FRTs came to be and how then to provide interventions into the

technologies requires a methodology that is as flexible and adaptable as FRTs themselves. As

such, beginning to explore the specific vision and observation of FRTs requires a tunnelling into

the apparatuses that the technology is composed of, and understanding a FRT as an assemblage

within a larger composition of other assemblages, each connected by vectors of informational

communication, image-making, and power.[22]

Manuel De Landa's figure of the robot historian, established in his *War in the Age of*

Intelligent Machines, aims to understand technologies, such as computer vision, through their

effects on human evolution via the logical and metaphoric systems assemblages like FRTs

grant.[23] In the case of this dissertation, the key question is: how does seeing and "recognizing" as

a machine influence how understandings of human vision have developed and continue to

develop? Across the development of FRTs, the mechanization of vision via the establishment of

the science of biology starting in the 19th century combined with 20th century computer science

in ways that encourage humans to imagine their own vision systems computationally, and to

understand computational technologies as supra-human in their abilities to transcend those

human abilities. Tracing the history of FRTs, as this dissertation does, therefore requires

retracing the relatively straightforward key landmarks of technical development of the

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[22] While I don't involve him directly, this dissertation owes further debts to Bruno Latour's notion of Actor-Network-Theory (*Reassembling the Social: An Introduction to Actor-Network-Theory* (Oxford: Oxford UP, 2005)). Further, Latour's earlier work, such as *Laboratory Life* (Princeton: Princeton UP, 1986) and *Science in Action: How to Follow Scientists and Engineers Through Society* (Milton Keynes: Open University Press, 1987), were incredible useful in arguing that analysis of scientific discourses is essential to understanding the types of knowledge those acts of science produce.

[23] Manuel De Landa. *War in the Age of Intelligent Machines* (New York: Zone, 1991). I first explained my relationship to De Landa's robot historian and his methodological approach in the introduction to my own *Interfacing with the Internet in Popular Cinema* (New York: Palgrave Macmillan, 2014. 1-26).

technology, but using those developments to uncover the desires and logics that undergirded such developments while simultaneously linking such histories to future projections of what the technology could be in its next iteration.

This dissertation, taking up the challenge of the robot historian, takes a three pronged approach to media archeology in order to best capture the diffuse circulations of power present within FRTs. Such a media archeology leverages the fact that the technology has a long and well-documented technical history of its computational vision and visualities. In turn, documents and developments related to the technical protocols contain within them the mappings of its representational and political protocols. Likewise, materials related to the photographic and/or political protocols often describe the necessary technical protocols needed to operationalize such logics. Taken together, a three pronged media archeology acknowledges that FRTs' development: has relied on various regimes of visuality and image-making, including positivist scientific photographic practices; has depended on the institution and acceptance of citizenship practices and vectors of subjectification that resulted in the normalizing of extractive data mechanisms for both citizens and non-citizens; and has consistently utilized the many private and public surveilling apparatuses that populate the current moment.

My media archeology draws from three braided paths: tracing FRTs in the context of Wolfgang Ernst's understanding of the operative moment which helps to reconstruct the evolutions of technical protocols;[24] utilizing the aforementioned Lisa Gitelman's framing of digital media as structured, maintained and controlled by hegemonic bureaucratic functioning which reveals FRTs' political protocols;[25] and Anna Munster's work wherein intense attention is

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[24] Wolfgang Ernst, *Digital Memory and the Archive* (Minneapolis: University of Minnesota Press, 2013)

[25] Gitelman, *Always Already New.*

paid to the flux of relationships forming and unforming in durational and dynamic pulses within the image-making of technological-biological networks that then form representational protocols.[26] While both Foucault's understanding of an archeological method and Friedrich Kittler's initial conceptions of media archeologies are obviously important, an approach in which these three approaches to media archeology are treated as symbiotic and interdependent allow this dissertation to best address the mix of protocols within the deployment of FRTs.[27]

Wolfgang Ernst follows Kittler's reassessment of Foucault's lack of consideration for the specifics of systems of inscription, storage and transmission within media technologies, but adds the need to understand such technologies on their own non-human terms. As Ernst argues, digital media are defined by mathematical laws that produce techno-mathematical signals in their operative moment that are not perceptible to the human sensorium; therefore, tracking the material history of techno-media objects tends to value humanistic-centric warpings of history, and does not engage with the processual, microtemporal mechanical logics of digital media. His media archaeology, as laid out in *Digital Memory and the Archive*, demands an understanding of the operative moment of a media and the technoepistemological configurations generated in turn. For Ernst, media archaeology is an analytic tool that demands an objective "cold gaze" aimed at digital media technologies 'own in-built temporal logics outside of the effects of human agency. As Ernst's media archaeologist must be computationally competent enough to comprehend the media at their own levels of organization and logic, my background in programming, critical making, and research creation related to FRTs grants me unique insights into the logics of FRTs. While it may be tempting to label Ernst a cold-eyed technological determinist, he does insist that,

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[26] Anna Munster, *Materializing New Media* (Hanover: Dartmouth College Press, 2006)

[27] Michel Foucault, *The Order of Things: An Archaeology of the human sciences* (New York: Routledge Classic, 1966); Friedrich A. Kittler, *Gramophone, Film Typewriter* (Stanford: Stanford University Press, 1986).

despite media technologies 'own autonomous natures, their machine agency does not overpower human agency; instead, such machine agency exists and must be understood precisely, and on its own terms.

Lisa Gitelman insists no media has a natural intrinsic logic; instead, each media must be understood through its protocols 'application to individual and specific bodies and populations, with a media's materiality shaped by social circulation, as well as social and economic forces; in turn, Gitelman's work exposes the deterministic protocols and practices that aim to bureaucratize the embodied experiences within digital media technologies. A media archeology that tracks the evolving variations and deliberate repetitions within both documents and their logics reveal the larger societal forces that shape and define media technologies and, from there, larger organizations, cultural economies, discourses, and truth regimes. Within her media archaeology, materiality exists to facilitate the smooth functioning of larger systems and discourses, making her well suited to this dissertation's discussions of FRTs' political protocols under biopower, ontopower, and governmentality.

Finally, Anna Munster's *Materializing New Media* focuses on the supposed dematerialization of the body within digital media technologies. Her centralizing of the aesthetic experience of media sets her apart from other scholars; too, her embrace of indeterminate human-technological relationships, defined by flows of information, cultural and social deployments, as well as delimitations and regulations distances her from media archeologies that are more friendly to technically-focused discourses. Munster argues that understanding how digital networks structure contemporary digital media technologies requires a comprehension of both human and non-human sensoriums, perceptions, and experiences. Her focus on flux and pulses stands in direct contrast to systems of standardization and homogeneity present within

dangerous algorithmic acts aimed at reducing such embodiment to numerical forces. In combination with thinkers such as Lisa Nakamura and Stuart Hall, this dissertation argues these forces are best captured within the images and image-making themselves, where the interrogation of facial images, and their blends of technological and biological materials, captures the vectors of power and protocols central to such images' representational protocols. Such thinking then allows for understandings of why difference, and in particular racialized and gendered difference, is so key to the production and annotation of facial data within FRTs, where tracing the history of FRTs' representational protocols explains the ways in which bias are so often inscribed into the technology throughout its history.

It is worth stressing again that no one of these three approaches to media archeology on their own is enough to capture the complex circulations of top-down and bottom-up power within FRTs. By constructing and reconstructing the ways in which these three methodological approaches simultaneously overlap grants the most robust tactics and strategies needed to grapple with and intervene into FRTs and technologies like it.

Finally, while Foucualt advocates focusing on "ruptures" in how he exposes the constellation of actors, actions, and discourses surfaced within a technology's development, this dissertation is most interested in searching out how power, through digital media apparatuses, reacts to ruptures and moves to combat such instability with corresponding vectors of uniformity and standardization. If governmentality is invested, above all else, in the perpetuation of its own existence, then building media archeologies based around the homogenizing responses to ruptures will make visible the apparatuses that aim to reduce nature and whole populations to stable materials which then smooths the centralizing and consolidation of power, in particular

within nation states. This dissertation insists that such stabilization often leverages vectors of citizenship, precarious populations, and the management of citizenship resources.

Importantly, however, governmentality is also an open and dynamic game, and therefore power is not fixed and is always vulnerable; revealing how power acts in response to, or in anticipation of, a threat and/or rupture also makes visible the mechanisms and possibilities for further resistance and intervention under a critical posthumanism.

Chapter Summaries

The following chapters each take up, in some form, the constellations of technical, representational, and political protocols within FRTs across various points in the technologies' histories. Doing so makes clear how FRTs act along vectors of power attached to citizenship in order to act as biopolitically-minded gatekeepers of citizenship resources, in particular social and physical mobility. As this dissertation will describe, such networks and assemblages are particular potent during moments of crisis and states of exception, with the last two decades of the technologies' development being defined largely by post-9/11 applications of ontopower and then the transition of the technology to the everyday lives of citizens via advancements in Big Data and machine learning.

Doing so, however, requires a detailed understanding of how FRTs vision and its visualities are formed. From a technical standpoint, this means answer the question of how a FRT "sees" and "recognizes". Further, once a reader understands a FRTs' linear computational pipeline, how does such knowledge shed light on how bias and "errors" are consciously and unconsciously developed and cemented within the technology? As such, Chapter 2, "The Operative Moment of a Facial Recognition Technology," draws heavily from Ernst by re-

creating the operative moment of a FRT in order to show how the technology, and its image-making and observation, is a combination of its technical, representational, and political protocols. Because of this, solutions to the "errors" and biases of FRTs based in diversity and/or privacy are often misguided and ineffective as they typically address only one of the three protocols, most often focusing on technical protocols. This chapter sets up one of the core arguments of this dissertation: the interweaving of these protocols and its production of operative images defined by image-making and data practices steeped in difference provides a core flexibility and adaptability to FRTs that allow for it to be tactically deployed with a wide array of biopolitical strategies.

Understanding the operative moment then allows for the following chapters' establishment of FRTs as an especially effective technology within the creation of citizenship and the management of citizenship resources. Key questions then emerge: beginning in the 19th century, who were the key figures of vision science and how did they work contribute to the technological-mediation and/or the mechanizing of human vision? In what ways did the arguments for understanding vision as a mechanized process lend itself to political and representational protocols that allowed FRTs to expand to a mass technology by way of leveraging aspects of citizenship? Chapter 3, "Francis Galton and Establishing Biopolitical Vision and The Conflation of Consent and Coercion in the 20th Century" utilizes unique archival research from the Francis Galton Papers (The National Archive, London, U.K.) to examine the ways in which 19th century vision science was tethered to image-making, in particular image-making within scientific discourses, to recreate FRTs emergent histories that were rooted in photographic practices within medical treatments and law enforcement. Stemming from these practices, this chapter then tracks the 19th and early 20th century development of FRTs and their

image-making in order to show the ways in which the conflation between coercion and consent within the technology was established, in particular through the establishment of identity documents such as passports and driver's licenses. This thinking then sets up future chapters' discussion of Big Data practices and the expansion of the technology to a mass scale. Yet, such a conflation also demonstrates one of the core problematics of the technology and its use: the dialectic of recognition within FRTs ensures that political recognition, and therefore access to citizenship and its resources, is asymmetrically controlled by the deployment of tactics such as FRTs.

By understanding the groundwork that the establishment of identity documents provided, how did computer science automate and further expand the pre-WWII desires explained in Chapter 3? How was vision science, like that done by Francis Galton, carried forward and evolved by the extreme growth of computer science post-WWII? What were the key political forces at play that established the bedrock of FRT infrastructure at the end of the 20th century that was then so crucial to the technologies explosion post-9/11? Chapter 4, "Infrastructure, Vigilance, Interdiction: the Automating and Decentralizing of Facial Recognition Technologies post-WWII" outlines how the integration of digital computing into FRTs in the decades between WWII and 9/11 installed forces attached to national and individual vigilance and would form the basis for the combination of simultaneous top-down and bottom-up forms of power that moved FRTs from a technology based in pre-WWII human-centric forms of identification and verification to an automated and decentralized FRT assemblage that gatekeeps citizen resources, primarily mobility, at a mass scale. Doing so reveals the shift from biopolitics of discipline and containment to those of control and flow, and the ways in which FRTs fit within new regimes of interdiction, or the ability to observe objects and populations without interrupting their

movement. This chapter utilizes two main cases studies. The first is the first public demonstration of an FRT at the 1970 Osaka World Fair and includes a previously-untranslated account of the exhibition and its impacts. This chapter's second case study of the FERET database, and the later Face Recognition Vender Tests (FRVTs), emerges from the argument that the 1980s American War on Drugs was the crisis that necessitated the deeply influential infrastructures for building and testing FRTs that were developed in the 1990s. Such infrastructure would act as one of the primary definers of the technical, political, and representational protocols that would be enacted in reaction to 9/11.

From this chapter, further questions emerge: how has understandings of crisis within biopolitical management formed crucial truth regimes and justifications for FRTs extreme proliferation in the 21st century? In what ways did key developments in machine learning and AI dovetail with logics and data practices engrained by 9/11 securitization? How did such constellations of protocols spring into effect during the COVID-19 crisis? Chapter 5 "The Face Under Crisis: From 9/11 to COVID-19" details how 9/11 became an incredibly coherent catalyst for the expansion of the technology, as its crisis nature elevated the applications of ontopower, or power based in the preemption of threat, under ongoing states of exception. This permanent state of crisis provided the rationales for the integration of FRTs into the everyday acts of management of citizenship which, in turn, laid the foundation for the 2010s acceleration of Big Data practices. Working symbiotically, the extraction of massive amounts of facial data under surveillance capitalism combined with enhanced machine learning and improved technical protocols to produce the expansive and wide-ranging automated field of vision that characterizes contemporary FRTs. From this, when the crisis of the COVID-19 global pandemic struck, the vectors of power and protocols established prior to the pandemic provided the support needed to

quickly solve the problem of occluded faces caused by mask wearing, further strengthening the potential tactical value of future FRTs. This chapter underlines that such a solution is emblematic of assemblages are built, improved, and deployed under self-perpetuating governmentality and points towards the future of how FRTs will continually adapt.

The final chapter, "Intervening into the Protocols of Facial Recognition Technologies," details the critical counter-tactics needed to effectively intervene into technologies like FRTs' wherein the targeting of the representational, political and technical protocols must be undertaken at once and in concert. Central questions include: what technically-minded tools most effectively short-circuit FRTs' automated vision? What might be the most adaptive forms of regulation of FRTs? In what ways is art-making a core part to building imaginaries in opposition to FRTs' biopolitical vision? Chapter 6 gives examples of how contemporary countervisualities have developed, taking the form of technical tools, artworks, and political policies. This detailing of resistant practices stresses that because of FRTs' adaptive nature, there is no one solution to the diffuse circulations of power enacted by technologies like FRTs; instead, a wide variety of counter-logics and tactics must be deployed in order to act effectively in the give-and-take game of governmentality. This chapter sharpens Braidotti's critical posthumanism by focusing on affect and indeterminacy as the way to consistently short-circuit FRTs.

Conclusion: The Further Horizons of FRTs

There is a tremendous need to imagine what the future of FRTs, and other AI-enabled technologies, might look like and the ways in which they might be used. As the Coda to this dissertation outlines, the rise of autocratic governments within the global landscape, combined with current and future crises such as climate catastrophe and the global COVID-19 pandemic,

demands that tools and counter-tactics provide the groundwork for future countervisualities and interventions into the coming as-yet-unrealized deployments of FRTs. As the example of the Moira Camp illustrates, FRTs are bound up in discussions of democratic governance as much as they are central to the managing of future mass migration caused by rising sea levels and chaotic weather systems. Alongside this, the expanded use of FRTs in the management of citizenship resources and the normalizing of the face as data-object, by signing into one's phone with one's face for example, means that the infrastructures for further ontopower and biopolitical control are already in place, potentially ready to be activated with the next crisis. As such, producing alternate futures and imaginaries now are incredibly necessary acts that look to the horizon and beyond in order to combat current applications of FRTs, while also preparing for the inevitable future expansion of problematic operationalizing of the technology.

CHAPTER 1:
LITERATURE REVIEW

In exploring the historical formations and contemporary moments of vision and observation within facial recognition technologies (FRTs), this dissertation requires a wide-ranging literature review. It begins by understanding how power circulates within biopolitical instances of governmentality, and how such circulations have changed over the past two centuries to focus on predictive logics often operating under securitization. The vast improvement of artificial intelligence (AI) in the 2010s, in particular via computational neural networks, requires contemporary scholarship that brings this dissertation into the current moment of Big Data, Critical Algorithm Studies, and algorithmic governance. Doing so brings the reader to the end of the Literature Review which identifies Donna Haraway's God Trick and Nicholas Mirzoeff's "right to look" as structuring some of the most harmful power dynamics within FRTs biopolitical vision.[28]

Power, Biopolitics and Governmentality

The establishment and circulations of power around the production of citizenship is crucial to understanding the ways that FRTs are utilized in the contemporary moment, where biopolitical and necropolitical management is central to the development and deployment of the technology.

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[28] Haraway, "Situated Knowledges"; Mirzoeff, *The Right to Look.*

Power

Power, for Foucault, is defined by its polymorphic, simultaneous, networked nature.

Foucault explains in *Security, Territory, Population*, that "power is not a substance, fluid or

something that derives from a particular source"[29]; in this, power is always relational and never

centralized. Understanding power means tracing how forces connect and relate by analyzing and

critiquing mechanisms, effects, and power-apparatuses as they interact with each other. Such

functioning produces an apparatus of power that also operates as a sets of discursive practices

that often hinge on logics of difference, in particular the normal and the abnormal, which

deliberately target the body. Colin Gordon summarizes this in *The Foucault Effect,* writing that

although Foucault acknowledges that power is omnipresent, power is never fixed nor closed, but

is an "endless and open strategic game."[30] Additionally, as Gordon's introduction to *The*

Essential Foucault explains, power does not belong to any specific regime and that the

techniques of power are not inherently evil nor bad, but are dangerous if left unexamined and

treated as invisibly neutral.[31]

In *Society Must Be Defended*, Foucault states that power can be understood only by

looking at the lowest levels of its application, and by tracking its circulation through interwoven

apparatuses, tactics, and strategies, with the individual body acting as a relay in such networks.[32]

This is exactly the types of dynamics which Foucault understands as linking notions of

citizenship to larger strategies of subjectification. In "The Subject and Power" Foucault names

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[29] Foucault, *Security, Territory, Population,* pp. 16.

[30] Colin Gordon, "Governmental Rationality: An Introduction" in *The Foucault Effect: Studies in Governmentality* (Chicago: University of Chicago Press, 1991), 5.

[31] Colin Gordon, "Introduction" in *Michel Foucault: Power - The Essential Foucault* (New York: The New York Press, 1998), xix; xv.

[32] Foucault, *Society Must be Defended.*

the three objectivities that produce subjects: "the first is the modes of inquiry that try to give themselves the status of sciences" (for example, "the objectivizing of the sheer fact of being alive in natural history or biology"); the second is what he calls "dividing practices" where "the subject is either divided inside himself from others" (for example, "the criminals and the 'good boys'"); and the third is the ways in which the human being turns themselves into a subject (for example, "how men have learned to recognize themselves as subjects of 'sexuality'") which Foucault explains, in his late-in-life works, as technologies of the self.[33] Power, for the subject, is not just found in dramatic forms of subjugation and domination, but also circulates through everyday life at the site of the subject's body, applying itself to daily activities in ways that compel the subject to affirm their subjecthood. In *Psychiatric Power*, he names such constellations of forces the microphysics of power, with different strategies and tactics, some at the macro level of power, others at the micro level, acting as mediators between the two.[34] While top-down, macrophyscial forms of dominant power, in the form of security, health and/or surveillance obviously deserve attention, so too, Foucault argues, must power be identified in the ways in which subjects are formed from "a multiplicity of organisms, forces, energies, materials, desires, thoughts" in bottom-up, microphysical forms of power.[35]

This dissertation's insists that FRTs' circulations of power grow from the history of the conflation between coercion and consent formed by citizenship practices found within the

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[33] Michel Foucault, "The Subject and Power," *Critical Inquiry* 8, no. 4 (Summer, 1982): 785. He explains further that "[the] form of power that applies itself to immediate everyday life categorizes the individual, marks him by his own individuality, attaches him to his own identity, imposes a law of truth on him that he must recognize and others have to recognize in him. It is a form of power that makes individuals subjects." Further insight was drawn from Paul Rabinow in the section "The Problem of the Subject" (in *The Foucault Reader* (New York, Pantheon Books, 1984), 8-11).

[34] Michel Foucault, *Psychiatric Power: Lectures at the Collège de France, 1973–1974* (New York: Picador Press, 2008)

[35] Michel Foucault, "Two Lectures" in *Power/Knowledge: Selected Interviews and Other Writings 1972-77,* ed. Colin Gordon (New York: Random House, 1980), 97.

technology's extractive data practices and its ubiquitous deployment under an extreme variety of use cases. The making of subjects, by both external and internal forces, is essential to citizenship, where governance of a population depends upon individuals regulating themselves in a bottom-up manner alongside the application of top-down actions and strategies from larger actors like nation state governments. Simply put, the effective deploying of technologies like FRTs at the scale of population requires individual citizens to contribute to their deployment. The blurring of consent and coercion is made more complex by the notion of individual and collective vigilance and enmity that has pulsed through the histories of FRTs, found within the Cold War, the War on Drugs, and 9/11 predominately. Such vigilance and enmity embeds national security logics into the subject such that they are each tasked with looking suspiciously at others while also allowing such vision to fall upon themselves in order to prove themselves innocent. These forces are heightened during moments of crisis, where the polymorphic forms of top-down power meld completely with bottom-up forms such that every large- and small-scale apparatus is responsible for maintaining governmentality.

The images and representational protocols incorporated into, and produced by, FRTs are a prime example of a mediation between micro- and microphysics of power, wherein the action at the site of the body is mirrored by actions at the level of large-scale governance. Exploring the image-making and visualities of the technology showcases the many different sites of power that arise within the technologies 'applications and its dangerous adaptability. The networks of power which produce the problematics of the technology do not stem solely from FRTs 'technical, political, nor representational protocols alone; instead, all three are inseparable, and indivisible from truth regimes based in difference and hierarchization. Taken together, these vectors

manifest a form of vision that targets the face under biopolitical logics and governmentality which foster life for some and precarity, debility, and death for others.

Biopolitics and Governmentality

Biopolitics, Foucault argues, is one of the main structuring elements of power beginning in the 17th and 18th century arising from the key cesura separating sovereign power from power that becomes situated in a governing liberal nation-state: life and death, under this new liberal paradigm, was governed by power that aimed to positively influence, optimize, and multiply life by way of administering life; this management of life took the form of expansive controls and regulations wherein the sovereign power "to take life or let live" is transformed into the power to "foster life or disallow it to the point of death."[36]

Foucault is careful to stress that this key shift in power is not the result of a teleological progression, and must be understood as simultaneous historical events tied to the emergence of modernity, and the subsequent rise of governmentality. Governmentality is a neologism that Foucault utilizes to explain the shifts from sovereign power to state power and the governmentalization of the state into the administrative state. The logics of governmentality are rooted in thinking like the 1798 *An Essay on the Principle of Population* by Thomas Malthus: not only does Malthus capture the statistical tactics and logics of biopolitics as enacted by a governmentalized administrative state, but his focus on biological reproduction and resources align themselves with a biopolitical focus on the management of life.[37] Governmentality is the improvement of conditions for the population within which the state embodies a series of

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[36] Foucault, *The History of Sexuality,* pp. 137-138.

[37] Thomas Malthus, *An Essay on the Principle of Population* (London: J. Johnson, 1798)

rationales, strategies and tactics that then form practices to manage populations. Rhetoric and logic like Malthus's were key to the emergence of governmentality: nation-state governance is similar to sovereignty in its aim at the individual, but expands by including population via the development of statistics and demographics (the science of state). The production of knowledge aimed at populations, makes governmentality, and its biopolitics, a key break from prior regimes of sovereign power.

Foucault argues however, and most importantly, that within governmentality, the state has its own self-interested self-preservation at the heart of all its tactics and practices. Within his lecture *The Birth of Biopolitics*, he argues that governmentality, as an application of power, is conservative and serves its own continued existence and power above all else. Governmentality then becomes an open and ongoing game wherein the State aims to maximize its own strength and minimize threats to its existence.

Thomas Lemke's work in *Foucault's Analysis of Governmentality* details this more thoroughly, moving from Foucault's writing on discipline, to the modern state, to the government of individuals under neoliberalism.[38] From his perspective, Foucault argues that the nation state in not an all-powerful repressive form; the state is a product of those relations and itself is constantly in flux. Because the state is not universal nor neutral, is not a given and historical fact, any understanding of a "state" is instead an understanding of a "state effect," of a truth produced to define that state. Extending from this thinking, Nikolas Rose, Pat O'Malley and Mariana Valverde take up the key objections to Foucault's explanations of governmentality, including its totalizing nature, its neoliberal leanings, and its lack of room for resistance. But, the authors

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[38] Thomas Lemke, *Foucault's Analysis of Governmentality* (New York, Verso Books, 2019)

ultimately stress that the analytics of governmentality is simply a part of a theorist's toolbox, not to be applied completely and fully.[39]

The section "The Problem of Government" within Paul Rabinow's introduction to the 1984 *The Foucault Reader* is one of the earliest and clearest texts connecting governmentality to biopolitics and biopower.[40] Within the constant flux of governmentality, biopolitics, and biopower, the management of life is core to the production of objects of knowledge and new bodies of information: the balancing of interests so as to reaffirm the state's own power and existence meant deploying technologies of power aimed at the reproduction of individuals and populations (biological life) and the managing of resources for those same individuals and populations (qualities of life) via the creation, re-creating and distribution of various state effects, truth regimes, and verification mechanisms centred on the management of life. From this perspective, biopolitics are a distinct combination of micro- and macro-physical powers, subjectification, and the simultaneous political management that undertake, simultaneously, the disciplining of the individual into a subject and the regulating of the population such that groups of people can be regulated via mechanisms and interventions centred on notions of security (like insurance, forecasts, estimates, surveillance).

At the site of the individual, the body is targeted by disciplining mechanisms and treated mechanically, with biopolitical tactics deployed to make the individual docile and useful, efficient and adhering. At the site of population, population is targeted by mechanisms of security wherein the continued biological existence of the species of man becomes the stakes of power; the ability to expose whole populations to death, while also administering life to other

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[39] Nikolas Rose, Pat O'Malley and Mariana Valverde, "Governmentality," *Annual Review of Law and Social Science*, no. 2.1 (2006): 83-104.

[40] Paul Rabinow, "Introduction" in *The Foucault Reader,* ed. Paul Rabinow (New York, Pantheon Books, 1984), 3-30.

populations, is key. At the same time, forces of subjectification, operating in bottom-up forms of power, encourage individuals to regulate themselves in ways often aligned with actions and strategies from larger actors like nation states.

Approaching the Year 2000, The Rise of Biotechnology, and Confronting Globalization

In the roughly two decades after Foucault's death, two main schools of thought arose around the concepts of biopolitics and their relationship to governmentality. First, there are those, like Rabinow and Rose, who took up the advances in 20th century scientific knowledge that fundamentally altered the concept of life itself. For these scholars, Foucault's earlier works, like *The Birth of the Clinic* and his understanding of "the clinical gaze," are repeatedly gestured to as core to their arguments. For this first group, the biopoltical alterations to the concept of life are best captured by the Human Genome project and the increased interpenetration of "unnatural" technologies into human life that they contend Foucault did not anticipate. From this perspective, scholars like Rabinow and Rose see biopolitical tactics as being re-centred around administration by medical authorities rather than nation-states, who then produce truths, strategies, and tactics aimed at the optimization of life.[41]

The second group of thinkers, which are more influential on this dissertation, are not binary nor entirely oppositional to the first group in that they all share the examination of the governing of populations and the rationales that dictated larger decisions about national security, health, and education (as just three examples). However, the second group of thinkers focus on

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[41] Texts that are indicative of this first understanding of biopolitics include Paul Rabinow's *Essays on the Anthropology of Reason* (Princeton, NJ: Princeton University Press, 1996); Nikolas Rose's *The Politics of Life Itself* (Princeton, NJ: Princeton University Press, 2006) and the essay Rose wrote with Carlos Novas titled "Biological Citizenship" (*Global Anthropology*. (New York: Blackwell, 2003)); Stephen Rose's *Biology Beyond Determinism* (Oxford, EN: Oxford University Press, 1998); and Hilary and Stephen Rose's" The Changing Face of Human (Nature." *Daedalus,* 138.3(2009): 7-20).

how biopolitical governmentality produces the death and near-death of certain populations so as to foster and strengthen the life of other populations. Generally, this group of scholars tend to focus more on Foucault's trio of later lectures *Security, Territory, Population, Society Must Be Defended,* and *The Birth of Biopolitics*.

One of the primary scholars in this part of the field is Giorgio Agamben and his concepts of "bare life" in *Homo Sacer* and "the state of exception" from his *State of Exception*.[42] Key to the emergence of biopolitical governmentality, Agamben argues, is the politicization of bare life which dangerously blurs the rights and dignity afforded another living human with the rights and resources that are granted to a citizen. This blurring then makes it so that bare life "vanishes into the figure of the citizen."[43] Agamben adds to this theorizing in his book *State of Exception*. Resulting from political crisis and emergency, the state of exception is the necessary suspension of normal conditions of jurisprudence in reaction to an emergency to the State and its citizens. Leveraging Foucault's understanding of mechanisms of security within biopolitical assemblages, Agamben argues "necessity" and "crisis" are subjective terms, and, as such, the deployment of the state of exception is similarly subjectively enacted. Agamben warns of nation states run under a permanent state of exception, wherein permanent extreme conditions become a tactic of governmentality that then has the potential to expand and exact biopolitical violence.

Similar to Agamben's post-9/11 struggles with biopolitics and governmentality in an increasingly globalized world, Hardt and Negri's Marxist analysis in both *Empire* and *Multitude* grapples with the nation-state's shrinking influence and the rise of what they call "Empire."[44]

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[42] Giorgio Agamben, *Homo Sacer: Sovereign Power and Bare Life* (Stanford, CA: Stanford University Press, 1998); Agamben. *State of Exception.*

[43] Agamben, *Homo Sacer*, 127.

[44] Michael Hardt and Antonio Negri, *Empire.* (Cambridge, MA: Harvard University Press, 2001)

Writing from the nexus of Gilles Deleuze and Foucault, the authors use the concept of Empire to encapsulate the move from nation-state driven imperialism to a global, supra-national entity that enacts power in a paradigm beyond national boundaries that rises out of modern capitalism, world markets, world economies, and globalization. Importantly, Empire is encapsulated within the central drive of governmentality in that Empire is rationalized by its a continuous call to its own existence and authority. Empire then forms and maintains itself, like Agamben's theorizing into the state of exception, on the grounds of crises.[45]

Post 9/11, The Rise of Dense Digital Networks, and Indeterminate Systems of Affect

Increasingly nuanced treatments of biopolitics and governmentality emerged after the turn of the millennium, spurred by the first widespread English translations of many of Foucault's lectures at the Collège de France. These accounts were driven further by the exponential increase in digital networks and the globalizing aftermath of the 9/11 terrorist attacks.

Alongside the explosion of digital technologies and networks, 9/11 inaugurated a concerted global War on Terror. In their introduction to *Foucault in an Age of Terror,* Stephen Morton and Stephen Bygrave echo Lemke when they contend "biopolitics and governmentally is becoming increasingly inadequate to describe the complexity of contemporary forms of sovereign power and biopolitical control"; the authors are particularly concerned with how this power and control exists under unending rationales of emergency post-9/11.[46] In his 2010 second

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[45] Roberto Esposito's work in *Bíos: Biopolitics and Philosophy* (Minneapolis: University of Minnesota Press, 2008) and Paolo Virno's *A Grammar of the Multitude* (Cambridge, MA: Semiotext(e), 2004) should also be included in this grouping. Esposito's work is taken up in more detail in Chapter 5's discussion of the biopolitics around the COVID-19 pandemic.

[46] Stephen Morton and Stephen Bygrave, "Introduction" in *Foucault in an Age of Terror: Essays on Biopolitics and the Defence of Society,* eds Stephen Morton and Stephen Bygrave (New York, Palgrave Macmillan, 2008)

edition of *Governmentality: Power and Rule in Modern Society*, Mitchell Dean adds a chapter titled "International Governmentality" that addresses Hardt and Negri's arguments about the governing principles of contemporary nation-states, in particular those at war in a globalized environment.[47] While Dean does argue that contemporary governmentality is more globally-centred than that of a 19th century nation state, necessitating the inclusion of strategies and tactics that allow the state to continue to exist in a globalized world, the basic mechanisms and desires of governmentality remain: the art of governing still targets, above all, the preservation of the state. However, post-9/11 in particular, such a governmentality has deepened its commitment to strategies and mechanisms centred on security, both internal to itself (i.e. within its own borders) and external, in relation to other nation states and groups. This focus on security aims most at controls and regulation around "circulation" (of people, resources) such that the state is as stable and balanced as possible; such stability is produced by making populations, forces, and individuals knowable and actionable by way of deterministic systems of algorithmic and statistical thinking. Within this increased focus on security, the most dangerous components of the state's relation of forces are those that are deemed chaotic. Contemporary governmentality is then characterized by the flux between insecurity and security, stable and chaotic, that then also dictates much of the theorizing into biopolitics which pits governmentality's rationales towards determinism against indeterminate systems of bodily affect.

Judith Butler's *Precarious Life* speaks from within American (national) grief, fear, "injurability," and aggression in identifying the 20th century American fantasy of total and final global control.[48] The biopolitics and governmentality that she finds most troubling then is based

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[47] Mitchell Dean, *Governmentality: Power and Rule in Modern Society.* (Los Angeles, CA: Sage Publishing, 2010)

[48] Butler. *Precarious Life.*

in the precarity, to the point of erasure, that some individuals and populations are managed towards, in order to generate and maintain life for other individuals and populations, often through aggrieved nationalism. Butler's notions of "injurability" and precarity is expanded further by Jasbir Puar in *The Right to Maim*[49]*:* she frames the two main metrics of power present in their notion of biopolitics as metrics of debility and capacity. Puar then identifies the right to maim, via technologies of security, that aim to debilitate, disable, and injure populations so that those populations can be deterministically measured, controlled and folded into other parts of a biopolitical economy and system. Echoing Butler, these systems and economies are managed such that certain individuals and populations are vulnerable to maiming, "a practice of rendering populations available for statically likely injury."[50]

Mbembe's essay "Necropolitics," explores the building of contemporary enmity and precarity by focusing on states of injury and colonialism. He resets Foucauldian biopolitics on the basis that biopower's focus on life does not address the complex forces dedicated to the management of death for individuals and populations.[51] Within an era of contemporary governmentality heavily centred on security, he tracks necropolitics, which he defines as the targeting of an enemy, not just for precarity and/or erasure as Butler argues, but for murder under the guise of war and/or resistance. This dynamic, Mbembe argues, is especially clear within the specific and unique biopolitics of colonialism which operate on logics and rhetorics enabled by segmentation and deterritorialization. Such logics are centred upon extracting resources and scattering populations across states to further their isolation and precarity; this further illuminates

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[49] Puar. *The Right to Maim.*

[50] Ibid., xvii-xviii.

[51] The term necropolitics was established in Achilles Mbembe's "Necropolitics" (*Public Culture*, 15 no. 1 (2003): 11-40) and expanded further in his *Necropolitics* (Durham: Duke University Press, 2019).

the chaos-stability dynamic of international governmentality, wherein certain populations are managed such that they are made chaotic in order to justify stabilizing rationales that further the nation state's own larger existence.

Further considerations of citizenship practices, in particular those around immigrants and refugees are core to this dissertation. As such, essays like Marisela Montenegro, Joan Pujol, and Silvia Posocco's "Bordering Exclusions and Necropolitics" are essential, where the authors contend that Foucault's writing on biopolitical governmentality needs further sharpening to address mass migrations and migrant expendability and death.[52] Necropolitics is most clearly demonstrated, the authors contend, by the construction, and enforcement of virtual and physical borders and territories that classify and hierarchize population. Such borders and territories target the mobility of populations, producing bodies that cannot circulate and are therefore left to let die.

Like Butler, Mbembe, and Puar, further scholars take up biopolitics and international governmentality with the understanding that not all forms of life are equal. This scholarship uncovers heteropatriarchal, white-supremicist, and/or settler-colonial power that, in turn, demand greater parsing of the "life" in biopolitics and the unique death, disability, and/or racialized tactics and strategies of governmentality. In *Habeas Viscus,* Alexander G. Weheliye provides a closer examination of racializing assemblages that make clear the gap in Agamben's and Foucault's systems of thought that do not fully address the "alternative modes of life alongside the violence, subjection, exploration and radicalization that define the modern human."[53]

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[52] Marisela Montenegro, Joan Pujol, and Silvia Posocco., "Bordering, Exclusions and Necropolitics," *Qualitative Research Journal* 17, no. 3 (2017): 142-154.

[53] Alexander G. Weheliye, *Habeas Viscus* (Durham: Duke University Press, 2014), 2.

Weheliye argues then that race must be placed at the centre of all considerations of political

violence so as to grapple with race as "a set of sociopolitical processes of differentiation and

hierarchization, which are projected onto the putatively biological human body."[54]

While Weheliye takes up biopolitics primarily as it relates to the American history of

slavery and Mbembe argues mostly from the context of the colonization of Africa, a number of

scholars address contemporary biopolitics and governmentality from within the structure of

settler colonialism. Most scholars in this vein reference Patrick Wolfe's notion of the "logic of

elimination": recalling, necropolitical drives, this settler colonialism logic is driven by

acquisition of territory and should be recognized as "a structure not an event," an ongoing

structure of interlocking practices, assemblages, tactics, and logics.[55] Scott Lauria Morgensen

agrees that settler colonialism is built on the elimination/genocide of Indigenous people as a way

of clearing space (and resources) that are then occupied (taken); as such, both Agamben and

Foucualt's earlier notions of biopolitics are incomplete because they situate colonization as a past

event, rather than an ongoing naturalized set of activities and laws.[56] This is further explicated by

Mark Rifkin in "Indigenizing Agamben": Indigenous life and sovereignty are then constantly set

within Agamben's state of exception wherein any recognition within the settler colonial juridicial

system only serves to erase and/or marginalize that population. Similar to Empire and the state

within international governmentality, he sees such strategies and tactics as reinforcing the settler

colonial state's own existence.[57]

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[54] Ibid., 5.

[55] Patrick Wolfe, "Settler Colonialism and the Elimination of the Native," *Journal of Genocide Research* 8, no. 4 (2006): 387-409.

[56] Scott Lauria Morgensen, "The Biopolitics of Settler Colonialism: Right here, Right Now," *Settler Colonial Studies: A Global Phenomenon* 1, no. 1 (2011): 52-76.

[57] Mark Rifkin, "Indigenizing Agamben: Rethinking Sovereignty in Light of the 'Peculiar' Status of Native Peoples," *Cultural Critique* 73 (2009): 88-124.

This dissertation's critiques of FRTs as automated gatekeepers of citizenship resources depends upon the understand that biopolitics' and governmentality's primary impulses are towards stability, visible and reproducible knowledges and truths, and an overall determinism. FRTs therefore depend on the fluctuating game of international governmentality and biopolitical power, both of which operates to make itself appear natural, stable, and determined through: predicative algorithms that categorize populations and individuals; an overabundance of hierachizing statistics; and risk-driven policies, tactics, and strategies of security. In turn, the power found within FRTs and other biometric tactics is rationalized and executed by marginalizing and/or eliminating entities that are viewed as chaotic and indeterminate, and whose relational and networked relationships do not fit within the deterministic, predictive and categorizing logics of a self-perpetuating governmentality.

Risk, Preemption, and Ontopower Under Contemporary Biopolitics and Govermentality

As biopolitics in the new millennium completed its move from strategies of discipline to those of control and flow, Brian Massumi argues that a unique form of consolidated power has moved to the centre of Western governmentality based on logics of preemption, which he names ontopower.[58] Although the notion of preemption is transhistorical, the rise of ontopower in the 21st century produces operative logics that evolved from logics of deterrence in the Cold War and, while it does not replace other forms of power such as biopower, its focus on prevention makes it always future-facing and predictive. Massumi links his work to that of Foucault's in that ontopower blends effectively with biopolitics of control, in particular within tactics like FRTs, wherein the predictive logics of ontopower come to be installed in decentralized and automated

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[58] Brian Massumi. *Ontopower.*

systems that are able to govern remotely by way of both interrogating those under its gaze while also maintaining the flow of goods and populations. In this way, ontopower strengthens truth regimes that aim to sort and reaffirm citizenship, wherein access to a citizenship resource is not just tied to whether an individual or population is deserving of resources, but also whether they will be deserving in the future.

Echoing Agamben's state of exception, ontopower relies upon uncertainty and the potential of threats and the risks attached. Rather than be causal, such power acts in the present via the presence of a future threat, thereby existing in a perpetual state of potential emergency. Importantly, like governmentality, ontopower is self-perpetuating, invested in the constant renewal of endemic potential and the production of precarious populations that takes the form of "the suddenly irrupting, locally self-organizing, systemically self-amplifying threat of large-scale disruption."[59] The production, renewal and proliferation of threats allows ontopower to spread to the entire field of life of a society, wherein the complex non-linear causation of future crises and their states of exception exist as a background condition thereby justifying any number of strategies and tactics, often targeting liminal populations, to meet such imagined futurities.

Under Empire, state power and governmentality fuse with other reciprocal regimes of power, such as predictive ontopower and capitalist processes, to produce systems that offer real and/or illusionary stability; at the same time, forces of subjectification invest citizens and non-citizens with vigilance and responsibilities to perform and maintain their citizenship in ways that serve that ontopower and biopolitics under governmentality.

Ontopower works well alongside Puar's, Mbembe's, and Butler's thinking around biopolitics: the circulations of ontopower allow for a focus on future-facing logics that

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[59] Ibid., 22.

preemptively identify enemies, in part by expanding its field of power to include all of citizen life. Once this expansion has taken place, the strategies and tactics that identify, measure, and control those deemed threats, such as FRTs, can also be used to predict and produce precarity, debility, and/or identify "risky" populations. Operating under ontopower and biopolitical strategies, FRTs, when enabled within this field of vision, are very powerful: they are able to predict, identify, and sort from a ubiquitous point of view, often acting from tremendous distances in automated and decentralized manners.[60]

Contemporary Critical Algorithm Studies

Understanding the rise of algorithmic governance demands comprehension of the ways in which the statistical and deterministic logics at the core of biopolitics and governmentality combine with the predictive mechanics of ontopower to provide the larger strategies within with FRTs act an adaptable tactic. When such ontopower gets shifted towards the everyday activities of citizens via assemblages like FRTs, the notions of preemption and prediction become increasingly oriented towards capitalistic impulses; aided by enhanced vision capabilities, each citizen becomes a rich data source that can be used to both target specific individuals while also building larger infrastructures to improve the state of art of FRTs.

AI and AI-enabled technologies like FRTs need to be understood as combinatory, a constellation of multiple histories, truth regimes, and vectors of power, including those based in biopower and ontopower, that inscribe such technologies with false senses of objectivity via positivism so as to better manage and monitor individuals and populations. Kate Crawford's *Atlas of AI* and Taina Bucher's *If... Then* are incredibly useful resources in understanding the

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[60] This discussion of ontopower is crucial to Chapter 5's discussion of FRTs' expansion post-9/11 as well as its circulations during the COVID-19 pandemic. As such, it is taken up with more detail there.

ways that machine learning and AI-enabled technologies are structured and carry out their

operations.[61] Crawford's work expertly recreates various constellations of AI historical

development in order to show the ways in which AI is neither "artificial" nor "intelligence":

instead, the AI models that are imported into then operationalized by technologies like FRTs is

defined by the embodied and material practices, resources, infrastructures, individuals, and

populations that collide in the building and deploying of AI. Butcher works well in companion to

Crawford in her focus on the co-production of technologies, wherein the reciprocal relationships

between AI-enabled technologies and its consensual and non-consensual users produce dense

forms of what she calls "algorithmic power".[62] Building from this thinking, in their essay "The

Nooscope Manifested," Matteo Pasquinelli and Vladan Joler describe contemporary Big Data

apparatuses as fuelled by a computational assembly line of brute force computing that strives for

a stable model, that can statistically replicate different aspects of the world. However, these AI

models are very often biased towards intersectionally-disadvantaged populations and individuals,

increasing those individuals 'and populations 'barriers to the resources of citizenship.[63]

The development of Big Data over the past decade has been instrumental to such

developments in AI. Shoshana Zuboff, in *The Age of Surveillance Capitalism*, argues that

surveillance capitalism's extraction of data from citizens aims to produce markets based on the

prediction of future behaviours.[64] Aligning itself with the statical logics of Empire and

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[61] Crawford. *The Atlas of AI;* Bucher. *If…then.*

[62] This definition can be expanded to "*how* and *when* different algorithms and the algorithmic becomes available to specific actors, under what circumstances, and who or what gets to be a part of how algorithms are defined" (author's italics, ibid., 4).

[63] Matteo Pasquinelli and Vladan Joler, "The Nooscope Manifested: Artificial Intelligence as Instrument of Knowledge Extractivism," KIM HfG Karlsruhe and Share Lab, 1 May 2020. http://nooscope.ai

[64] Shoshana Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (New York: PublicAffairs, 2019)

ontopower, smart phones and personal computers act under instrumentarianism, which aims to automate behaviour in order to stabilize it into quantifiable and repeatable data to be mined, circulated, and processed, the result of which is the proliferation and strengthening of biopolitical management. John Cheney-Lippold, in *We are Data,* usefully connects such proliferations to algorithmic infrastructures and surveillant tactics which are essential to determining algorithmic citizenship, in turn providing increasingly far-reaching, interlocking biopolitical apparatuses.[65]

Data mining and statistically-based governance drawn along lines of racial and gendered difference is not new and was key to the 19th century establishment of biopolitics. Jacqueline Wernimont's *Numbered Lives* uses local death records from the 19th century alongside Victorian fitness devices to make arguments about how such earlier devices counted (bodies, steps etc), and, by counting, managed life and death in ways that were often driven by discourses around race, citizenship, and gender.[66] Simone Browne's reading of such surveillant assemblages in *Dark Matters* likewise insists that such algorithmic governance is not new, but rather emerges from a long history that has used black bodies as experimental fodder to prototype and perfect such systems, including the slave ship and lantern policies in reaction to slavery.[67] In the contemporary moment, the inscription of white prototypicality, or the default white male body, into algorithmic systems and governance reify the effects of the histories of racializing phenomena within surveillance and surveillance capitalism; individuals and populations are made and kept precarious by the manipulation of behavioural data and algorithms and forms of power that monitor and enforce truth regimes derived from such data. Eziekiel Dixon-Roman,

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[65] John Cheney-Lippold, *We are Data: Algorithms and the Making of Our Digital Selves* (New York: NYU Press, 2017).

[66] Jacqueline Wernimont, *Numbered Lives* (Cambridge: The MIT Press, 2018).

[67] Browne. *Dark Matters*

drawing from Jacques Derrida, calls such histories the "hauntings" that are produced by a 19th

century Humanism, and that have continued forward into the contemporary algorithmic

apparatuses that operate in the daily lives of citizens and non-citizens. The resultant

psychometrics are bound together by the data within AI-enabled technologies in ways that

reaffirm governmentality in the form of white, male power and deepens hierarchies and

categorizations based on difference.[68] Ramon Amaro and Murad Khan name these hauntings

"preconditions," arguing that the multiple combinations of time and space within data, data

assemblages and AI-enabled technologies like FRTs make it such that the biases of the past are

not only inscribed into the protocols of the technology, but also structure a world in which

escaping the preconditions is inconceivable.[69] The collision of historical and contemporary

discourses, durations, and images within FRTs act together to reaffirm the past in ways that

naturalize that past and their truth regimes into invisibility and ubiquity.

Such prototypicality, hauntings, and preconditions have been strengthened by the

centring of ontopower and biopolitics of flow and control within the contemporary moment.

Ontopower, when applied under survellience capitalism, aims to both predict and shape the

future at a mass scale at those borders, producing an extractive paradigm that generates and

maintains precarious populations, including through the management of social mobility and

health care. As an example, Safiya Noble's *Algorithms of Oppression*, details how algorithms

based in difference produces what she calls technological redlining, linking data about race and

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[68] Eziekiel Dixon-Roman, "Toward a hauntology on data: On the sociopolitical forces of data assemblages," *Research in Education* 98, no. 1 (2017), 44-58.

[69] Ramon Amaro and Murad Khan, "Towards Black Individuation and a Calculus of Variations," *E-flux Journal,* no. 109, May 2020, https://www.e-flux.com/journal/109/330246/towards-black-individuation-and-a-calculus-of-variations/

geographic neighbourhoods to higher morgues and premiums.[70] Further, in *Automating*

Inequality, Virginia Eubanks argues that marginalized groups face high rates of data extraction

when accessing public benefits by being consistently red-flagged, thereby creating a "feedback

loop of injustice" resulting in those populations being relocated to digital poorhouses.[71]

Ontopower targeting precarious individuals and populations makes it such that risk and threats

are repurposed into capitalistic biopolitics, wherein the predictive logics combine with

subjectification to become a powerful form of mass control over social mobility.

Likewise, in her discussion of the socioalgorithms of race, Lisa Nakamura links

representational protocols in data to profiling, in particular the notion that one can be categorized

before they commit any act deserving of such categorization, in turn doubling the scrutiny put on

precarious populations; the inscription of race into algorithmic systems encourages and

reinforces the automated decision making made by way of Big Data practices.[72] Cathy O'Neil, in

Weapons of Math Destruction, systematically links the building and deploying of algorithms, and

the discourses attached, to the discriminatory management of employment, lending credit,

insurance, as well as the justice system.[73] Ruja Benjamin, in *Race After Technology*, names such

instances as examples of the New Jim Code, what 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, "their personality and potential, where

they come from but also where they should go."[74]

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[70] Noble, *Algorithms of Oppression*

[71] Eubanks, *Automating Inequality*, pp. 4.

[72] Lisa Nakumura, *Digitizing Race: Visual Cultures of the Internet* (Minneapolis: University of Press, 2008).

[73] Cathy O'Neil, *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* (New York:Crown, 2016)

[74] Ruha Benjamin, *Race After Technology: Abolitionist Tools for the New Jim Code.* (Newark: Polity, 2019), 5

Biometrics within Critical Algorithm Studies

The aforementioned scholars are key to understanding how the integration of AI and Big Data Practices in general have allowed FRTs to become incredible effective and adaptable biopolitical tactics. More specific to biometrics and FRTs, Simon Cole's expansive *Suspect Identities* is a crucial resources in further linking the identifying technologies of the 19th and 20th century to modern day biometrics, focusing on the ways in which the body was used to reveal truths about inner character and morals, in particular about those individuals and populations who were labelled as threats.[75] Texts such as Shoshana Magnet's *When Biometrics Fail,* in particular the chapter "I-Tech and the Beginnings of Biometrics," contends that the development of biometrics is tied directly to the precarity of racialized and gendered populations.[76] Utilizing examples like those drawn from the increase of biometric experimentation in the US carceral system, Magnet shows how biometrics owe a deep debt to the interweaving of Empire and governmentality, wherein technologies like FRTs leverage spaces defined by the conflation between coercion and consent within asymmetrical power dynamics. Joseph Pugliese, in *Biometrics: Bodies Technologies, Biopolitics*, updates Cole's work by focusing on biometrics as technologies of capture wherein biopolitical governmentality thrives on the creation and circulation of identifying "biometric proxies."[77] Pugliese then builds his genealogy of biometrics by stressing the importance of body measurements, corporeal signs, and the body templates that emerged from such practices. Importantly, such measurements, signs, and templates become, as Wendy Hui Kyong Chun in *Programmed Vision* argues, computational

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[75] Simon Cole, *Suspect Identities: A History of Fingerprinting and Criminal Identification* (Cambridge: Harvard University Press, 2022).

[76] Shoshana Magnet, *When Biometrics Fail: Gender, Race, and the Technology of Identity* (Durham: Duke University Press, 2011).

[77] Pugliese, *Biometrics.*

models of sensory perception that are deeply tied to the powerful predictive qualities that contemporary software enables. For Chun, this shift is underpinned by the desire to obliterate volatility and instead produce stable versions of information as computer memory, reducing the chaos of bodies in relation to each other to informational patterns through logics of equivalence.[78]

These reductionist desires are prevalent within FRTs and central to their use in service of biopolitics, ontopower, and the maintaining of governmentality. The AI with FRTs works to hierarchize and categorize based on the hauntings and preconditions in its development, and where computer vision acts in linear and uniform ways to generate stable measurements and templates under predictive logics from the indeterminate materials of individuals and populations. While there is, in 2023, new scholarship rooted in critical algorithm studies that targets FRTs specifically, Kelly Gates's *Our Biometric Future* stands as the first full manuscript dedicated to the technology. Gates's indispensable text traces the historical roots of FRTs through the 19th century development of biology and eugenics melding with the emergence of photographic practices. Published in 2013, the work's strongest contribution delves into the post-9/11 explosion of the technology, wherein forms of bottom-up power, like what she names as the tech-savvy citizen, combines with top-down forms of domination resulting from the War on Terror and the various governmental and corporate actors that powered such a conflict.[79] More recent work, like Lila Lee-Morrison's *Portraits of Automated Facial Recognition*, and the article "Seeing Infrastructure" by Nikki Stevens and Os Keyes, take up narrower problems and histories than Gates's work, but are strong in their diving into the specific technical and representational

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[78] Chun, *Programmed Vision.*

[79] Gates, *Our Biometric Future.*

protocols that underpin FRTs. Lee Morrison's tracking of the various computer science developments that led to contemporary FRTs is effectively done, while Stevens and Keyes unpack the histories and representational protocols within important facial databases.[80]

The Ethical Imperative in Observing the Face

This dissertation intervenes into the complexes of vision generated by FRTs by insisting that such vision allows for the gatekeeping of citizenship and citizenship resources in ways that ignore the affective and entangled phenomena of those individuals and populations under observation. Drawing from Emmanual Lévinas's *Totality and Infinity*, enacting such vision on the face produces circulations of power that further support systems of asymmetrical political recognition, biopolitics, necropolitics, debility, and precarity.[81]

For Lévinas, the face has the potential to produce the positive structures of the ethical through recognition of another, drawing into question the relationship and responsibility one has to another. The temptation is to say that the face gives gateways into the interior of the other person in a way that flattens the face into a field of observable evidence. Yet, to only view the face, without listening to it speak or engaging with the entanglement of its affect, is a form of knowledge that appropriates the seen into the observer's own worldview, sensations, and beliefs. Such an appropriation mirrors the self in the other rather than grappling with the other at the site of the face as a separate and equal being. As Lévinas contents, vision alone does not capture any necessary ethical exchanges as it focuses too heavily on the expression, or exterior, of the face.

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[80] Lila Lee-Morrison, *Portraits of Automated Facial Recognition: On Machinic Ways of Seeing the Face* (Lund, Sweden: Lund University Press, 2020); Nikki Stevens and Os Keyes, "Seeing infrastructure: race, facial recognition and the politics of data," *Cultural Studies* 35, no. 4-5 (2021): 833-853.

[81] Lévinas, *Totality and Infinity*.

Such thinking argues then that the face is inadmissible to technological capture by FRTs, as its isolating of vision into a technological apparatus enacts the exact form of vision that Lévinas critiques. Yet, this is exactly how FRTs function: within examples such as the production and processing of identity documents, the decentralized and automated vision of FRTs provides a distanced evaluation of faces that does not possess the exchange that Lévinas deems so necessary, nor the responsibility that arises from such an exchange. The externalizing of vision within FRTs depends nearly entirely on predictive logics linking the exterior of the face to imagined or predicted internal motivations, personal histories, and embodied experiences; such linking does not address the actual motivations, histories, or experiences of the other, nor its obligation to the other.

The Right to Look within the God Trick

In opposition to Lévinas's ethical exchange at the site of the face, FRTs' vision is rooted in what Nicholas Mirzoeff, citing Jacques Derrida, calls "the right to look" which "claims autonomy…the claim to a political subjectivity and collectivity."[82] This right then produces a visuality that can be broken down into actions: first, defining and categorizing; second, separating individuals and populations based on those definitions and categories, preventing those separated from "cohering as political subjects"; and third, fixing those separations as "truth" and aesthetic. These three actions then generate what he calls "a complex of visuality," defined further as "both the production of a set of social organizations and process that form a given complex."[83]

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[82] Mirzoeff, *The Right to Look*, 1

[83] Ibid., 3.

Such a right to look is incorporated, in often near-invisible manners, into the landscapes and bodies of the everyday; vision then can be used to monitor and track, as well as categorize and sort. By enfolding the body within its operations, the early stages of FRTs set the stage for its current use as especially effective as a biopolitical tactic that efficiently governs mobility: FRTs are particularly effective because the perceived indexicality of the photographic facial images used as input are presumed to be replicated by the body itself, generating an inescapable technological ecosystem that travels and targets wherever the body itself goes.

Empowered by Donna Haraway's understanding of the God Trick, FRTs encapsulate many of the desires of biopolitical management in how its quantifying and numerical logics can be automated, providing disembodied "objective" control over the mobility and flow of individuals and populations.[84] Haraway critiques the application of such vision within scientific fields by illustrating that this type of vision has been tethered to cybernetic thinking, overrun by the biopolitical impulse to constantly improve the ability to see the world through technological devices and instruments. Such a vision is borne of mechanics designed to "distance the knowing subject from everybody and everything in the interests of unfettered power."[85] In opposition to the situated knowledges that she advocates for, these positivistic mechanics, discourses, and instruments produce "technological feasts" that give the illusion of The God Trick, a disembodied gaze that sees without being seen, resulting in "a conquering gaze from nowhere" that activates an infinite vision that depends on the taxonomies of objects, measurements, and deterministic connections between entities by way of informational patterns.[86] When paired with the right to look, The God Trick and the resulting complexes of vision provide an authority and

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[84] Original citation in this dissertation's Introduction. Haraway, 1988.

[85] Ibid., 581.

[86] Ibid., 583.

set of truth regimes that is incredibly adaptable to ontopower and biopower, wherein the body is remade into data, then categorized, hierarchized, and processed in ways that appear objective while acting under political protocols serving governmentality.

FRT as a biopolitical vision technology

This dissertation is unique in its tracing of FRTs' scaling to a mass technology, where such scaling produced decentralized technological observers, like FRTs, within biopolitical tactics. Such tactics were and are deployed under distanced control in order to execute political protocols that are interwoven with technical and representational protocols. Justified by the God Trick, these practices were greatly expanded in the 20th century, namely by the expanded use of photo IDs like driver's licenses and passports, the spread of mugshots as law enforcement practices, as well as VISA and refugee applications.[87] The resulting databases of faces built from precarious populations have been used to improve FRT's abilities throughout its history. Such practices are not unique to FRTs and have been present across the developments of computationally-based biometrics within the United States, including the US-VISIT program (now the Office of Biometric Identity Management) and the 25 year history of the The Automated Biometric Identification System (IDENT). As Petra Molnar and Lex Gill explain in *Bots at the Gate*, such apparatuses are "a high-risk laboratory for experiments in automated decision-making" that is especially dangerous for vulnerable and under-resourced communities.[88] Leveraging circulations of power within the right to look, such precarious

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[87] This argument is expanded in far more detail in Chapter 3.

[88] Petra Molnar and Lex Gill. *Bots at the Gates: A Human Rights Analysis of Automated Decision-Making in Canada's Immigration and Refugee System.* University of Toronto: The Citizen Lab, 2018, 4. https://citizenlab.ca/wp-content/uploads/2018/09/IHRP-Automated-Systems-Report-Web-V2.pdf.

populations are then the most likely to be targeted by biopolitical vision, as well as used as experimental fodder to stimulate FRTs' abilities to more efficiently and effectively categorize and separate individuals and populations.

Biopolitical vision, as a particularly effective regime of vision, is encapsulated by FRTs' combination of ontopower, algorithmic governance, technically-advanced mechanisms, and image-making practices, all of which are rooted in the bureaucratic management of life under governmentality. From this perspective, FRT's vision is a potent normalizing force, one whose distribution is tethered to diffuse circulations of power and larger biopolitical strategies. In this way, the image-making of FRT perfectly illustrates the crux of contemporary governmentality: the flux between insecurity and security, stable and chaotic, pits governmentality's rationales towards determinism against indeterminate systems of bodily affect. The technologies' political and representational protocols are key components to these networks of power, where precarious populations form the images and image-making core to the operations of the technical protocols, and where the political protocols act to reinforce and produce precarious populations. This is then further complicated by the technologies' ubiquity in the everyday of citizen's lives: FRTs depend upon the insertion of bottom-up forms of vigilance and subjectification, so that ontopower and biopolitics within governmentality act at the thresholds of sites of local indeterminacy, particularly affect. FRTs, acting under the God Trick, attempt to contain that indeterminacy and situated knowledges so that it can be made logical within self-preserving governmentality.

Conclusion

This dissertation is unique in that it considers how technical, representational and political protocols work completely interdependently to produce the FRT apparatuses that are so

currently ubiquitous. Further, this dissertation's focus on linking those three protocols to the production of citizenship by way of the collapse of consent and coercion within data enrolment and machine learning apparatuses is unique in how it shows how crisis, undergirded by asymmetrical applications of political recognition, act together in dense networks to reaffirm governmentality by way of biopolitics and ontopower. Ontopower's installation of risk-focused operations grounded in Empire, in particular within moments of crisis, are essential when tracing how FRTs moved from specialized technologies operating primarily in top-down forms of power to the past two decades 'evolution. Further aided by great advances in AI and machine learning, FRTs are no longer constrained to obvious sites of security and surveillance, such as border crossings and law enforcement. Instead the technology operates ubiquitously in service of the biopolitical management of everyday citizenship resources. When ontopower and bottom-up subjectification combine, the individual is encouraged to become actively incorporated within the very algorithms that measure and maintain their relationship to citizenship resources, further shaping the discourses of risk and threat inscribed into mechanisms of algorithmic governance and tactics such as FRTs. Tracking the constellations of the three entwined protocols within FRTs, as this dissertation does, shows how images and image-making combines with the gatekeeping of political recognition and technically minded "objective" computational systems to generate the flexible FRT apparatuses in use today.

While this Literature Review has largely been dedicated to outlining the core thinkers and terms that are most useful to identifying the problematics of FRTs, in particular those related to power and vision, this dissertation's following chapters also provide space for interventions and counter-tactics into the technology. In particular, Chapter 6 outlines a number of specific examples that utilize the theorists and works explored in this Literature Review to produce

technical tools and artworks as well as policy and regulatory frameworks that grant resistance to

FRTs as much potential flexibility and adaptability to the technology as the technology itself

possesses.

CHAPTER 2:
THE OPERATIVE MOMENT OF A
FACIAL RECOGNITION TECHNOLOGY

A May 2nd 2021 Google news search for "facial recognition technology" gives a globe-spanning cross-section of use cases for the technology. Within the top 50 results of the nearly 4 million total results were articles about: the Canadian use of FRTs in animal shelters to unite lost pets with their owners; how, in India, the technology is proposed as a means to authenticate those about to get a COVID-19 vaccine; instances where Moscow police deployed FRTs at a peaceful protest in support of Aleksei Navalny to identify activists and journalists; the RCMP in British Columbia, Canada, who were exposed as having used the services of the company IntelCenter in its search for alleged terrorists; how the United States Senate is in the process of approving the use of the technology to help with an extreme backlog of child abuse cases by automating searches of seized personal electronics; the cruise line Royal Caribbean, who were touting the technology as a way to replace wearable technologies, like wristbands, in order to create a more convenient environment for their customers.[89]

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[89] "Facial recognition technology is helping reunite lost pets with their families," *Security Magazine,* April 26th, 2021, https://www.securitymagazine.com/articles/95086-facial-recognition-technology-is-helping-reunite-lost-pets-with-their-families; "Digital Rights Bodies Warn Against Use of Facial Recognition Technology in Vaccination Drive," *The Wire,* April 14th, 2021, https://thewire.in/rights/COVID-19-vaccination-facial-recognition-technology-aadhaar-vaccine; "Russia: Police target peaceful protesters identified using facial recognition technology," Amnesty International, April 27th, 2021, https://www.amnesty.org/en/latest/news/2021/04/russia-police-target-peaceful-protesters-identified-using-facial-recognition-technology/; Bryan Carney, "RCMP Secret Facial Recognition Tool Looked for Matches with 700,000 'Terrorists'," *The Tyee,* April 28th, 2021, https://thetyee.ca/News/2021/04/28/RCMP-Secret-Facial-Recognition-Tool-Looked-Matches-Terrorists/; Alan J. Keays, "Facial recognition technology is needed to help with backlog of abuse cases, panel told," *VTDigger,* April 9th, 2021, https://vtdigger.org/2021/04/09/facial-recognition-technology-is-needed-to-help-with-backlog-of-abuse-cases-panel-told/; Matt Hochberg. "Royal Caribbean sees facial recognition technology, not wearables, as the future of personalization," Royal Caribbean, April 15th, 2021, https://www.royalcaribbeanblog.com/2021/04/15/royal-caribbean-sees-facial-recognition-technology-not-wearables-the-future-of

This sampling, of course, does not cover all the ways FRTs are deployed, but it is an effective example of the myriad ways in which the technology is put to work, showcasing both top-down forms of power and bottom-up forms of subjectification. This chapter grapples with this phenomenon by looking closely at the operative moment of FRTs in order to explain how the technology is able to be flexibly deployed across a wide variety of different types of tasks at a mass scale. Doing so will recreate the many layers of images, computer code, machine learning training and artificial intelligence (AI) models, data practices, and image-making that takes place within FRTs. Included within a typical FRT are: facial images gathered by various data acquisition practices; blocks and libraries of code as well as predetermined facial patterns and/or AI model/models that are accessed into order to detect each face in the crowd; there are blocks and libraries of code, aided by an AI model/models often further parsed by data annotation practices, which identify the faces in the crowd by matching that face to a connected facial database; there is the AI training that makes such the matching mechanism possible, which itself is comprised of facial databases, human-annotated data, and dense computer code that together form the computational models that a FRT uses in its detection and identification mechanisms; finally, blocks and libraries of code render all of this computational processing visible to humans, often by layering identifying information, like a bounding box and/or a demographic information, overtop of the originally captured footage.

As the introduction to this dissertation explains, when analyzing complex media technologies like FRTs, it is difficult to single out a specific form of media archaeology as the singularly appropriate method to explain and critique FRT. This chapter begins with a media archaeology as proposed by Wolfgang Ernst in order to reconstruct what he names as "the

operative moment" of a FRT.[90] For Ernst, digital media are defined by mathematical laws that produce techno-mathematical signals in their operative moment that are not perceptible to the human sensorium. Understanding a technology's operative moment makes visible the specifics of systems of inscription, storage, and transmission within a media in order to comprehend such technologies on their own non-human terms. Doing so examines media in action; the storage and archive of media are always in motion and must be understood as such, a point made even more urgent when considering contemporary digital media's continuous flows of data.

Deconstructing a FRT's operative moment provides a cross-section view of the technology in action, a vivisection, in order to enhance understandings of its machine actions and logics. From this, understanding how a FRT maps individuals and populations as data-objects, allows for those political protocols, those boundaries and categorizations, to be questioned with more precision. FRT's operative moment can be used to clarify its nature as an observer and the representational protocols that are used and formed by that observation. Further, interrogating the FRTs' operative moment links its vision and visualities to the technology's use of AI, its Big Data practices, and the many types of image-making it incorporates within its deployment.

An understanding of the operative moment, and how a FRT's components interact and affect each other, makes clear why the technology is a prime example of how biopolitical vision is deployed across a wide variety of use cases. Yet, examining the operative moment alone is not enough, as such limited analysis would only replicate the linear pipeline that has been central to FRT's technical development, and would further entrench truth regimes around the technology's disembodied neutrality, all the while ignoring the very real political powers in action within the technology. In this way, this chapter resists focusing entirely on the operative moment of FRTs,

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[90] Ernst, *Digital Memory.*

their technical protocols and their resulting imaging-making, and instead expands on what have been named networked images by Andrew Dewdney, operational images by Harun Faroki, and invisible images by Trevor Paglen.[91] Such scholarship, broadly, argues that contemporary visual cultural, and vision itself, has shifted to paradigms where machine actors are examining data-objects meant only for machine reading outside of the human sensorium and action; therefore, photography and older forms of representation no longer capture image-making that is infused by AI and computer code within apparatuses such as FRTs. This chapter initially agrees, arguing that such image-making enabled by the deployment of biopolitical vision within FRTs' operative moment reduces those under its gaze to numerical and calculable materials, rendering them deterministic objects that are more easily understood by probabilistic and predictive machine logics.

However, in the case of FRTs, the thinking of those like Dewdney, Paglen, and Faroki is both true and limited in that it does not address the very real ways that the history, politics, and circulations of power and authority of photographic representation, specifically at the site of the face, are still central to FRTs. As this dissertation's introduction argues, facial recognition is a vision problem first, and a face problem second: it is important to note that many of the general technical protocols deployed within the operative moment of an FRT are utilized across the vast majority of computer vision tasks; the technology's specialization in faces is what separates FRTs from other object-detection computer vision apparatuses. A FRT targets the face and in doing is distinct from other invisible or networked images that are not bound up in the representational and political protocols that portraits and facial images have long been tangled

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[91] Andrew Dewdney. *Forget Photography.* (Cambridge: MIT Press, 2021); Harun Faroki. "Phantom Images" *Public* 29 (2004), 12-22; Trevor Paglen. "Invisible Images (Your Pictures Are Looking at You)." *The New Inquiry.* December 8 2016. https://thenewinquiry.com/invisible-images-your-pictures-are-looking-at-you/

within. As such, this chapter argues that understanding the operative moment makes visible the operational, invisible, and networked images within FRTs, but that a restructuring of the operative moment, and its technical protocols, must be combined with an analysis of the ways in which representational and political protocols are also made possible by a FRT's operative moment. Therefore, discussion of FRT's operative moment enables the criticality of vision and visualizing practices that Haraway calls for, ultimately understanding how the illusion of the God Trick works within FRT in order to better understand the affective bodies captured within its workings. Doing so acknowledges, as Haraway demands, that FRT be seen as an incredibly flexible agent imbued with political and representational protocols, instead of a purely functional and neutral device defined by its operative moment.[92]

As this chapter will make clear, all of the different interlocking code components, images, and image-making demonstrate the ways in which power circulates through the whole of the technology. FRTs' biopolitial vision is formed by the multiple observing mechanisms that are core to its operative moment: such observation takes place during the operative moment, but also incorporates observation, within prefabricated facial databases, that are outside the duration of the operative moment but are centrally crucial to its functioning; this is further complicated by the machine-level observation that takes place within machine learning which produce the AI models that are imported into and utilized by FRTs. These multi-temporal combinations of facial images, storage, data transfer, and computational action is present within other contemporary digital biometric tactics, but looking closer at FRT specifically shows how the initial vision accomplished by a camera's capturing of live action is complicated by, first, software aimed at face detection, then, second the identification mechanisms that are augmented by AI and robust,

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[92] Further explanation of Haraway's *God Trick* can be found in the Literature Review.

and often long established, data practices. Each layer of vision presents opportunities for visualities potentially inscribed with biopolitical management and limits that are typically shrouded in opaque computer science and corporate/proprietary knowledge.

Recalling the opening to this chapter, FRTs effectiveness as a potential biopolitical tactic is borne of its extreme flexibility enabled by the aforementioned layers of code, AI models, data practices, images, and image-making, each of which are potential sites of power and/or governmentality. Importantly, at each layer there are vectors of subjectification and moments where coercion and consent are collapsed in the ways that the face is made legible for observation. This chapter will lay the foundation for future chapters of this dissertation by demonstrating how flexible FRTs are; how they are able to adapt to a diverse set of situations and large groups of people; and how they are therefore operating as an effective biopolitical tactic at the scale of population. As examination of FRTs' operative moment makes clear, the technology is far from the linear and modular assemblage that is presented within the technical history of the technology. Instead, the entwined technical, representational, and political protocols facilitates the technology's adaptive nature such that populations and individuals can be seen or ignored, categorized as one form of a citizen or other, freed or restricted, promoted or targeted, according to the complexes of power that a FRT is operating within.

The Operative Moment

A simple version of the technology's code would involve running a single file that: imports the code libraries it needs; loads in footage; then loads in the mechanisms it need to detect faces; this is followed by lines of code that would surface that detection in some way (like a bounding box around any detected face); the process would end with code that recombines the

footage back into a human-visible media like a digital image or moving-image.[93] Although FRTs appear to operate in real-time, the knowledge and representations it generates can be broken into three relatively discreet stages: recording footage; detecting faces; and identifying and/or verifying faces.

Recording Footage

A FRT begins by recording and storing some form of live action as footage.[94] To simplify, I use the term "footage" to mean either moving or still images. Footage may take the form of a previously captured still image; it may take the form of recorded live action in a co-operative setting where the resulting still or moving image is input into the technology; it may take the form of recorded live action via a CCTV-style camera that captures an area relatively indiscriminately and continuously, where the bodies under FRT's observation are non-cooperative. Importantly, whether an FRTs original footage is a still or moving image, the code within the first stages make the footage into still images so that it can enact its subsequent detection and identification/verification mechanisms on individual frames; these still frames are then often converted into black and white in order to make the face more legible to the aforementioned mechanisms in the following stages of the operative moment.

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[93] There are many different code libraries and approaches to both detection and identification but the basic principles of the software remain roughly the same across computer languages and architectural approaches. This does not mean, of course, that specific instances should be not be taken up and analyzed individually, as they will throughout this dissertation. Knowing this, I will simplify here by basing my critical engagement on my own research creation experiences focused primarily on FRTs as enabled by the coding language of Python.

[94] Outside the scope of this dissertation, a FRT's operative moment could be further parsed by focusing on the specific camera apparatus that is capturing the initial footage. How footage is gathered by a CCTV camera, by a border-crossing kiosk, and by a smartphone are fairly different. However, I made the decision in this dissertation to simplify the recording footage stage in order to focus on the software portion of a FRT's operative moment.

Footage is either cooperative or uncooperative: as defined within the National Institute of Standards and Technology's (NIST's) 2017 report "Face in Video Evaluation (FIVE): Face Recognition of Non-cooperative Subjects," a cooperative setting is where the body within the frame knows that they are visible to a camera for the purpose of having their image captured.[95] Non-cooperative footage is where those being observed are unaware of the exact recording apparatus and are not actively positioning themselves so as to be visible to a FRT. Non-cooperative FRT footage, in this sense, can be short-circuited by those knowingly or unknowingly obscuring their faces, by camera position and light conditions, and by the general movement of a body, or bodies, through space.

For now, however, it is enough to say that the start of FRT's operative moment is the cooperative or uncooperative digital capture of a live body by a camera that is then held as footage in a storable digital form until it is ready to be processed in the following stages. Further, it is worth repeating that what is being passed to the following stages is a single still image that can be then subjected to detection, identification, and/or verification mechanisms. While FRTs often operate so as to produce moving images as their end, human-visible results, the processing of still images within the first complex stages of the software recalls analogue film, wherein the individual frames are made to appear to be moving when they are re-composed in the processed end results.

Detection

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[95] Patrick Grother, George Quinn, and Mei Ngan, "Face in Video Evaluation (FIVE): Face Recognition of Non-cooperative Subjects," National Institute of Standards and Technology, March 2017, https://nvlpubs.nist.gov/nistpubs/ir/2017/NIST.IR.8173.pdf

Once recorded, the footage must be input into a piece of software that can detect whether there is a face within said footage. It is important to know that without a face being detected within a still image an FRT cannot move to the next stage of verification and identification. Detection, therefore, is a key bottleneck within a FRT.

Within detection, an FRT is not trying to identify a specific face as a specific individual but is, rather, trying to determine whether a face, any face, is present in the still image. Some form of this technique is what powers social media filters that allow users to put virtual sunglasses on their faces, or attach pet ears to their head; in this version of the assemblage, the technology is face-neutral in the sense that it does not differentiate between faces, but is instead detecting a face, any face, then placing some form of augmented reality filter over that face.

Detection is a binary problem (is there a face in this still image or not?) and is based on pattern matching. This pattern matching is made possible by the reduction of previously labelled facial images in databases into computationally-friendly information, effectively creating numerical facial patterns. The automated datafying reduction of faces has taken many forms throughout the development of FRTs, with the first influential large-scale model being the utilization of eigenfaces as described by Matthew Turk and Alex Pentland in 1991.[96] Early research, like Sirovich and Kirby's writing on eigenpictures and the later oft-cited Turk and Pentland papers establishing eigenfaces, tied proposed systems of computer recognition to human vision. In reality, however, their statistical nature bore little resemblance to, as Chapter 4 explores further, the manual and semi-manual extractions and analysis of the human face that

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[96] Matthew Turk and Alex Pentland, "Eigenfaces for Recognition," *Journal of Cognitive Neuroscience* 3 no. 1, (1991): 71-86.

initial FRT methodologies from decades prior utilized.[97] Turk and Pentland call an eigenface an

informational processing model that is designed to be potentially be implemented into other

systems, such as artificial neural networks.[98] Despite its technical complexity, Lee-Morrison

writes a very thorough and readable explanation of what an eigenface is, dividing the process up

into three key components: Principal Component Analysis (PCA), the eigenvector, and face

space.[99] This approach relies on the global features of a face, such as the assumptions that any

face will have two eyes, a nose, and a mouth in relatively similar positions; the goal then is to

map the variations between these faces in matrixes of high dimensional space, with the resulting

vectors forming an eigenface that would function as a unique facial pattern that an input image

could be matched to. Both Lee-Morrison and Wendy Chun offer more complicated descriptions

of PCA and eigenfaces.[100] Within the scope of this chapter, it is key to know that eigenfaces can

be used for detection and identification, though, as the next section of this chapter will explain,

identification and verification are much more complex problems where the limits of eigenfaces,

within massive datasets and potentially non-cooperative environments, become clear. In the

detection stage, however, if a similar eigenface is found, a face is detected and it can be moved

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[97] Larry Sirovich and Michael Kirby, "Low-dimensional procedure for the characteristization of human faces," *Journal of the Optical Society of America* 4, (1987): 519-524.

[98] Turk and Pentland, 83.

[99] Lee-Morrison, 67.

[100] At the root of eigenfaces is a detection mechanism, wherein each face is mathematically translated into an eigenvector in high dimensional space, with the eigenvector's coordinates becoming a unit of measurement, or a weight, corresponding to the unique identification of that face. As Lee-Morrison explains, "in this way, the eigenvector comes to represent faces based solely on their relationship with other faces. The eigenvector is a representation of the differences and similarities between faces and in this way function as a unit of facial measurement" (72). When a new face is captured, it is compared to the known faces to produce a degree of variation/deviation. That deviation can be used to either identify that face, if the difference is small and therefore matches an eigenvector already known, or further train the system by being incorporated back into the algorithm as a new variation, if the difference is too large as to be recognizable. Wendy Chun writes forcefully about the history of PCA, especially in relation to Karl Pearson, a biometrician and eugenicist, in "Recognizing Recognition" (*Data Discrimination,* 185-229); her work usefully links further into Chapter 3's discussion of Alphonse Bertillion and Francis Galton.

to the next stage of identification and/or verification. In this sense, "similar" is defined by a human-set level of acceptable variance (ex. the face is above 70% similar to a facial template).

This approach was augmented by techniques such as Haar Cascades, producing a detection mechanism that proved to be less complex but easier to enact and distribute digitally, becoming effective up until the increased incorporation of AI-trained models roughly ten years following. The publicly-available Haar Cascades are standalone files that are built by algorithmically pre-processing, by way of reducing different images to grids of pixels, a wide number of images containing and lacking facial images, in order to identify the best features within those photos by which to detect a face.[101] Such a process relies on finding contrasting light and dark pixels that form the pattern of the contours of a facial feature. Watching a short video that visualizes this process, one can see the software scan over the photo in pixelated chunks, searching for patterns that signal to it that the footage matches an image within its bank of predetermined facial patterns.[102] Both eigenfaces and Haar Cascades can technically be used for the more complex mechanism of identification, but both are relatively inflexible, in particular to as they relate to facial position, and are defined by the pre-processing knowledge of datafied facial templates.

Haar Cascades are an example of pre-AI detection mechanisms which relied on smaller datasets and a fair bit of human labour. As will be discussed in more depth in the following section on identification, with the wide adoption of Big Data practices, these mechanisms have been taken over by AI models, which have then been incorporated into the direct functioning of

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[101] A further explainer of Haar Cascades, with images, can be found at "Haar Cascade" *Computer Vision: My Personal Notes*. https://cvexplained.wordpress.com/2020/08/24/haar-cascades/.

[102] Ankur Divekar provides an excellent video visualization of a Haar Cascade in his Youtube video "Haar Cascade Visualization" (Youtube. April 21st 2014. https://www.youtube.com/watch?v=L0JkjIwz2II).

code libraries. However, although the AI-enabled methods are exponentially larger in scale, the central principles remain the same: the models are produced by training a neural network to recognize what a face is by having it compare, hundreds of thousands (of millions) of times, images known to have faces and not have faces. The FRT then accesses these models in order to see if the input image contains a face or not. As the next section explains, such models are much more useful for the more complicated tasks of identification and verification within a FRT's operative moment.

Whatever the exact mechanism, it is worth stressing that the detection stage, like the verification and verification stage that follows, is based on probabilistic logics. It is highly unlikely, in widespread use, that the facial patterns within footage would exactly match the predetermined facial patterns; doing so would mean they were likely the exact same face. Instead, detection, verification, and identification all depend on human-defined boundaries where a facial pattern in footage must cross a threshold wherein the system finds a similar, not exact, match within the predetermined facial patterns.

Verification and Identification

Verification and identification are more complex tasks than detection because of the desired matching of a specific detected face to a specific face within an attached database. Differentiating between verification and identification within FRT is essential: verification answers the question "Is this person who they say they are?"; identification answers the question "Who might this person be?" Verification is thought of as a 1:1 problem and very often depends on cooperative environments: a person enters a biometric, allowing their face to be captured as footage for example, along with an identifying piece of information; the system then tests that

biometric (a person's face) and information (a passport) against its own databases and answers in the affirmative or not whether that person is who they say they are. Identification is a 1:N problem: a biometric is given and the apparatus predicts whose biometric is the likeliest match. Of the two, identification is a more difficult technical problem and is more open to variability and predictive logics without the guidance of the identifying information present within verification. As such, popular accountings of FRT's biased failures tend to focus on 1:N apparatuses, though often without differentiating between verification and identification.

As mentioned in the previous section, the datafying of footage in the detection stage holds two purposes: it generates a set of numerical values that can be used for detection via a probabilistically matching to the predetermined facial patterns; at the same time, those numerical values also form a unique facial pattern that can be used for verification and identification. This process is best understood as verification and/or identification rather than recognition because, as illustrated in the following chapter, recognition is a political act that captures a biological substrate for the purpose of administration by state powers under governmentality. Identification and verification leads to recognition, but identification and verification are closer to technical acts of vision and therefore more useful when reconstructing the operative moment of FRT.

While detection provides the unique facial pattern needed for verification and identification, the act of identification within FRT has been greatly altered by the integration of AI and machine learning-generated models. While techniques like eigenfaces and Haar Cascades could also be used for identification, such a process is time and resource intensive, as each would involve giant collections of unique facial patterns that FRT would have to cycle through entirely each time it detected a face in order to find its unique match. Obviously, the brute computational force of this would be faster and likely more efficient than a human undertaking the same task,

but the automation of FRTs was exponentially improved by training computational systems to

learn how to identify a face. Further, AI-enabled detection, verification, and identification

mechanisms have the added benefit of being able to access exponentially more data; that data is

also more varied and thus more likely to work for a wider range of faces.

Using AI within FRT means separating the ability to verify and/or identify a face from

the actual acts of verification and/or identification that an FRT does. Within an AI-enabled FRT,

the technology imports an AI model produced by machine learning that tells the technology how

to verify and/or identify a face, a model that is generated entirely separate from the FRT itself,

then imported into its operative moment. These models begin with the gathering of increasingly

massive facial datasets. Earlier research into FRT composed their relatively small databases by

photographing government and/or academic lab employees or would use photographic materials

gathered for governmental purposes, such as driver's licences, passports, and/or materials drawn

from law enforcement or border security measures.[103] As the Internet expanded into a mass

technology, the proliferation of facial images combined with the infrastructure necessary to store

and circulate such massive amounts of facial data. This leads to contemporary machine learning

databases made from celebrity headshots, Creative Common-licensed Flickr photos, and bot-

gathered images from social media accounts that are magnitudes larger than previous

databases.[104]

After a training database has been gathered, it has to be labeled. Such labelling is most

often done by humans, where a person will look at an image, detect the face within it and attach

identifying information to that photo; while this labelling is increasingly automated, human

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[103] Such early facial databases are explored more fully in Chapter 4

[104] These larger scale facial databases and the expansion of machine learning techniques, most notably neural networks in the 2010s, is explained more fully in Chapter 5.

annotation is generally the most reliable. The labelling may include straightforward identification (a proper name), but is often augmented with other data categories such as age, race, and gender. Such categorization allows for more fine-tuned machine learning capabilities which might empower an identification system to match a facial pattern to another specific facial pattern, while also being able to probabilistically estimate that face's race, gender, and age. The more robust the data labelling is, the more potential tasks can be extracted from the database via machine learning. Once programmers have a labeled dataset, the programmers will increase its accuracy by algorithmically training it, with the most common form of training being undertaken by forming an artificial neural network. This artificial neural network tests the versions of the software and aims to correct its own errors via a process called backpropagation: a neural network would initially be fed a facial image; it would then reduce that face to information, as it does in detection, then attempt to match that facial pattern to one within the labeled dataset; this attempt would fail and, by using the labeled dataset, the neural network would be able to produce a model formed by tracking how incorrect the attempt was and how it might improve on its next attempt; this information is based back to the beginning and the process loops again within another input facial image. Eventually, though many iterations, the model would improve and, at a certain point, it would be able to cross an acceptable threshold of accuracy when attempting to identify faces. As with detection, this AI model is built on probabilistic logics wherein the person monitoring the machine learning has to decide at what point it is producing results that cross their threshold for desired accuracy, after which the model can be exported and operationalized within a FRT.

Once a model has reached a desired state of machine learning, it can be imported into a FRT and used to verify and/or identify a face within footage. However, these actions require yet

another facial database, labeled and categorized, that the FRT can reference. These databases would contain the facial data accompanied by identifying information that might include names, phone numbers, addresses as well as other categories similar to those in the machine learning labelling. As explored in more detail in the following chapter, applications of FRTs desiring accurate identification will most often leverage materials gathered via governmental actions, wherein the facial pattern in the footage would be matched to data drawn from other informational systems via identity documents like passports, mugshots, immigration and refugee application materials, and/or driver's licences, then expanded further by other sources such as social media accounts and other Big Data practices.

The larger the database a FRT can reference, the more likely it is to verify and/or identify a face accurately. However, even if the unique face is not within that database, the FRT may still be able to predict the face's race, age or gender, depending upon the abilities granted by the AI model. The FRT's code can then be formatted to decide what data is to be human viewable: the footage will reappear with digital layers of information, such as the face contained within a bounding box and/or the image now overlaid with whatever identifying information within the database. If the original footage was a moving image, the still images processed throughout the technology's operative moment are stitched together to form a moving image with identifying information overtop, if desired.

Duration, Images, and Image Making Within FRT Observation

FRT's operative moment is clear: footage is gathered and stored; that footage is made into still images then datafied and matched against pre-determined facial patterns in order to detect any faces within the footage; then, aided by an AI model, each detected facial pattern is

matched to another specific facial pattern within an attached facial database which includes further identifying information; finally the footage is re-composed, appearing in near real time, with the identifying data layered overtop.

Analyzing a technology on its own terms while it is in action provides effective insight into the power that the technology generates and operates in service of, while also making visible the historical connections that might be made, in a media archeological manner, to other technologies. At the end of the discussion of the operative moment, it is possible to envision how the stages fit together to form an assemblage composed of many layers of vision and visualities that can be operationalized as an effective deterministically-defined biopolitical tactic. The clinical mapping of FRT in this chapter thus far illuminates the machine-specific logics at work, how information and data is passed from one component to the next, and how the end human-visible media is produced. Yet, reconstructing the operative moment alone does not reproduce the political machinations that produce the software, AI, and databases nor the agents of power that deploy the technology. The operative moment must be combined with a serious contending with the vision and visualities at work within the technology.

It is useful to return to this dissertation's Introduction to borrow again from Crary and Galloway and to think of an FRT as an observer. Drawing from the mix of subjective observation and scientific practices that emerged from the 19th century, Crary describes the observer as one that is augmented by scientific technologies and methodologies to better understand vision: with this, the visual field was recomposed as potential statistical information.[105] The tool and the observer are then bound together, wherein a technology, like a

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[105] Crary's definition of an observer emerges from his work in *Techniques of the Observer* (Cambridge: MIT Press, 1990)*, Suspensions of Perception* (Cambridge, Mass: MIT Press, 1999), and the essay "Modernizing Vision" (in *Vision and Visuality,* ed Hal Foster (New York: New Press, 1999), 29-50). His definition is produced by his tracing

photographic camera, act as a symbiotic technological-biological assemblage. The human vision

and involvement within FRTs are further complicated by the complexes of vision created by the

further integration of AI and complicated automated and centralized forms of computer vision:

FRTs have been granted relative autonomy under the rationale that the vision is operates under is

disembodied and objective, and that it is so advanced and automated that human involvement

can be kept to a minimum, intervening only at the level of the final product of visuality that FRT

produces. In this, Crary's focus on observers is best suited to biopolitics of discipline and must

be combined with Galloway's aforementioned writing on protocols within biopolitics of flow

and control in order to update the notion of an observer to better suit a 21st-century FRT. While

such an observer remains a symbiotic assemblage of human and the technological, its increased

decentralized and automated nature is geared towards an observation of the globalized

movements of goods and populations, often as bureaucratic extensions of a nation state's

governmentality.[106] A FRT is a media technology that interfaces relatively easily into larger

systems of national security, public health, and finance (to name only three), made possible by

the aforementioned interlocking technical, political and representational protocols. Such

interfacing is core to the production of behaviour and comportment around ideals of citizenship,

in particular as citizenship relates to both societal and individual health and security, that then

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of the breakdown of the camera obscura as the main model of vision that happened through the 19th century. This discussion fits well with the prior discussion of modernity's relationship to the development of biopolitical vision and Haraway's God Trick and will be expanded in Chapter 3 when discussing 19th- and early 20th-century scientific observation.

[106] Galloway, *Protocols*, 2006. His arguments are further illuminated in "Protocol vs Institutionalization" (in *New Media, Old Media: A History and Theory Reader,* eds Thomas Keenan and Wendy Hui Kyong Chun (New York: Routledge, 2006), 187-198) which traces the specific infrastructural bodies that are the undergirding of the Internet in order to surface how contemporary technologies rely upon webs of bureaucratic maintenance that value standardization and mass adoption.

manifest in truth regimes used as rationales for the extreme expansion of FRTs in the 21st century.

This chapter's mapping shows the many different types of observing that construct a FRT's complex of visions and visualities. The initial observation undertaken by the camera gathering footage is re-observed within the detection stage, re-observed again in identification, then again one last time when the final product is surfaced for human vision. These layers of observation is further complicated by the technical and political practices that construct the facial patterns and facial databases used in identification and detection. Looking at these multiple layers of observation also makes clear how many images and sites of image making are present within a FRT, whether it be the images in footage or those within the identification/verification databases the FRT accesses, or those utilized within the machine learning that produced that AI models. Taken together this complex of vision shows the many different sites that power is produced and operates, resisting simple explanations of top-down dominance and/or surveillance.

Such a complex is further complicated by questions of duration within a FRT's operative moment: within the technologies' varied acts of vision is the multiple image-making durations that the technology utilizes and how they fuse with the technology's representative practices. While functioning, a FRT's image-making, from footage to processed footage, appears near-instantaneous; however, the generation of an AI model or a facial database that a FRT uses in its operative moment may take weeks or months or years. In this, the biopolitical vision of a FRT is both very fast and very slow. The processed footage, viewed at its final stage, is the result of an automated and decentralized image-making that appears to happen in near real-time. By comparison, the facial data patterns used in detection, verification and identification, are

gathered over weeks and months, then stored indefinitely within the technology. Similarly, the training of an AI is a long, computationally-intense period of time, which is further related to the hardware and code architecture utilized. Further, the portrait-like photographs that are used to generate the facial patterns have their own variable duration of capture and storage, a fact that carries over to the original facial images used in the training of the AI model. Finally, the databases used in in verification and identification are composed of photos, such as passports of driver's licences, captured under their own durations.

Within the scope of the remainder of this chapter, looking more specifically at a FRT's operative moment shows how the technology's image-making is underpinned by three primary facts. First, a FRT is an observer structured by its compliance to established technical protocols. Each of these durations within the layers of observation are defined by the protocols that lead to their production: they include the technical elements, such as the placement of a camera, the datafying code within a Haar Cascade, or the algorithm used to produce an AI model. Second, a FRT targets the face (as opposed to more general object-detection computer vision systems) and therefore simultaneously relies upon representational protocols, as well as the consistent use of bureaucratic images by way of its access to facial databases; the resulting visualities of those captured by its observation are further interpenetrated by digital imaging, identifying information, and inscribed with categorization, primarily along lines of difference. Third, a FRT produces and relies upon political protocols; such protocols include, but are not limited to, the rationales for the collection of facial data, the asymmetrical use of computational resources, and the act of categorizing and separating populations based on representations.

FRTs' vision components structure an observer apparatus that is tasked with making those in its field visible to systems of power by way of its reforming of individuals and

populations into bureaucratic and calculable materials; these materials then typically fit within existing infrastructures and with also remaking them into stable image-objects for further administration, including potential integration into a wide array of other biopolitical strategies and systems. Such infrastructure is often defined by extractive practices which are leveraged in moments of crisis. The intertwining of the technology's representational, technical, and political protocols are seen in the observation and re-observations present within FRTs and are captured across the multiple durations that characterize the technology's image-making. It is this complexity, and this complex of vision, that lends a FRT its nimble nature, with its adaptive nature making itself a useful biopolitcal tactic to a wide array of strategies of governmentality.

Face Recognition is a Vision Problem First but Still a Face Problem

FRTs' flexible nature are extremely susceptible to manipulations: the technology can be inscribed with a wide range of biases depending on what power it is serving. From this thinking, it is not enough to strike down FRTs as biased technologies, but rather to look at how such technologies, and others like it, become very effective tactics precisely because they can be adapted to a variety of larger biopolitical and necropolitical strategies.

Importantly, laying out the operative moment of technology shows its vulnerabilities, in particular in the multiple sites of image and image-making within its facial databases and the databases used in AI and non-AI detection, identification, and verification mechanisms. Potential circulations of power within such images and image-making are then amplified by the multiple layers of observation and re-observation within an FRT, then exaggerated further by its data annotation practices, further still by considering where and how the technology is utilized within a chosen environment. In this way, close scrutiny of the technical protocols lead to a better

understanding of the representational and political protocols, together working to unveil potential harms and dangers that can arise from the deployment of the technology.

However, as stated in this chapter's discussion, an FRT's operative moment uses the majority of the same computer vision principles and mechanisms present within the pattern matching of other automated and decentralized object detection apparatuses. In this way, and as the next chapter will discuss, the 19th- and early 20th century work by thinkers such as Francis Galton into fingerprint and signature matching as forms of identification and verification is important as it shows how the same technical protocols used for those systems were applied to face recognition tasks. Generalized pattern matching-as-observation is the key to the flexibility at the core of FRTs, and demonstrates how vision, and the ability to recognize objects, any objects and not necessarily faces, is the driving force behind the technical protocols and the histories of FRTs.

It is tempting to label the image-making within FRTs technically-minded data images invisible to human vision and processing outside of prior representational systems. Such thinking would pull from work such as Vilém Flusser, who describes technical images as those that are abstracted and mosaic reconstructions of particles of information; technical images are calculated and that relies more upon mechanics of visualization than depiction or representation.[107] Joanna Zylinska relies upon Flusser's work in proposing a nonhuman photography: using examples such as drone photography and CCTV, she argues that such machine-infused photography is driven by nonhuman agency produced by algorithms and computational activities; such images, and the representations within, are increasingly not taken by humans and are generated for nonhuman

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[107] Vilém Flusser, *Into the Universe of Technical Images* (Minneapolis: University of Minnesota Press, 2011).

entities utilizing computer vision.[108] From this perspective, FRT utilizes technical images in its capturing of footage which are then processed and re-combined back into images or moving images outside of human agency, reflecting the current moment of nonhuman photography.[109] Harun Farocki complicates this further with his outlining of operational images, which he explains are "images that do not represent an object, but rather are part of an operation"; such images are made and processed by the pattern-seeking eye of computer vision, acting as sensory automatons.[110] Trevor Paglen addresses how AI might fit within operative image making, naming invisible images as those indicative of the paradigm shift that has seen visual culture centred increasingly on the ubiquitous machine-to-machine exchanges of vision within machine learning systems and AI-enabled technologies such as FRTs to the point where human vision is rarely in the loop.[111] Finally, Andrew Dewdney in *Forget Photography* prefers the term "networked images" for those images that are so deeply embedded within the digital circulations and algorithmic logics of computational systems to the point where the mathematical logics generate a nonrepresentation in comparison to prior forms of vision and visual cultures based in photography.[112]

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[108] Joanna Zylinska, *Nonhuman Photography* (Cambridge: The MIT Press, 2017).

[109] Within nonhuman photography, Zylinksa argues, a nonhuman vision is an ethico-political response that extends beyond human-centric logics. While appreciating the circuit-breaking potential of such thinking, the technical and political protocols within a technology like a FRT undertake acts of vision and representation at the expense of indeterminate and affective bodies in order to further harmful biopolitical desires under governmentality. While Zylinska does discuss this when separating nonhuman from inhumane photography, the fact remains that even nonhuman photography, in particular that which target the face in its image-making, are not just technical acts but utilize and produce practices of bodily representation that themselves are entangled in asymmetrical vectors of power and drawn along lines of difference and imbued with political protocols.

[110] Faroki, 17.

[111] Paglen, "Invisible Images" 2016.

[112] Dewdney, 2021, 22.

As the introduction to this chapter states, these types of images and image-making are undoubtably present within FRTs, in particular within operative images where the image is more functional than representational. In fact, if this chapter were to end with the conclusion that FRT is primarily a computer vision problem, then such theorizing would encapsulate much of the arguments made thus far. However, while facial recognition is a vision problem first, it is a face problem second, and this is crucial. The face, as the specific target of FRTs' observation, makes the technology beholden to discussion of the very real past and present representational and political protocols present within every image and image making process that utilizes the face as its materials, digital, machine, or human. While Dewdney does state that getting outside the systems of photographic representations and its harmful histories of authority, racism, and domination is impossible, the notion of forgetting photography is wrapped in privileged thinking that does not account for the almost two centuries worth of its practices and its deep normalization within contemporary visual cultures, despite the rise of AI and machine-to-machine image systems. The face in particular has been a concentrated site of such histories and FRTs focus on the face makes it such that the technology must be separated from other forms of networked, invisible, and/or operative images. In particular, the face, as an object of observation, has been the site of biopolitical categorization and hierarchization based on logics of difference. Image-making that targets the face, whether invisible or visible, networked or non-networked, human or nonhuman, is necessarily bound up in specific histories, actors, and examples of power that must be addressed differently that image-making involving other objects.

Images and acts of nonhuman photography capture only a portion of the images at use in a typical FRT, and are overly focused on the operative moment of FRT. A focus on AI and machine-to-machine image-making leaves out the initial photographic materials for detection,

verification, and identification that are imbued with representational practices centred upon the body before they are repurposed into operative, networked, and/or invisible images (such as the data patterns produced by eigenfaces or used within the production of AI models). Similarly, the recorded footage and the processed footage also represent human-visible bodies that bear strong resemblances to photographic practices, despite their digital nature. The inclusion of such images within a FRT does not outweigh nor erase the image-making which empower biopolitical strategies and the right to look present within the image. As examples, when FRT is used in law enforcement contexts, it often utilizes mugshots, representations that are potentially inscribed with over-policing practices and other biopolitical strategies; when the technology is used under contexts of immigration and refugees, buttressed by rationales of border security, the representations within FRT are marked by the binary of citizen-noncitizen.

By mixing both operative images and "traditional" human-visible images under photographic logics, a FRT expands its potential sites for biopolitical manipulation: not only is the technology vulnerable at the different layers of observation described in this chapter's description of its technical protocols, but the representational practices in the images and moving images inscribe applications of biopower in their execution of political protocols.

Returning to the FRT's Operative Moment and Its Technical Protocols

Knowing all this lays the foundation for how the representational and political blend into the technical protocols such that FRTs become adaptable to many different types of circulations of top-down and bottom-up power. Because of this, it is worth revisiting an FRT's operative moment to show the ways in which the technology's technical protocols become inscribed with power and logics of difference.

Returning to this chapter's understanding of detection within FRT's operative moment reveals that there are various protocols that leave a FRT open to application of biopolitical vision. Joy Buolamwini argues that the logics of difference underneath that haunt the technology emerge in part from the conscious and unconscious biases that are embedded within those who code systems such as FRTs: if straight white men are the predominate demographic creating FRTs, then it stands to follow that the technology will become imbued those creator's values, resulting in what she names the Coded Gaze of FRTs.[113] It is this gaze, Simone Browne insists that creates a visuality that views whiteness as the default and produces a white prototypicality that operates throughout the whole of a biometric technology.[114]

White prototypicality can be instilled by the designers and their code design but also via the construction of facial databases used within FRTs. As Buolamwini and Gebru's *Gender Shades* project highlights, where the racially demographically-uneven construction of databases are folded into a probabilistic system like FRT, it results in the technology struggling to effectively differentiate darker-skinned female faces from each other.[115] Future chapters will take this up in more detail: Chapter 4 looks more closely at the post-WWII making of a FRT, with figures such as W.W. Bledsoe and Takeo Kanade. Within the scope of this chapter, Sirovich and Kirby's aforementioned research into eigenspace is a powerful example of such white prototypicality wherein their initial datasets is composed of 115 "smooth skinned caucasian males."[116] While Turk and Petland do not identify the exact demographics of their database, they

[113] Joy Buolamwini, "InCoding — In The Beginning Was The Coded Gaze," *Medium,* May 16th, 2016, https://medium.com/mit-media-lab/incoding-in-the-beginning-4e2a5c51a45d.

[114] Browne, 2015, 26-27; 122.

[115] Buolamwini and Gerbu, 2018.

[116] Sirovich and Kirby, 1987, 521

do state that that their database is composed of 2500 photos of 16 individuals, with the images

included in the article's documentation being of individuals who present as light-skinned men.[117]

Likewise, key early research datasets like the ORL database and the Yale Face Database are

based primarily on the white male face: in the ORL database, produced between 1992-1994,

contains 40 subjects, with 36 presenting as white-skinned male faces, 3 presenting as white-

skinned women, and 1 dark-skinned male[118]; in the 2001 Yale database, 14 of 15 subjects present

as male, and while the dataset is more racially diverse, more than half present as light-skinned.[119]

Further, white prototypicality is potentially inscribed through the use of celebrity faces

from headshots and moving-image stills, a practice consistent throughout the post-WWII history

of FRTs. Such facial data is not neutral: as I have written in my book chapter on the exhibition

"Computer Physiogomny" and photogénie, and have expanded in Chapter 4 of this dissertation,

the use of famous faces within FRTs is a common practice and the Youtube Faces dataset, the

CelebA dataset, and the MS-Celeb-1M dataset.[120] Such usage reifies cultural biases towards

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[117] Worth potentially expanding at some point outside this dissertation, white prototypicality is further complicated by the fact that the images within machine learning are greatly reduced before being processed. In the case of Turk and Pentland, they describe the process as going from 512 x 512 pixels to image-objects that are 16 x 16 pixels, before they are then transformed into eigenvectors/weights (81). This reduction in quality of facial images, for the purpose of being machine processed, also affects representational protocols, but making the faces less distinct and detailed, less individual.

[118] "The Database of Faces," AT&T Laboratories Cambridge, 2001, https://cam-orl.co.uk/facedatabase.html

[119] "Yale Face Database," USCD Engineering, n.d., http://vision.ucsd.edu/content/yale-face-database. As is the case with the ORL database referred to in the previous note, I have downloaded these databases to my own computer and inspected their contents to generate these statistics on these databases.

[120] Aaron Tucker, "The Problem of Recognition: Celebrity Faces, Photogénie and Facial Recognition Technologies," in *Faces on Screen: New Approaches,* ed Alice Maurice (Edinburgh U.K.: Edinburgh University Press, 2022): 60-74. Lior Wolf, Tal Hassner, and Itay Maoz, "Youtube Faces DB," Tel-Aviv University, https://www.cs.tau.ac.il/~wolf/ytfaces/; Ziwei Liu, Ping Luo, Xiaogang Wang and Xiaoou Tang, "The CelebA dataset," The Chinese University of Hong Kong, September 10th, 2021, http://mmlab.ie.cuhk.edu.hk/projects/CelebA.html; although the original MS-Celeb-1M dataset found at https://msceleb.org/ has since been discontinued, further information about the MS-Celeb-1M dataset can be found at "MS-Celeb-1M: Challenge of Recognizing One Million Celebrities in the Real World" (Microsoft, June 29th, 2016, https://www.microsoft.com/en-us/research/project/ms-celeb-1m-challenge-recognizing-one-million-celebrities-real-world/)

white faces in spaces like popular culture and Hollywood, circulating celebrity faces as normalized facial templates within FRT machine learning and AI models.

These flaws are amplified when considering the AI training within the detection, verification, and identification mechanisms of FRT. In terms of training, AI is repetitive and greatly restricted by the databases it is learning from. Putting aside the substantial resources required to train an artificial neural network effectively, training becomes inscribed with the protocols of the databases it accesses. The most straightforward ways that protocols are inscribed into a model is via over- or under-representation in a facial databases training, factors that will optimize the model for the faces that are the most consistently present. This end of this chapter will explore the specific representational practices within FRT's materials, but it is worth thinking of the problem as statistical at this point: an artificial neural network's training will be greatly affected by the presence or absence of certain faces over others. A FRT's knowledge system is relatively self-contained and leaves little room for deviation from its own norms and standards: this leaves wide swathes of faces, defined by race, gender and/or disability, that may not be included in these facial patterns and are therefore not detectable within FRT. Diverse datasets may solve for improvements in detection, but that increased efficiency and accuracy does not always serve the best interests of populations under observation, and while compensating for the vulnerabilities, it does not alter the technology's problematic internal technical protocols.

In addition, white prototypicality can be instilled via its technical protocols within the operative moment. In this way, the bias with FRT's observation is similar to those described within Lorna Roth's research into Shirley Cards, reference cards that featured predominately

white women, that was used to calibrate the skin tones of the photographs being printed.[121] The result of these cards were protocols where the camera apparatus was optimized for white skin and faces, in turn naturalizing whiteness and making other skin tones difficult to see and print with the same ease and effectiveness.

Again, this is a problem rooted in FRTs technical protocols. The history of the optimization and naturalization of lighter skinned faces, which in turn produce liminal populations, is amplified by the datafying process that both produce the informational facial patterns and that process the input footage, surfacing a major vulnerability within FRTs. The technology's dependance on facial patterns made by binary pixelations of dark-light in segments of lines makes it such that facial detection is much simpler when enacted upon faces with skin tones that have pronounced dark-light contrasts. Within the context of a contemporary FRT, if a dark skin tone of the forehead matches the dark colour of the hair line, there is little contrast between those facial elements, making it much more difficult to detect that facial feature; while detection may be able to overcome one such problem, it is compounded when other facial features are similar, such as the skin tones of cheeks and nose and/or darker lips. These issues can be more easily overcame in co-operative environments, where more control can be asserted by standardizing light and posture to make faces their most visible.[122] However, while the deployment of such protocols may make the technology more effective, they do not solve for the problems at the core of the technology: the need for FRT's vision to break facial patterns down to the level of the contrasting pixels processed in segments makes it so that certain faces, most

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[121] Lorna Roth, "Looking at Shirley, the Ultimate Norm: Colour Balance, Image Technologies, and Cognitive Equity," *Canadian Journal of Communication* 34, no. 1 (2009): 111-136.

[122] This notion is further complicated by the fact that much of the construction of detection, identification, and verification mechanisms within FRTs are built with facial images produced in controlled environments; when such mechanisms are used in instances of FRTs capturing footage of non-cooperative subjects in non-controlled environments, the demographic effects of the facial images become potentially even more pronounced.

commonly dark skinned faces, are rendered indistinct and featureless and therefore unable to be detected within the second stage of an FRT's operative moment.

Yet, importantly, FRTs are not defined entirely by white prototypicality and can be built in ways to be quite effective at targeting non-white faces, say within systems produced to monitor national borders for potential drug smugglers.[123] The facial images used to produce said facial patterns could be of darker-skinned mugshots of "criminal" faces or "terrorist" faces and a FRT's observation will be optimized for those accordingly. Again, it is an FRT's adaptability that makes it such a useful biopolitical tactics. In instances of FRTs that have been optimized for non-white faces, these patterns are generally produced in asymmetrical relationships defined by political protocols, making FRTs vulnerable through the decisions around which faces are used to generate the facial patterns at the core of detection, verification, and identification. This is true in facial patterns generated by Visa applications, refugee and immigration materials, mugshots, and, in general, in spaces where the data acquisition was done at sites of citizenship and the management of citizenship resources where the conflation between coercion and consent is the strongest.

That a FRT's vision can be manipulated by the types of faces that the technology has been optimized to detect, verify, and/or identify is what makes it more desirable to a wide range of biopolitical strategies. FRTs inherent instability and manipulability is a feature, not a bug.

Data Practices and Annotating Facial Data

FRTs rarely rely on facial images alone, and instead depend upon their facial images being annotated, typically by a human, in ways that make the content of the images more legible

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[123] This example will be taken up further in Chapters 4 and 5.

and easily sorted. Images could be associated with biographical data, as in a bureaucratic

document like a passport or driver's licence, but are often, in particular in Big Data assemblages,

augmented further by categorization related to race, gender, emotion, and physical descriptions.

Within machine learning datasets, these annotations are typically done by humans, who use their

own judgement in labelling the images that they see. This annotating is meant to broaden the

abilities of an FRT: instead of only being able to identify and verify a person, an FRT can now

aid in demographic predictions, able to sort different types of faces from each other in their field

of vision, and link such faces to potential future behaviour; these practices have increased

alongside the desires for automated and decentralized control within contemporary biopolitics of

flow. The application of these annotated images can range from the use of FRTs in shopping

environments to predict purchasing habits via analysis of facial expression to those used in

airports to predict and track individuals whose faces have made them suspicious.

Bowker and Star's foundational work *Sorting Things Out* demonstrates the ways in which

the act of classification within informational systems serves as an invisible and bureaucratic

infrastructure by which individuals and populations can be sorts quickly and effectively.[124] These

segmentations are not objective categories but are instead shaped by standards and protocols

formed over years and decades that empower large-scale actors to assert power over a wide

range of entities. In this way, it is not just the facial images included within the aforementioned

AI models and the detection, identification and verification mechanisms within an FRT, but how

those images are classified within those models and mechanisms. It is essential then, as Lisa

Gitelman and Virginia Jackson in *Raw Data is an Oxymoron* argue, to examine the "conditions

of inquiry, conditions that are at once material, social, and ethical" in order to understand how

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[124] Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things Out: Classification and its Consequences* (Cambridge: The MIT Press, 1999).

raw data is "cooked." Such an understanding reveals the particular set of patterns that an AI

model and other mechanisms within a FRT's observation is attempting to reinforce by its

distribution and operation.[125] How data is cooked reveals the types of statistical correlations the

system deploying that data is relying on.

The dangers of these data annotation practices have been laid clear by projects such as

Trevor Paglen and Kate Crawford's "Imagenet Roulette," a project wherein a user could upload

photos and have the items in the image that were recognized tagged based on the data annotation

practices of ImageNet dataset.[126] Users then were often confronted with strange and sometimes

offensive labels of objects they own and/or the faces in the images, that would label people

"pedophile" or "sluts". These issues are by no means contained to ImageNet: a 2015 incident

with Google's object detection library consistency labelled darker-skinned faces "gorillas"[127]; in

a more complicated example using the Google Vision Cloud, a white hand holding a

thermometer was labelled as holding a monocular, while a dark-skinned hand holding the same

object was labelled as holding a gun.[128] Each of these examples show how an FRT's technical

protocols combine with data annotation practices that are tethered to representational and

political protocols. Within it's operative moment, a FRT's vision matching of a citizen face to

those within its AI-training it knows to be labeled as "pedophile" is actually the machine

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[125] Lisa Gitelman and Virginia Jackson, "Introduction," in *Raw Data is an Oxymoron,* eds Lisa Gitelman. (Cambridge: MIT Press, 2013), 4

[126] The original interactive piece produced by Crawford and Paglen has since been taken down, but the two have written on ImageNet in their essay "Excavating AI" (n.d., https://excavating.ai/). Further description of the piece can be found in Cade Metz's review "'Nerd,' 'Nonsmoker,' 'Wrongdoer': How Might A.I. Label You?" (*The New York Times*, September 20th, 2019, https://www.nytimes.com/2019/09/20/arts/design/imagenet-trevor-paglen-ai-facial-recognition.html?smid=url-share.

[127] "Google apologises for Photos app's racist blunder," BBC, July 1st, 2015, https://www.bbc.com/news/technology-33347866.

[128] Nicolas Kayser-Bril, "Google apologizes after its Vision AI produced racist results," *Algorithm Watch,* April 8th, 2020, https://algorithmwatch.org/en/google-vision-racism/

working exactly as it is intended to, as it surfaced the label associated with the facial pattern it knows, from its training, to be most statistically similar to the uploaded photo. However, it is the representational protocols embedded within the original image which caused it to be labelled as "pedophile" (or "slut" or any number of politically volatile categories); that a human looks at the image and labels it in certain ways, explains how that human vision is then embedded and perpetuated throughout the whole of any assemblage which uses that annotation.

In the example of dark-skinned faces being labelled "gorillas," the limitations of a FRT's technical protocols, as explained previously in this chapter, make it so that darker-skinned faces are harder to differentiate from one another than lighter-skinned faces, including animal and human faces; the long history of associating darker-skinned faces with animalistic, savage, and atavistic qualities is surfaced by the technical protocols limitations. The third example builds from this, where the object recognition system is correlating white skin with certain objects (a monocular) and darker skin with other objects (a gun) is based on, again, the training that it has be given via images and data annotation in its machine learning stages and the AI model that was imported; in this case, the machine learning dataset likely contained multiple instances of dark-skinned people holding guns, with the images labelled correctly as such. Like the examples from ImageNet, this is an example of the system working exactly as intended (pattern matching to the best of its AI-granted knowledge) and, in doing so, surfacing how a dataset is "cooked" with certain political and representational protocols by its human-led data annotation.

An FRT's use under governmentality camouflages the fact that, as Matteo Pasquinelli and Vladan Joler contend, data is always "dependant on individual labor, personal data and social

behaviours that accrue over long periods of time."[129] This obfuscation is done in order to promote the false narrative of raw data's existence by naturalizing the conditions and methodologies of data practices as statements of objective fact. Doing so depends on ignoring the ways in which, as Yanni Loukissas's excellent *All Data Are Local* argues, data are pluralistic; any data collected is itself full of local and situated matter and knowledge.[130] AI models' attempts to cook this matter and knowledge shows how tactics like FRT are built to repurpose indeterminate and interconnected bodies into stable and deterministic systems which can be effectively incorporated into biopolitical strategies.

Similar to how a facial database's composition will optimize a FRT for certain types of faces over others, the manipulation of data annotation practices grants flexibility, where certain faces can be linked to certain categorizations and values in an AI model's machine learning, which are then imported into a FRT. The relative simplicity by which an AI model can be imported into the technology makes this type of repurposing a nimble and adaptive version of biopolitical vision.

It is not enough to say the technology is biased by its data practices and be constantly suspicious or dismissive of FRTs 'applications. It is worth reiterating that within many moments where FRTs are "making mistakes" they are actually functioning perfectly, matching known patterns to the faces under its observation given the technical, political, and representational protocols they are drawing from. Any biases within the technology are not stable and can be

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[129] Matteo Pasquinelli and Vladan Joler, "The Nooscope manifested: AI as instrument of knowledge extractivism," *AI and Society* (Oct. 2020): 4. More specific to the training and classification within AI, Matteo Pasquinelli's "How a Machine Learns and Fails – A Grammar of Error for Artificial Intelligence" (*Spheres: Journal for Digital Cultures* 5 (Nov. 2019), https://spheres-journal.org/contribution/how-a-machine-learns-and-fails-a-grammar-of-error-for-artificial-intelligence/) is an excellent addition to this chapter's discussion of an FRT's operative moment, in particular as it relates to the training of AI.

[130] Yanni Loukissas, *All Data are Local: Thinking Critically in a Data-Driven Society* (Cambridge: MIT Press, 2019).

manipulated depending upon how the data is cooked and the technology is deployed; in this way, any perceived bias present within the use of FRT is an indicator of the vectors of power operating, and the greater desires of the govermentality it serves.

FRTs' Political Protocols for Observation

Political protocols rely upon the technical protocols within an FRT's operative moment and the representational protocols within the images captured and circulated, and are most clear when put alongside a biopolitical governmentality's desire for identification. The initial stage of a FRT's operative moment, where it is gathering footage as a still or moving image, is especially important for these desires, and the place where the political protocols are likely deployed and strengthened.

Within this chapter's previous discussions around data practices and database construction, the acts of classifying and categorizing tend to highlight FRTs' abilities to act broadly in quick and efficient manners. The most common and effective political protocols found within FRTs align with the ability to verify a body that very often corresponds to a state-authenticated identity. Such conjoining is essential to the ongoing management of individuals and populations, in particular the encouragement of technologies of the self and subjectification within individuals that normalize and incentivize the use of tactics like FRTs.

Importantly, such subjectification via political protocols is apparent within users are increasingly using FRT within their everyday interactions and transactions. One of the most obvious examples of this are those who take selfies: the use of a personal phone to capture footage in order to apply a social media filter, for example, trains that individual how to position themselves for a FRT's processing while also normalizing and internalizing this process. FRT

usage overtly tied to biopolitical management rely on these technologies of the self: within the

report "TSA Biometrics Roadmap for Aviation Security and the Passenger Experience" the

expanded use of the technology in airports is justified in large part because "travellers

increasingly use biometrics, such as fingerprint and facial recognition, in their daily lives to

access their mobile devices, apps, and accounts."[131] The expanded use of FRTs in everyday life,

or what Ajana calls "feature creep," makes it so that the affective and indeterminate body is

reorganized by such cooperation so that it can more easily be incorporated into systems aimed at

making this bodies stable and measurable bureaucratic materials.[132] As Chapter 3's exploration

will make clear, technologies centred around identity inscribe, then reinforce, internal and

individual rationales for larger state-sanctioned behaviours. Giving each person a unique marker

of identity under a nation state makes them responsible to that nation state; by becoming a

subject, they will be motivated to police their own behaviours such that they fit what is defined

as normal, further enabling the decentralized and automated logics of control that a modern

governmentality acts upon. Further, combining practices of data enrolment with technologies

like FRT that verify and authenticate identity allows for an expanded ability to target, monitor,

and manage specific individuals.

This subjectification is especially important for what John Durham Peters calls a

logistical media. Such media operate under infrastructuralism, within larger and often sprawling

apparatuses, often under asymmetrical state or corporate control; a logistical media is tasked with

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[131] "TSA Biometrics Roadmap for Aviation Security and the Passenger Experience" Transportation Security Administration (July 2018), 6. https://www.tsa.gov/sites/default/files/tsa_biometrics_roadmap.pdf. I also used part of this thinking in my article "The Citizen Question: Making Identities Visible Via Facial Recognition Software at the Border," *IEEE Society and Technology* (December 2020): 52-59.

[132] Btihaj Ajana, *Governing Through Biometrics (New York:* Palgrave Macmillan, 2013), 73.

the job is the "ordering of fundamental terms and units…The job of logistical media is to organize and orient, to arrange people and property…They both coordinate and subordinate, arranging relationships among people and things."[133] As a logistical media, a FRT depends upon citizens' and non-citizens' comportment in order to expand and entrench its infrastructures, continuously feeding such infrastructures more data while normalizing the logistics and behaviour surrounding such assemblages.

It is within this large-scale management and gatekeeping within infrastructralism where a FRT is further complicated by how the technology observer nature incorporates and is incorporated into other biopolitical strategies' and tactics' protocols, in particular those that target and produce liminal populations. This fact is made obvious by looking closer at the recording footage stage of FRT's operative moment and the problem of co-operation within its detection mechanisms.[134] Cooperative footage is captured when the face under observation consents to political protocols and the capture of their face; however, in many instances where the capture of the face is tethered to access to citizenship resources, such tethering leaves little room for some populations to not consent to such an action. This conflation of consent and coercion commonly exists at sites of border control, such as customs or country entrance points, where a person must make themselves visible to an assemblage that can take their photo and tie their identity to further systems of monitoring information. Such assemblages may attach themselves to protocols linked to the application of immigrant, refugee and/or Visa materials, where, similarly, faces must present themselves as potential state subjects defined within the

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[133] John Durham Peters, *The Marvellous Clouds: Toward a Philosophy of Elemental Media* (Chicago: University of Chicago Press, 2015), 37.

[134] Such thoughts will also be expanded further in the following chapter with a further discussion of the collapse between consent and coercion within FRTs data enrolment and deployment.

image by standardizing protocols similar to that of a mugshot. In other situations, such as test environments or job interviews, the faces under observation must also submit themselves to the protocols of those deploying a FRT; without cooperation and consent, the face under observation is unable to move to the next stage of access to the resources of citizenship.

Similarly, in non-cooperatively gathered footage, such as in CCTV environments monitoring large areas indiscriminately, the unblinking mechanical observation is combined with protocols designed to hide such systems from being immediately noticed. Compared to co-operatively gathered footage, FRTs' observation in non-cooperative instances depends a great deal on the technical protocols of a FRT. As such, the difficulties associated with uncooperative footage is one of the main drivers of the technology's improvements, so that FRTs can be deployed in more varied environments in order to detect, then identify, faces that have been increasingly obscured. Alongside this, the political protocols in these environments are commonly structured by anticipatory rationales, within contemporary environments being defined by security and risk, in particular in moments of crisis. The biopolitical marking of individuals and populations as current and/or future threats provides the rationales to place those systems in areas where those threatenings groups are most likely to appear and circulate; further, it justifies technically optimizing a FRT so that it can better identify and sort those threats. In this way, a FRT's indiscriminate observation over an area marked as housing potential threats treats each face as guilty and worthy of inspection. Somewhat counterintuitively then, a FRT proves a person's innocence by confirming their identity does not match one that has been deemed a threat. This vigilance at the core of FRTs' political protocols justifies its application as a function of wide-spread and decentralized control under governmentality.[135]

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[135] The shift to vigilance as core to the biopolitcal vision of FRTs, post-WWII, is taken up in more depth in Chapter 4.

The technical and political observer protocols of FRT make it so that the technology is effective on both scales of biopolitics: its ability to categorize and classify at the level of population lends itself to large-scale management; its abilities to verify and authenticate at the level of the individual reinforces subjectification, situating the logics for the State's ongoing existence within the individual's responsibility.

The Representational Protocols of FRT

This chapter's previous discussion of a FRT's observer nature, as structured by its technical and political protocols, looks closely at how images are made computable. However, while the technology may reduce those representations to data for use within its own computational logics, FRT depends upon the gathering of facial images, within the facial databases as well as within those images produced as final footage, which act as representations of the targeted individuals and populations. Such images also demonstrating the power that enrols such facial data, then operationalizes it within a tactic like FRT.

This chapter ends with discussion of FRTs representational protocols in large part to balance the largely technical focus this chapter has taken and to remind, again, that the specific tasks of detecting, identifying, and/or verifying faces with automated and decentralized systems makes it such that any discussion of FRTs as a computer vision technology must discuss how the face is unique in its histories of being under observation and categorization. Observation of the face has long been grafted to logics of difference and biopolitical management, and therefore the face's centrality within FRTs deserves extended attention. Returning to the prior section's discussion, identity, under biopolitical vision, is both stable and fluid: identity, and to be identified, is a collection of unique facial landmarks, encapsulated within FRT by photography

of the face which itself is often defined by protocols of light, pose, and composition; at the same time, those identifying visual markers within the photographic representation of a person's face link directly into reductive categories like race and gender (to name only two) which can then be linked into larger groups of biopolitical identification such as nationality and citizenship status, which can then be leveraged into further predicative systems tied to the resources of citizenship, such as wealth and mobility. Ending the chapter by focusing on FRTs' representational protocols recalls the ways in which this dissertation's Literature Review argued that FRTs deny Lévinas's demand that observing the face is a reciprocal and ethical action. While such suppression may be found primarily in the technical protocols that produce and process networked, invisible, and/or operative images, the capture of faces in various durations and image-making within FRTs makes it essential that the representational protocols structured around the face be placed as the final word within discussion of the technology's operative moment.

In general, an FRT's dependance on images fits within what W. J. T. Mitchell calls the pictorial turn and, recalling this dissertation's introduction, what Mirzoeff contends is at the heart of the right to look.[136] While Mitchell acknowledges the ramifications this turn has on the increase in surveillant power, he argues that the most attention must be paid to the representations produced by images at the nexus of power/knowledge, the corrosive power dynamics inscribed into those images and the technologies that utilize those images, and the ways in which those images circulate as icons within larger systems of power.[137] Within this turn, representational protocols are essential: representational practices within images are then

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[136] W. J. T. Mitchell, *The Pictorial Turn* (New York: Routledge, 1992).

[137] Mitchell ties representation and mediation through images to the production of political power; the pictorial turn then is the deliberate and constant production of images as a dominate form of making the world, and its individuals and populations, visible to regimes.

sites of conflict between the dominated and dominant ideologies, surfacing the biopolitical

pleasures and desires of the dominant regimes of representation while also producing liminal

populations.

Stuart Hall's work stresses that systems of representation work because they have central

elements that make meaning within larger cultural codes that make possible communication

between varied populations. At the same time, representations "connect with power, regulate

conduct, make up or constructs identities."[138] The apparatuses that depend on images as

representational objects, such as FRTs, are then invested in powers that make representation true

and therefore knowledge which can be operationalized, in particular at the site of the body. In

this way, bodies are remade as subjects, and are imprinted upon by the politics of the

representations of bodies; the identity attached to subject-bodies are drawn from the discourses

that produce representations of bodies. 19th century scientific discourses around vision were

deeply influential on the development of FRTs because such discourses insist that

representations hold the essence of the object it is representing; under such logics, the

photograph of a face is a mirror of that face, and examination of that representation was the same

as examining the face itself, wherein the same fixed and stable truths could be extracted.[139] This

is how certain facial features become associated with certain populations, which links to

representational practices that foreground racial and ethnic difference and otherness in the form

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[138] Stuart Hall, *Representation: Cultural Representation and Signifying Practices* (London: The Open University, 1997), 6.

[139] Hall clarifies further: "The body itself and its differences [are] visible for all to see, and thus provided 'the inconvertible evidence 'for a naturalization of racial difference" (Ibid., 244). He illustrates this further within his description of the rise of scientific racism beginning in the 19th century where binaries of civilized/savage and natural/unnatural were ingrained in visual practices, in particular via cinema like D.W. Griffith's *The Birth of a Nation*. 19th century and early 20th century vision science, and figures such as Francis Galton, are central to Chapter 3's discussion of how such visualities spread to a mass application.

of stereotypes. Simone Browne complicates this phenomenon further by way of Fanon's concept

of epidermilization, arguing that visions of the face are defined by the colour of the skin and the

logics of difference which that enables. Skin colour, magnified by the mediation of

representational practices in images and moving-images included within biometrics, is then the

most visible marker by which the face is identified and categorized.[140] In this way, when

difference is marked within a FRT's complex of visuality, it is often constructed as outside of the

dominant regimes of representation, the body within that representation is placed into categories

that potentially align with liminal populations such as immigrant, criminal, and/or mentally ill.

Concordantly, those deploying a FRT are firmly justified in their right to look by their alignment

with "normal" hegemonic power.

The representations that emerge from these vulnerabilities become especially

concentrated when focused on the face, wherein a FRT's functioning leverages the tensions

between the unique and the general nature of the face to great effectiveness. Anna Munster

names the specific vision at the site of the face as facialization, "a system of codifying bodies

according to a centralized conception of subjectivity and agency in which the face, literally or

metaphorically, in the conduit for signifying, expressing and organizing the entire body."[141] The

face is therefore essential to FRT's image-making within deterministic governmentality: the face

is both unique enough to provide the materials needed for automation of the identification and

authentication of unique identities; however, from a biopolitical perspective, the face is also

generic enough to be a template such that the object of the face can be stereotyped, datafied, and

incorporated into large scale tactics and strategies. In terms of data annotation practices, those

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[140] Browne, 109-113.

[141] Anna Munster, *Materializing New Media: Embodiment in Informational Aesthetics* (Hanover: Dartmouth College Press, 2006), 122.

within database images have little to no self-representation: data labelling is done by strangers, people reliant upon their own conscious and unconscious biases. The faces within datasets and under FRT observation are not just defined by logics of difference, but are also not allowed to speak for themselves. Instead, they are beholden to observation-by-others, human and machine, that then categorizes and hierarchizes based on the representational protocols of the image.

Logics of difference within representational protocols are then augmented by the probabilistic nature of FRTs so as to make the technology flexible and adaptable to many different types of faces, depending on the power the technology is serving. Those predictions are based on the facial databases used in the technology's AI training, which themselves are vulnerable to biopolitical categorizations and inscribed with biopolitical strategies; likewise, the databases that are used to identify the face, or the category of face, being seen are also produced by practices based in difference, and marked by reductionist categories vulnerable to dominant regimes of power. When FRTs utilize such models to undertake categorization tasks, they move beyond identification and into determining the likelihood that a face under observation is that of a criminal, terrorist, or drug smuggler, wherein the predictive logics work in lockstep with biopolitical management. When the technology is used to categorize those searching for jobs or applying for bank loans, or determining cheating in test-taking environments, the representational protocols within an FRT's many facial images are leveraged to make predictions that, again, are extremely flexible to power and the definitions of truth regimes. However, the technology's predictions are often treated as objective fact because of its external observer nature, while its results are based on probabilistic logics and visualizations that are vulnerable to the representational protocols inscribed with racialized and gendered difference. Such difference,

in turn, produces representations that carry the same principles and inscriptions forward into a FRT's own image-making.

The entwining of representational, technical, and political protocols often work to ignore its representational protocols and render the affective value of the faces within their image-materials nonexistent. In this, the technology's dividing and reductionist logic does little to acknowledge the lived realities and experiences of those being represented and serves instead to split those that are abnormal and/or threats from those that are deemed normal and/or safe. Within the specific assemblage of FRT, this splitting is essential to the biopolitical categorizations that the technology is tasked with. The computational models that enact FRTs' vision completely eradicates the affective face so that it, and the body it represents, can be more easily deterministically rendered and controlled. The production of standardized faces and facial features drawn from facial databases, as well as within detection and identification mechanics like eigenfaces and Haar Cascades, also produce a normalized and generalized body that does not address the different forms and affect that bodies inhabit. These facts shows how FRTs produce a vision that relied on linear processes made from cascading segments that makes FRTs an adaptable mass biopolitical tactic. The facial databases and their representational protocols, and their opaque origins and treatments, also point to future data practices that both inscribe adaptability into the technology, while also treating such bodies as informational resources to be used as needed.

Conclusion

A FRT does not utilize nor produce simple digital images. Instead, the technology's observation as a logistical media, structured by tangled technical and political protocols, produce

representations that are reformed into images, further engraining acts of biopower along lines of difference. FRT's particular biopolitical vision is constructed by the multiple observational systems, durational periods, and visualities it encompasses. The observation of observation that is core to the technology's functioning and image-making makes it an effective technology of identification that can then be folded into technologies of political recognition; the ability to manipulate its numerical logics by way of code libraries, data annotation practices, and the composition of facial databases keep the technology's dangers away from immediate human vision, framing improvements in the technology as scientific endeavours driven by objective benchmarks of efficiency and accuracy.

It is not that a FRT has a strong ability to detect, identify, and verify that makes it indicative of the issues brought about by the expansion of contemporary apparatus deployed under rationales of decentralized and automated control. The technology's greatest strength as it relates to biopolitical strategies is its astounding flexibility, brought about by the aforementioned layers of observation and the representative practices within those layers; such flexibility is dispersed by both top-down and bottom-up forms of power at both macro- and microphysical scales. Further, such malleability enables the scaling of the technology to the level of populations, which increases its effectiveness exponentially by way of observing masses of people; such implementations are simultaneously buttressed by vectors of subjectification and desires for of co-operation by individuals. Lastly, the probabilistic logics generate a core uncertainty in the technology that is able to be leveraged to produce whatever vision the logics of governmentality desire: it can be technically optimized for any type of face while simultaneously targeting those same faces via manipulation of political protocols. Yet, this chaos and instability

within the technology is masked by discourses that align the technology with Haraway's God Trick, presenting the technology as mechanically objective and rational.

Extending from this argument, and as later chapters will prove in more depth, FRTs' gatekeeper potential most often operates along the lines of citizenship, where both nation states and a nation's subjects simultaneously take on the responsibilities of citizenship. As the following chapter will explore in more depth, FRT's linking of identification to political recognition makes it flexible to vectors of power guided by governmentality, forming a biopolitical vision that is immune to neoliberal solutions tied to simple understandings of diversity. Enabled by its observation of observation, a FRT is most dangerous when used to reaffirm citizenship and gatekeep the resources that are associated with citizenship. Citizenship is tied to FRTs' desires for identification, with the technology functioning as a tactic that is integrated into larger biopolitical strategies. The manipulation of the operative moment of a FRT can be leveraged to produce new liminal populations while also reaffirming those already labelled liminal populations, in particular through the access to citizenship resources. These desires serve as the infrastructural response to threat and crisis serving as homogenizing responses to ruptures and/or potential ruptures to biopolitical governmentality.

Finally, looking at a FRT's operative moment therefore provides parts of the essential transparency and intelligibility needed to best resist, audit, and potentially repurpose such technologies in less extractive and damaging ways; such perspectives will be taken up in more detail in Chapter 6, with the full understanding that any solutions themselves are not neutral nor devoid of circulations of power. This chapter therefore provides the necessary transparency into the technology to begin to both trace its historical roots and the truth regimes FRTs have been

enabled by, while also looking to the future and imagining how such technologies might be

better understood and policed.

CHAPTER 3:

FRANCIS GALTON AND ESTABLISHING BIOPOLITICAL VISION AND THE CONFLATION OF CONSENT AND COERCION IN THE 20TH CENTURY

<u>Introduction</u>

When researching within the Francis Galton Papers at the National Archive (London, United Kingdom), I was struck by the plethora of different sizes and kinds of graph paper across decades of his work. Galton, a 19th scientist and the father of eugenics, would then draw various objects, commonly facial profiles, onto these grids, effectively dividing the faces into smaller units. Such work is accompanied by tables of those units of individual segments of faces that are labelled with their curvature and facial characteristic. While there are numerous faces in profiles segmented in this way throughout his archive, he also uses a similar process to divide up individuals' fingerprints and signatures into discernible and replicable units of measurement.[142]

One of Galton's lifelong projects was attempting to technologically replicate human vision, and identification within acts of human vision, by generating methodologies that divided the visual field into grids, so that he could measure the curves and length of the segments within each unit of the grid; there is even a device in his archive, made from a square of cardboard with cheesecloth at its centre, that would allow a person, when they placed the device to their eye, to view the world with a grid overtop of whatever they looked at. This research culminates, in the final years of his life, in the 1910 paper "Numeralised Portraits for Classification and

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[142] I consistently found graph paper and drawings of faces throughout many multiple boxes in Galton's papers, including materials for what he was calling "cyclostyle profiles" (Box 94, Folder 2/7/4/11, n.d., Collection of the University of College London, The National Archives, London, U.K.) as well as a handmade device consisting of cheesecloth within a cardboard frame meant to be placed over the viewer's eye to place a "grid" over the user's view of the world (Box 118, Folder 2/9/5/6, n.d., Collection of the University of College London, The National Archives, London, U.K.)

Recognition": the paper lays out a methodology wherein the profile of a face can be "lexiconised" into a corresponding "figure" made from 5 cardinal points that can then be translated into a combination of digits, stops ("."), slashes ("/"), and hyphens ("-").[143] These figures, functioning like lexical phrases, can then be transmitted over telegraphs; so long as the recipient has the legend to decode the phrases, they can work backwards from the lexiconised figure and reconstruct the profile. Galton imagined that such this numeralising of faces could be utilized in a way, broadly, "that promises to be serviceable for eugenic records…[and where] a refugee criminal could easily be outstripped by his portrait, sufficiently like to him to justify, in connection with corroborative evidence, his being placed under police observation"[144] This focus on law enforcement and racial categorization formed twin focuses throughout the whole of Galton's lifelong work and defines much of the later discussion within this chapter.

There is a wealth of scholarship on Galton's impacts on FRTs already written, the majority of which focuses on his creation of 19th century Composite Portraits.[145] His composite portraits were made by overlaying many faces of a single "type," and developing them such that they then appeared as a single face; in this way, Galton was able to create representations of different types of faces, such as a criminal face, a Jewish face, a syphilitic face and so on. In his essay "Generic Images" he argues that the portraits portray the genus of a collection of individuals, that he argues act in the same way that a statistician's use of objects that cluster around a common centre.[146] Framed as statistical and objective, composite portraits undeniably

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[143] Francis Galton, "Numeralised Portraits for Classification and Recognition," *Nature* 83, no. 2109 (1910): 127-30.

[144] Ibid., 127.

[145] Later instances in this chapter will provide even more sources, but powerful statements on this portraits include: Josh Ellenbogen, *Reasoned and Unreasoned Images* (State College: Pennsylvania State University Press, 2012); Katherine Biber, *In Crime's Archives* (New York: Routledge Press, 2019); and Jonathan Finn, *The Criminal Image: From Mug Shot to Surveillance Society.* (Minneapolis: Minnesota University Press, 2009), to name only three.

[146] Francis Galton, "Generic Images," *Proceedings of the Royal Institution* (1879): 1-11.

haunt contemporary FRTs: his use of technological practices in the form of photography, in combination with scientific rhetoric, generates a methodology that argues that such portraits are objective and crucial to categorizing the different individuals and populations of a society. That these facial portraits fall completely in line with his eugenic logics and consistently utilize liminal populations in their representations is also core to understanding how bias and uneven power dynamics are inscribed into many modern FRTs. Critical to this dissertation, composite portraits were not limited to just faces: using Galton's methodology, other scientists of his time utilized composite portraits to create identification systems for signatures, fingerprints, skulls, and even meteorological events. In other words, while composite portraits of the face are potentially dangerous, so too is the flexibility and adaptability of the methodology, so that its potential biopolitical visual logics can then spread to many different types of applications observing and representing an increasing range of individuals and populations. As the previous chapter established, adaptability is similarly core to the power that circulates through uses of FRTs, where its biopolitical vision is flexible to a stunning array of deployments.

Yet, far less attention has been paid to projects like Galton's Numeralised Portraits and his relationship and contribution to the vision science of his time. As evidenced by his paper "The Just-Perceptible Difference," Galton was deeply influenced by early experimental psychologist Ernst Heinrich Weber and Gustav Fechner's mid-19th century psychophysics.[147] As this chapter will discuss in more depth, Fechner's work established vision as a process that could be translated to stable forms of data that then saw vision as isolatable and replicable by technological devices, logics that then became core to Galton's contributions to criminological identification and early biometrics in the forms of signature and fingerprint identification and

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[147] Francis Galton, "The Just-perceptible difference," *Proceedings of the Royal Institution* 14 (1893): 13-26.

verification. As this and the following chapter will argue, such thinking is also central to the post-WWII development of FRTs and the technology's current forms, where FRTs, and other computer vision systems, computationally automate the principles laid out in psychophysics and experimental psychology over as wide a field of vision as possible in acts of detection, identification, and verification. Galton is especially important because he understood the value of the technological, in particular in the form of photography. Importantly too, his Numeralised Profiles are designed to be transmitted across the networked technology of the telegraph makes the project an important harbinger of the Internet-enabled forms of data exchange, in particular facial data.

At the same time, Galton was undeniably a racist, believing firmly in the power of eugenics. He wrote a novel in the final year of his life, "The Eugenic College of Kantsaywhere" that depicted a utopic society built on eugenic principles that was so blatantly racist that his niece literally cut the most egregious parts of the work out so that future scholars could not read it.[148] His work in eugenics, however, was taken seriously and his writing on the ways to foster the best citizens within a society, such as the thinking found within his *Hereditary Genius*, were influential long after his death.[149] He cared as deeply for the lifelong project of developing eugenics as he did for his work technologizing vision: his passion can be found in the unpublished article "A Plea to Experiment on the Artificial Fertilisation of Mammalia," where he extends his logics on fertilizing domestic animals to humanity, fantasizing about a world where women can be impregnated without losing their virginity and that "a maid might bear her first-

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[148] Francis Galton, "Edited Manuscript of 'The Eugenic College of Kantsaywhere'," Box 72, Galton 2/4/19/6/1, n.d., Collection of the University of College London, The National Archives, London, U.K.

[149] Francis Galton, *Hereditary Genius* (London: Macmillan and Co., 1869)

born to the State unsullied by sexual passion."[150] The creation of the ideal state would then involve the correct breeding of humans, preferably in ways that were as divorced from familial and passionate bonds, where every birth was in service of the State. His obsession with hierarchizing, measuring, and categorizing as a way to foster the best life for the ongoing existence of the State follow the broad strokes of Foucault's understanding of biopolitics. Such logics cannot be separated from his work in vision science and facial photography. They are entwined in ways that, as this chapter will argue, showcase how contemporary FRTs owe a great deal to the constellations of the technical, political, and representational that Galton established and perpetuated.

The first half of this chapter then takes up Francis Galton's work as central to the development of FRTs: his work built on and/or established the use of liminal populations in the evolution of technological acts of vision while, at the same time, arguing for continued forms of governmentality through the conflation of coercion and consent. This chapter will examine the ways in which biopolitical vision, aligning with the symbiotic rationales of health and security, have evolved from 19th century photographic practices, such as Galton's, into the contemporary moment of AI-enabled computational FRTs. Doing so requires returning to the prior chapter's technical understanding of cooperative and uncooperative footage: 19th century biology, criminology, and psychology utilized the capture of faces in cooperative environments with photographic practices in order to diagnose, categorize, and discipline individuals and populations; the cooperative environments constructed to produce such images continue to hold great influence on the protocols of contemporary FRT. Rather than simply rehash the cornucopia

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[150] Francis Galton "Handwritten draft of A Plea to Experiment on the Artificial Fertilisation of Mammalia", Box 73, Galton/ 2/5/2/1, June 28, 1894, Collection of the University of College London, The National Archives, London, U.K.

of research already undertaken in this area,[151] this chapter will explore how those early practices,

camouflaged by scientific desires and logics, utilized strategies of coercive enrolment of facial

capture that simultaneously took advantage of vulnerable populations while reinforcing the

marginality of those populations. The right to look embedded within these practices deliberately

aimed at the liminal populations, primarily of the mentally ill and those deemed criminal, in

order to produce a wide-ranging and effective set of infrastructural practices that set the stage for

FRTs' expansion to the massive scale of the general citizenry in the 20th century via identity

documents.

Such an expansion relied upon consensual participation within cooperative environments

that encouraged citizens to make themselves legible to larger power structures in order to receive

access to citizenship resources. As the second half of this chapter will argue, the mass

application of identity documents did not abandon the disciplinary work and logics produced in

the 19th century, but formalized the inscriptions of logics of difference into an increasingly

wider range of sites of power. In order to achieve biopolitical management at the scale of

populations, forces of governmentality increasingly incentivized citizens to consensually enrol

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[151] As just a few examples: Kelly Gates, in her chapter "Automated Facial Expression Analysis and the Mobilization of Affect" (*Our Biometric Future*, 151-190) links physiognomic and pathonomic analysis of the face with the advent and spread of photography, to provide insightful statements about the mechanical capture and cataloging of human faces undertaken by thinkers such as Guillaume Duchenne and Francis Galton. Likewise, Patricio Davila and Peter Hall, in *Critical Visualization* (New York: Bloomsbury, 2022), link modern biometrics and the establishment of contemporary versions of the quantified self to Galton's use of photographic portraits taken from the Home Office of inmates at Pentonville and Millbank prisons, as well as Alphonse Bertillion's deployment of signaletics. Shoshana Magnet (*When Biometrics Fail*) compares the algorithmic implementation of measuring and cataloguing the face within FRT to the 19th century practices of anthropometry. Lisa Cartwright and Matrita Struken (*Practices of Looking: An Introduction to Visual Culture* (Oxford: Oxford University Press, 2011)) flag the visual taxonomies of Cesare Lombroso, linking his work to Jean-Martin Charcot's clinical photographs of patients at the mental institute Salpêtrière to then argue argue how such practices evolved into the mapping of faces present within contemporary FRT. More recent examples of scholarship include the aforementioned Kate Crawford and Trevor Paglen's "Excavating AI" (https://excavating.ai/) which was written as a companion to their ImageNet Roulette project, and bridges contemporary data annotation practices to Lombroso's criminologist work. In addition, the 2020 issue of the journal *Public* dedicated to biometrics and mediating bodies provides a myriad of articles on the various histories of photography of the face within art and design to current applications of computational forms of identification and categorizing (*PUBLIC 60: Biometrics Mediating Bodies* 60 (2020)).

themselves within identification systems that utilized facial data and that would serve as the early

facial databases and sites of later computational FRTs. Importantly, the early 20th century is

marked by the expansion of the subject under observation by FRTs: while early versions of the

technology typically targeted predominately liminal populations, later versions increasingly

included, at a mass scale, the everyday bodies of citizens in the form of cooperative

environments that produced identity documents such as driver's licences and passports. These

infrastructures aided the coercive elements within what appeared to be consensual cooperative

environments. In reality, the gatekeeping of citizen resources by identity documents produced

and sanctioned by the nation state made it so that a citizen, in order to get access to resources,

had to consent to the collection and circulation of their facial data. Therefore, this chapter

explores the levels of consent and coercion present in the technical protocols of cooperative

environments. As this chapter will argue, FRTs surface the collapse of consent and coercion

within media technologies under governmentality, with that collapse producing bureaucratic

materials that can used and/or repurposed into a variety of biopolitical strategies at the scale of

population.

This chapter will end by complicating the typically technical notion of "recognition"

within FRTs. This will be done by linking the mass expansion of FRTs in the early 20th century

to the asymmetrically-defined notions of political recognition within FRTs that still operate in

2023. While Chapter 4 will address this further in its discussion of the building of the post-WWII

FRT apparatuses, this chapter's conclusion contends that the expansion of the technology in the

20th century underlines the fact that the recognition of citizenship is not done through self-

determination, but rather through validation by an external force, often bureaucratic and

governmental, operating at the scale of population. Such operating takes place at sites that

conflate consent and coercion, where tactics such as FRTs are on the frontlines of decision-making environments acting as automated observers and enforcers of political recognition.

The Science of Vision and Technical Protocols at the 19th Century Advent of Biology

Famed 19th century psychologist Gustav Fechner's measuring of the phenomena of the material world is a key missing link in the understanding of how FRTs have come to operate.[152] Past scholarship has typically begun the tracings of FRTs histories with the technological capture and cataloguing of the body by way of photography and later cinema. That work is undoubtably important where such tracings reveal that technological capture of the body under truth regimes defined by scientific discourses were often deployed under rationales of security and health. Under such truth regimes, vision was seen as stable, passive, and objective and often served under larger biopolitical strategies and tactics. While this chapter will build from prior scholarship in this area, it diverges in its insistence that the technological capture within FRTs depends upon, first, an understanding of vision, emerging from the 19th century, that enables vision to be isolated and disembodied in ways that remained core to the eventual automated technical protocols within FRTs.

In Fechner's concept of psychophysics, the observable physical world, tied to physics and chemistry, is an incomplete, yet primary, way by which humans can understand how thought and psychic activity comes to be. Fechner's developed experimental methodologies wherein external stimuli could be measured and correlated to inner sensation, whereby incremental increases in stimuli could be found in proportion to the bodily processing of sensation in a psychophysical

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[152] Fechner's most well-known work is likely *Elements of Psychophysics* (Trans. Helmut E. Adler (New York: Holt, Rinehart and Winston, 1966)) which I have relied on heavily, including the biographical materials and theorization provided in the edition by Edwin G. Boring.

relationship. As Michael Heidelberger expertly summarizes, the general principle of

measurement relies upon comparing the magnitude of different stimuli and their accompanying

the bodily reaction so that the difference between those reactions becomes the ways to measure

sensation; this reliance on difference, then produce units of measurement by which sensations

can begin to be quantified, resulting in "just noticeable differences" defined as the "increase in

intensity of stimulus that first becomes noticeable when the stimulus slowly increases."[153]

Psychophysics then becomes the scientific study of these differences and thresholds, including

vision, ideally spreading from basic sensations (brightness, colour) into more complex internal

processes (such as memory and attention). Despite Fechner's own admission that his principles

of measurement were not a law but are theoretical, Heidelberg argues that Fechner, based on his

methodologies, viewed "mental data as statistical data" that were able to fit within stable

formulas of correlation.[154]

     Scholars typically link Fechner to Hermann vonn Helmholtz as pioneers of experimental

psychology. Helmhotlz is a deeply influential figure: more so than Fechner, Helmholtz's

advanced understanding of physics, in particular light, allowed for a more robust and less

theoretical understanding of vision as a distinct act; his integration of electricity and a

galvanometer further contributed to the instrumentalization of vision.[155] Importantly, in his

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[153] Michael Heidelberger, *Nature From Within: Gustav Theodor Fechner And His Psychophysical Worldview* (Pittsburgh: University of Pittsburgh Press), 201

[154] Ibid., 205. Despite this, it is important to note that Fechner's principles of measurement are not a law but are theoretical, in that the internal processes of sensation cannot, by his own admission, be totally known. This incompleteness is due to the acknowledgement that sensation and stimuli are part of "nature [which is] a single continuous system of component parts acting on one another, within which partial systems create, use, and transmit to each other Kinect energy of different forms" (*Elements of Psychophysics,* 23); within this, foreshadowing quantum physics and Werner Heisenberg's later theorizing, the observer themselves, and the unmeasurable portion of inner thought, are part of that system.

[155] His views on vision are best expressed in his three volume *Treatise on Physiological Optics* (1910; Trans. The Optical Society of America's Southall (1924)).

Popular Lectures on Scientific Subjects, he described the eye itself as an optical instrument: this instrument was a combination of physical characteristics, physiological processes, and psychological reactions, each of which could be measured and replicated.[156] Though the eye was prone to errors and adjustments that were difficult to fully measure and comprehend, Helmhotz conceded, the eye could be understood as a mechanistic device, similar to the instruments that had begun to populate laboratories of the time and vision as a process that could be isolated and duplicated as optics within technological devices.

Such thinking was aided by what Nicholas J. Wade calls the Instrumental Revolution of vision science in the 19th century.[157] The century saw the invention of a number of instruments that allowed for the science of vision to move from natural observation into laboratory settings that better controlled and monitored the data of stimuli and sensation. This instrumentalization took two primary forms: first, the measurement, production and control of stimuli could be generated, replicated, and adjusted, in particular with the popularization of electricity, in experimental settings; second, increasingly complex instruments and technological methodologies made it possible to view sensory organs, like the eye, in finer and greater detail, thereby connecting the physiological structure of organs to sensation and perception. One of the results of this instrumentalization, rise in measurement, and datafication was the notion that senses could be isolated; such isolation, aided by technological devices within laboratory settings, allowed for scientists to form truth regimes around how vision, as a distinct act, could be understood outside of the messy interrelations of continuous systems, including the senses in interaction with each other in the body. Following from these logics, vision could be

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[156] Hermann vonn Helmholtz, "The Eye as Optical Instrument," in *Popular Lectures on Scientific Subjects,* trans. E Atkinson (New York: D. Appleton and Company, 1885): 197-205.
[157] Nicholas J. Wade, *Perception and Illusion. Historical Perspectives* (New York: Springer, 2005): 109-131. This text was also very useful in understanding Fechner and Helmhotz's work more clearly.

homogenized into a set of protocols in ways that objectively reconstructed how a person viewed the world.

The rise in instrumentalization and isolation of the senses disembodied observation such that vision was understood as potentially being able to be replicated outside the biological body within technological devices. Helmhotz and the like fit in within the long history of conceiving of the eye as acting similarly to a camera, beginning with Johannes Kepler's linking of the camera obscura to the lens and image-making of the eye, where the eye's functioning, as paralleled with the camera, imagines vision as images projected onto the retina, like a photographic projector or cinema.[158] Further, the previously mentioned integration of electricity further deepened the technological-biological melding that was taking place at the site of the body within scientific understandings in the 19th century. The understanding of the eye as mechanistic optical instrument combined with the abilities to isolate vision as an act to form truth regimes wherein instruments, namely photographic and cinematic cameras, were able to act remarkably similar to the eye. The key difference, however, was that technological vision was more rational and positivistic than human vision, and therefore more objective and trustworthy. Unlike the body within the single continuous system at the centre of Fechner's understanding of vision, technological devices were self-contained and enabled completely rational and positivistic forms of observation. Again, there is much scholarship in this area, relating technological capture to biopolitical visualities from thinkers such as Lisa Cartwright, Tom Gunning, and Mary Anne-Doanne.[159] This belief is a critical step in the automation of vision

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[158] Ibid., 76

[159] Lisa Cartwright unites Etienne-Jules Marey's chronophotography to the phrenology and cultural topologies practiced by Matthew Brady, arguing that Marey's early cinematic techniques are related to Brady's photographic optical models (*Screening the Body: Tracing Medicine's Visual Culture* (Minneapolis: University of Minnesota Press, 1995). Tom Gunning has written effectively about the linking of scientific desires, in particular those aligning

within FRTs, as it provides the technical framework within which computer vision can be designed and implemented while, at the same time, justifying such isolatable, technical vision as valuable given its nature as a decentralized and objective observer.

Francis Galton, in his aforementioned paper "The Just-Perceptible Difference," developed his composite portraits and other forms of vision from Fechner's work in part by measuring how much the eye could observe, in particular how many dots per inch the eye could observe, and correlating them to acts of recognition and identification. Using the drawn profile of "a Greek girl drawn from a gem," Galton concludes that the human eye can differentiate difference between two profiles at roughly 50 dots per inch at the smallest; any less tends to exceed the eye's natural abilities.[160] He then uses that information to theorize which points on a line that composes a profile of a face are the best to measure, segment, and capture, if one wishes to replicate that profile in forms that he eventually codifies in his numeralised profiles.

Galton's understanding that the eye perceived objects in segments that were then put together internally by the mind are built on experimental psychology of the time. This understanding of vision recalls the technical protocols described in the previous chapter's discussion of an FRT's operative moment, where an image is similarly deconstructed into pixels, lines, contours, and segments as a way of computationally processing. Galton's folding of this

with techniques of circulation, with 19th and early 20th century film and photography that operated as instruments of knowledge; both "Tracing the Individual Photography, Detectives, and Early Cinema" (in *Cinema and the Invention of Modern Life,* eds Leo Charney and Vanessa R. Schwartz (Berkeley: University of California Press, 1995): 15-45) and "In Your Face: Physiognomy, Photography, and the Gnostic Mission of Early Film." (*Modernism/modernity* 4, no. 1 (1997): 1-29) are very powerful pieces of scholarship which provide many useful details about the technological datafying of the body, and the face, within modernism. Likewise, Mary Ann Doane connects 19th century physiognomic studies to the gnostic impulses present Béla Balázs and Jean Epstein's writings on cinema (Mary Ann Doane, "Facing a Universal Language," *New German Critique* 41, no. 2 (2014): 111-124; Mary Ann Doane, "The Close-up: Scale and Detail in the Cinema," *differences: A Journal of Feminist Cultural Studies* 14, no. 3 (2003): 89-111).

[160] Galton, "The Just-Perceptible Difference," 19-20.

vision into technological devices, whether that was a telegraph or a photograph, is crucial as well

and exemplary of the time period wherein the isolation and replication of vision away from other

senses and biological processes. These developments were critical to the eventual decentralizing

and automation of FRTs, providing a key building block of the technology's technical protocols.

However, as this dissertation has repeated, FRTs are not generalized acts of vision but are

technologies that target the face; this is important as the face holds specific representational and

political value that then structure the corresponding protocols found within the technology.

Importantly then, Galton is a figure whose work further networks to other thinkers of the 19th

century and early 20th century who used photographs of the face, alongside leveraging liminal

populations and logics based in security and health operating under scientific discourses, in ways

that would become core to the future political and representational protocols of FRTs.

Scientific Knowledge at the Site of the Face

As stated in the introduction to this chapter, there is a wealth of scholarship written

connecting 19th century photography and image-making to contemporary instances of FRT.

Despite this well-established core of scholarship, it is worth lingering further on some of the

major 19th century figures alongside Galton in order to link their practices to the establishment

of biopolitical vision, in particular the ways in which the asymmetrical power relations, found

primarily in cooperative medical and carceral environments, become the spaces in which the

facial data was extracted and enrolled mostly under coercive top-down circulations of power. As

will be demonstrated in the second half of this chapter, the largely non-cooperative extraction

and enrolment within such 19th century photographic practices examined become the

infrastructures to produce and reinforce liminal populations, a biopolitical strategy that is central

to the following century's development of FRTs. Within such apparatuses, it is not only the

photos, and their representational protocols, that lay the groundwork for future FRTs and their

expansion to the scale of population, but the accompanying systems of cataloguing and

organizing the photos into taxonomies as facial data that were harbingers of contemporary facial

databases and data annotation practices. As observer apparatuses, the 19th century doctors and

scientists undertaking their research embodied a right to look which repeatedly leveraged the

objective evidence that photographs were seen to provide in order to better reinforce what a

healthy and/or law-abiding citizen face should look like, a face most often defined along lines of

racial and gendered difference.

Medical Photography

Francis Galton collected photographic portraits, staged identically to mugshots, from a

variety of sources including dozens from male and female patients at the Bethlem Royal Hospital

and the Hanwell Asylum.[161] In doing so, Galton was part of an established history of utilizing

medical patients in his experiments, in particular as test subjects for methodologies intended to

applied to larger populations. The fact that the face is central to these photographs is essential.

Early practitioners of physiognomy, such as Johann Kaspar Lavater, Petrus Camper, Franz

Joseph Gall, and Charles Bell, focused on linking the face to divinely granted moral worth, using

sketches, paintings, busts, and silhouettes as means of evidence[162]; each aligned their religious

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[161] I saw these images as part of the Galton Papers ("Composite Photographs: Bethlem Royal Hospital Patients." Box 98, Folder 2/8/1/5/4 and Folder 2/8/1/5/, c1880s, Collection of the University of College London, The National Archives, London, U.K. These photos, along with other parts of The Galton Papers, have now be digitalized as part of the Wellcome Collection (The Wellcome Collection. n.d. https://wellcomecollection.org/works/vaktxnt9/items?canvas=876)

[162] A sampling of texts from these thinkers include: Johann Caspar Lavater, *Essays on Physiognomy for the Promotion of the Knowledge and the Love of Mankind,* trans. Thomas Holcroft (London: G. G. J. & J. Robinson,

beliefs with scientific observation, generating taxonomies and categorizes of faces that would

provide an influential infrastructure for later thinkers. In one early example, Alexander

Morison's 1840 *The Physiognomy of Mental Diseases* was created by 100s of commissioned

portraits of asylum inhabitants with Morison identifying the face as the site where mental disease

would be imprinted; these portraits were then tied to diagnostic categories, meant to be used as a

useful resource for other medical practitioners.[163]

By the mid-19th century, psychiatric doctors in particular were turning to photography as

means to produce physiognomical images of those deemed mentally and physically ill to both

catalogue their ailments and, in many cases, as a means to treat the patient. Hugh W. Diamond,

working at the Female Department of the Surrey County Lunatic Asylum (1848-58), saw the

photograph as a technology which "speaks for itself with the most marked precision…[the

photographer can] arrest the attention of the thoughtful observer more powerfully than any

laboured description."[164] This precision was effective for both the doctor-observer and the

patient-observed; Diamond would include the photographic portraits as part of the treatment,

wherein looking at an image of oneself would give the patient the necessary objective point of

view to see themselves and their illness. Additionally, the portraits also provided an image that

could be used for bureaucratic tracking of patients, in particular for purposes of re-admission.

1789); Petrus Camper, *Dissertation physique de mr. Pierre Camper, sur les differences reelles que presentent le traits du visage chez les hommes de differents pays et de differents ages* (Utrecht: B. Wild & J. Altheer, 1791); Franz Joseph Gall and Johann Gaspard Spurzheim, *Anatomie et Physiologie du Système Nerveux en Général, et du Cerveau en Particulier (4 vols. and an atlas)* (Paris: Schoell, 1810); Charles Bell, *Essays on the Anatomy and Philosophy of Expression* (London : J. Murray, 1824).

[163] Alexander Morison, *The Physiognomy of Mental Diseases,* Self Published, 1840. This text has been digitized by the Wellcome Collection (n.d. https://wellcomecollection.org/works/pwz3j53y/items?canvas=7)

[164] Hugh W. Diamond. "On the Application of Photography to the Physiognomic and Mental Phenomena of Insanity (1856)," PSICOART 1. 2010 para. 2. Further information on Diamond's practices was found in Sharrona Pearl's "Through a Mediated Mirror: The Photographic Physiognomy of Dr. Hugh Welch Diamond," *History of Photography* 33, no 3 (2009): 288-307.

Diamond's work connects to Jean-Martin Charcot later work at the Salpêtrière, and the publications *The Iconographie photographique de la Salpêtrière* and *Nouvelle Icongraphie de la Salpêtrière*, which focused on women diagnosed with hysteria in order to document their maladies.[165] Like Diamond, Charcot saw his photographic portraits as a means to look upon his patients and "freeze the abnormality, to decompose the various abnormal movements one by one, and thereby capture the disorder with precision."[166] His portraits were powerful and permanent aids in capturing "abnormalities" so that they could be looked examined at any point thereafter, in particular when used as medical slides where "images lifted from the retina of the unblinking, all-seeing composite eye [of the projector] were distributed throughout the space of the amphitheatre."[167]

Guillaume Duchenne de Boulogne was a sometimes mentor to Charcot, with his earlier work *The Mechanisms of human facial expression* (1862) serving as the templates for Charcot's later works.[168] Not associated with any specific hospital in Paris, Duchenne saw himself as part artist and part experimenter, and used the new technologies of localized electricity alongside photography to produce an orthography of the innate language of facial expressions for use in anatomy, physiology, psychology, and fine arts like painting and sculpture. Five of the six subjects of his portraits were his patients, including one opium addict who died two days after

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[165] Désiré Magloire Bourneville and Paul-Marie-Léon Regnard, *The Iconographie photographique de la Salpêtrière* (Paris: Aux Bureau de Progres Medical, 1878); Georges Gilles de la Tourette, *Nouvelle Icongraphie de la Salpêtrière.* (Paris: Masson, 1902).

[166] Quoted in in Jonathan W. Marshall's *Performing Neurology. The Dramaturgy of Dr. Jean-Martin Charcot.* ((New York: Palgrave Macmillan, 2016), 28).

[167] Ibid., 96.

[168] Guillaume Duchenne de Boulogne, *The Mechanism of Human Facial Expression,* trans. R. Andrew Cuthbertson (Cambridge: Cambridge University Press, 1990).

his portraits; the portraits themselves are presented individually, and then in taxonomical arrangements he calls synoptic tables later in his text.[169]

Taken together, these photographic practices are defined by biopolitics for which life is captured within the health of the individual body and defined by what Foucault explores as the medical gaze. Explained in *The Birth of the Clinic*, the medical gaze is structured by the medical authority of the doctor, who uses the asymmetrical power relationship that they have with their patients to transform their bodies into objects of diagnosis.[170] This reduction of the body is an example of the right to look present within biopolitical vision, where the medical gaze works to define, categorize, and separate those under its observation. Doing so granted vision that operated under largely coercive top-down power, aligning itself with the qualities of empirical diagnosis, making the bodies under its observation into fields of data, arranging them into photographic taxonomies, and ultimately providing the basic informational structures of later FRTs.[171]

Importantly, and key to Galton's work in particular, rather than apply vision to the entire population, the coercive enrolment of the mentally ill, in particular women, produced a liminal population which could be documented, experimented upon, and circulated as image-objects with little oversight. The image-making here produces a visuality where the local embodiments of the patients are mediated such that the authority of the doctor overshadows the local affect and

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[169] Ibid., 212, 232. Duchenne de Boulogne's work was very influential on Charles Darwin, who used plates from Duchenne's experiments in his *The Expression of the Emotions in Man and Animals* (London: John Murray, 1972)). Darwin's *On the Origin of Species* (London: John Murray, 1859) was an obviously important work from this time period, and, unsurprisingly, the text's theories on evolution would be adopted by other scientists with the aim of proving what sort of human beings were the most advanced, including Darwin's cousin, Francis Galton.

[170] Michel Foucault, *Birth of the Clinic: An Archaeology of Medical Perception* (New York: Pantheon Books, 1973).

[171] Subjectification in such examples depends on the abilities and desires to incorporate the mentally ill back into the "healthy" population of the larger society: as such, the subject that emerges from this practice is able to be medically categorized as "healthy" by way of scientific observation, thereby differentiating them from the ill; further, as is seen best in Diamond's practices, the patient must recognize themselves as a healthy citizen in order to be cured.

bodily experiences of the patient. The gaze, augmented by portraits of the face, works at the site

of the individual body, using vision as a force to attempt to allegedly cure the body, while also

providing, via the public circulation of such images, the larger social body with a catalogue of

symptoms and the means to define and differentiate the healthy from the ill.

In addition to medical patients, Galton also targeted individuals and populations that had

been labelled criminal in this experiments, creating similar scientific photographic taxonomies

and measurements as their medical counterparts. Importantly, those labeled as mentally ill and

those labeled as criminal often overlapped, and there is therefore linkages between the medical

practitioners previously explored at the criminologist of the following section. However, instead

of curing the individual body, the criminologists like Galton aimed to protect the social body by

identifying more generalized traits within the body, and the face in particular, with their

biopolitics being aimed at the social health and security of populations.

Criminal Photography

The Kilmainham Gaol was the type of panoptic prison that Foucault centralized in his

thinking through the disciplining of the body that came with the 19th century modernization. The

prison also utilized a series of photographic techniques to document and monitor its prisoners. In

the early 1850s, the proto-mugshots were collected to keep track of potentially returning

prisoners, with each inmate's portrait taken and stored; by 1871, the system had expanded to

include a card with identifying information alongside the portrait including categories such as

"Trade," "Education" and "Religion."[172] While arguably too much emphasis has been placed on

the panopticon within Foucault's thinking, in particular as to how it relates to the contemporary

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[172] *History of Kilmainham Gaol 1796-1924* (Dublin: Office of Public Works Ireland, 2001), 26.

moment, the example of Kilmainham Gaol shows how the panopticon, as a colonial British technology, became melded with other forms of technology, like photography, in the securitization of the Irish public.

The Gaol's collection of mugshot-like photographs was not that unusual as, at that time, many law enforcement apparatuses in Europe and North America used photo proto-databases similarly. This also included Rogue's Galleries, collections of photographs displayed prominently and circulated publicly in hopes of catching criminals who were trying to hide their identities.[173] Thomas Byrnes's *Professional Criminals of America* was collected during his time as inspector of police and chief of detectives in New York City, and was one example of a book-length work that served to give a face to what was named as a mysterious and slippery class of people, who needed to be continuously monitored and controlled; like Diamond and Charcot, photography became a way to "freeze" the criminal's face so as to better examine it.[174]

Like the use of physiognomy in the treatment of mental illness, the knowledge gained from scientific and "objective" methodologies, augmented by the use of large archives of photographs, made criminal photography an influential set of theories that informed 19th century understandings of criminality. The leading figures of this school of thinking were Ceasare Lombroso and Galton, but also included works such as *La crane des Criminels* by A. Debierre and Havelock Ellis's *The Criminal*.[175]

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[173] There were two useful resources for the basics of Rogues Galleries including the aforementioned "Tracing the Individual: Photography, Detectives, and Early Cinema" by Tom Gunning and Theodore Kytka's 1901 essay "The First Rogue Gallery in the World" (*Camera Craft* 2, no. 5 (1901): 379-384; digital copy at https://archive.org/details/cameracraft1219001901phot/page/n495/mode/2up?view=theater.

[174] Thomas Byrnes, *Professional Criminals of America* (New York: Cassel & Company, 1886).

[175] A. Debierre, *La crane des Criminels* (Lyon : A. Storck, 1895); Havelock Ellis, *The Criminal* (New York: Scribner & Welford, 1890).

Lombroso advocated for what he called anthropological criminology, wherein certain physical traits, especially facial, were inherited markers of atavism; this atavism would be linked to a pre-human-like population, who, despite the world moving forward, were stuck as uncivilized savages and un-evolved. His work, like *Criminal Man*, is filled with tables upon tables of measurements of facial characteristics and "physical anomalies," alongside explanatory statistics, which were then contrasted against what he claimed as moderate and normal European features; the segmenting of the body, and the face specifically, can been seen in the precise measurements that sit alongside series of photographs of the parts of the body.[176] With these banks of photos as his empirical evidence, Lombroso's atavism explained that certain faces were more prone to criminal behaviour, based on their inferior hereditary stock, rendering whole populations animalistic and not worthy of full designations of life.[177]

Francis Galton was a more respected scientist than Lombroso, and Galton's composite portraits and work on eugenics would resonate into various governments' policies well into the 20th century. In order to construct some of his composite portraits, Galton utilized a collection of photographs from Sir Edmund Du Cane during his role at the Pentonville and Millbank prisons[178]; the composite portrait, he then argued, then provided insight into the types of faces and characteristics that were most like to signal criminality. In this way, both Galton and Lombroso were most concerned with generalizable traits which could be used to categorize and

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[176] Ceasare Lombroso, *Criminal Man*, trans. Mary Gibson and Nicole Hahn Rafter (Durham: Duke University Press, 2006).

[177] In addition, a pupil of Lomboroso, Lorenzo Tenchini, produced sculptures of inmates' faces in order to better study their facial characteristics and their relationship to criminality. His work came to my attention via the exhibition catalogue for "Facial Recognition" at the Wende Museum (Dec 12, 2015, https://issuu.com/wendemuseum/docs/updated_facial_recognition)

[178] Digitized versions of Galton's photos can be accessed through the Wellcome Collection at "Composite Photographs (c1877)" n.d., https://wellcomecollection.org/works/eg6jc222/items

sort worthy populations from those who were not, with such traits being in-born and evolved from the generations before.

Galton's work was influenced by Alphonse Bertillon whom he considered a contemporary and exchanged correspondence with. Bertillon was focused on the identification of the individual through the building of a scaleable and portable law enforcement infrastructure composed of carefully gathered data and photographs; his work formalized, then circulated widely after his exhibition at the 1893 World Fair in Chicago, much of the type of work already happening in places like the Kilmainham Gaol.[179] Via his method of signaletics, alternately known as "anthropometric identification" and the Bertillon Method, a law enforcement team was encouraged to take detailed measurements of anyone they expected of criminal behaviour, not just criminals charged with crimes, and build detailed profiles from that information. Bertillon's metric photography was essential to this process: he did this by precisely standardizing the photographing environment, providing detailed description of where the camera and its subject should be placed, with objects included for scale. An initial record of the criminal's body, broken into quantifiable identifying measurements, were also accompanied by two photographs, one where the person faced the camera and the second in profile, among the first forms of the mugshot. Bertillon's system was meant to teach law enforcement how to properly identify, then catalogue criminals; such a system separated the face into neutral and disconnected parts via the "objective" mechanical apparatus of the camera. Francis Galton admired Bertillion's work, keeping examples of his anthropometric cards, which can be found in his archive; in his notes, he

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[179] His more influential works include: Alphonse Bertillon, *Metric Photography,* trans. Dr. Louis Tomellini (Lyon, France: A. Rey Imprimeurs-Editeurs, 1908); Alphonse Bertillon, *Signaletic Instructions Including the Theory and Practice of Anthropometrical Identification*, trans. R. W. McClaughry (Chicago: Chicago Day Press, 1885).

copies out Bertillion-like tables of bodily measurements, cataloguing the best data needed for establishing his version of a Bertillion system.[180]

There is a further glut of effective scholarship on the figures of Galton, Bertillon, and Lombroso, including Allan Sekula's oft cited "The Body and Archive" as well as Stephen Jay Gould's *The Mismeasure of Man*.[181] Contemporary scholarship links these 19th century scientists fairly directly to FRTs to argue that the technology has long been biased and continues to be racist and sexist because of these roots[182]; similarly, tying FRTs to the 19th century medical photographic practices, as the earlier part of this chapter does, might give the impression that there is a straight-line between figures like Charcot and Duchenne and the exploitative instances of contemporary FRTs. While these are discussions are not wrong, they are often too simple: examining how power circulates within these early photographic practices show how disembodied and clinic vision became normalized, even something to aspire to, after which other ideologies and biopolitical strategies can be layered on top of. To this end, like the medical photo practices discussed earlier in this chapter, the criminologists leveraged their asymmetrical

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[180] "Bertillion Notes." Box 116, Folder 2/9/2/15/1-2, n.d., Collection of the University of College London, The National Archives, London, U.K.

[181] Allan Sekula, "The Body and Archive," *October* 39 (Winter, 1986): 3-64). For Sekula, the instrumental use of photography in taxonomical formations by law enforcement generated criminal biotypes while also enlisting vigilant citizens in observing each other for potential criminality. Stephen Jay Gould's *The Mismeasure of Man* (New York: Norton, 1981) similarly takes up thinkers like Galton and Lombroso, uniting them with different forms of evolution and biological determinism alongside the underpinning political contexts of such arguments; Gould's text then analyzes the truth regimes of 19th century scientists alongside their use of photography, arguing that such thinking, while erroneous and racist, needs to be understood within the rationales of its time in order to see the limits of the time's theories and methodologies.

Further work includes Paul Rabinow examining Galton's invention of fingerprinting in order to explain the desire to link individuals to populations to better govern; for Rabinow, the standardizing uniformity of Galton and Bertillion have deeply dangerous influences on contemporary biopolitics, in particular within broad applications of risk profiling and population genetics. ("Galton's regret and DNA typing." *Culture, Medicine and Psychiatry* 17 (1993): 59–65). Similarly, Nikolas Rose, in a section on eugenics within his *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century* (Princeton: Princeton University Press, 2007) locates the 19th century biologization of race within contemporary biopower (54-55).

[182] See notes from the introduction to this chapter.

authority to coercively enrol individuals in their systems and research, likewise producing a liminal population that could safely be used to experiment on while perfecting and expanding the deterministic systems of datafying the body. Similarly, such image-making practices strips the face of its agency and human qualities, recoding it as a part-object, and ignoring the full range and interdependent components of the subjectivity that is housed in the person that possesses that face.

The blending of Bertillion's work with an understanding of vision aligned with thinkers like Fechner and Helmhotz makes Galton's work a prime example of the early political, technical, and representational protocols that would later come to define automated FRTs. His composite portraits, and their political and representational protocols, provide broad categories of Other, producing a base logic dependent on racial and gendered difference that was augmented further by the scientific methodologies; such logics could then operate predictively to identify the types of faces most likely to be criminal and/or ill. In this way, the technical protocols in his numeralised portraits established by segmenting, cataloguing, and measuring of the face into specific and anonymous smaller parts is a form of observation which provided the base mechanics for post-WWII FRT; later computational versions of FRTs utilize an isolated form of vision within a technological device that reduces the face into discrete and segmented parts. Further, Galton's concern with generalizable faces speak to the central use of facial templates within later FRTs: the notion that faces could be reduced to repeatable patterns, like Haar Cascades or the more complex eigenfaces, stems from the discourses that emerged from Galton's search for common traits among different populations.

The linking of specific faces to larger generalizable traits, wielded under predictive logics, is a major enabling component of FRTs' eventual scaling to the level of population,

where suddenly masses of individuals could be sorted quickly and efficiently. Galton is again a key harbinger of such logics wherein his larger societal concerns enact biopolitics at the scale of population: rather than just aid in the management of "life" as the health of the individual body, his photographic practices deploy biopolitical vision in order to foster life through mechanics of public safety, promotion of civilization, and the ongoing preservation and growth of a "healthy" social body by parsing populations into useful and not useful citizens. This required an expanding of the system of biopolitical vision to include the population as a whole, wherein his thinking and techniques needed to be applied to every citizen in order to be most effective.

Expanding Biopolitical Vision to a Mass Citizenry

Drawing from such writers as Thomas Malthus, Galton's treatment of the health of a population can be found in the later chapters of *Hereditary Genius* where he discusses the best paths for the survival of civilization and future generations in the chapters "The Comparative Worth of Different Races" and "Influences that Affect the Natural Ability of Nations."[183] Alongside discussions of birth rates, labour, nomadism, and intelligence, he argues that a country "should maintain, during many generations, the policy of attracting eminently desirable refugees, but no others."[184] Galton advocates for systems to sort not just citizen from non-citizen, but desirable non-citizens from those that are undesirable. This finer form of separating must occur at a mass scale, where enrolment in biopolitical systems becoming completely widespread, in order to best foster the healthiest civilization.

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[183] Malthus, *An Essay on the Principle of Population;* Galton, *Hereditary Genius*, 336; 351.

[184] Galton, *Hereditary Genius*, 360.

Advocates of Bertillion's signaletics argued similarly: as the Publishers' Preface to *The Bertillon System of Identification* explains "in order for society to reap [the system's] full benefit, every human being should be partially signalized…at about the age of ten years, and completely so at the age of maturity; and every country should have a national signaletic office where all the signalments of its inhabitants would be filed" (viii).[185] The authors go on to argue that not only could such a system take the place of passports and other identifying documents, but it would be incorporated into documents such as life insurance policies and permits, wherein the system even further expands its biopolitical management. Within this schema, facial photographs could be used to detect and predictably sort desirable citizens from undesirable citizens while also activating identification and verification mechanisms that slide more precisely into the desires of large-scale control of mobility, in particular by nation states. Lest anyone think that Bertillion's system was bad science or a forgotten relic, Martine Kaluszynski states directly that the vision and information systems of anthropometry and signaletics "placed identity and identification at the heart of government policy, introducing a spirit and set of principles that still exist today"[186]

While such systems had begun well before the 20th century, including widespread use of censuses and other forms of documenting and registering citizens, the popularization of national ID cards, driver's licences, as well as passports in the 20th century began to regularize and standardize the facial image within identification apparatuses; these systems are a very effective

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[185] The Publishers, "Publishers' Preface," in *Signaletic Instructions Including the Theory and Practice of Anthropometrical Identification,* trans. R. W. McClaughry (Chicago: Chicago Day Press, 1885): viii.

[186] Martine Kaluszynski, "Republican Identity: Bertillonage as Government Technique," in *Documenting Individual Identity: The Development of State Practices in the Modern World*, eds Jane Caplan and John Torpey (Princeton Princeton University Press, 2001), 123. Josh Ellenbogen and Alison Langmead, in "Forms of Equivalence: Bertillonnage and the History of Information Management" (*Technology and Culture* 61, no. 1 (January 2020), 207-238), detail the strong influence Bertillon had on information and data management, linking his practices to the later developments of digital computing and the 20th century culture of information broadly; the algorithmic character of Bertillon's work, in particular the ways in which he encoded the body, would be utilized to act as "the functional equivalent to an impossibly precise human perception and memory" (214).

example of Chapter 2's discussion of infrastructuralism, and extends the linking of thinkers such as Galton and Bertillon to FRTs beyond simple explanations of sexism and racism. Such 20th century systems became ways to identify and verify citizenship, and allow access to citizenship resources to those that have been deemed desirable potential citizens. Following from this, the FRT apparatuses of this time were defined by their framing as external and objective devices which helped to transcend human vision and provide an objective evaluation of the face under scrutiny: as such, the positivist practices associated with FRT of this period were rationalized as effective means by which to define and evaluate citizenship, and manage access to the resources of citizenship from those who were not, while also providing clear predictive criteria to include or exclude others who had yet to fall under a FRT's gaze.

Making the Desirable Citizen Legible through "Consensual" Documentation

The 20th century shift in fields of vision from FRTs that targeted relatively small liminal populations in order to prototype the technology, to those instances where the FRTs functioned as a mass technology depends on circulations of power defined by citizenship. Broadly, esteemed sociologist Gerard Delanty argues that citizenship "has been held to imply membership of a polity and is defined by the rights bestowed by the polity on the individual. In the most general terms, citizenship involves a constitutionally based relationship between the individual and the state."[187] Importantly, this relationship, and the rights bestowed, become the means to connect the individual with resources that the polity defines as necessary for its citizens. Btihaj Ajana expands this notion further, arguing that that the notion of citizenship includes actual

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[187] Gerard Delanty, "Models of Citizenship: Defining European Identity and Citizenship," *Citizenship Studies* 1, no. 3 (1997), 287.

resources, such as wealth, health care, and education, but must also incorporate the fact that

citizenship is as much about "issues of access to resources, services, spaces and privileges."[188]

Resources, and access to resources, is not simply granted by national membership but is

contingent, as J.M Barbalet contends, on whether an individual fits "a set of practices…which

define a person as a competent member of society."[189] Therefore, within citizenship, there are

further notions of "fitness" wherein certain individuals and populations are better able to meet

the expected set of practices. While the most obvious sites that such fitness might be tested

would be at national borders, and apparatuses surrounding the crossing of national borders,

citizenship is also marked by the the integration of the borders and thresholds into daily

administration and bureaucratic spaces.

The 20th century's sense of citizenship was further formed in large part by the previous

centuries 'turn from sovereign power into the formation of nation states; the subsequent

territorializing brought about by the forming nation states, drove symbiotic rationales of health

and security that lead to, among many other things, this chapter's prior discussion of the use of

photographic practices that defined who a healthy and safe citizen was. The development of

nation states, and the citizens of nation states, were done wherein health, security, and citizenship

were defined relationally to each other, but also in relation to the rise of scientific methodologies

and the advent of biology and the man as a figure of study. This complex of power helping to

mould citizenship is further complicated by the invention of race, and racial difference being

inscribed into the representational practices of image-making technologies, such as photography.

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[188] Anjana, *Governing Through Biometrics,* 12.

[189] J.M. Barbalet, *Citizenship: Rights, Struggle and Class Equality* (Minneapolis: University of Minnesota Press, 1988), 2.

Images, vision, and representation is core to the forming of citizens, where the production and reinforcement of visualities serve to foster identities that can then be leveraged into forces of subjectification. Returning to Stuart Hall, in "The Question of Cultural Identity" he argues that nationality and national identity "are formed and transformed within and in relation to representation."[190] The nation is a symbolic community wherein citizens participate in the idea of the nation as defined by the dominant system of cultural representation; this symbolic community is tied directly to the representations that it produces and generates about itself. Cultural identity operates on discourses and truth regimes under homogenizing and unifying principles wherein class, race, mental health, and/or gender are said to be ignored and/or incorporated seamlessly into the nation state so as to produce a united nation. This unification is indicative of governmentality, wherein the self-preservation of the nation's heritage and ongoing existence has limited tolerance for pluralization and hybridity; instead, the desire for stability produces an imagined homogeneity whose continued existence is seen as urgently necessary. However, in practice, this process does not homogenize, and instead relies heavily on the production and inscription of difference. Such logics are essential to both the production of liminal populations (and the materials extracted from those liminal populations) and to rationales of biopolitical tactics and strategies, like FRTs. At the same time, the representations gathered within large-scale bureaucratic acts, that are then folded into tactics such as FRTs, are also imbued with protocols aligned with a unified national identity.

Finally, the formation of nation states established phenomena like the development of mass FRTs through the collapsing of consent and coercion at sites of citizenship, in particular in data enrolment practices within identity documents. It is critical then to understand the ways in

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[190] Stuart Hall, "The Question of Cultural Identity," in *Modernity and its Futures,* eds. Stuart Hall, David Held and Tony McGrew (Oxford: Polity Press, 1992), 292.

which the citizen-subject is imbued with the responsibilities of being a citizen and makes themselves a subject in forms of bottom-up power in a performance of their own fitness for citizenship.

The Consensual and Coercive within Co-Operative and Non-Co-Operative Environments

The deployment of FRTs has long depended upon data enrolment in various forms, which themselves are interwoven with the dynamics of consent-coercion that are very often present in citizenship. The roots of this can be seen within the establishment, distribution, and reinforcement of the influential protocols in 19th and 20th century photographic practices that are most present in the first stage of a contemporary FRTs operative moment: capturing footage. Recalling Chapter 2, the capturing of footage is defined by technical protocols and split into the two general categories of cooperative and non-cooperative. Cooperative footage is where the individual captured is aware of their being captured and is made visible to the apparatus in a controlled environment; non-cooperative footage is where the user may or may not know they are being captured, but are not actively made visible. While this chapter focuses primarily on cooperative environments, where light, pose, and other aspects of data collection can be most easily controlled in the production of uniform materials, the capture of images in non-cooperative will be explored in later chapters.[191] At this stage, however, the cooperative/non-cooperative binary is too simplistic and technical and must be complicated by incorporating sliding scales of consent and coercion, which then make bare the different types of circulations of power present within an FRT's operative moment. It is also important, again, to imagine

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[191] This will be expanded in Chapters 4 and 5 in further discussion about the automation of FRTs vision, and the massive leaps the technology made in the 2010s with the implementation of neural network-trained artificial intelligence models.

consent-coercion not as binary terms but rather two poles of scale that can be combined with the notions of cooperative-non-cooperative environments, specifically within the stage where footage is captured. Such a dynamic further defines the type of observer FRT is operating as in the various ways that the technology is deployed.

In both cooperative and non-cooperative environments, consent and coercion are increasingly blurred together within the use of contemporary FRTs, with such conflation having roots in early 20th century data enrolment practices. In the examples of both consensual cooperative and non-cooperative environments, while an individual knowingly allows to have their image captured, other forces ensure that there are few alternatives than to allow such capturing of one's image: for example, if one wishes to travel by air, they must make themselves visible in the space of the airport and in the controlled environments of passport image-making. Further, such pseudo-consensual acts double as tests of citizenship fitness, wherein the citizen is taking on the responsible of a citizen and cooperatively performing as such. Therefore, citizenship is a powerful force within these dynamics, wherein consensual activity within co-operative environments is often driven by subjectification and the performance of citizenship in order to gain access to the resources of citizenship; these result in performances of the demanded "fitness" where the citizen shows they can and will participate in the established sets of practices that define citizenship. This dynamic of consent-coercion within controlled environments becomes even more complicated within identity documents and processes like those involved with the gathering of immigrant, VISA, and/or refugee materials, within which facial images have long operated under a variety of functions within different FRT usage. Again, an individual must present themselves as an act of "good" potential citizenship for the capture of such materials in order to prove themselves worth of citizenship; there is no other option if one wishes

to gain access to the resources attached. Not only are the resulting materials deliberately marked by difference in their representational protocols, but they are then folded into further political protocols by the use of the materials in the training and improvement of FRTs.[192] Following from this chapter's discussion of 19th century medical and carceral photographs, the liminal populations most leveraged by the consent-coercion dynamics produce the experimental fodder for the improvement and expansion of FRTs such that the technology reaches a point where it can look over entire populations at once.

In the early 20th century, the mass gatekeeping of access to citizenship resources that was tethered to the cooperative environments of FRTs was established by the expansion of identity documents, wherein the citizen submitted themselves, in acts of subjectification, to presenting their face, while the nation-state was able to set the terms of of such submission. As will be discussed in the coming chapters, this collapse of consent-coercion borne from the illusion of cooperation between citizen and nation state only grows more pronounced in the post-WWII establishment of biometrics and the large scale application of computational technologies, like FRTs, in the 21st century. As the conclusion to this chapter argues, this collapse produces a complex of visuality that is undergirded by the asymmetrical location of political recognition within larger apparatus of power that makes it such that citizens must be recognized by an apparatus like an FRT in order to receive citizenship resources.

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[192] In the case of FRTs, following examples detailed in Chapters 4 and 5, this allows materials collected in immigrant materials to slide into larger infrastructures meant to test and evaluate the technology; in some cases these materials are used in training models which are then imported into FRTs for a variety of other purposes. Collecting facial images within such layers of bureaucratic functioning is not harmful in and of itself, but it does produce a wealth of materials and protocols that can be repurposed and reused in a myriad of ways that serve a range of powers and desires. In the case of identity documents, the expansion brought on by increased popular mobility lead to an increase of facial photos tethered to identifying information that would be used in the second half of the 20th century to create the bedrock of FRTs that would be exponentially expanded in the 21st century.

Within examples of cooperative environments, overt and subtle coercion structures a nimble and adaptable version of the FRT observer that effectively operationalizes biopolitical vision; as a tactic, the leverage provided by the collapse of consent and coercion works under numerical and superficially "objective" logics in ways that drawn from a wide range of biopolitical strategies. Core to this chapter, the right to look that emerges from 19th and 20th century photographic practices conflates consent and coercion within increasingly larger bureaucratic infrastructures so that the dynamics, and the protocols and technologies that accompany those dynamics, can be scaled to the mass level of population, in particular within identity documents. The resulting image materials can be used directly within the immediate biopolitical tactics that they are collected for, or can be repurposed and folded into other biopolitical strategies.

Mobility and the Beginnings of the Rise of Biopolitics of Flow

Within the establishment of 20th century FRTs as a mass technology, the collapse of consent and coercion is best captured by the popularization of identity documents brought about in large part by the increase in citizen mobility necessitating the increase in biopolitics of flow and control.

Gilles Delueze's well-referenced "Postscript on the Society of Control" aptly explains the shift from a 19th century biopolitics defined by confinement and discipline to the 20th century biopolitics of control defined by flow and what Deleuze names as modulations.[193] As, he argues, disciplinary biopolitics peaked at the beginning of the 20th century, the tensions between individual and population remain but are instead governed primarily by numerical languages and

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[193] Gilles Deleuze, "Postscript on the Societies of Control," *October* 59 (Winter, 1992): 3-7.

checkpoints; under such a system, individuals become "dividual" materials more easily

circulated in globalized environments but defined and monitored as informational bodies. This is

not to say disciplinary biopolitics disappeared, but rather such logics begin to meld with

biopolitics of control which are not defined by restriction, but rather by allowing movement,

such as migration and urbanization, while monitoring and documenting such movement in ways

that make management of the individuals' and populations' mobility possible. Deleuze's brief

essay provides an essential turning point from this chapter's focus on 19th century photographic

practices, many of which taking place in the disciplinary enclosures that Deleuze flags as dying

institutions (prisons and asylums), towards the consensual enrolment of citizens by nation states

and capitalist entities that was increasingly defined by ways in which individuals made

themselves into citizens.

The pillars of health and security within disciplinary biopolitics were carried forward into

the 20th century and, while the discourses around health and security changed, the twin concepts

remained central to the biopolitics of flow and control. This took the form of arguments centred

on citizens consensually enrolling in mechanisms of identification and verification in the form of

identity documents, often incorporating facial photographs. Such enrolment was essential to

discourses which stated that in order to be the most healthy and the most secure national state,

the state needed to be able to effectively distribute and monitor resources; "good government"

meant managing such resources, allowing differing levels of access to different populations.

These types of bureaucratic structures are not inherently bad: within the citizen-state

relationship, bureaucratic infrastructures provide the assemblages and labour needed to provide

populations with the necessary citizenship resources. Yet, bureaucracy also accumulates, with

layers being added on top of initial layers, connecting disparate spaces and ingraining and

normalizing prior protocols; such systems-on-top-of-systems, allow for materials collected

within one bureaucratic infrastructure to more easily slip to another bureaucratic infrastructure.

Some of the most compelling parts of Surveillance Studies comes from scholars such as

Anthony Giddens who follow these lines of argument and make arguments against the ways in

which mass records were collected and maintained as a form of administrative control and

bureaucracy.[194] Gary Marx's work effectively parses the types of data that are included in such

enrolment, with his model of identifying data as concentric circles being a useful metaphor.[195]

Similarly, James Rule was instrumental in linking mechanisms of identification, in particular

personal documents such as birth certificates, passports and driver's licences to other

organizations such as credit card companies as a means to create a dense web of citizens who are

documented in minute detail. In describing the linking of ration cards to Britain's mass

enrolments of citizens, Jon Agar argues that identify cards gain "'parasitic vitality' from

attachment to other systems"[196]; this phenomena is also referred to in the contemporary as

feature creep, where the normalization of a technology by way of its incorporating into

interlocking apparatuses, grants a technology, like FRT, the appearance of ubiquity, further

strengthen rationales for its deployment. Within such sprawling and linked assemblages, identity

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[194] Anthony Giddens, *The Nation-State and Violence* (Cambridge: Polity Press; 1985); Anthony Giddens, *Social Theory and Modern Sociology* (Cambridge: Polity Press, 1987). Given more time and space, this chapter likely could have grappled more with Max Weber's work on unconstrained bureaucracy and control at the turn of the 20th century.

[195] Gary T. Marx, "Varieties of Personal Information as Influences on Attitudes Toward Surveillance" in *The New Politics of Surveillance and Visibility*, eds Kevin Haggerty and Richard Ericson, (Toronto: University of Toronto Press, 2006): 79-110.

Although not often referenced directly, other key texts in surveillance studies were important to my thinking most notably Philip E. Agre's canonical "Surveillance and Capture" (in *The New Media Reader,* eds Noah Wardrip-Fruin and Nick Montfort (Cambridge: MIT Press, 2003): 737-760). He writes on the symbiosis between surveillance and data capture, explaining how a observer-technology like FRT's can be effectively deployed as an automated and decentralized tracking device, undermining privacy, while also effectively sorting populations and individuals.

[196] Jon Agar, *The Government Machine: A Revolutionary History of the Computer.* (Cambridge: The MIT Press, 2003), 102.

is a stable set of data that can be recalled and stored with ease and citizens offer their information as much as other actors take it.

These assemblages would be essential to the monitoring and control of increased citizen social and physical mobility at the start of the 20th century. Mobility in this era was defined by mass immigration and urbanization, in particular within North America during and immediately after WWI, wherein large groups of people were moving across national borders and within national territories. Aiding this were increasingly popular and available forms of transportation that made such movement possible: the train is an obvious force within this, but the automobile not only greatly increased mobility, it also required an expansion of infrastructures, physical and bureaucratic, to manage their proper and continued functioning. Increased physical mobility was matched by the rise of the middle class, in particular among immigrant and former-slave populations, where an increasing amount of individuals and populations were accruing wealth and property, and therefore opening more opportunities for social advancement for themselves.[197]

This increase in mobility provided potential threats to the governmentality of the state: with individuals and populations circulating at an increasing rate while gaining more wealth, the abilities for the state to monitor and control their citizens became more difficult; without monitoring and control, not only could the state not provide the necessary resources to its citizens in the most effective ways, but fraud and crime was made easier by the inability to effectively track citizens. Once again, the dual concepts of security and health were deployed: as

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[197] At the same time, media technologies evolved alongside this increase in circulation and flow: the radio and film standout as technologies able to communicate at the scale of populations and across geographies; like film, photographs were stable forms of informational image-making that could be transported across distances and times that would also be increasingly relied upon, in particular within identity documents. From this, the scaling of media technologies, and their protocols, is also a central force within the move from disciplinary biopolitics; the control and use of media technologies is an effective set of tactics in aid of potential biopolitical strategies centred upon flow and circulation.

examples, the nativist American Immigration Act of 1917 and the 1924 establishment of the American Border Patrol as part of the Immigration Bureau both secured the borders and ensured that the national population would remain healthy because only desirable immigrants were allowed into the country. In terms of social mobility, mechanisms like segregation and Jim Crow laws worked similarly, restricting wealth and access to resources along lines of difference.

Returning to the collapse of consent and coercion, bureaucratic structures are also the repeated sites where the submission-subjection dynamic within citizenship takes place: citizens must be identifiable in order to be given access to resources, with part of that being made identifiable being the citizen's responsibility as part of their performance of fitness. With fraud and crime being a concern within such systems, the tracing and verification of citizens, and their actions related to citizenship resources, is crucial. Knowing this, 20th century identity documents therefore became a key development that was produced, in part, to create the sort systems capable of tracking individuals and therefore providing the citizenship resources at the same time as it generated the stability and uniformity among citizens that would help the state function at its most efficient and self-preserving manners in times of increased citizen mobility. The images produced and circulated within the identification systems are a function of a visuality, undergirded by the collapse of consent and coercion, that demanded that the citizen prove themselves to be a citizen, leveraging both internal and external forces of subjectification in the forming of individual identities and larger national identities. In the case of FRTs, the technology owes a great deal to the 20th scaling of identity documents in that it produced a bedrock of technical, representational, and political protocols that would then be expanded upon in various forms in the following century.

Making Citizens Legible

As discussed earlier in this chapter, citizenship drawn along binary terms of belonging and alien captures an incomplete version of the types of power that are dispersed through technologies like FRTs and other apparatuses associated with citizenship, while also conflating the dynamics of consent-coercion often found within the cooperative enrolment environments of the technology. Citizenship is not a threshold; rather, it is a shifting circulation of power, a relationship between potential citizen and nation-state that depends upon the performance of citizenship and the multiple sites of power that determine eligibility and access to the resources of citizenship.

Therefore, it is more useful to look at the ways in which, as David Lyons describes, citizens are made legible and how citizens make themselves legible.[198] Legibility is not just about having a sanctioned identity, but about being able to have that identity be provable and understood by other actors, such as nation states and/or corporations; citizens then must present themselves in the ways that a nation state recognizes in order to be included within that citizen membership. John Torpey, in his excellent text *The Invention of the Passport*, states simply that "identities must become codified and institutionalized in order to become socially significant."[199] Yet, nation states, and other actors, do not operate strictly in a top-down manner, and are, by no means, effective at exerting complete control within the desires of governmentality; rather, such codifying and institutionalizing of the citizen also relies on consensual elements, wherein the citizen is equally invested in the types of enrolment and registration that nation states have. In

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[198] David Lyons, *Identifying Citizens: ID Cards as Surveillance* (Cambridge: Polity, 2009). Lyon's work, while not consistently cited overtly, has been present in my mind throughout the writing of this dissertation, including the texts: *Surveillance as Social Sorting: Privacy, Risk, and Digital Discrimination* (New York Routledge, 2002) and *Surveillance Studies: An Overview* (Cambridge: Polity, 2007).

[199] John Torpey, *The Invention of the Passport: Surveillance, Citizenship and the State* (Cambridge: Cambridge University Press, 200), 13.

this way, these acts of legibility can also aid in more finely dividing populations into sub-populations, by way of mechanisms like job and mortgage applications, that can then be leveraged in biopolitical strategies based in percarity and debility.

Considering the specific example of FRTs, legibility requires two types of consent with subjectification being captured in how the act of making oneself visible to the gaze of the technology: the first is the enrolment in identification documents which utilize and store facial images; the second, includes the cooperative environment and the technical protocols of pose and lighting, that make the technology function more smoothly. Within the histories of FRTs, acts of legibility are enacted where the citizen performs key aspects of their membership to a nation state by knowingly enrolling themselves, and their facial image, in larger governmental apparatuses while also willfully submitting themselves to other FRTs, in exchange for access to the resources of citizenship. This is a particular effective tactic for those already labelled as liminal populations, such as the 20th century expansion of immigrant and refugee populations: co-operative enrolment signals that a person is a desirable and rule-abiding individual, potentially fit for citizenship; the substrate of liminal populations is therefore able to be further divided and differentiated, with stronger biopolitical control reinforcing precarity and debility being asserted with each division. Lyon's work is crucial to this discourse and ties acts of identification back to 19th century practices of categorization and what he calls social sorting. In his *Identifying Citizens*, he speaks to national ID programs and documentation as employing "a sorting system that puts citizens into categorizes to be better 'seen' and thus differently treated by the state"[200]; importantly, such surveillance makes life legible and therefore able to be managed. Martine Krajewska, in *Documenting Americans*, calls this the practice of identity

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[200] Lyons, *Identifying*, 40.

policing, which "encompasses registration, identification, authentication, and prevention of fraud. It also encompasses the classification a sorting of people into legal and illegal status"[201]; within such a dynamic, the burden of proof lays on the identification documents, and the apparatuses, like FRTs, tasked with such identity policing. The images produced and utilized within the citizenship identification and sorting apparatuses are marked by difference at the level of data acquisition and data annotation, as well as by focusing on the face as the bodily target of identification: a person's face becomes both the unique marker of identity and an encapsulation of representational protocols that further mark that face as potentially belonging or not, potentially threatening or not, potentially desirable or not, classifications which can be used for further biopolitical sorting.

While the biopolitical vision of the 19th century was grounded in the objective knowledge of the scientific methodologies and the mechanical apparatuses aiding those methodologies, the 20th century version, encapsulated by mass identification systems, desired the acquisition and storage of as much information as possible, in forms that could be easily arranged and retrieved. Operating at a mass scale, these newer systems of vision did not wish to explain something about man or nature per say, but instead aimed to make individuals and populations visible at a mass scale through technologies of identification and verification that were reliant on large-scale data enrolment. The facial images collected and deployed, much like many facial images gathered today, were bureaucratic materials that were useful only in so much as they could be operationalized within increasingly automated and decentralized systems.

In order to better facilitate such a dynamic, the 20th century normalized and expanded identity documents as a main way in which nation states enrolled and managed their populations.

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[201] Krajewska, 3

Identity documents are important as they function, as Caplan describes, as a "portable token of

an originary act of bureaucratic recognition of the 'authentic object '- an 'accurate description 'of

the bearer recognized and signed by an accredited official, and available for repeated acts of

probative ratification."[202] It is worth repeating that such practices did not begin in the 20th

century, but the period marks a massive expansion. In particular, the document's portability,

combined with systems that encourage parasitic vitality, allows for the continuous modulations

that Deleuze describes and for individuals to be monitored without interrupting the flow of goods

and populations. Facial photographs were increasingly included in such identity documents,

rationalized as the most accurate description of the bearer, an objective and accredited version of

the body that can be easily included into a variety of bureaucratic functions. In the contemporary

moment, as the Georgetown Law 2016 report "The Perpetual Line-up" details, such practices

have lead to a reality in which nearly half of all American citizens are in a facial database.[203]

Identity Documents

Returning to Torpey, he lays out the three major types of identity documents in his

concluding section "A Topology of 'Papers'": identity cards, internal passports, and international

passports.[204] Each of the three have different relationship to citizenship but are similar in how

they conflate, in various intensities, the consent and coercion of the citizen; when facial images

are included in such documents, beginning for many in at the beginning of the 20th century,

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[202] Jane Caplan, "'This or That Particular Person': Protocols of Identification in Nineteenth Century Europe," in *Documenting Individual Identity: The Development of State Practices in the Modern World,* eds. Jane Caplan and John Torpey (Princeton Princeton University Press, 2001), 51.

[203] Clare Garvie, Alvaro Bedoya and Jonathan Frankle, "The Perpetual Line-Up: Unregulated Police Face Recognition in America." Georgetown Law Center on Privacy and Technology, October 18th, 2016, https://www.perpetuallineup.org/.

[204] Torpey, *The Invention of the Passport,* 158-163.

those images leverage the objective qualities of a photograph to transform the face into a site of bureaucratic authentication. Importantly, Torpey argues that the three types of identity documents are not unique to each other, but rather they all operate on a continuum; too, a citizen might posses some form of all three simultaneously. Within the framework of subjectification, each of the three types contain different ratios of objectivities, consent and coercion, which are then captured by the facial image itself and its later repeated processing. As such, each of the three identify documents deserve specific attention.

Identity Cards

Identity cards, take many different forms, from national ID cards to birth certificates to driver's licences to health cards. These type of documents are most overtly tethered to access to the resources of citizenship and are one of the less immediately intrusive forms of bureaucratic monitoring and control. The effectiveness of these documents hinge on the fact that they are quite often rationalized under infrastructures connected to everyday activities, such as driving or health care, and their ubiquity then allows these documents to function as an identity document.[205] These sorts of identity documents then are meant, in large part, to apply to the whole population, as a giant dragnet; the information gathered from such practices can then be used for further political tactics and strategies. In terms of subjectification, this type of identity document perhaps best captures the shift in 20th century biopolitics in that it requires the citizen

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[205] Kelly Gates provides useful and direct recent historical instances that tie such documents to the history of FRTs, including the 1997 use of automated FRTs to monitor enrolment in driver's licences (*Our Biometric Future*, 51). Such a system allowed for a massive bureaucratic and infrastructural upgrade to the Department of Motor Vehicles (DMV) and a present where "The driver's licence has become a de facto all-purpose form of identification (Ibid., 52).

to make themselves legible and available to larger systems, with the expectation that the citizen will perform those acts as part of their responsibilities as citizen.

The facial images included in such documents operate in two ways: first, they act to identify and monitor individuals and make the individual legible via the authenticating process of comparing the photograph of the face to a person's actual face; second, they act as raw data for training materials for expansion and improvement of existing and future biopolitical tactics. In the case of FRTs, the 20th century expansion of identity documents granted a great wealth of facial data that was then folded into later computational systems post-WWII. The storage and organization of such systems are key to their operation and their standardizing is key to their visuality. The right to look in this case is indiscriminate and about mass extraction, tying such apparatuses to an individual's desires to be legible within larger systems of citizenship. As later chapters will explore in more depth, identify cards are further augmented by contemporary Internet practices, in particular social media sites, which incentives co-operation in their online community building. The amount of facial data, consensually uploaded and annotated by the user themselves, is staggering: as IBM's now-shuttered Diversity in Faces demonstrates, over one million facial photos were pulled under a Creative Commons licence from the photo-sharing site Flickr[206]; the nebulous Clearview AI has gone even further, scraping over three billion facial photos and accompanying data from Google searches, social media sites, and other online

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[206] While the database itself has been pulled, the documentation after its release can still be found: Michele Merler, Nalini Ratha, Rogerio Feris, and John R. Smith, "Diversity in Faces," arXiv.org, April 10th, 2019, https://arxiv.org/pdf/1901.10436.pdf. I was able to obtain a version of the database before it was removed and can confirm that its data practices were alarming to say the least.

spaces.[207] While less overtly tied to formal notions of citizenship, the practices do aid in the

creation of mass datasets that then are able to be deployed in other FRTs.

Internal Passports

By contrast, internal passports tend to be documents whose power operates in more of a

top-down coercive manner, typically targeting specific populations, present in overt biopolitical

and necropolitical domination that aim to subdue and restrict via monitoring and control of the

citizen's actions within the state, in particular that of mobility. Like identity documents, they also

grant access to privileges, but this access is often part of a larger hierarchical system wherein the

internal passports serve to reinforce difference and control. Achilles Mbembe ties such

documents and their desires to practices of deterritorialization and the management of chaos and

fracturing for certain populations as necropolitical strategies: these documents act to reduce or

segment territory for populations as a way of managing their deaths, precarity, and debility.[208]

This type of document can be seen in 19th century practices at the sites of internal borders such

as the slave passes and runaway slave advertisements as well as the many examples from

colonial rule, providing the broad template for practices that have continued into the

contemporary moment.[209] The identification that comes with the facial images within these

documents rely more heavily on the second objectivity of subjectification, wherein the internal

passports are generated to produce and reinforce power via differentiation. Broadly, the face

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[207] Much has been written about Clearview AI in the brief few years since its release but a useful overview can be found at: Kashmir Hill, "The Secretive Company That Might End Privacy as We Know It," *The New York Times,* January 18th, 2020, https://www.nytimes.com/2020/01/18/technology/clearview-privacy-facial-recognition.html

[208] Mbembe, "Necropolitics."

[209] Simone Browne discusses these topics with clarity and skill in *Dark Matters*, 11-12; 51-55.

within these photographs expressly marks the person categorically, using the facial image as evidence of difference and the need for further control.[210] As opposed to identity cards, the data enrolment here is similar to those emerging out of the aforementioned 19th century practices, where more specific liminal populations are produced and reinforced through the facial images. When incorporated into FRTs, the facial databases generated from such apparatuses are more blatantly targeting, with biopower and necropower more overtly inscribed into the systems and their operation. Here, vision, powered by its asymmetrical and unidirectional right to look, is an act of power meant to generate hierarchies of difference that ultimately serve the original power in a self-preserving manner.

International Passports

The third type of identity document, the international passport, exists at the nexus of nation-states' relationships to each other, and to their own citizens, transforming its holders into "quasi-diplomatic representatives of particular countries."[211] Such documents are especially important in a globalized biopolitics of control and modulations, as the larger systems both define membership in a nation state, which is accompanied by privileges and access to citizenship resources, and allow for mobility across national territories and borders. Like identity cards, the passport system is a technology of the self, relying heavily on performances of citizenship and opt-in, including consensual enrolment in the system itself; the facial images then provide a larger database for a nation state to sort and monitor it's own citizens, as well as those

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[210] Torpey makes the point that these documents are typically not used in contemporary Western democracies and are seen in more totalitarian and colonial states. However, mugshots and mugshot databases act in similar fashions, marking the individual as criminal and therefore a person potentially less deserving of the resources of citizenship.

[211] Torpey, 160.

entering its borders.[212] However, like internal passports, international passports also offer the opportunity to operate on principles of difference and target specific populations that a nation deems undesirable; its operation then more explicitly sorts populations, in particular in times of crisis where rationales of securitization are especially strong.

In this way, and indicative of the 20th century's increase in immigration, materials such as Visa and refugee applications should also be considered alongside international passports; while holders are not members of a nation state, but rather applying to become one, the subjectification present is particularly performative, leaning heavily on applicants making themselves especially legible and desirable. As such, in the contemporary moment, such databases are filled with individuals likely eager to be photographed in order to be seen as fit and eligible for resources of citizenship. This produces a visuality that serves Galton's earlier arguments for sorting the desirable from the undesirable immigrants: both the image itself and the making oneself available to image-making can be used to determine the fitness of the individual captured. Like mugshot databases, immigrant and border crossing materials are regularly used in state applications of FRT, as well as in testing and improving the technology, again relying on such liminal populations for the technology's continued functioning.

Building a System of Mass FRTs

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[212] In addition to Torpey's work, Martin Lloyd's *The Passport: The History of Man's most Travelled Document* (London: Queen Anne's Fan, 2008) and Craig Robertson's *The Passport in America: The History of a Document* (Oxford: Oxford University Press, 2010) are detailed explorations of the history of international passports and when combined with the previously mentioned *Documenting Americans* give an admittedly American-centric view of the history of the passport, but a more thorough understanding nonetheless. Lloyd specifically gives a brief, but effective, history about the introduction of the photo into the passport and how later 20th century designs worked to make the bearer more literally visible to bureaucratic systems through standardizing of pose and photo size; similarly, Robertson devotes an entire chapter to the photograph in passports, tying their use to the photograph's authoritative likeness of the individual, focusing on the unmediated truths that such a photo circulated within the bureaucratic systems of national management.

Overall, the expansion of identification documents in the 20th century facilitated the bureaucratic management of enrolment and deployment of personal data, with facial data becoming increasingly prominent as the century progressed and computational infrastructures become entrenched; the different types of identity documents used in such process speaks to this and the prior's illustration of the types of micro- and macro-powers that circulate within the operative moments of technologies like FRTs. Tying this back to the previous chapter's discussion of a FRT's operative moment, the wide variety of facial images, augmented by their enrolment and photographic practices, grant FRTs a stunning flexibility; the circulation of power at the many sites and durations of a FRT's operative moment shows how the inscription of biases and dangerous protocols of difference are embedded and deployed within the technology. Mass cooperative registration, by making enormous amounts of individuals and populations legible, serves the citizen-sorting mechanisms while also providing the key protocols for expansion of FRTs in the second half of the 20th century: this includes the development of informational systems capable of storing and processing mass amounts of facial data; it includes the consensual-coercive enrolment of citizens that leads to the collection of facial data on a large scale, generating, in term, a myriad of databases that can then also be used to test and improve the technology; lastly, it signals a clear move towards subjectification and expectations that the citizen will be responsible for acting as a citizen.

The following chapters will expand on this discussion in a number of key ways. As the next chapter will illustrate, FRTs have built from the photographic practices and bureaucratic protocols of the 19th and 20th centuries to become effective automated gatekeepers of citizenship resources, in particular mobility. The large-scale deployment of biometrics post-WWII is greatly contingent on the development of automated and decentralized computational

systems. While FRTs discussed in this chapter were still largely dependant on human actors doing the bulk of the processing of identification documents, the integration of computational systems and protocols exponentially expanded the value of such documents under biopolitical vision. Alongside the establishment of such complex computational systems, there was a vast increase in the amount of data produced and stored, alongside increasingly data-driven forms of vision that, as the prior chapter demonstrated, rendered captured faces as data-objects in order to make individuals and populations more easily and efficiently integrated into bureaucratic systems. In addition, as Lyon has argued, automated biometrics also signalled the move from identification papers-as-physical objects to the body itself being turned into an identity document, a fact crucial to the mass application of automated FRTs[213]; as the following chapter will argue, while FRTs remain image-making media, the technology depends on the bodily face itself as the site of capture and processing. Within increasingly permanent crises of health (such as the COVID-19 pandemic) and/or security (such as the ongoing threat of terrorism) such biometrics, as detailed more fully in Chapter 5, have become increasingly ingrained into active and daily layers of bureaucracy within sprawling and interconnected infrastructures, normalizing their own presences with each passing day.

Conclusion: The Face Within the Political Problem of Recognition

This chapter will end by returning to the problems of legibility and subjectification within citizenship, and the problem of FRTs' protocols revolving around political recognition. The mass establishment of identity documents using facial images was centred on acts of political

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[213] David Lyon, "Under My Skin: From Identification Papers to Body Surveillance," in *Documenting Individual Identity: The Development of State Practices in the Modern World,* eds Jane Caplan and John Torpey (Princeton Princeton University Press, 2001): 123-138.

recognition, wherein the citizen made themselves legible so as to be recognized by the nation state, and then given access to citizen resources. However, recognition in such instances is incredibly unidirectional and speaks to a long and continued history wherein the continued asymmetrical control of political recognition, captured within identity documents of various kinds, is key to governmentality.

"Recognition," is literally central to "facial recognition technologies," and takes many forms. As Chapter 2 details, in the technical protocols of a FRT, "recognition" is a short hand for either detection, identification, or verification, but can also be used to encompass the process of all three mechanisms; despite its muddy definition, the use of the word within technical protocols points to its importance as a concept. Key to such protocols is the fact that being recognized requires another entity: a person needs to be observed in order to be seen and therefore detected, verified, and/or identified. This externalizing of observation runs throughout the history of FRTs' representational protocols. As discussed prior, there are the racialized and gendered scientific categorizing by external parties present through history of FRTs and its photographic practices; this categorization and annotation is driven by being "recognized" as a particular race and/or gender, and ensures that the images and image-making within FRTs operative moment are structured by difference.[214] This discussion can extend to the central role of forces of subjectification that runs through this chapter, where there is a desire to submit, a consent to being seen, a wanting to be seen, in order to be recognized as a citizen.

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[214] " Recognition" is complicated even further by the presence of celebrity faces within the history of FRTs, including within the first public demonstration of the technology (examined in depth in Chapter 4), as well as the ongoing practice of using famous faces in machine learning training; as outlined in Chapter 2, the use of "recognizable" faces reflects cultural norms of image-making, and a key aspect of the white-prototypicality that runs through the history of FRTs.

Judith Butler drawing from Lévinas, explains that the face is the central site of this recognition, in turn getting at the heart of the problematics of recognition within biopolitical tactics like FRT: the dependence on another self-consciousness to both see and acknowledge the life of another another is reappropriated into biopolitical strategies, such as identity documents, to reinforce strategies of larger domination; a person is not allowed to self-determine their personhood but instead relies upon another entity granting it through recognition.[215] The political problems of recognition within the last two decades have tended to centre around the concept of citizenship, wherein the tension around political recognition is in the performative elements of citizenship in the instances where citizenship is tied to moral and/or performance-based metrics, echoing this chapter's prior discussion of the collapse between consent and coercion found through the history of FRTs.[216]

However, within uses of FRTs, such a performance is never consistently mutual nor done with a meaningful understanding between participants and is markedly different for populations sorted as being outside the hegemony of central power through protocols of difference. For example, Simone Browne, pulling from scholar Lewis Gordon, argues that white prototypicality within a technology like a FRT is tied "the visual economy of recognition and verification" that

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[215] Judith Butler, "Precarious Life," in *Precarious Life: The Powers of Mourning and Violence.* (New York: Verso Books, 2004): 128-152.

[216] I primarily used Nancy Fraser and Axel Honneth's co-written *Redistribution or Recognition: A Political-Philosophical Exchange*, *t*rans. Joel Golb, James Ingram, and Christiane Wilke (New York: Verso Books, 2004) in my thinking here, but also utilized Simon Thompson's *The Political Theory of Recognition* (Cambridge: Polity, 2006), Tony Burn's and Simon Thompson's "Introduction" to *Global Justice and the Politics of Recognition* (Ed. Tony Burns and Simon Thompson. (New York: Palgrace Macmillan, 2013) as well as Thomas Swerts and Stijn Oosterlynck's "In Search of Recognition: The Political Ambiguities of Undocumented Migrants' Active Citizenship" (*Journal of Ethnic and Migration Studies* (2020): 1-19).

imposes identity, in particular racial identity, onto the body without consent; such an imposition is "the enabling condition of the structured violence of 'the dialects of recognition.'"[217]

The dialects of recognition is a process posited by Georg Wilhelm Fredrich Hegel in *The Phenomenology of Spirit*: the struggle for self-consciousness, he writes, is a trajectory wherein a person separates themselves from the objects of the world and asserts their own consciousness by way of exchange with another person; he argues, broadly, that self-consciousness exists only as a recognized being and dependant on another person seeing and recognizing them as a subject.[218] Unlike Lévinas, who argues that this exchange can be done without violence, for Hegel, the exchange of recognition is essential for both people, but is a site of conflict, a life and death struggle, as each attempts to assert themselves, and their consciousness, over the other. Taken to its extremes, Hegel describes, this results in a dynamic of dominance where one person serves as master to the other, who is cast as the slave. Importantly, despite the uneven power dynamic, each needs the other, as each depend on the other to assert their selfhood: the slave needs the master to grant it subject status, while the master needs the slave, and their labour, to recognize it as master in order to maintain its position of power. This is complicated further when the subject passes into citizen. From this, as Robert Stern summarizes, "in society proper individuals can show themselves to be 'worthy of recognition' by showing themselves to be rational subjects by obeying the law, filling a post, following a trade, or other kinds of social activity."[219] This is exactly the dynamic of consent and cooperation within acts of citizen legibility that is core to this chapter's earlier arguments.

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[217] Browne, 110.

[218] Georg Wilhelm Fredrich Hegel, *The Phenomenology of Spirit,* trans. Terry Pickard (Cambridge: Cambridge University Press, 2018)

[219] Robert Stern, *Hegel and The Phenomenology of Spirit* (New York: Routledge, 2002), 81.

As such, power within the dialects of recognition, while an exchange and interdependent, is not mutual nor even.[220] Franz Fanon, in his chapter "The Negro and Recognition" sees the dialects of recognition as the core of colonial power: the reliance on an outside actor to grant recognition gives that outside actor all the power and, taken to its inevitable extremes of conflict, the master-slave dynamic becomes ingrained into the whole of society.[221] This argument is central to a number of Indigenous scholars writing on recognition and biopolitics. Morgenson and Rifkin, for example, both take care to define the biopolitics targeting Indigenous people under settler colonialism from other forms of biopolitics in focusing on settler-colonial desires for land as territory. Morgenson, using Patrick Wolfe's notion of the logic of elimination, contends that recognition, in particular, is especially fraught as being recognized by the parameters and logics of settler colonial law also means accepting the asymmetrical and non-reciprocal authority of settler of colonialism, and thereby extending and validating that power.[222] Ruskin, in conversation with Agamben, argues that when Indigenous life, and the sovereignty of Indigenous peoples, is recognized within the settler colonial juridicial system, it only servers to erase and/marginalize that population. In this way, settler colonial law should be seen as a metapolitical authority that operates on a monopoly of legitimacy and asserts itself, in a circular

[220] Alexandre Kojeve's insightful *Introduction to the Reading of Hegel: Lectures on the Phenomenology of Spirit* (ed. Allan Bloom, Trans James H. Nichols Jr. (London: Cornell University Press, 1980)) states clearly that the dialects of recognition results in dynamics rooted in dominance where "the vanquished has subordinated his *human* desire for *Recognition* to the *biological* desire to preserve his *life*" (author's italics, 42); it is not then just a struggle to be recognized but also a struggle to be worthy of recognition.

[221] Franz Fanon, "The Negro and Recognition," in *Black Skin, White Masks,* trans. Charles Lam Markmann (London: Pluto Books, 1986; 2008). Fanon argues further that, within the dialects or recognition, once the slave is recognized, resources can be granted and freedoms can be given, but that distribution is deeply asymmetrical and never leaves the initial master-slave dynamic.

[222] Scott Lauria Morgensen, "The Biopolitics of Settler Colonialism: Right here, Right Now," *Settler Colonial Studies: A Global Phenomenon*. 1, no. 1 (2011): 52-76.

and self-validating manner.[223] Most forcefully, Glen Sean Couthard's *Red Skin, White Masks* ties

contemporary practices of recognition and reconciliation from the Canadian federal government

to a liberal form of governmentality wherein recognition is not posited as a resource of freedom

and dignity for the colonized, "*but rather as the field of power through which colonial relations

are produced and maintained.*"[224]

When dialects of political recognition are then externalized, automated, and decentralized

into technologies like FRTs, the face is the site where fields of power potentially affirm,

marginalize, and efface individuals and populations.[225] Operating under acts of biopolitical

vision, FRTs observe the face and constitutes it as a datafied object. This type of observation is

not just present in the capturing of footage within an FRT, but also present, as this chapter has

demonstrated, in the consensual and cooperative image-making within identity documents and

data enrolment tied to the management of citizenship resources. Further, following from this

chapter's discussion of the legibility of citizens, desirable immigrants, and whether a person is

worthy of recognition, recognition cannot be understood as binary. It is true that FRTs do deploy

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[223] Mark Ruskin, "Indigenizing Agamben: Rethinking Sovereignty in Light of the 'Peculiar' Status of Native Peoples," *Cultural Critique*, 73 (Fall 2009): 88-124.

[224] Glen Sean Couthard, *Red Skin, White Masks* (Minneapolis: University of Minnesota Press, 2014), author's italics, 17. Such a field of power does not address how the state demands subjectification in order to be recognized: settler colonial rule "rests on the ability to entice Indigenous peoples to *identify*, either implicitly or explicitly, with the profoundly *asymmetrical* and *nonreciprocal* forms of recognition either imposed on or granted to them by the settler state and society" (author's italics, 25). The colonial state nor colonial society does not need any such recognition. In North America, the installation of blood quantum, which required Indigenous people to prove they possessed a certain percentage of indigenous "blood" in order to qualify for citizenship resources, is a perfect examples of such asymmetrical and nonreciprocal dynamics.

[225] Wendy Chun's chapter "Recognizing Recognition" within her *Data Discrimination* (2021) overlaps with some of the arguments in the conclusion to this chapter, wherein she asks and answers "how did identification and discrimination become recognition?" (198). I read this chapter after I had completed multiple drafts of this chapter, but nonetheless found her connections to Galton, Bertillon and Hegel in response to her question similar to my own, most notably in the sub-section "Mis-recognizing Politics" (213-216). While there are overlaps between her work and this chapter, my focus on transforming citizens' facial images into bureaucratic identity documents and the gatekeeping of citizenship resources via vectors of subjectification and bottom-up power based on political recognition makes my critique unique from hers.

base binary logics of recognized and unrecognized in its detection phase, but the final stages of identification and verification are threaded with deliberate recognition, statistically likely recognition, and accidental mis-recognition alike. Mis-recognition, within the example of instances of false-positives in mugshot database that lead to erroneous arrests, are further amplified by other intersectional factors and asymmetrical acts of force, such as the over-policing of certain populations. In addition, to mis-recognition, there is the further logics of categorizing within recognition, wherein those captured as recognized often along racialized and gendered lines of logic; therefore, political protocols of recognition also involves questions of what a person is recognized as, which are defined by machine learning and data practices in the technical protocols and difference in the representational protocols. The states of recognized, unrecognized, mis-recognized and categorically recognized are again largely asymmetrically defined by the dialects of recognition.

Perhaps there is an argument to be made that instances of white prototypicality work to cloak certain faces from surveillance and that the ability to remain illegible and unrecognized by systems like FRTs is actually beneficial. If true, it is only so within a small set of FRT use cases. The fact remains that FRT is increasingly ubiquitous and utilized in everyday decisions, including unlocking a rental car and entering public housing, to say nothing of the expansive law enforcement and border security usages of the technologies. Such varied examples showcase how problematic the mechanisms of recognition is within a facial recognition technology. The functionality of a tactic like FRT is secondary to the power it serves: when it functions perfectly it recognizes, mis-recognizes, and categorically recognizes certain population over others; when it "malfunctions," it also recognizes, mis-recognizes and categorically recognizes specific populations over others. FRT is a dangerous technology not because it "malfunctions" and

demonstrates bias, but because it is wildly flexible at many levels of its operation, making it an extremely powerful and nimble tactic within applications of asymmetrical power and for gatekeeping tactics resources attached to citizenship. These dynamics make calls for diversity within the coding teams tasked with the construction of FRTs and/or within the contents of the datasets half-measures at best: diversity does not address the core complications brought about by the symbiosis of the technology's protocols, nor does it grapple with the ways in which power within FRTs is not distributed in a top-down manner, but rather circulates through the material and virtual components of the technology and the bodies under observation

While specific targeting in identification systems, like those described by the afore-cited Black and Indigenous scholars, do very much take place, the dynamics are extended further to potentially include every citizen in the move from the enrolment of liminal populations in the 19th century to mass legibility in the 20th century. This is the realization of Sekula's shadow archive, which is, by its nature, broadly inclusive and holds within in both "the traces of the visible bodies of heroes, leaders, moral exemplars, celebrities, and those of the poor, the diseased, the insane, the criminal, the nonwhite, the female, and all other embodiments of the unworthy."[226] While Sekula sees 19th century versions of the shadow archive as being defined by the entwined schools of physiognomy and phrenology, the 20th century expands the shadow archive to one that includes every citizen body under the same dialects of recognition. FRT utilizes an expansive shadow archive in order to very often acts as an automated and decentralized extension of the political acts of recognition by nation states, both externally at its borders and internally through its gatekeeping of citizenship resources; such a monopoly inscribes into each citizen potential danger and uses technologies like FRT to "prove" their

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[226] Sekula, 10. The strength of such a unified archive is it "encompasses an entire social terrain while positioning individuals within that terrain" (10).

innocence and fitness as a citizen. The result of this, Giorgio Agamben argues in "No to

Biopolitical Tattooing," is that the use of biometrics by nation states:

> "… no longer has to do with free and active participation in the public sphere, but instead concerns the routine inscription and registration of the most private and most incommunicable element of subjectivity — the biopolitical life of the body…Thus, by applying these procedures to the citizen — or rather, to the human being as such — the State is applying a technological apparatus that was invented for a dangerous class of persons. The State, which ought to constitute the very space of public life, instead has made the citizen into the suspect par excellence — to the point that humanity itself has become a dangerous class."[227]

Once each citizen is deemed dangerous until proven otherwise, often via biopolitical tactics such

as FRTs, the dialects of recognition becomes a mass phenomenon. Within this, as the nation

possess the whole of the abilities to recognize, and the individual has little space for ideas of self-

determination within such models of citizenship, relying entirely on an outside actor to affirm

their membership and access to resources; even then, certain political acts of recognition work to

"see" populations only to further mark those populations for expanded necropolitical and

biopolitical management. Such a system of vision, when deployed within FRTs, works directly

against Haraway's situated knowledges, which are driven by the knowledge producers 'abilities

to "self-represent" (and therefore manipulate and control their own image). Instead, identification

systems work to impose identity and citizenship status, while the image-making within that

imposition reinforces representational protocols of difference.

As the following chapter will detail, such a trajectory has only intensified post-WWII,

wherein the 19th scientific observer, often grounded in biology and/or psychology, has been re-

centred by computer science. In this way, the later 20th and 21st century interpenetration of

digital technologies has worked symbiotically with the shift to biopolitics focused on control and

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[227] Giorgio Agamben, "No to Biopolitical Tattooing," trans. Stuart Murray, *Communication and Critical/Cultural Studies* 5, no. 2 (June 2008), 202.

the management of the flow of resources and populations. With these desires in place, Chapter 4 demonstrates, the post-WWII establishment of computer science centred on facial recognition provided the new frameworks under which the subject is formed, with the dividing practices being inscribed in multiple ways into FRT. Such inscription allows the technology to be, as the previous chapter argued, utilized in a stunning array of biopolitical strategies aimed at the monopolization of physical and social mobility. Such strategies have then been engrained, as Chapter 5 describes, by permanent states of conflict and anxiety wherein the rationales that produced the infrastructures and desires for the technology within moment of crises remain in place long after the initial crises, and are thereafter normalized into ubiquitous practices and presences.

CHAPTER 4:

INFRASTRUCTURE, VIGILANCE, INTERDICTION:
THE AUTOMATING AND DECENTRALIZING OF FACIAL
RECOGNITION TECHNOLOGIES POST-WWII

<u>Introduction</u>

In the 1970s, Checkpoint Charlie was a border crossing that was emblematic of the

tensions between capitalist democracies and socialist bureaucracies that undergirded the Cold

War; passing between East and West Germany was fraught with conflicting ideologies and

economic systems that cast deep suspicions over whomever was crossing. As such, the Berlin

Wall was the site of a great deal of surveillance, with each side attempting to reveal where their

citizens' allegiances lay. In the case of potential spies, it was essential to know who exactly a

person was talking to and for what reasons; too, keeping citizens inside East Germany was

essential to maintaining the labour force and economics needed to support the nation state.

Checkpoint Charlie was a site to confirm the identities of those passing, to record and verify that

the border crossers were who they said they were.[228]

Major Peter Bochmann, a commander in the East German Border Guard who had been

trained by the Ministraist of State Security (Stassi), designed and implemented a facial

recognition system at Checkpoint Charlie in the 1970s.[229] Under his leadership, each guard was

given *People's Physical Characteristics* (*Merkmale des Ausseren von Personen*), a manual that

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[228] Portions of this chapter have been adopted from my article "The 1980s War on Drugs, the FERET Database, and Building Future Infrastructure for Facial Recognition Technologies," *Stream: Interdisciplinary Journal of Communication,* 14 no. 1 (2022): 9–26.

[229] Research about Bochmann's system came primarily from the exhibition catalogue for *Facial Recognition (December 12, 2015 - March 18, 2016)* (Wende Collection, Dec 12, 2015, https://issuu.com/wendemuseum/docs/updated_facial_recognition. Further information was taken from "Peter Bochmann Border Guard Collection," Wende Collection, n.d., http://www.wendemuseum.org/collections/peter-bochmann-border-guard-collection; "Historical Witness - Peter Bochmann," Wende Collection, n.d., http://www.wendemuseum.org/participate/historical-witness-peter-bochmann.

presented a series of hand-drawn taxonomies of facial characteristics; echoing the systems of datafied partitioning within 19th century vision systems discussed in the previous chapter, each guard was taught to look at the face in the passport and compare it to the person's wishing to cross by first isolating eyes, eyebrows, the nose, lips, and ears in order to categorize their type: eyebrows could be *buschig* (bushy) or *spärlich* (sparse); eyes could be *tiefliegend* (deep-set) or *vorspringend* (protruding). Bochmann's systems was put into action at Checkpoint Charlie where the guard would decide, with each pair of faces that passed before their vigilant observation, whether he/she could verify that the two identities matched.

This addition of vigilance and suspicion to the FRT observer is a key shift in the mass application of the technology within the second half of the twentieth century. FRTs have always involved some form of interrogation in its biopolitical vision. However, 19th century FRTs, grounded in the principles of the burgeoning field of biology, were primarily interested in understanding and explaining the human body; their deployment as rational and scientific tools were largely diagnostic and taxonomical. The first half of the twentieth century's explosion of identity documents were deploying early human-centric FRTs as initial gatekeepers to citizenship resources; most important to this phenomenon was the mass enrolment of citizens into bureaucratic infrastructures, leveraging the collapse between coercion and consent within acts of political recognition, which enabled such systems to be applied on the largest scales. Such gatekeeping not only attached itself to the distribution of citizenship resources, but increasingly simultaneously operated under modes of heightened securitization and surveillance. Bochmann's system is an excellent example of a human-centric FRT which is being used not only to record border crossings, but as a means to reinforce ideological purity by way of vigilant observation.

However, post-WWII, a biopolitics of flow and control became increasingly centric to the management of citizenship resources, in particular mobility of goods and populations within a globalized economy that blended the nation state with capitalist corporate entities, even in spaces like East Germany and the Soviet Union.[230] This chapter will use two primary case studies in understanding how infrastructuralism, vigilance, and a desire for automated and decentralized vision collide in post-WWII FRTs. The first case study will be of the first public demonstration of a FRT at the 1970 Osaka World Fair, where the Nippon Electric Company (NEC) hosted the exhibition "Computer Physiognomy"/"Computer Magnifying Glass." This case study is based on original research in the British Library (London U.K.) and is centred on a unique English translation of the Japanese NEC Technical Journal completed for this dissertation. While this chapter will, first, trace the technical protocols and influential vision science in the decades following WWII, "Computer Physiognomy"/"Computer Magnifying Glass" is incredibly useful in illustrating how the technical, representational and political protocols blend symbiotically in automated and decentralized FRTs post-WWII. First, the computer vision science within the exhibition, captured within the writing of Takeo Kanade, were instrumental in the development of computer vision science; at the same time, the use of celebrity faces and multi-media spectacle in the exhibition normalized the technology through its carnivalesque exhibition, while also operationalizing an enhanced *photogénie* on a general public. Finally, in illustration of the

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[230] However opposite their political facades, the reality was that the Eastern Bloc, and the G.D.R. in particular, adopted many of the American computational practices. Too, both sides were invested in discourses around the value of cybernetics, with thinkers both sides advocating for the automating of previously human-centric processes. As examples, the American Joint Publication Research Service re-published cybernetics papers translated into English from Russian from the 1960s through the 1970s, such as *Problems of Cybernetics and Law* by V.N. Kudryavtsev (U.S. Dept. of Commerce, Clearinghouse for Federal Scientific and Technical Information, Joint Publications Research Service, 1968). Interestingly, while researching in the archives of Woodrow "Woody Bledsoe, one of the first automated face recognition scholars who is discussed in-depth later in this chapter, I found one such report, the 1971 *Legal Cybernetics* (The Woodrow Bledsoe Papers, Box 96-349/24, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.)

political protocols of enhanced globalization post-WWII, companies like NEC, were crucial in leveraging their expansive technical and intellectual resources such that FRTs were incorporated into already existing structures and knowledge systems, in ways that would be deeply influential in the decades that followed. As this chapter will argue, NEC's sprawling range of endeavours, alongside its symbiotic relationship with the Japanese nation state, constructed an environment wherein FRTs not only advanced from a technical standpoint, but were also given existing structures and technological apparatuses that the technology could be melded with. In 2023, such a base has made NEC one of the world's largest providers of biometrics, including a wealth of clients in the United States.

This chapter's second case study will be the establishment of the Facial Recognition Technology (FERET) database (1993-96) and the Face Recognition Vendor Tests (FRVTs).[231] Prior to FERET, the twin pillars of computer science research and corporate entities lead to the the late-1980s, where the Berlin Wall, a technology best suited for disciplinary biopolitics, was fast becoming outdated; as a tactic, a physical barrier was too easy to circumvent, and was more symbolic than functional. FRTs like those developed and deployed by Bochmann at Checkpoint Charlie were too inefficient in part because the humans at the centre too fallible and slow. There were, of course, other forces at work compounding such developments.[232] However, a biopolitics of flow, grounded in securitization and vigilance, demanded automated monitoring of continuous

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[231] "Face Recognition Technology," National Institute of Standards and Technology, July 13th, 2017, https://www.nist.gov/programs-projects/face-recognition-technology-feret; "Face Recognition Vendor Test (FRVT) 2000," NAVSEA Dahlgren, National Institute of Standards and Technology, and NAVSEA Crane, June 2nd, 2021, https://www.nist.gov/itl/iad/image-group/face-recogntion-vendor-test-frvt-2000; "Face Recognition Vendor Test (FRVT) 2000," National Institute of Standards and Technology, June 2nd, 2021, https://www.nist.gov/itl/iad/image-group/face-recognition-vendor-test-frvt-2002.

[232] These developments included: the concurrent proliferation of corporate and personal hardware in the 1980s and 1990s; an increased public comfort and knowledge about computational systems; and the emergence of a globally networked form of information sharing and transferring in the form of a popular Internet.

movement and the idea of stopping each face for sustained human observation quickly grew increasingly more outmoded. In this new environment, although Bochmann attempted to resuscitate his human-centric system, he was told it was obsolete and was rejected; automated and decentralized FRTs were the present and the future.

Accompanying this obsolesce was a shift in truth regimes, wherein the vigilance within the FRT observer shifts from detecting opposing ideological forces to the monitoring of the movement of goods and populations named as illegal. More specifically, Isaacson writes that the War on Drugs replaced the containment of Communism as the main rationales for American desires for global securitization.[233] 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. In turn, the American War on Drugs generated the boogeyman needed to spur the development of FRTs to a mass scale. Importantly, as the rhetoric around the War on Drugs was being amplified, President Ronald Reagan was also pushing hard for the opening of national borders and the reduction of tariffs to better facilitate trade, in theory bolstering the American economy. In this way, the opening of the Iron Curtain and the reunification of Germany also collided with logics that led to agreements such as the trilateral trade-bloc NAFTA in 1994. The central desires of such globalization strategies, grounded in the need for permeability and flow, initially seem at odds with the securitization central to the War on Drugs: borders, in particular the Mexican-American border, needed to be both open to the certain types of approved goods and populations while closed to others; under such observation, tracking and sorting needed to be done quickly, without interrupting the mobility of legal resources while protecting against those named as illegal.

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[233] Adam Isacson, "The U.S. military in the war on drugs," *Drugs and democracy in Latin America: the impact of U.S. policy,* eds C. Youngers and E. Rosin (New York: Lynne Rienner Publishers, 2005): 15-60.

Under the truth regimes of the 1980s American War on Drugs, the FERET database and the later FRVTs emerge from this desire to enact "interdiction," a term used to describe strategies that could quickly and unobtrusively sort legal from illegal populations and resources, thereby enabling a biopolitics of flow that was still rooted deeply in discourses of securitization and vigilance.[234] FERET, as the first large-scale facial database, established the core protocols that would be inscribed into the next decades of FRTs. Further, this chapter will take up the FERET in detail as a case study of large-scale building of automated vision based in interdiction, where the centralizing of FRTs' political protocols were developed to be an extremely effective technology at managing the seemingly contradictory desires for flow and security at once.

Using these two case studies, this chapter will map the dominate truth regimes from the decades following WWII to the new millennium that produces a vigilant technological observer that could operate under principles of interdiction, in turn birthing automated and decentralized FRT assemblages that acted as gatekeepers of citizen resources, primarily mobility, at a mass scale.

The Initial Automating of 19th Century Vision Into FRTs' Technical Protocols

This chapter's focus on post-WWII developments of FRTs demands a return to this dissertation's refrain that face recognition is a vision problem first. The 19th century vision protocols established by thinkers such as Fechner and vonn Helmhotz, established in the previous chapter, were the core principles that established 20th century technical protocols for FRTs.

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[234] My first encounter with "interdiction" as a term was in the report *Joint Counter Drugs Operation* by the Joint Chief of Staffs (Feb. 17, 1998, I-13. https://www.hsdl.org/?view&did=3751)

Establishing Computer Vision

19th century psychologist Gustav Fechner, whose work was examined in the prior chapter, describes his theory of psychophysics as an oarsmans subjected to the river of natural phenomenon: the oarsman steers the boat, which Fechner equates to human thought and will, but that oarsman is ultimately continually subjected to the river, which Fechner parallels with the laws of the physical world and the body's perception of stimuli. From this standpoint, Fechner defines his concept of psychophysics, which attempted to measure stimuli, and therefore linking corporality and physical sensation to the inner, psychological phenomena of the human mind. The observable physical world, tied to physics and chemistry, is an incomplete, yet primary, way by which humans can understand how thought and psychic activity comes to be.

Norbert Weiner, one of the originators of post-WWII first-order cybernetics, also drew "cybernetics" from the Greek word for "steersman." However, his figure of the oarsman was imagined at the centre of a river of technologically-mediated information in ways that enhanced and amplified that human. Doing so meant advocates of first-order cybernetics, such as Weiner and W. Ross Ashby, harnessed behaviourist engineering logics aimed at the optimal design of human-technological assemblages.[235] Second-order cybernetics, as advocated by thinkers such as Heinz von Foerster, utilized such thinking to expand to automated systems wherein, systems of knowledge are mediated by statistically generated models of perception and life, which act as simplified representations of the systems of knowledge, providing theoretical and practice

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[235] Norbert Weiner, *Cybernetics: or Control and Communication in the Animal and the Machine* (Cambridge: The MIT Press, 1961); Norbert Weiner, *The Human Use of Human Beings* (London: Free Association Book, 1989); W. Ross Ashby, *Introduction to Cybernetics* (London: Chapman & Hall Ltd., 1957). I owe further debts to N. Katherine Hayles's indispensable *How We Became Posthuman* (Chicago, University of Chicago, 1999) and Manuel de Landa's *War in the Age of Intelligent Machines* (New York: Zone Books, 1991) for proving further background into the development of cybernetics.

groundwork for advanced automated feedback systems operating under autopoesis that pointed

towards a general artificial intelligence.[236] The forms of automated computer vision that

developed from such thinking required that the logic of a human nervous systems be remade into

data under feedback-driven instruction such that it, and the sensations its receives, become

information within the larger data processing systems of the world.

FRTs, namely their technical protocols, were the direct decedents of cybernetic thinking

and the explosive development of digital computing in the second half of the twentieth century,

wherein the instrumentalization and isolating of senses established in the previous century led to

the development of computer science and computer vision. The principles of such developments

were reliant on the understanding that the world, and the human body within it, was made

entirely of informational patterns, all measurable and therefore computationally processable. In

the process, the representational and political protocols of FRTs were almost completely ignored

and subsumed within the state of the art advancing its technical protocols.

The initial logics for FRTs technical protocols are built from research like J.Y. Lettvin,

H.R. Maturanat, and W.S. McCulloch's 1959 paper "What the Frog's Eye Tells the Frog's

Brain": supported in part by the U.S. Army and U.S. Air Force, the paper recreates the anatomy

of the frog's eye alongside the animal's typical behaviour in order to argue that the eye

communicates to the brain in a high organized and interpreted manner.[237] Rather than the eye

taking photos of the world like a camera, the breaking down of vision into four general

operations at the end of the paper, pave the way for many of the techniques of computer vision,

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[236] Heinz von Foerster, *Cybernetics of Cybernetics* (Urbana: University of Illinois, 1979); Heinz von Foerster, *Understanding understanding: Essays on Cybernetics and Cognition* (New York: Springer Press, 2003); Francis Heylighen and Cliff Joslyn, "Cybernetics and Second-Order Cybernetics," in *Encyclopedia of Physical Science and Technology.* New York: Academic Press, (2001): 3-7.

[237] J.Y. Lettvin, H.R. Maturanat, and W.S. McCulloch, "What the Frog's Eye Tells the Frog's Brain," Proceedings of the IRE (1959): 1940-1951.

in particular those within facial recognition: by proposing that the eye systemically processes edges, contrasts, and movement, rather than transmit whole images that are then processed later by the nervous system, did the key work of isolating vision as a discrete acts of cognition in ways that echo Fechner's and Galton's work explained in the previous chapter. Importantly, under this schema, systems of knowledge are cybernetic and mediated by models, which act as simplified representations of the systems of knowledge. Using such models, vision, externalized and automated, could then be located in nonhuman apparatuses, observing the world with increasingly complex computational devices.[238]

Alongside Lettvin, Maturanat, and McCulloch's paper, the piecemeal adoption of James. J. Gibson's work in the 1950s by computer vision scientists is a good example of the ways in which computer vision pulls from many different disciplines, often picking and choosing the portions that best suit its needs.[239] Within the working of a FRT, the linear pipelines that characterize computer vision draw from portions of Gibson's arguments about vision, which allows for different invariants to be taken up in task-focused modules, blocks of code within computer vision, that are dedicated to specific aspects of computer vision. These modules break objects into their smaller, invariant parts so that they can be serially arranged, decontextualized

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[238] Further, in terms of a more general computer vision, both Orit Halpern's *Beautiful Data: A History of Vision and Reason since 1945* (Durham: Duke University Press, 2014) and Wendy Chun's *Programmed Visions* theorize the post-WWII realm of cybernetics and the thinking of Norbert Weiner, Warren McCulloch, Karl Deutstch, George Kepes, and Gordon Pask. Doing so recreates some of the bedrock of FRTs' technical protocols by outlining such thinkers' harnessing of behaviourist engineering logic aimed at the optimum design of human-technological assemblages. Within such paradigms, vision soon came to be driven by explanations that linked vision to the ability to store and retrieve information, alongside notions that vision was a module which interfaced with reality in order to pass information between sensory organs and the brain. In addition, Alexander Andreopolous and John. K. Tsotsos's "50 years of object recognition: Directions forward" (*Computer Vision and Image Understanding* 117, no. 8 (2013): 827-891) is a very thorough, if technical, story of this technical trajectory of computer vision, outlining many of the key techniques that have emerged post-WWII.

[239] J. J. Gibson, *The Perception of the Visual World* (Boston: Houghton Mifflin, 1950); J. J. Gibson, *The Senses Considered as Perceptual Systems* (London: George Allen and Unwin, 1966); J. J. Gibson, *The Ecological Approach to Visual Perception* (Boston: Houghton Mifflin, 1979).

from the original object and its context; the breaking of vision into segmented parts here recalls the work of Galton in his numeralised portraits where faces were broke into segments, coded to dashes and dots such that they could be sent over a telegraph.[240] Returning to Gibson, within such systems of thought, vision, whether enacted by a human or a machine, were proposed in a number of ways that would be influential to later developments of FRTs: vision is a neutral process that can be reduced to a series of replicable steps, within which informational patterns, based on invariants, are stably produced then processed.

While Gibson's work was widely read and discussed within computer science, most focused on his writing on sensations and the invariants within a visual field and largely put aside his less positivistic theories of affordances and ecological perception.[241] Importantly, when later scholars like David Marr would adopt portions of Gibson, as William Warren writes, they would do so under the assumption that the goal of vision was to recover a physical description of the world, where Gibson was interested in the ways perception functioned, not just by the world of physics, but by ecological operations of simultaneous interactions between environment and embodied observer. The adoption of only portions of Gibson's thinking was in part because he largely forewent experiments in support of his research; as such, his writings on sensation were adopted because they could be more easily tested in a variety of animals, understood empirically, and reproduced within computational systems. Doing so did not efface the body entirely, as understandings of biological functioning of the eye are central to computer vision, but did reduce

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[240] From his thinking, sensations are the stable invariants within a visual field that can be drawn from the contours, textures, and forms that are received by the eye. Each sensation, Gibson argues, are distinguished from each other by their action-functions, and then are serially joined in order to produce an ecological understanding of perception.

[241] William H. Warren, "Does this Computational Theory Solve the Right Problem? Marr, Gibson, and the Goal of Vision," *Perception (London)* 41, no. 9 (2012): 1053-1060.

bodies to mechanistic and static parts to be assimilated into larger assemblages, including

biometrics.

By ignoring the nuance from Gibson's thinking, computer vision advanced forward by

adopting truth regimes that made vision into a completely isolatable, algorithmic, and linear act

within computational systems. Externalizing vision into decentralized and autonomous

apparatuses reduced the visual field to sets of patterns (such as contours and contrasts) that

assumed that detection and recognition were neutral and objective acts; further, such thinking

hinges on the belief that there is a singular and perfect idea of vision, with little reflection of the

individual embodiment of each person's seeing and observing. Such truth regimes around vision

manifested in linear and deterministic models that enacted computer vision through the reduction

of visual sensations into computationally-processable units of data.

Returning to the Problem of the Face Within Computer Vision

Face recognition as a specific computer vision problem was established in the 1960s,

most notably by the work of Woodrow "Woody" W. Bledsoe. While researchers like Lee-

Morrison, Gates, and Stevens and Keyes have given broad histories of Bledsoe, discussion of

Bledsoe's and his research team's influential structuring of FRTs 'operative moment has gone

largely unexamined.[242] Similarly, comparatively little attention has been given to Bledsoe's work

in using computer vision for pattern recognition under the principles found in his 1959 paper

"Pattern Recognition and Reading by Machine" which argued that computer reading should be

"inspection [centred] upon analysis of the specific characteristics of patterns into parts, followed

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[242] Lee-Morrison, 57-61; Gates, 208; Stevens and Keyes, 835-840.

by a synthesis of the whole from the parts."[243] His production of a general computational pattern recognition system was built by breaking an image (in his case type-written numbers) into binary "mosaics" of cells (functionally dark and light pixels that recall later Haar Cascades) that are then coded as numbers and stored in memory matrixes in ways that they could be then used in comparison to any newly input numbers. Such work on generalized computer vision recalls Galton's work from the previous chapter, where images are broken into segments and portions as a way of datafying them, work drawn from Fechner and vonn Helmhotz's vision science. It also enforces this dissertation's refrain that face recognition is a vision problem first and Bledsoe's work in general pattern recognition within computer vision made him well suited for his later work on facial recognition.

In fact, when undertaking unique archival research in Bledsoe's papers at the Dolph Briscoe Center for American History (University of Texas at Austin), it became clear to me that Bledsoe's contribution to FRTs in the 1960s is buttressed by a number of other complex, mostly military-led, engineering problems. This included his 1950s mostly classified work at the American Defence-led Sandia Corporation on aspects of nuclear fallout and missile-air defence as well as papers such as his 1961 "A Basic Limitation on the Speed of Digital Computers"[244]; in a job application found in his archive he lists explains in the section on work experience that

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[243] W. W. Bledsoe, "Pattern recognition and reading by machine," *IRE-AIEE-ACM '59* (1959), 225. It is worth adding his "Some Results on Multicategory Pattern Recognition" (*Journal of the Association of Computing Machinery* 13, no. 2 (1966): 304-316) and "Improved Memory Matrices for the n-Tuple Pattern Recognition method" (*IRE Transactions on Electronic Computers* 11, no. 3 (1962): 414-415; co-authored with C.L. Bisson) to this conversation as well.

[244] W. W. Bledsoe, "A Basic Limitation on the Speed of Digital Computers," *IRE Transactions on Electronic Computers* 10, no. 3 (1961), no pp. Examining his archive, there are multiple instances of his CV which list his publications; those publications vary depending on the year the CV was being circulated and, one assumes, the security clearances around his work at Sandia. Still, the 1953 technical memorandum "A problem in air defence when the lethal volume of an aircraft in flight is approximated by a spheroid," published by the Sandia Corporation and found in his archives, gives a sense of his work (Woodrow "Woody" W. Bledsoe Papers. Box 96-349/7, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.).

from 1957-1960 he was the manager of Mathematical research department undertaking "system studies on proposed weapons to determine their capability and required characteristics."[245] His engineering focus that is imbued with his military service situate him, both technically and politically, within the discourses of the era's cybernetics. This should be remembered when analyzing his work at Panoramic Research with a team that included co-authors Helen Chan Wolf, Lawrence Chowdy, and Charles L. Bisson, among others. Together, their work provided key technical protocols that would structure the largely linear pipeline outlined in Chapter 2's discussion of an FRT's operative moment. To be clear, the work was more theoretical than actual; simply put, the computational systems needed to undertake complex FRTs did not exist. Yet the research team built work-arounds and basic systems that establish core protocols for later versions of the technology. This is captured within Bledsoe's own "Feature Extraction Method For Recognizing Faces" in the 1964 *Facial Recognition Project Report*, where he lays out a proposed computational pipeline. First, the team understood that the key to having a computational vision system recognize any object was translating, or "transducing," the footage into a form that a computer could understand and process.[246] Second, this preprocessing of footage (still images in Bledsoe's case) is then fed into a detection mechanism. This detection mechanism needed to be built ahead of time, and was trained to recognize what a face is by building, effectively, a cybernetic model: Bledsoe details this process wherein the computer "simulates" detection and accumulating information from pictures of known and previously categorized faces and "learns" how to detect faces by cycling through many photos and forming

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[245] Woodrow "Woody" W. Bledsoe Papers, Box 96-349/29, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.

[246] W. W. Bledsoe, "Feature Extraction Method For Recognizing Faces," *Panoramic Research: Facial Recognition Project Report*, (1964): 1-6. Recently this report has been declassified, digitized, and made available at https://ia601208.us.archive.org/26/items/firstfacialrecognitionresearch/SecondReport.pdf.

its own database of what it knows to be a face; this becomes a cybernetic model, a part of its memory that can then be used to detect faces in new footage. This generalized mechanism also functions to datafy individuals so as to create unique profiles for each face, based on distances between facial features for example, which can them be compared to the new face captured in the footage. Using the ability to find facial features in combination with the unique facial profiles in its predetermined memory/database, the computer program, or the "look up machine," consults its memory/database which correlates the pre-determined unique facial profiles to specific names, and surfaces the identities seen as the most likely match.

By 1966, the practical realities of a fully automated FRT was seen as beyond the currently technical capabilities of digital computers and cameras, complicated further by the head position and lighting of faces within photographs. Bledsoe and his team then focused on man-machine procedures, wherein a human operated used a RAND tablet as a transducing device to identify and mark the facial landmarks in a photo as part of the photo pre-processing.[247] As in the East German example from this chapter's introduction, Bledsoe saw humans as necessarily (at that time) present throughout the process, not just in hand-annotating faces, but in verifying the results from the list of probable identities that the FRT would produce at the end of its process. Shortly after this, Panoramic Research was dissolved and Bledsoe took a position at the University of Texas at Austin, with the popular narrative being that Bledsoe left the building of FRTs behind to pursue the work in AI that would eventually make him famous.[248]

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[247] Woodrow "Woody" W. Bledsoe Papers, Box 96-349/7, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.

[248] Take for example the narrative within Shaun Raviv's "The Secret History of Facial Recognition" (*Wired Magazine*, Jan. 21st, 2020, https://www.wired.com/story/secret-history-facial-recognition/)

My unique research in his archival papers revealed a great deal more. While Bledsoe would dedicate the majority of the rest of his academic life to AI, he was still well-known for his facial recognition work, even while his work remained classified; he would be invited to give talks on the topic in 1968 at Texas Christian University, in Edinburgh in 1973, and in Austin in 1991.[249] Too, he would co-publish a technical report in 1969 with P.E. Hart titled "Semi-automatic Facial Recognition" for the Stanford Research Institute.[250] Beginning by situating FRTs within law enforcement contexts, the report details reports of a semi-automated process that build on Bledsoe's earlier work with some success, including the introduction of more complicated mathematics in the form of a Bayesian Approach to object recognition. Testing on "400 adult male caucasians," the semiautomated approaches were compared to human acts of facial recognition; ultimately, humans were better able to deal with variability (such as head rotation) which machines had better tolerances around age differences. The authors conclude that their work, while again not possible given the era's computational systems, could in the future lead to "a semiautomatic classifier that is more accurate and much faster than an unaided human."[251] Finally, over the decades following his 1960s FRT work, he did take on a variety of piecemeal face recognition projects that include trying, in 1977, to determine the age of Abraham Lincoln in a 19th century daguerreotype and attempting to determine whether a criminal was

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[249] The materials for the 1968, 1973, and 1991 talks were found in Woodrow "Woody" W. Bledsoe Papers, Box 96-349/18 (Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.)

[250] W. W. Bledsoe and P.E. Hart, "Semi-automatic Facial Recognition," Stanford Research Institute (1969): 1-17. Found in Woodrow "Woody" W. Bledsoe Papers, Box 96-349/7, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.

[251] Ibid., 15

present in a 1982 bank robbery using FRT on CCTV footage.[252] While not his focus, FRT remained present on the edges of his life throughout his work on AI.

There is much more to discuss in the Woodrow "Woody" W. Bledsoe Papers, in particular related to the political and representational protocols of his work which were largely unacknowledged.[253] It should not be ignored that recent research has uncovered that Bledsoe was secretly funded by the American government and the CIA, and that he eventually asked the Pentagon for funding to research a FRT that could identify a person's racial background.[254] As well, the photos used in testing his FRTs of this time straddle the representational protocols of mugshots and governmental identity documents: while they are undoubtably all light skinned male faces, some of the photos bear portions of what looks like government stamps in Cyrillic; I suspect they may in fact be bureaucratic materials issued by the Soviet Union.[255] In relation to the prior chapter of this dissertation, not only does Bledsoe's work cite Alphonse Bertillon and Cesare Lombroso, but there is also startling work on the simulations of genetics and computationally modelling how genetic traits are passed on from generation to generation.[256] There is no evidence that Bledsoe openly harboured the racist beliefs of Galton and Lombroso,

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[252] Materials related to his Abe Lincoln project was found primarily in Woodrow "Woody" W. Bledsoe Papers, Box 96-349/18, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A. Materials for his work on the bank robbery trial was found in Woodrow "Woody" W. Bledsoe Papers, 96-349/31, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.

[253] Due to the COVID-19 pandemic, I delayed my research in the Bledsoe Papers for multiple years until after I had written a full draft of my dissertation. As such, the materials are not as much of a focus as I might have expected when I began writing this dissertation, and there is a wealth to write on in the future.

[254] Further details of Panoramic's work with King-Hurley Research Group, a CIA front, can be found in the previous cited *Wired* article by Shaun Raviv. The 1965 letter asking for further funding from Dr. Samuel Koslov at The Pentagon was found in Woodrow "Woody" W. Bledsoe Papers, 96-349/21, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.

[255] The images for this work was found in his drafts for his Man-Machine Proposal in Woodrow "Woody" W. Bledsoe Papers, 96-349/30, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.

[256] His work on the EVOLVE and EVOLVE Pulse projects were found in Woodrow "Woody" W. Bledsoe Papers, 96-349/7, Dolph Briscoe Center for American History, University of Texas at Austin, U.S.A.

but it is important to note that the three do overlap in their focus on facial features and the tracing of genetics from generation to generation.

However such protocols, as was often the case, were largely subsumed in the technical achievements and protocols that Bledsoe's team's work established. While their systems were still relatively human-centric, Bledsoe and his team's work in standardizing the linear nature of FRT's operative moment, alongside his methodologies of producing facial templates and detection mechanisms, would be greatly influential on the next decade's research into FRTs, in particular for those, like Takeo Kanade, who were working on fully automating the technology.

Case Study: "Computer Physiognomy"/"Computer Magnifying Glass"[257]

The first public demonstration of a computerized FRT was the exhibition "Computer Physiognomy" at the 1970 World Fair in Osaka was lead in part by Takeo Kanade and was funded by the Nippon Electric Company (NEC). Superficially, "Computer Physiognomy"/"Computer Magnifying Glass" is a light-hearted tech demo. At the exhibition, "a person sits before a Picamera, the picture of [their] face is digitized and fed into the computer… [and their] face is classified into one of seven categories, each of which is represented by a very famous person," which included Marilyn Monroe, Winston Churchill, and John F. Kennedy.[258] It is worth noting, therefore, that the post-WWII American presence in Japan was both military and cultural: the inclusion of a figure like Monroe shows how wide-spread a Hollywood star's

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[257] Portions of this section of this chapter are adapted from: Aaron Tucker, "The Problem of Recognition: Celebrity Faces, Photogénie and Facial Recognition Technologies." *Faces on Screen: New Approaches,* ed Alice Maurice. (Edinburgh U.K.: Edinburgh University Press, 2022): 60-74.

[258] Takeo Kanade, *Computer Recognition of Human Faces* (Basel und Stuttgart: Birkhauser Verlag, 1977): 33–4. A full list of the included celebrity faces is not provided in the text. However, in a 2015 talk, Kanade details how each person would be matched to one of "Marilyn Monroe, Winston Churchill, John F. Kennedy" etc (Takeo Kanade, 'Takeo Kanade: Computer Face Recognition in Its Beginning', *MITCBMM*, 22 April 2016, Video, 25:10. https://www.youtube.com/ watch?v=fY98kQWxJQc&t=5s)

celebrity was spread in the 1970s, cutting across geographies and casually installing itself in the image-making of FRTs.

This case study is interesting as there are slightly competing narratives about this exhibition. Prior scholars primarily rely on Takeo Kanade's description of the event, as outlined his "Picture Processing System by Computer Complex and Recognition of Human Faces."[259] While this description of what he names "Computer Physiognomy" is incredibly useful, if brief, my research in the British Library (London U.K.) uncovered a further description of the event in *The NEC Technical Journal* in the paper "Image Information Processing - Exhibition Contents of Electronic Fortune Teller of Sumitomo Pavilion," housed within an issue dedicated to NEC's contributions to the Osaka World Fair.[260] From the perspectives of the NEC engineers, who use the name "Computer Magnifying Glass," the exhibition was a carnivalesque fortune teller where the drawn caricature of a person's face (and not a photo as is implied by Kanade's writing) would be matched to not only a celebrity face, but also a personality type ("clingy" or "manic-depressive," for example), after which an audio system would announce the results loudly; participants were also given a print out of the results as a souvenir. While Kanade's account narrowly focuses on the technical protocols of the FRT, the NEC's account makes clear the company was simultaneously showcasing its computational, audio, video, video capture, and printing technologies, wherein the face recognition element was one component within a much larger apparatus.

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[259] Takeo Kanade, *Picture Processing System by Computer Complex and Recognition of Human Faces*, Department of Information Science (Kyoto: Kyoto University, 1973).

[260] T. Wantanabe, R. Niwa, T. Fujimaki, and T Murao, "Image Information Processing - Exhibition Contents of Electronic Fortune Teller of Sumitomo Pavilion." *NEC Technical Journal* 100 (November 1970): 21-29. The original article is in Japanese and I give many thanks to Renge Rho for her original translation of the article into English.

This exhibition is an incredibly useful case study as it highlights the technical, representational, and political protocols that would become ingrained in the spread of automated FRTs from lab spaces in the 1960s through the 1980s into later mass applications in the 1990s and beyond. Kanade's technical protocols establish an automated FRT pipeline that removes much of the human work present in Bledsoe's earlier versions of the technology. At the same time, the building of a "personality assessment," in part from matching public faces to celebrity faces, established core representational protocols by normalizing the use of famous faces in FRTs, a practice that continues to this day. Finally, the NEC's blending of FRTs into its expansive offerings of established technology is useful to look at in the following decades' melding of corporate and national interests under globalized capitalism, wherein FRTs are now one tactic within larger strategies of governmentality. In this sense, the NEC's integration of FRTs into larger technological apparatuses and logics is as important, if not more important, than the FRT itself.

Technical Protocols: Building Interlocking Subsystems of Computer Vision

In his aforementioned 1973 thesis, Kanade takes care to contrast his work with Bledsoe's and others, stressing that he aims to automate as much of the human elements from the FRT as possible.[261] As such, Kanade outlines an automated processing of the entire human body for the purpose of identification that bears striking resemblances to Bertillon's signaletics, wherein he establishes a system for the automated templating and sub-templating of the human face; this templating is combined with mechanisms aimed at extracted the contours and edges of a face in an image in order to detect, then identify a unique face.

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[261] Kanade, *Computer Recognition,* 4; 10.

The FRT that emerges is one that relies on a series of systems and subsystems, hinging

first on the initial act of computer vision and the creation of a binary picture of the face: like

Bledsoe, this initial datafying of the face is key, and Kanade's process uses a line-extraction

program to create an image that represents the contour of the face (essentially a white outline of

the face against a black background).[262] Once the binary picture is created, specific programs

aimed at facial feature extraction are deployed, locating the eyes, nose, mouth and chin;

importantly these subroutines aimed at locating the features operate interdependently, each

providing predictions on where the desired facial feature may be, then providing feedback to

each other, so that the eventual finished process is able to map the entire face.[263] While the

process retains the basic footage-detection-identification of the linear pipeline of Bledsoe's FRT,

Kanade champions it as being created to be as flexible and adaptive as possible; the feedback

mechanisms correct and adjust the predictive feature extraction mechanisms so that the FRT can

operate more accurately.

It is this flexibility that makes Kanade's work, and "Computer Physiognomy," especially

relevant to understanding how contemporary FRT usage has sprawled so far while becoming an

effective gatekeeper of mobility: as discussed in Chapter 2, the flexibility within FRTs make it a

very nimble potential biopolitical tactic, with its vision being able to be adjusted and re-

operationalized into a wide variety of situations and environments, able then to track and to

monitor the face-as-identity document in increasingly decentralized manners. This is facilitated

by the base principles in Kanade's work in two core ways: first, the complete automating of the

process allowed the technology, in its future, to be increasingly decentralized, aiding in its spread

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[262] Kanade, *Picture Processing*, 33.

[263] Ibid., 60.

into near-ubiquity; second, it enabled the necessary system-subsystem architecture to make it more easily scalable to the size of populations, building increased tolerance for non-cooperative environments and instances. The resulting complex of vision is a version of biopolitical vision that is better suited to large-scale and public-facing monitoring of mass groups, and would be a key step towards the management of flow arising in the late 1980s and beyond.

Representational Protocols: Automating Photogénie

Interestingly, the anthropological theory behind the exhibition is provided by Professor Yamazaki of Tsurumi Women's University, a fact that is unacknowledged in Kanade's work. Yamazaki is a fascinating figure: he was a former dentist, whose initial research on teeth spread to the skull, where he developed an interest in physiognomy and facial studies.[264] His work linking personality types to facial features, of course, draws from the prior century's work detailed in Chapter 2, and is core to uniting FRTs' desires to predict, sort, and hierarchize the human face based on its characteristics. In this sense, both titles for the exhibition ("Computer Physiognomy" and "Computer Magnifying Glass") make sense: there are physiognomic elements, but also the computer is imagined as a magnifying glass-turned-fortune teller, a neutral tool to be looked through in order to reveal the greater truth of the face underneath.

Knowing this, it is crucial to unpack the fact that the exhibition utilizes celebrity faces as the end result of its identification mechanism, where the inclusion of movie stars within "Computer Physiognomy" unites the histories of filmmaking with the development of FRTs. As I have written in the book chapter "The Problem of Recognition: Celebrity Faces, Photogénie, and

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[264] Thanks again to Renge Rho for her translation of the biography of Professor Yamazaki ("日本の人類学者９. 山崎清（Kiyoshi YAMAZAKI）［1901－1985]" June 6 2012. https://blog.goo.ne.jp/garfsn1958/e/6f853f3e5387b3368a76e7e24c7dd7c7)

Facial Recognition Technologies," the exhibition fits in with a long history of images and

moving images of the face, in particular famous faces, being used to determine the true states of

the human mind and, in more racially charged manners, the "true nature" of a person based on

their hereditary materials[265]. Recalling the previous chapter, 19th century scientist Francis Galton

exchanged letters with Eadweard Muybridge (considered one of the earliest theorists and

practitioners of cinema), eventually linking his work on Composite Portraits to Muybridge's[266];

Galton also utilized famous faces (all men) throughout the whole of his work, tracing faces from

George Dance's *A Collection Of Portraits Sketched From The Life Since The Year 1793* (a

collection of sketches of the faces of famous artists, physicians, actors, and politicians) as

experimental materials.[267] Further, as discussed in the previous chapter, both Tom Gunning and

Mary-Ann Doane have written effectively on the historical overlaps of cinema and famous faces,

in particular linking such histories to atavistic and physiognomic logics.[268]

Such thinking is also captured within the writing of Béla Balázs, but is probably best

known by way of Jean Epstein's notion of photogénie. The basis for Epstein's concept of

photogénie is outlined in the much-cited passage: "We have discovered the cinematic property of

things, a new and exciting sort of potential: photogénie….photogénie [is] any aspect whose

moral character is enhanced by filmic reproduction."[269] The use of "enhanced" does not mean to

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[265] Tucker, "The Problem of Recognition," 2022.

[266] "Eadweard Muybridge" Box 116, Folder 2/8/8, n.d., Collection of the University of College London, The National Archives, London, U.K. Galton published . It should be also noted that Galton had three flip books, two in French, that were early cinema prototypes.

[267] "Tracings of George Dance's Profiles." Box 118, Folder 2/9/5/2, n.d., Collection of the University of College London, The National Archives, London, U.K.

[268] Gunning, "In Your Face," 1995; Doane, "Facing a Universal Language," 2014.

[269] Jean Epstein, "On Certain Characteristics of Photogénie," in *French Film Theory and Criticism: A History/Anthology Vol. 1*, ed. Richard Abel (Princeton: Princeton University Press, 1988), 315.

increase, but rather to make more clear to the viewer. Epstein repeatedly describes such abilities as acting as a microscope and/or a magnifying glass, with the face in close-up being "the soul of cinema" and the maximum expression of photogénie.[270] However, the less explored notions of Epstein's work relate to the interrogatory powers of photogénie: Epstein argues that photogénie can function as a moral index. In the first instance, he argues "if a high-speed film were made of an accused person during [their] interrogation, then from beyond his words, the truth would appear, unique, evident, written out, that there would no longer be any need of indictment, or of lawyers' speeches, or of any other proof than that provided by the deep images."[271] Further, in "Photogénie and the Imponderable" he gives the example of an American judge watching and re-watching the film of two different women claiming to be a girl's mother in order to accurately discern which was telling the truth. Empowered by photogénie, cinema is "a machine that would confess souls," one potentially "capable of baring the most secret thoughts."[272]

When situated in automated FRTs, the face in close up enables a photogénie which grants the potential for a technological vision capable of accurate and objective interrogation of the face. Photogénie can be used to detect guilt or innocence, personality type, but was also core to

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[270] These thoughts are expanded in other essays by Epstein, including "Photogénie and the Imponderable," "Magnification," and "L'Ame au Ralenti" wherein photogénie is described as the manifestation of cinema's quasi-spiritual abilities to manipulate and display beyond-human depictions of movement and time. Jean Epstein, "L'AmeauRalenti", *Écrits sur le cinéma: tome 1* (Paris: Editions Seghers, 1974), 191; Jean Epstein, "Magnification," *French Film Theory and Criticism: A History/Anthology Vol. 1,* ed. Richard Abel (Princeton: Princeton University Press, 1988), 235–40; Jean Epstein, "Photogénie and the Imponderable," *French Film Theory and Criticism: A History/Anthology Vol. 1,* ed Richard Abel (Princeton: Princeton University Press, 1988), 188–92.

[271] Tom Gunning, in "In Your Face," attributes this quote to Epstein's "The Soul in Slow Motion" but an inspection of Epstein's essay in the original French shows no such quote. Instead, Annette Michelson, in "Reading Eisenstein Reading 'Capital'" (*October* 2 (Summer, 1976), 33) cites the quote as coming from "A Conversation with Jean Epstein," (*L'Ami du Peuple*, 11 May 1928, Lamberton, New York, Anthology Film Archives). I was unable to find this original text and am relying on the Michelson citation.

[272] Epstein, "Photogénie and the Imponderable," 192. In Richard Abel's footnote following this quote, he explains that Epstein 'inadvertently…attributes to cinema a unique power of rational analysis that could extend - and has extended - the Panopticon-like surveillance system of the modern state.'

the logics informing Ekman, Wallace V. Friesen, and Jospeh C Hager, whose research into

building systems capable of cataloguing and tracking emotions as they relate to facial

expressions, in particular the Facial Action Codes (FACs), began in 1972.[273] A full discussion of

their work is beyond the scope of this chapter; further, Kelly Gates has already written

effectively on FACs in her chapter "Automated Facial Expression Analysis and the Mobilization

of Affect."[274] In the context of this chapter, briefly, their work is closer to Guillaume Duchenne

de Boulogne's taxonomies of the expressive face collected in the prior century, in that they

aimed to make blueprints of facial expressions by dividing up the features of the face into

observable states; such states would be observed by both a human and a camera that took either

still photos or moving images. Technologically aided, the goal of learning their FACS system is

to understand the "true" thoughts and feelings of a person through the observable states of the

face, and is underpinned by the logic that the face, consciously and unconsciously, surfaces one's

underlying emotions and intentions.[275]

Such discourses were, and remain, essential to the mass expansion of FRTs, as they have

greatly multiplied the potential use cases for the technology while also, allegedly, greatly

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[273] Paul Ekman, Wallace V. Friesen, and Phoebe Ellsworth. *Emotion in the Human Face: Guidelines for Research and an Integration of Findings.*(New York: Pergamon Press, 1972); Paul Ekman and Wallace V. Friesen. *Unmasking the Face: A Guide to Recognizing Emotions from Facial Expressions.* (Englewood Cliffs: Prentice-Hall Inc, 1975); Paul Ekman. *Telling Lies: Clues to Deceit in the Marketplace, Politics, and Marriage.* (New York: W.W. Norton, 1985).

[274] Gates, "Automated Facial Expression Analysis and the Mobilization of Affect," *Our Biometric Future*, 151-190.

[275] In particular, the system could allegedly be used to detect whether a person might "controlling" their facial expressions, which the authors link to potential lying. Once a system like FACs is automated into FRTs, the face, under technological observation that splices the face into minute frames of movement and time, is revealed and becomes a powerful tactic for, as Eklund imagined, trial lawyers and law enforcement instances. Gates's discussion of the implementation of FACS into the U.S. Transportation Security Administration's SPOT Program in the early 2000s provides a sample of the biometric in action, but the SPOT program is also as a harbinger for more contemporary uses in the everyday lives of citizens, from their use as part of enhanced border security to the mapping of facial affect within shopping environments. (Gates, 180-181).

reducing the chance for the types of errors enacted within human-centric FRTs. As will be

discussed Chapter 5's linking of FRTs to the management of social mobility, such logics make it

so that FRTs are seen as capable of observing and making choices about people in situations as

varied as Ekman and Wallace imagined, including by personnel managers, bank loan

applications, and teachers.[276] Again, the adaptability of FRTs make it an effective technology to

gatekeep mobility, in particular in every day spaces targeting social mobility. Crucial to these

uses are the discourses present in photogénie and FACs that are grounded in underlying

suspicion: that technological vision can reveal the "real" individual, their histories, and their

intentions. Once that discourse was accepted in a wide-spread manner, the machine ensemble

spread further and wider, as instances of its use could be rationalized as being necessary in the

wide variety of environments listed above. Such truth regimes were, and remain, essential to the

control of mobility: FRTs enable and justify the asymmetrical control of both the technology

itself and the resultant gatekeeping of citizenship resources, such as physical and social mobility.

Returning to the NEC's 1970 exhibition, NEC has since gone from providing public

FRTs as an exhibition to becoming an international vendor of the technology. The relatively

small-scale "Computer Physiognomy"/"Computer Magnifying Glass" provided technical

protocols that paved the way for the tracking of facial landmarks, and therefore facial

expressions, while the inscription of photogénie via its treatment of representations of the face

allowed the technology to leverage the celebrity face such that the technology could be applied

to everyday fair-goers and normalized under the guise of a light-hearted experiment. However,

the spread of FRTs vision beyond the small experimental group to the scale of populations

depended upon the vast infrastructure and history of prior NEC technological developments. The

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[276] Ekland and Friesen, *Unmasking the Face*, 3-5.

NEC exhibition is an example of how a tactic like FRTs becomes located within larger strategies, wherein the power that circulates through the technology is diffused through an interconnecting apparatuses made of a symbiotic meld of hardware, software and actors. Within such apparatuses, a FRT is a relatively small component, a technology that facilities other technologies, with its adaptability to larger strategies and apparatuses becoming its greatest asset.

Political Protocols: One Small Part within a Larger Apparatus

Looking closely at the NEC's publication "Image Information Processing," great attention is paid to how the FRT operates, but details of the system are preceded by an explanation of "System equipment configuration": this section explains how the exhibition, with its complex video and audio components running for 12 hours a day, were built to run.[277] Key to this was the NEC's then state-of-the-art NEAC Series 2200 Model 200, the NEC's advanced computer, as well as the ITV camera Type TI202 which was used to capture the faces of the general public for the exhibition. The detailed description of how the hardware worked, including the camera and the audio equipment that announced the results and the printer which granted the ability to give the general public a souvenir of their experience, becomes the technological triumph that the NEC is trumpeting. The FRT is the technology that demonstrates the value and strength of other NEC technologies.

Pulling out further to the Sumimoto Pavillion, a reader gets the sense of the wide variety of technologies that NEC was responsible for at the World Fair: there are video phones and large-scale immersive video installations, but also an in-depth surveillance and emergency

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[277] "Image Information Processing", 21-26.

response system that the NEC deployed throughout the World Fair.[278] When examining the issues of the technical journal just prior and just after this issue, one can see that the NEC was responsible for researching everything from fluorescent lamps to television receivers as well as national telecommunication systems, building algorithmic models of traffic for highways across Japan, to say nothing of their massive contributions to advancing satellite communication systems.[279] It comes as no surprise then that in 2023, the NEC is a world provider of biometrics and FRTs more specifically: from the 1960s onward, they had the base and variety of advanced technologies that could enable FRTs and further research into their improvement, including footing in communication and data processing systems as well as hardware (such as their NEAC series of computers and high quality cameras), all of which were well suited to a coming biopolitics of flow. Their adoption of FRTs in the 1970 exhibition is a model for how other large apparatuses, corporate, state, or a blend of the two, could leverage their already existing infrastructures and resources so as to be able to incorporate a FRT. This asymmetrical distribution of resources is in potential service to a conservative governmentality and recalls the argument at the end of Chapter 3 that the technological capture of the citizen face within FRTs is not reciprocal nor even.

This case study from 1970 lays the ground for the expansion of an automated biopolitical vision via FRTs to a general public in the decades to follow, one in which mobility, flow, and

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[278] Photos and brief write-ups of the Pavilion detailing the technologies are found on pages ii-ix (*NEC Technical Journal* 100, 1970). There are more specific papers in the same issue, such as "EXPO '70 Switching System for Video Telephone Service" (Y. Ariizvmi et al, 69-66) and "EXPO-X Emergency Information Receive and Instruction Equipment" (M. Hirasawa et al, 152-165).

[279] Tatsua Kobayashi and Isao Kaneda, "Alternation of Cathode Spot and its Application to High-Output Lighting System for Fluorescent Lamp," *New Nippon Electric Technical Review* 1, no. 1 (1966): 12-23. Y. Numakura and S. Tominaga, "Automatic Call Distribution Systems," *NEC Technical Journal* 99 (1969): 79-88; J. Yagi et al, "On-Line System Test Using Artificial Data Traffic Generator," *NEC Technical Journal* 101 (1971): 24-35; Volume 103 is dedicated to NEC's many contributions to Japan's launching of a space satellite the year prior (*NEC Technical Journal* 103 (1972)).

control would demand advancements in technologies of interdiction. The exhibition's demonstration of a modular and adaptable computer vision pipeline, enhanced photogénie, and incorporation of the technology into larger apparatuses would be essential for the shifts in truth regimes brought about by the rise in globalized mobility of goods and populations dovetailing with the War on Drugs and the fall of the Berlin Wall.

Making the Face an Identity Document and Establishing Technologies of Interdiction

In the gap between the 1970 "Computer Physiognomy"/"Computer Magnifying Glass" exhibition and the construction of the FERET database in 1993, development of FRTs was relatively incremental, with the technology being slow to be adapted at large scale from laboratories into real world environments. While James L. Wayman's brief general history of biometrics highlights the main points on the timeline of FRT development, Kelly Gates's "Facial Recognition Technology from the Lab to the Marketplace" is a much more thorough underlining of the history of the largely black-boxed military, academic, and corporate development of early automated FRTs, wherein the technology was produced, tested, and, and produced by a very small group of experts with very little public oversight.[280]

By the 1980s, FRTs' migration out of labs and governmental spaces into the public were guided primarily by logics of securitization, in particular by private spaces like banks; the need to verify a user's identity was crucial, and biometrics, including FRT, were an expanding tactic to do so. While corporate interests were increasingly introduced into the application of FRTs, the work in creating and improving the technology was still largely driven by academic and military spaces, who held the most resources and expertise; they were joined by private sector actors like

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[280] James L. Wayman, "The Scientific Development of Biometrics over the Last 40 Years," *The History of Information Security,* eds Karl de Leeuw and Jan Bergstra (London: Elsevier Science, 2007): 263-274; Gates, 25-62.

IBM who held key thinkers and produced essential work for advancing of the technology. Until the late 1990s, the technology remained largely institutionalized within bureaucratic structures that threaded together private interests with governmental logics, a dynamic that became stronger as FRTs became more of a public-facing mass technology.

However, in the last decade of the 20st century, key developments in vision science and computer vision collided with desires that ensured that the face itself was transformed into an identity document. The work of David Marr in the 1980s should be placed alongside the development of eigenfaces as key advancements in technical protocols, leading to the technology's improvement to a point where identity documents, such as those checked and double checked in Bochmann's Checkpoint Charlie system, became secondary to the targeting and the computational processing of the face as an identity document.

David Marr

While J. J. Gibson's aforementioned work was key to the initial decades of automated FRTs, David Marr's work at the MIT Artificial Intelligence Laboratory in the 1970s and 80s solidified the technology's technical protocols leading into the explosive growth of the technology in the 1990s and early 2000s. Although Marr worked on studying biological vision and placed himself in conversation with Gibson, his ideas were drawn to his ideas as a way of constructing the now-familiar pipelines of computer vision.[281] His most influential work was

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[281] David Marr, "The Approach of J.J. Gibson," in *Vision: A Computational Investigation into the Human Representation and Processing of Visual Information* (The MIT Press, 1982): 29-31. William H. Warren traces Marr's reliance on Gibson for core concepts, while also detailing where the two deviate, in particular around what Marr sees as Gibson's naive treatment of the complexity of sensations and invariants within an environment. William H. Warren, "Does this computational theory solve the right problem? Marr, Gibson, and the goal of vision," *Perception*, 41 (2012): 1053-1060.

Vision, published in 1982: central to Marr's thinking was the proposition that vision, first and foremost, was "information-processing task" for which the perception of an object corresponded to abstract, symbolic representational assertions about that object that broke vision into three specific levels.[282] What was then compelling to computer scientists was how vision can be stably understood and represented, in particular the invariants and constraints of the environment that would structure the information available, and where data is queued then cascaded between successive stages. Further, such vision relied upon calculable and computationally replicable modular design. Similar to Kanade's systems, within modular design any computation can be broken into increasingly smaller and independent parts, each of which have their own different processes, invariants, and constraints, making them functionally distinct but interoperable so that they can be serially connected into larger functions; this then allows computational strategies wherein individual invariants, as information further structured by constraints of the environment, can be solved for, then combined in complex acts of computer vision.

Marr's work contributes to the logics that structured computer vision as a linear and modular process, wherein individual tasks, or models, could be constructed and combined in ways that replicated human vision. Within each of these compartmentalized tasks the face becomes a computer processable-data object, with the late 1980s establishment of eigenfaces being a major technical breakthrough.

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[282] Marr, *Vision*, 1982. Marr's theorizing allowed three specific levels of vision: first, the computational, which is defined by specific goals of the computation and the logics drawn from its being carried out which information is derived from the environment's visible properties (what is being carried out and why); second, the representational and algorithmic, where the computational level can be implemented by way of representations of the information derived in the computational level that can be transformed by an algorithm (how is it being carried out?); and third, the hardware where the representation and the hardware are realized physically

Eigenfaces and the Face as Complex Data Object

Around the time of the fall of the Berlin Wall, just as Bochmann's system was being pushed out of use, Sirovich and Kirby were creating a methodology for creating low-dimensional vectors of faces within images that would become the basis for eigenfaces; this leap forward in the technology, which rendered the face a numerical data-object was detailed in the description of FRTs operative moment in Chapter 2. It is worth reiterating, however, in the context of this chapter's understanding of post-WWII automation of FRTs, the development of eigenpictures and, later, eigenfaces, was a collection of technical protocols that further automated and scaled the computational recognition of faces; unlike the methodologies used by Bledsoe and Kanade, eigenfaces, as an image-making technology, was one of the most influential systems for computer vision because it better harnessed the abstracting and numerical logics of computational systems in ways that extended well beyond human capabilities. This reduction and transformation of the face into informational data-object is an act of vision that is a clear break from previous systems, wherein the face is abstracted completely away from the body, and processed as a purely informational object. This then allows for the types of automated interoperability that define modern FRTs, where Marr-esque models can be created and plugged into systems in the ways that are described in Chapter 2; after a model's import into a FRT, the acts of detection and identification are operations wherein the face is subsumed by completely statistical logics.

Marr's work and the innovation of eigenfaces dovetailed with 1990s desires that defined the shift to a biopolitics of flow: the ability to process the movement of exponentially more objects and individuals while ensuring that nothing or no one illegal was allowed across any of the quickly proliferating internal and external borders. Doing so required the harnessing of

technical protocols in ways that generated apparatuses, like FRTs, capable of rendering the face an identity document.

Making the Face an Identity Document Through Acts of Computer Vision

Desires to control mobility and/or reform excesses of mobility, as the previous chapter established, have been core to the historical development of FRTs. This control works best when the citizen is legible to the larger biopolitical and governmental forces. Such legibility is typically an asymmetrical act of political recognition, wherein the consent and coercion of the citizen are conflated when the citizen has to perform in ways that prove their fitness for citizenship (by consenting to having their facial data collected, for example).

The face then becomes the central object of computer vision under such strategic logics, with FRTs being a primary tactic for automating and decentralizing such strategies. Bochmann's East German FRT system, reliant on physical identity documents, works so long as those documents are accurate; if those documents, and/or their representations of the face, have been altered and/or falsified, the system can be short-circuited. However, an individual's face, as a site of unique identity, is far harder to fake and targeting that face and connecting facial images to a network of informational systems that can both scrutinize and verify the identity of that individual became a solution to instances of fraud.

In disciplinary systems that can more easily control mobility, a system like that at Checkpoint Charlie can be relatively effective; likewise, fingerprinting as a biometric technology is useful in such disciplinary environments.[283] However, a biopolitics of flow demands that a

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[283] Fingerprinting had a more initially successful history as a biometric than FRTs. As both Cole's and Pugliese's work lays out, fingerprinting dates back into the 19th century and was a much more widespread technology than FRTs until relatively recently; fingerprinting was one of the first instances of tracking involuntary traces of the body

person's identity be as continuously visible and traceable as possible. In the context of a post-WWII world, the rise of digital computing made possible algorithmic systems which leveraged the face as the involuntary trace of the person. From this, biometrics, such as FRTs, depend upon, as David Lyon argues, the process by which the physical body becomes a verification machine, wherein the distinctiveness of an individual's body is leveraged such that portions of the body function as passwords; Lyons ties these mechanisms to top-down definitions of suspicion, risk, and prevention, but apparatuses like FRT, operating in tune with technologies of the self, also shape behaviour and structure performances in a bottom-up manner.[284]

Once the face becomes a password, it serves as an identity document. The face's uniqueness, as it relates to individual identity, combines with the face's inseparability from the individual to make FRTs a powerful biometric apparatuses within a variety of cooperative and non-cooperative environments. Further, the face is typically regularly visible and therefore easier to capture than a physical document (like a passport) or a fingerprint as it moves through physical space.

When the face itself becomes an identity document it also works broadly to produce and reinforce difference between populations so as to make their biopolitical management easier. The face grants the ability to develop protocols based on difference by way of the visible markers of racial and gendered identity more effectively than a biometric like fingerprinting. Further, and perhaps superficially contradictory, while the face is a unique marker, faces also acts as a

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that, when excavated by the state or other entities, could be used to establish identity and physical presence in a space. Yet, those traces remain difficult to extract, making the process much slower than other biometrics; in environments of increased mobility, fingerprints are near-invisible. Simon A. Cole, *Suspect Identities: A History of Fingerprinting and Criminal Identification* (Cambridge: Harvard University Press, 2001); Jospeh Pugliese. *Biometrics.*

[284] David Lyons, "Under My Skin: From Identification Papers to Body Surveillance," in *Documenting Individual Identity: The Development of State Practices in the Modern World*, eds. Jane Caplan and John Torpey (Princeton Princeton University Press, 2001): 291-310.

generalized data templates and patterns within FRTs that are often tethered to systems of difference alongside normalizing categorizations, in particular along gendered and racialized lines. This aspect allows FRTs to then function not just as identification apparatuses but also as categorizing and sorting apparatuses, wherein the faces captured are realigned into like populations based on similarities in facial features and skin tones. Therefore, the abilities to manipulate representational protocols within FRTs, both at the level of individual identification and as general social sorting mechanisms, grants greater control of recognition present within instances of the technology; this adds another layer of power to the technology, while simultaneously granting it the adaptability that is core to the technology's success as a biopolitical tactic. When this vision is expanded to the mass scale of populations, it overlays asymmetrical power dynamics over its entire field that are in effect anywhere the face, acting as identity document, is present and visible, making it a powerful monitor of the citizenship resource of physical mobility in particular.

Technologies of Interdiction and the War on Drugs[285]

The desires to make the face an identity document would not have been realized without discourses that justified the building and expanding of FRTs as a tactic. While the face was more easily made an identity document though the advancements in technical protocols like eigenfaces, the War on Drugs and attached truth regimes were a key ingredient in the 1990s establishment of the FERET database and the later FRVTs, both of which were crucial components of FRTs mass expansion in the 21st century. Core to these truth regimes were the sorting of those individuals and populations labelled threats, which the 1998 American Joint

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[285] Portions of this section of this chapter are adapted from the previously cited "The 1980s War on Drugs, the FERET Database, and Building Future Infrastructure for Facial Recognition Technologies."

Counterdrug Operations' report defined as "Those who contribute to the production, transport, sale, and use of illegal drugs and laundering of drug money [who therefore] present a threat to the national security of the United States."[286]

The American infrastructure for the contemporary FRT machine ensemble 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 US congress had named illicit drug trafficking a 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.[287]

The primary strategy of interdiction speaks directly to the previously discussed biopolitics of flow: interdiction involves 5 phases, central to which is "the sorting of legitimate traffic from that which might be illegal"; "Our most pressing goal in non-intrusive inspection is to develop a rapid, modern automatic system to inspect shipment and cargo containers for contraband without physically removing all the contents/'or a manual inspection."[288] This meant

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[286] *Joint Counter Drugs Operation* by the Joint Chief of Staffs (Feb. 17, 1998, xii, https://www.hsdl.org/?view&did=3751)

[287] This history is outlined as background in David L. Clark's letter to Caucus on International Narcotics control. "Research and Development: Counterdrug Technology Assessment Center" (Sept 24 1999,

Process for Funding Projects, https://www.gao.gov/assets/aimd-99-277r.pdf), but is also a matter of public record.

[288] *Joint Counter Drugs Operation,* 1998, 28.

a rise in so called non-intrusive forms of vision technologies that could enable the sorting of

illegal from legal traffic quickly and efficiently, without disrupting the general flow of goods and

populations. 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

potential match faces with known drug traffickers at border crossings.[289] Aided by the previous

decades' improvement of technical protocols alongside truth regimes that tied such

advancements to the powers of enhanced photogénie within FRT, the technology was pitched as

an effective biopolitical tactic by way of transforming the face into an 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."[290] In this way, FRTs enabled strategies of interdiction because of its

enhanced photogénie and its abilities to observe the true nature of those under its gaze,

efficiently turning the face into an identity document while sorting those labelled illegal from

legal in non-intrusive ways.

It is not to be forgotten that underneath such discussions is the need for open borders that

comes with globalized capitalistic economies: when the War on Drugs is combined with such

desires, sites such as the Mexican-American border needed technologies that would ensure that

goods and populations could pass smoothly and efficiently while also securing the border by

closing it off to illegal products and resources. The War on Drugs, and the demonizing of often

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[289] "A Counterdrug Research and Development Blueprint Update," Office of National Drug Control Policy Counterdrug Technology Assessment Center, April 1995, pp 18, https://www.ojp.gov/pdffiles1/Digitization/156214NCJRS.pdf

[290] Ibid., 23

racialized citizens and non-citizens, was used to fuel the improvements of the technologies and infrastructures in the 1990s. This reliance on discourses grounded in vigilance and securitization, rather than those centred in globalizing economics, placed political protocols, and the asymmetrical control of political recognition at the core of FRTs developments; such developments also affected the representational protocols, through the building and circulating of racialized facial databases, practices that are still in use today.

However, in the 1990s, most of the focus on the potential deployment of FRTs focused on enhancing its technical protocols. A central roadblock to such improvements was that 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 limited facial datasets.[291] In order for FRTs to progress to a mass scale, and produce an automated field of vision capable of observing all of the different types of mobility that needed to be monitored, there needed to be a more centralized and standardized infrastructure put in place to improve, evaluate, and discuss the developments of FRTs. The FERET database, begun in 1993 is an essential combination of representational, technical and political protocols that coalesced into the necessary large-scale building and testing infrastructure that would be later amplified further in the 21st century.

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[291] As reported by the NIST: "Before the FERET database was created, a large number of papers reported outstanding recognition results (usually >95% correct recognition) on limited-size databases (usually <50 individuals). Only a few of these algorithms reported results on images utilizing a common database, let alone met the desirable goal of being evaluated on a standard testing protocol that included separate training and testing sets." "Face Recognition Technology (FERET)," NIST, July 13th, 2017, https://www.nist.gov/programs-projects/face-recognition-technology-feret

The FERET database 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.[292] As such, the FERET database was 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. 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. Within this list, there is a sense of the multiple biopolitical strategies that FRTs could serve as effective tactics for monitoring and management mobility, with its use spreading over public spaces and interjecting itself into specialized and everyday environments alike.

The authors for the earliest publications detailing the work of FERET laid 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

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[292] The photos themselves were captured at a combination of sites at George Mason University and at the ARL, with each person having to sign a consent and release form.

standardized tests and test procedures.[293] 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: the first stage focused on 5 contracts

for algorithm development and one for facial database construction; the second phase extended

three of the algorithms and expanded the database. By 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 or 1199 individuals; the testing had expanded to include 12

algorithms, including 2 fully automatic algorithms.[294]

　　As the first large-scale and centralized facial database, FERET set the protocols for future

FRTs. Constructing a standard database of facial imagery was essential: as a result, 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 front images, specific angles of profiles, 5 irregularly placed

positions, and the mixing in of glasses and hairstyles.[295] These technical protocols homogenized

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[293] P. Jonathon Phillips, Patrick J. Rauss, and Sandor Z. Der, "FERET (Face Recognition Technology) Recognition Algorithm Development and Test Results," United States Army Research Laboratory and DARPA, 1996, pp 7, https://www.hsdl.org/?view&did=464698.

[294] Ibid., 14; P. Jonathon Phillips Hyeonjoon Moon, Syed A. Rizvi, and Patrick J. Rauss, "The FERET Evaluation Methodology for Face-Recognition Algorithms," Department of Defence Counterdrug Technology Development Program Office, 1999, pp 1, https://nvlpubs.nist.gov/nistpubs/Legacy/IR/nistir6264.pdf.

[295] Phillips, Rauss, and Der, 1996, 11-12.

the image-making within FERET and beyond, effectively producing reproducible best practices. There is nothing inherently negative about this process, but it does highlight how determinism and stability lies at the centre of the technology, with its replicable nature reaffirming its expansion into other experiments and spaces of progress related to FRTs.

Looking within the FERET documentation 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; others include zipped files that must be decompress to reveal the images, encoded as .ppm files. Files like "documentation.txt" give more detailed descriptions of the database than the public reports, with further statistics on how many pictures are within what head positions as well as the detailing of changes between different versions of the dataset; it also lays out the particular subsets, or partitions, within the dataset hold labelled ground truth images that are recommended for use for testing facial recognition. 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. Taken together, 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 in real-world settings. 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 labs 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 1998 report "The FERET Verification Testing Protocol for Face Recognition Algorithms" both reports on the 1996 series of tests undertaken but 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."[296] 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 and further inscribed its place into the machine-ensemble of FRTs: first, the facial images and associated data granted, for those developing algorithms, a mass database to use to improve their versions of the technology, a database that would continue to be used for generations of the technology afterwards; second, the evaluation infrastructure would allow for comparison of facial recognition 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 at a small scale, the testing methodology that the FERET database enabled would be able to be scaled to increasingly larger and more wide-ranging databases and instances of use while at the same time remaining

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[296] Syed A Rizvi, P. Jonathon Phillips and Hyeonjoon Moon. "The FERET Verification Testing Protocol for Face Recognition Algorithms." Department of Defence Counterdrug Technology Development Program Office. 1998, pp2, https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=151387

very adaptable to, as the next chapter will discuss, the oncoming crises and technical

developments that would define the 21st century.

Underneath the development of these technical protocols and infrastructure is the goal of

non-intrusive interdiction, and the accompanying suspicion that rationalizes the expanded field

of automated vision that interrogates 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. 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 period between 1993's inception of a public Internet and the turn of millennium saw

an exponential growth in computer use, and the expectations that computational systems would

be increasingly incorporated into a wider range of daily activities. With this came an increasing

comfort with the capturing and circulating of digital images of the face which a number of

private companies were leveraging in order to produce FRTs. The need to evaluate such systems

and compare them was essential, in particular for governmental agencies increasingly invested in

monitoring and controlling different forms of physical and social mobility.

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.[297] 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. However, the FRVT would build on the

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[297] Duane M. Blackburn, Mike Bone, and P. Jonathon Phillips, "Facial Recognition Vendor Test 2000 - Evaluation Report" National Institute for Standards and Technology, February 16th, 2001.

infrastructure laid out in the 1998 report and would be the first to evaluate and rank those systems, 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 cosponsorship from the National Institute of Justice.

P. Jonathon Phillips was a DARPA computer scientist who runs through the history of FERET and FRVT as 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 FRVT and already discussed in this chapter. His paper 2002 "Meta-Analysis of Face Recognition Algorithms," co-authored with Laine M. Newton, coalesces the central arguments of this chapter's section: that 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.[298] 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 to provide an increasingly homogenized framework for building the technologies[299]: their 10 criteria are built from Phillips's work establishing the aforementioned FERET methodologies, arguing "to establish a sound foundation for the incorporation of standard control algorithms into an experimental method, it is necessary

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[298] P. Jonathon Phillips and Laine M. Newton, "Meta-Analysis of Face Recognition Algorithms," *IEEE International Conference on Automatic Face Gesture Recognition*, 2002, 1-7.

[299] The ORL database, also called "The Database of Faces" was created by AT&T Laboratories Cambridge and includes "contains a set of face images taken between April 1992 and April 1994 at the lab. The database is still accessible at "The Database of Faces," AT&T Laboratories Cambridge, 2001, https://cam-orl.co.uk/facedatabase.html.

to establish accompanying standard evaluation protocols and image sets."[300] Imbued with such

logics, the FRVT, 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."[301] Based on the legitimacy granted by the FERET program, the FRVTs

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 a portion of the DARPA-led HumanID database[302]; 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, with the number growing to 14 algorithms in 2006.[303] Recalling

the introduction to this chapter, in order to announce the death knell of human-centric FRTs, the

2006 FRVT definitively compared automated systems to human systems, with the results

overwhelmingly favouring automated versions of the technology.[304]

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[300] Phillips and Newton, 5.

[301] Blackburn, Bone, and Phillips, 5. It should be noted that much of what is cited in this section of this chapter was obtained by using the Wayback Machine (https://archive.org/web/). Part of my media archeological method was to find URLs in documents that are, in 2022, offline; once I found these links, I would use the Wayback Machine to navigate the older forms of the websites, gathering all the documents that I could.

[302] The HumanID dataset was involved in the 2000 FRVT, but the establishment of the HumanID program 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 problems within FRT development, HumanID aimed to improve the technological abilities to identify people at a distance. With Philips 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. P. Jonathon Phillips," Human Identification Technical Challenges," Proceedings. International Conference on Image Processing, 2002, 49-52; "Human ID at a Distance," DARPA, http://dtsn.darpa.mil/iso/programtemp.asp?mode=349

[303] P. Jonathan Phillips et al, "Face Recognition Vendor Test 2002," National Institute of Standards and Technology, 2003, 1, https://nvlpubs.nist.gov/nistpubs/Legacy/IR/nistir6965.pdf; P. Jonathan Phillips et al, "FRVT 2006 and ICE 2006 Large-Scale Results," National Institute of Standards and Technology, 2007, 9, https://tsapps.nist.gov/publication/get_pdf.cfm?

[304] Phillips, "FRVT 2006 and ICE 2006 Large-Scale Results," 3.

Within the report about 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]."[305] Right away, the importance put on technical improvements of the technology are placed alongside 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 as the best systems also delineated how FRTs might be used.

Such proposed uses did not abandon the vigilance and suspicion that had produced the FERET database in the first place, with the ultimate goal of expanding the FRT machine ensemble to greater and greater fields of automated vision. Importantly then, the tests each took on increasingly more difficult and "real-world" problems that acknowledged and encouraged the migration of the the technology outside of more restrained and cooperative environments (such as laboratories) into spaces (like airports) and, eventually, at other biopolitical borders; this included evaluation of FRTs operating using moving images as footage (such as CCTV footage), while also testing new potential FRT techniques such as the incorporation of 3D facial models into verification and identification mechanisms. While the next chapter will return to the FRVT, in particular in response to 9/11 and the COVID-19 pandemic, within the scope of this chapter, the initial reports show the evolution of the types of problems that FRTs were being asked to

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[305] Blackburn, Bone, and Phillips, ii.

solve, and the resulting truth regimes, often centred on securitization by way of the control of mobility, that would emerge. In the first 2000 evaluation, the two tests 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, that included a "watch list" test, wherein a non-cooperative environment is monitored in order to identify any potential peoples of interest, namely known terrorists and drug traffickers. Doing so meant expanding the datasets involved from FERET to include Mexican non-immigrant border crossers and VISA application materials, as well as subsets and full datasets like the HCInt dataset, the MCInt dataset, and the HumanID dataset.[306]

The inclusion of border crossing and VISA materials is a key shift away from the laboratory-driven, more consensual data practices present in FERET. Such developments should be put alongside the FRVT use of mugshot databases in its testing as illustrations of the ways in which the databases 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; the truth regimes underneath such tests, which aimed to maintain and improve the security and health of the population by targeting threats such as criminals and drug traffickers, were key to their implementation. This closed loop of discourse would educate the public and biometric

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[306] The HCInt database, or at least the portion of the database that the 2002 FVRT utilized contained "121,589 operational images of 37,437 people. The images were provided from the U.S. Department of State's Mexican non-immigrant visa archive." (Phillip et al, "Face Recognition Vendor Test 2002," 4). The MCINT dataset "is composed of a heterogeneous set of still images and video sequences of subjects in a variety of poses, activities and illumination conditions"; the images were collected by the National Institute of Standards and Technology, Naval Surface Warfare Center, the University of South Florida (USF) and The University of Texas at Dallas (Ibid., 16).

community, but in a circular fashion that would reinforce existing rationales and logics around securitization.

This is, as Chapter 5 will argue in more depth, what makes FRTs particular effective during crises: the technology's adaptability to different datasets and different tasks, make it nimble enough to work alongside the rationales that justify the states of exception instituted during a crisis, such as 9/11 and the COVID-19 pandemic. This nimbleness, however, is aided greatly by infrastructures like the FRVT so that, within a moment of crisis, FRTs have a sturdy set of protocols to fall back on in order to improve and address the problems arising from the crisis. Building 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 moment of crisis, but also to address new and/or expanded uses of the technology.

It is worth reiterating that while the FRVT frames 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. In this way, truth regimes around the technologies' usage meld with the right to look within the technologies' operations: if the monitoring of the mobility of terrorists and drug traffickers is the rationale for the technology's use, for example, the technology would likely rely heavily on logics of difference, most obviously aligned along racial identifiers, that would justify its expanded field of vision such that the right to look covers anywhere potential terrorists may be; at the same time, any citizens captured within that field of vision are subject to the circulations of power and right to look of that FRT. Further, such an application would not be possible without the other vectors explored in this chapter that produce such complexes of vision, such as the face operating as an identity

document, the truth regime that the objective vision of FRTs can reveal the truths of those it views, but also how the technology became increasingly automated, leading to more decentralized use of FRTs.

More, the FRVTs do not interrogate the datasets nor the specifics of the algorithms that are submitted for testing; instead, they focus on the end result of the algorithms, translating only their performances into stable numeric logics. In this way, the FRVTs, as a centrally influential infrastructure, is emblematic of the logics surrounding the alleged neutrality of data. However, as argued in Chapter 2, data is not neutral; data are representations of embodied and indeterminate experiences and affect that are imbued with relational logics that demand local and unique treatment. Yet, to use Gitelman and Jackson's phrasing, the FRVT are examples of those actors that use cooked datasets relatively uncritically, in effect stripping out the conditions of the data's creation and circulation.[307] Whereas human-centric FRTs like Bochmann were expressly interested in the face as a marker of political affiliation and identity, automated FRTs treat all facial data as potential materials for the development of the technology; data's inclusion in machine learning and FRT research is all means to an end. This superficially apolitical treatment of data that focuses on its technical protocols reinforces truth regimes that fashion FRTs into a task-oriented tool of objective computer vision, where data is extracted at massive scales and treated as a neutral infrastructural resource. Powered by such logics, the FRT assemblage, throughout the whole of its histories, has been able to steadily expand, making increasingly more dense interconnections between data sources, sites of the technology's deployment, and the results of the automated decisions made by FRT observation.

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[307] Gitelman and Jackson, 2013.

The FRVTs were essential in expanding FRTs' biopolitical vision so as to be potentially

capable of monitoring and controlling many forms of citizenship mobility. With this bedrock

infrastructure in place, the next problem to be solved was scaling of automated FRTs to a mass

technology that could be in used in the everyday activities of citizens; as such, explored further

in Chapter 5, the expansion of FRTs to its contemporary forms required an insatiable amount of

facial data. Within the scale of this chapter, however, the rise of FRTs in the last decade of the

twentieth century, the rationales that enabled the acquired massive amounts of information

required by Big Data had to first insist that data was a neutral resource to be used within

objective vision apparatuses.

Conclusion

In 2023, the FRVT has expanded to include a stunning array of databases, a number of

which are not publicly available, that include mugshot databases, undefined images captured "in

the wild," as well as facial images gathered from Visa applications and US border crossings.[308]

Such reappropriating of data from one biopolitical strategy into other biopolitical tactics, such as

FRTs, shows one of the key logics that the technology has expanded beyond a human-centric

technology to the mass technology of the contemporary moment: that facial data is by its nature

neutral, and, as such, is fair game for improving the overall protocols of FRTs. Recalling Chapter

3, this is why infrastructures that aim to enroll citizens and thereby make them legible are so

important: data is gathered from other infrastructures, themselves cross cut with vectors of

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[308] In "Face Recognition Vendor Test (FRVT) Part 3: Demographic Effects" the authors detail the specific
"Annexes" (databases) as: "Domestic mugshots collected in the United States"; "Application photographs from a
global population of applicants for immigration benefits"; "Visa photographs submitted in support of visa
applicants"; and "Border crossing photographs of travellers entering the United States." Patrick Brother, Mei Ngan
and Kayee Hanaoka. "Face Recognition Vendor Test (FRVT) Part 3: Demographic Effects" NIST. December 2019,
1, https://nvlpubs.nist.gov/nistpubs/ir/2019/NIST.IR.8280.pdf

biopower, such that populations seen to be possessing excess mobility and/or labelled threats are a powerful renewable resource to expand the machine ensemble's automated field of vision. Identity documents, conflating coercion and consent, become consistent data mines wherein such documents and bureaucratic data materials can be reappropriated into tangential biopolitical tactics. Such thinking is amplified, as the next chapter will discuss, by the exponential glut of individual digital data that would accompany 21st century's Big Data practices.

In summary, mapping the contemporary automated and decentralized version of FRTs has shown how the technology has been build from post-WWII vectors reliant upon exponentially increasing digital computing that relocated identity documents into the body itself and then automated the processing of the face in increasingly more computationally abstracted forms of vision. Such vectors were able to make the face the site of ever-present site of computer vision's scrutiny. Alongside this, discourses buttressed by the logics of FRTs as enacting an enhanced photogénie affirm the face as a window into the "true" thoughts and value of an individual. Augmented by technological innovations that transformed the face into increasingly positivist data objects, individuals and their identities were able to be revealed, identified and/or verified through modular computational architecture.

While human-centric versions of FRTs remained viable into the late 1980s, the rise of globalization at the end of 20th century, aided by the disintegration of the Soviet Union and the further entrenchment of systems of global capitalism produced forms of mobility, for both goods and populations, that a human-centric FRT could not process. This increased mobility instilled vigilance into FRTs' observation: while early versions of the technology were imbued with the ideologies of the opposing forces of the Cold War, the 1980s and 90s turned the suspicion within FRTs to those populations connected to the American War on Drugs. Driven by logics of

interdiction, the FERET database and FRVTs were direct results of this shift, in turn building the necessary infrastructures to ensure the continued evaluation and improvement of the state of the art of FRTs. As this infrastructure was being put in place, truth regimes that established data as neutral rationalized the extraction and re-appropriating of an ever-increasing amount of facial data, some of which, like mugshots and immigration materials, were taken from bureaucratic materials formed by the conflation between coercion and consent within data enrollments. These developments taken together were the death knell of the human-centric FRT: by the mid-2000s, an automated and decentralized FRT processed far more data than any human or team of humans ever could.

Once FRTs made the transition from a human-centric technology to one that could deploy its vision in automated and decentralized manners, it became a much more powerful potential biopolitical tactic. Following the trajectory of FRTs' post-WWII history has shown that when the power dynamics described in the previous paragraph are folded into a FRT's operative moment, the technology becomes a self-perpetuating producer and affirmer of liminal populations. The resulting biopolitical vision leverages its political protocols to improve its technical protocols, while deepening, as Chapter 2 argues, white prototypicality and the affirmation of difference within its representational protocols as a mode of monitoring and managing social mobility. As a core example, in the last 25 years of the 20th century, biometrics in general had expanded from securitization in private spaces to concerns with national mobility, and had begun to be adopted in the spaces of immigration and refugee control, such as legislation like the Immigration Reform and Immigrant Responsibility Act that implemented an Alien Border Crossing Card.[309] The sorting of illegal from legal forms of citizenship drove a number of

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[309] Wayman, 271.

the discourses 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.[310] The following chapter will expand on this history in its discussion of post-9/11 use of FRTs and the blanket targeting of non-citizens and citizens alike. 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.

Further, the following chapter will show how security and health remain core concepts to the operation of the FRTs in the 21st century. The vigilance that undergirds post-WWII automated FRTs remains, if not grows, when new threats brought about by the crises of 9/11 and the COVID-19 pandemic form to reshape who and what exactly the FRT observer most needs to be most suspicious of. As the following chapter will illustrate, any effects caused by the circulation of power through the whole of a FRT are heightened in moments of crisis; further, these amplified effects can be leveraged to produce and reinforce liminal populations while maintaining and/or regaining governmentality. Crisis provide rationales for the expansion of FRTs, with the implementation of the technology lasting long after a crisis has passed. Exemplified by the reaction to 9/11 and the COVID-19 pandemic, crisis are powered by chaotic and indeterminate citizen bodies; the infrastructural elements put in place before a crisis provide the bedrock protocols to go forward, in turn providing a reliable system to re-stabilize the media and remaking bodies into determinate systems of positivistic and observable data, and regain control of the management of citizenship and citizenship resources. As Chapter 5 will make clear, political acts of recognition tied directly to vigilance are core to the operation of FRTs,

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[310] "8 U.S. Code § 1357 - Powers of immigration officers and employees." Retrieved from Cornell Law School. n.d. https://www.law.cornell.edu/uscode/text/8/1357

before, during, and after a crisis, and thereby become the leading factors in the development of

the technology's technical, representational, and political protocols.

CHAPTER 5:
THE FLEXIBLE FACE UNDER CRISIS:
FROM 9/11 TO COVID-19

<u>Introduction</u>

The National Institute of Standards and Technology's (NIST) July 2020 report, "Ongoing

Face Recognition Vendor Test (FRVT) Part 6A," subtitled "Face recognition accuracy with

masks using pre-COVID-19 algorithms" describes a crisis defined by a global pandemic wherein

"the widespread requirement that people wear protective face masks in public places has driven a

need to understand how cooperative face recognition technology deals with occluded faces."[311]

The underperformance of FRTs described in the NIST's July report makes visible the ways in

which the management of citizenship resources, such as health care and breathable air, collided

with logics of securitization and other rationales that have previously provided the impetuses for

FRTs 'usage. During the COVID-19 pandemic, new biopolitical tactics (wearing masks) clashed

with older strategies (monitoring and controlling of mobility), to effectively short circuit older

tactics such as FRTs.[312]

As a solution, the report details the creation of a testing process that begins with two

databases of photographs collected as part of US governmental applications totalling "6.2 million

images of 1 million people": the first database is composed of "unmasked application

photographs from a global population of applicants for immigration benefits"; the second is

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[311] Mei Ngan, Patrick Grother, and Kayee Hanaoka, "Ongoing Face Recognition Vendor Test (FRVT) Part 6A: Face recognition accuracy with masks using pre-COVID-19 algorithms," National Institute of Standards and Technology, July 2020, i.

[312] Portions of this chapter were published in Aaron Tucker "Solving the Conflict Between Breathability and Masked Faces within Facial Recognition Technologies," *Afterimage* 48, no. 3 (2021): 58–70.

made from "digitally-masked border crossing photographs of travellers entering the United States" to which masks have been computationally added to the faces.[313] Then, just four months after the initial report, in November of 2020, the NIST released a follow-up report stating" We observe that a number of algorithms submitted since mid-March 2020 show notable reductions in error rates with face masks over their pre-pandemic predecessors."[314] Building from the previous chapter's arguments around the NIST's FERET database and the Face Recognition Vender Tests (FRVTs), the speed at which the field of FRTs solved for masked faces is impressive and show how nimble the technology is, while also reinforcing the value of infrastructure to a logistical media: because the NIST had decades of FRT evaluating infrastructure, in large part because of the FRVTs, it was able to quickly both test FRTs while also proposing a potential solution, to be taken up in more depth later in this chapter, of creating a synthetic dataset of that computationally added masks to faces drawn from immigrant and border crossing materials.

In addition to the bedrock granted by FERET and the FRVTs, the rapid and targeted improvements of FRTs during the COVID-19 pandemic were borne of the reaction to 9/11 and the resulting rise in the enhanced securitization of the borders. There was a wide-expansion of FRTs in the years immediately following 9/11 under the rationales of national security and the urgent need to identify and capture terrorists and potential terrorists; the current wide adoption of FRT into near-ubiquity was built in large part on the discourses that arose following 9/11. This chapter will bridge from 9-11 to the COVID-19 pandemic by understanding both as instances of crisis. Crises, Nabers contends, revolve around notions designed to "designate momentary

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[313] Ngan, Grother, and Hanaoka, July 2020, ii.

[314] Mei Ngan, Patrick Grother, and Kayee Hanaoka, "Ongoing Face Recognition Vendor Test (FRVT) Part 6B: Face recognition accuracy with face masks using post-COVID-19 algorithms," NIST, November 2020, https://pages.nist.gov/frvt/reports/facemask/frvt_facemask_report.pdf

emergencies, recurrent derailment and enduring catastrophes, which are then countered by those in power."[315] From this perspective, crises are events that demand change, but that change is intersubjectively interpreted by different vectors of power, which are discursively generated, wherein crises themselves express constellations of protocols, actors, and circulations of power. At the same time, the solving for masked faces within FRTs is demonstrative of the fact that, as Neumman and Sending argue, crises are performances of statehood that are dependent on the set of practices that are available to that state; the methodologies, strategies, and tactics in place before a crisis become the foundational practices that respond to crises.[316]

As importantly, crises are moments of chaos, in which new elements, dynamics, and relationships between actors are introduced. In some instances, it is in governmentality's interests to sow chaos, to simultaneously hinder certain populations and make the populations in power stronger. However, in the cases of 9/11 and the COVID-19 pandemic, chaos was a threat to governmentality, as the novel forces and vectors of power disrupted arguments and rationales for further governing by exposing their limits and weaknesses; at the same time, the crises threatened the life of the individuals and populations that are essential to the continued production of resources and power that undergird governmentality. In a broad sense, addressing chaos within crises provides two opportunities for forces of governmentality: first, it rationalizes the installation of biopolitical tactics that respond to such a crisis; and second, it justifies the improvement of older biopolitical tactics to meet the demands of the new crisis. It is essential then that forces of governmentality work to re-stabilize circulations of power, in particular the

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[315] Dirk Nabers, "Crisis as Dislocation in Global Politics" *Politics* 37, no. 4 (2017): 264.

[316] Neumann, Iver B. and Ole Jacob Sending, "Performing Statehood through Crises: Citizens, Strangers, Territory," *Journal of Global Security Studies* 6, no. 1 (2021): 1-16.

management of life, death, precarity, and debility, back into deterministic and manageable systems in order to ensure their own continued existence.

As this chapter will detail, this reorienting towards deterministic systems gives rise to what Brian Massumi names ontopower, a circulation of power that depends on truth regimes based in preemption, risk, and security; ontopower then operates larger preventative tactics and strategies through the deployment of probabilistic logics.[317] Within ontopower, FRTs are a technology that is able to capture the face and predict whether it is a known or likely threat, working to quickly and efficiently categorize individuals and populations.[318] Both 9/11 and the COVID-19 pandemic are essential moments in the development and future deployment of FRTs: they are both crises that were able to produce truth regimes that revolved around biopolitical concerns for security and health that then justified the expansion of the technology in order to re-stabilize the chaotic and invisible/illegible elements within its field of vision back into larger strategies based in governmentality. This chapter will expand upon this argument more completely by linking such automated fields of vision to biopolitical strategies and tactics aimed at the control of citizenship and citizenship resources which combine with forces that aim to increase the legibility and visibility of those within the nation state. These combinations amplify previously existing tactics and strategies that conflated consent and coercion while also introducing new technologies and media technologies to solve the unique problems of a specific crisis. Crises, by expressing configurations of social forms of power, are moments that crystallize the relationship between the production of citizenship, the management of citizenship resources like mobility, and the building, deployment, and improvement of biopolitical tactics like FRTs.

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[317] Brian Massumi. *Ontopower: War, Powers, and the State of Perception.* (Durham: Duke University Press, 2015)

[318] Massumi's theorizing of ontopower is expanded in this dissertation's Literature Review.

In the case of FRTs, crises have repeatedly been the impetuous for the expansion of the technology's field of automated vision such that its biopolitical vision makes every face it looks upon potentially legible and identifiable, regardless of guilt, consent, and/or privacy.

Between the reactions to 9/11 and the COVID-19 pandemic, the entrenchment of big tech companies and their Big Data practices dovetailed with nation state management of citizenship resources, in particular physical and social mobility. Simultaneous to these practices were key advancements in the technical protocols of FRTs, including the advance of machine learning and AI models, and their incorporation into the operative moment of FRTs, as mapped in Chapter 2. These technical protocols combined with the exponential adoption of always-on smart devices, each with increasingly sophisticated cameras, that lead to the rise of Big Data practices of big tech companies. These practices, in turn, generated massive facial datasets that could be combined with state infrastructures to produce the increasingly nimble and ubiquitous FRTs that are now the mass technology that operates today. In the contemporary moment, while these developments increase the effectiveness of tactics reliant on surveillance, it also normalizes a right to look that increasingly ignores notions of consent and leverages FRT's representational and political protocols to further marginalize and govern liminal populations and those deemed threats to governmentality. The trajectory from 9/11 to the expansion of Web 2.0, smart devices, and Big Data to the COVID-19 pandemic will show how biopolitical tactics like FRTs are expanded in moments of crisis, maintained and expanded during the residual state of exception, then re-amplified within the next crisis. Importantly then, the successful solutions in reaction to crisis of COVID-19 allows FRTs to not only be folded back into prior infrastructures effectively, but provides further groundwork to expand future FRTs into previously untouched space.

From this, this chapter will end by looking to the present and the near future of climate catastrophe and the resulting mass migration. This near future makes clear that not only do the effects of a state of exception linger after such a state has passed, but as Nabers and numerous scholars have argued, crisis have become "a permanent attribute of the social, not some transitory condition that appears from time to time" and are therefore an omnipresent and defining component of the daily lives of citizens.[319] This permanent state of crisis is combined with the lasting effects of each state of exception; each compounds the other, potentially providing a space where a technology like FRTs will only become more ingrained in the monitoring and management of citizenship resources; mobility, as a resource tied directly to climate catastrophe and mass migration, will be controlled, and with technologies such as FRTs being increasingly deployed as automated decision makers in contemporary environments involving the linking of citizenship to both physical and social mobility. This chapter will lay the groundwork for Chapter 6 by arguing that there is an urgent need to completely reconsider technologies like FRTs in order to promote ethics of relationality, embodiment, and affect.

Crises and Citizenship Under Empire and Ontopower

Understandings of citizenship constantly fluctuate as the rights and obligations are negotiated in an ongoing system, often defined by this dissertation's prior discussions of fitness and performative practices of citizenship wherein a citizen is invested in demonstrating that they are worthy of citizenship. These practices include co-operating and consenting to making themselves legible to identification infrastructures, encapsulated within identity documents such as passports and driver's licences.

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[319] Nabers, 265.

Therefore, citizenship within increasingly prolonged and/or permanent states of crisis is being constantly negotiated, dependant on the particular crisis that is in effect; likewise the resources to citizenship are then also always in constant negotiation. The nature of 9/11 and the COVID-19 pandemic are, obviously, very different. 9/11 was a crisis that generated discourses around national security in the face of unknown and potentially hidden terrorists and their excess mobility. As such, the improvements of FRTs during this time period revolved around the desires for increased visibility of targeted faces and were therefore centred upon generating a mass technology capable of the general task of identification, aimed at expanding the automated field of vision so that every face, each a potential terrorist, could be surveilled and scrutinized.

The COVID-19 pandemic, by contrast, was caused by a virus, an invisible enemy, which then caused a crisis of what Parikka and Soncul call "breathability": breathability does not just relate to the COVID-19 pandemic, but is present in any instance where breathable air is in limited supply; in such instances, interrogating the management of breathability reveals the vectors of power, the strategies, and the histories surrounding fresh air as a resource.[320] Responding to the COVID-19 pandemic therefore required tactics that could ensure the health of citizens in part by monitoring and controlling the mobility of goods and individuals, including breathable air, not necessarily by targeting those faces for identification.[321] However, as the introduction of this chapter detailed, the occlusion of faces by masks disrupted the expanded field of automated vision created by the post-9/11 advancements of FRTs and so the crisis of COVID-19 provided the rationales and data to begin to greatly improve more specific tasks

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[320] Yiğit Soncul and Jussi Parikka, "Masks: The Face Between Bodies and Networks," *Paletten Art Journal,* April 28, 2020, https://paletten.net/artiklar/masks-the-face-between-bodies-and-networks.

[321] While this dissertation doesn't take them up in detail, other solutions are worth attention in relation to face recognition technologies, breathability, and the COVID-19 pandemic in other spaces, such as: the use of thermal and infrared imaging in airports to check on passenger's temperatures; and the use of FRT-enabled drones to maintain curfews and lockdowns.

within FRT, such as the identification of non-cooperative subjects and those whose faces were partially hidden. This becomes especially important when considering that the COVID-19 pandemic coincided with racial justice protests, and that the identification of masked protesters, then and in the future, would be greatly enhanced by improvements to FRTs. Further, the use of potential and real liminal populations of immigration applications and border crossing populations within the solution of the synthetic dataset laid future groundwork for improving a FRT's biopolitical vision applied to those very populations.

However different, there are similarities to be drawn between the responses to both crises, more specifically the ways in which Empire operates under states of exceptions to leverage previous asymmetrical power dynamics, and produce and/or strengthen new circulations of self-preserving power over knowledge, resources, and the deployment of bioplitical tactics such as FRTs.

The State of Exception and Empire

Resulting from political crisis and emergency, Agamben writes, the state of exception is framed by the state as intensely necessary, resulting in the suspension of normal conditions in reaction to a crisis.[322] Under crisis, the blurring between lawful and unlawful, between consent and coercion, fuels the creation and expansion of asymmetrical uses of biopolitical tactics and infrastructures. From this, power over defining the legality of violence, authority, and biopolitical governance within states of exception take place at all kind of scales and within many different apparatuses and technologies, with various overt and subtle results. Further, prior and/or nascent protocols and infrastructures are essential within states of exception as they can

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[322] Agamben, *State of Exception,* 2005. The state of exception and its relationship to biopolitics was taken up in more detail in this dissertation's Literature Review.

become forces that can wrangle chaotic forces back into deterministic systems of knowledge and control. Simultaneously, states of exception are opportunities to build and/or expand new centralizations of power, wherein the overt and subtle violence justified under rationales of securitization produce new circulations of top-down and bottom-up power that always return to self-preserving governmentality.

Scholars such as Lemke and Rose and Rabinow have critiqued Agamben's state of exception as not reflecting the tangle of contemporary power networks that, when discussing digital media technologies as biopolitical tactics specifically, do not include vectors produced by global economies and corporate actors in particular.[323] While Hardt and Negri's concept of Empire does not completely solve these problems, it does expand the concept of the state of exception to better address how FRTs, as digital media technologies, have both strengthened and grown within the overlaps between globalism and the 21st century's first two decade's moments of crisis.[324]

Hardt and Negri use the concept of Empire to encapsulate the 21st century globalization and global capitalism that has united compare and state actors in ways that extend well beyond. While some scholars have critiqued Empire as being far too wide ranging and unfocused, Empire is ultimately useful in exploring the ways in which networks of power have expanded outside state actors.[325] Hardt and Negri better grapple with the rise of digital media technologies, such as

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[323] Thomas Lemke, *Biopolitics: An Advanced Introduction.* (New York, New York University Press, 2011): 62-4; Paul Rabinow and Nikolas Rose, "Biopower Today," *Biosocieties* 1, no. 2, 2006: 202-3.

[324] Hardt and Negri, *Empire,* 2001. Further discussion of Empire and Hardt and Negri's work is found in this dissertation's Literature Review.

[325] Lemke, *Biopolitics: An Advanced Introduction,* 74-5; Rabinow and Nikolas, "Biopower Today," 203-4. Lemke, in his summarizing of the authors 'work, argues they are too dependant on a teological model of historical progression and, further, too all encompassing so as to blot out all other potential forms of political or social action. Within Rose and Rabinow's "Biopower Today," Empire's biopolitics is critiqued as overly centred on elimination and domination resulting on a distracting focus on thanatopoltics. They see their own positions as differing in that

FRTs, at the turn of the millennium than Agamben: they stress the importance of cybernetic systems and the widespread integration of computer systems, such that the computer is a flexible tool which can effectively manage communication and control in a distanced, decentralized manner; this information infrastructure tends to structure itself, the authors contend, as a combination of democratic (decentralized, rhizomatic) and oligopolistic (centralized, all branches have one root) mechanisms.

FRTs encompass much of what defines Empire: drawing from the previous chapter, the actors that have worked through the history of FRTs, in particular those beginning post-WWII, are dense blending of state, corporate, military, technologies of the self, and academic actors and infrastructures. As biopolitics of flow rose to prominence in the 20th century, the effective management of the mobility of goods and populations by way of tactics based in interdiction set the groundwork for the technology to become increasingly invested in capitalistic systems. Further, as established in Chapter 2, the operative moment of FRTs rely on calculable logics in order to exercise its form of automated and decentralized control, with the underlying algorithmic equations serving as the sort of technology capable of governing all activities that might pass through its field of vision from a distance.

More specifically, this dissertation has already outlined previous examples of FRTs under forms of Empire. As detailed in Chapter 4, the Nippon Electric Company (NEC) was the main technological driver of the exhibition "Computer Physiognomy"/"Computer Magnifying Glass" in 1970, with the company leveraging its wide-ranging expertise in computing alongside its

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Hardt and Negri have a monolithic image of sovereignty; similar to their critiques of Agamben, they contend the authors need to attend to the specific and unique technologies of contemporary governmental rationales, in particular as they relate to specific local individuals and histories, in order to understand the nuanced and ubiquitous biopolitical apparatuses and tactics permeating the globe at the turn of the millennium.

government contracts to produce a larger infrastructure into which FRTs could be folded; with such an infrastructure in place, NEC has expanded to the point that it is a contemporary global supplier of biometrics.[326] Further, late-20th century biopolitics of control require the economic policies and truth regimes that allow for the movement of goods and populations, which in turn requires technologies that can monitor and catalogue such resources within interrupting the flow. In the case of FRTs, and the rise of interdiction, this meant the increased cooperation between corporate and state elements in the technology's development: within the establishment of the FERET database in the 1990s, Empire is expressed in the inclusion of entities like Excalibur Corp., a company that specialized in computer vision and neural networks.[327]

At the turn of the millennium, FRTs had just begun to establish itself as a technology capable of such distanced governance under Empire. However, it was the state of exception brought about by 9/11 and the subsequent rise of ontopower that provided the truth regimes necessary to greatly expand and enhance the technical, political and representational protocols of the technology by leveraging the desire to preemptively identify and control those individual and population who presented threats to governmentality.

Risk, Preemption, and Ontopower

Recalling this dissertation's Literature Review, Brian Massumi names ontopower as a unique form of power that arose alongside biopolitics of control and flow that is predicated

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[326] "World-leading Face Recognition for Multiple Industries," NEC, n.d., https://www.nec.com/en/global/solutions/biometrics/face/index.html. Importantly, as the website details, the NEC's NeoFace system was rated very highly by National Institute of Standards and Technology testing infrastructure. Further, and directly relevant to this chapter, by January 2021, NEC was touting the abilities of its FRT systems to identify and verify masked faces. Chris Gallagher, "Masks no obstacle for new NEC facial recognition system," Reuters, January 7th, 2021, https://www.reuters.com/article/us-health-coronavirus-japan-facial-recog-idUSKBN29C0JZ

[327] Phillips, Moon, Rizvi, and Rauss, *The FERET Evaluation Methodology*, 1998, 8.

primarily in prediction, risk and preemption. Ontopower is useful within this chapter's discussion

of Empire, state of exceptions, and crisis because it shows how modern forms of circulations of

power react to as varied an idea of threat as terrorists (as after 9-11), disease (as in the COVID-

19 pandemic) and weather (as in climate catastrophe). To this dissertation's larger themes,

Massumi links his work to Foucault and biopower and systems of governmentality in particular,

tying the notion of risks and potential threats to the management of life as a calculation of

interests and risks bound to statistics.[328] Ontopower works symbiotically with discourses that aim

to sort and reaffirm citizenship and its resources; such sorting and confirming determines who is

deserving of resources but also predicts whether they will deserve resources in the future.

Ontopower and states of exceptions often work symbiotically, where current and future

crises maintain and produce threats at both the level of the individual and at the level of

population. These perceived threats then justify the implementation and improvement of

biopolitical and nectropolitic tactics and strategies, while also rationalizing the entrenchment of

Empire in the fusing of governmentality with global capitalism in the management of risk and

threat in order to produce the promise of stability, security, and safety.

Biopolitics in reaction to 9/11 and the Mass Expansion of FRTs

Massumi wrote *Ontopower* in the aftermath of 9/11 and its events reverberate

consistently throughout the text. His thinking should be combined with those detailed the

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[328] Many of the authors included in the collection *Beyond Biopolitics* (ed. Patricia Ticineto Clough and Craig Willse (Durham: Duke University Press, 2011)) provide valuable links between ontopower, biopolitics, and crises under Empire-like conditions, exemplified by Clough and Willise's introduction "Beyond Biopolitics: The Governance of Life and Death" (pp 1-18) which focuses on the "life capacities" of certain populations guided by risk assessment, "probabilistically marked," statistics that then preemptively mark certain populations as in need of preemptive governance and regulation.

Literature Review of this dissertation, such as Puar, Mbembe, and Butler who all write

powerfully on the forms of biopolitics that emerged post-9/11.[329] 9/11 and the resultant War on

Terror is a crisis stemming from enmity and the need to identify and exterminate that enemy;

having an enemy provides the rationales that enable the state of exception, made all the stronger

by having an enemy that is perceived as being potentially anywhere. Fuelled by 9/11,

ontopower's future-facing logics were seductive because they could identify current and future

enemies and threats; doing so, however, required expanding such applications of power to

include all of citizen life. Within such dynamics, FRTs were key tools, as the technology's

decentralized and automated vision could observe wide fields of vision, identifying those who

fell under the technology's vision while also sorting threat from non-threat and reinforcing

liminal populations. In terms of FRTs, 9/11 resulted in an expanded automated field of vision

that, in 2023, includes drones and satellites whose arial views augment the land-level cameras

operated by nation states and their citizens. Infused with ontopower, FRT are tasked with

predicting, identifying and sorting, all the while producing debility and precarity for certain

individuals and populations.

Amplifying and Expanding Surveillant Systems in the Wake of 9/11

A number of authors, in particular those writing in Surveillance Studies, have efficiently

detailed: the explosive growth of biometrics in reaction to 9/11; the effects of this explosion on

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[329] For Butler, the crisis of 9/11 stems from the destruction of the American fantasy of total global control with the grief and fear following rationalizing new forms of biopolitics aimed at precarity (Butler, *Precarious Life*). Like Butler, Mbembe's essay "The Society of Enmity" and his concept of necropolitics situates contemporary biopolitics and governmentality within the impulse to generate and/or eradicate an enemy (Achille Mbembe. *Necropolitics*). Similarly, Puar, in *Terrorist Assemblages* (Durham: Duke University Press, 2007), sees the production of the terrorist, queered and made unhuman, as the enemy figure core the crisis to the threat to American exceptionalism which feeds narratives about the global universality of American values.

formations of citizenship; and the ways in which such expansion continued once the initial state

of exception had passed.[330] In one effective example, Lyons ties post-9/11 expansion in

technologies like FRTs to corporate actors proposing biometrics as technical fixes to ensure that

a similar event did not occur again. The leveraging of the crisis during a state of exception was

"immediately seen as an opportunity for already existing systems and capacities to be more fully

exploited."[331] Gates echoes Lyons in arguing that after 9/11 "proponents of biometrics in

particular saw a major opportunity to capitalize on the emerging 'homeland security' regime, and

in fact to participate in the very construction of the strategies and programs that would define

what homeland security looked like in practice."[332] In this, the capitalistic crossing of corporate

and nation state desires that produce an environment where FRTs are seen not just as a solution

to the problems arising from securitization, but become active technologies in the shaping of

what "security" looks like and how citizens are expected to act under such truth regimes. Top-

down applications of power, such as the American US-Patriot Act (2001) and the forming of the

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[330] As examples, Torin Monahan, in "Surveillance and Terrorism" also draws attention to historical programs, such as the Cold War-era ECHELON system and COINTELPRO system of domestic surveillance to explain, in part, the rise of Empire and how the responsibility to preparedness and security began to be situated within a network of state, corporate and citizen actors (*Routledge Handbook of Surveillance Studies*, eds. Kirstie Ball, Kevin Haggerty and David Lyon (Florence: Routledge, 2012): 285-292). Louise Anmore's essay "Biometric borders: Governing mobilities in the war on terror" demonstrates how top-down circulation of power work work under Empire to broaden the reach and exceptions of securitization placed on citizens, especially when combined with forces based in subjectification: the essay shows how the biometric US-VISIT program is crosscut by vectors of power rooted in the contractors and companies making the technologies, that then link into bottom-up applications of power, wherein legitimate and illegitimate mobilities are enforced by way of citizenship fitness (*Political Geography* 25 (2006): 336-351). Extending these thoughts, citizens are the key observers in this field of vision operating under interdiction wherein, using Thomas Matheison's understanding of the term synopticon, the many watch the many; the synopticon would be expanded post-9/11 by an increase in personal computational technologies, as well as discourses that insisted that citizen watching and monitoring was an effective defence against insecurities within a survivor society ("The Viewer Society: Michel Foucault's `Panopticon' Revisited." *Theoretical Criminology* 1, no. 2 (1997): 215-234). In this way, being a patriot and citizen under The Patriot Act meant both observing others and reporting suspicious behaviours, but also making oneself legible and visible to more top-down applications of power, further blurring together the notions of consent and coercion.

[331] David Lyons, *Surveillance After September 11* (Cambridge: Polity, 2003), 18

[332] Gates, *Our Biometric Future*, 100.

Department of Homeland Security (2002) powered a greatly expanded program of surveillance that indiscriminately gathered reams upon reams of data from often unknowing citizens and corporations. In addition, there are further pieces of American policy such as the Total Information Awareness Program, as well as the expansion of the US-VISIT program powered by recommendations from entities such as RAND and other think tanks.

Taken together, these forces and assemblages interacted to create frameworks within which FRTs could be expanded to a mass technology, capable of viewing and processing an increasing number of individuals in real-time. Post-9/11, what were previously "innocent" traces (such as credit card transactions, web browser history, and geolocation data) become both evidence and parts of predictive systems, while simultaneously legitimating truth regimes that required the mining of such traces under the guise of security, risk, and threat prevention. Richard Gruisin, speaking more specifically to networked media technologies, links the extraction of such traces and their use in algorithmic acts of prediction to global capitalist systems and the types of Big Data practices that will explored later in this chapter.[333]

Key to the functioning of FRTs, the face became a trace, a predictive trace, that could be cross-matched with other proliferating forms of data. The image of the face, and the algorithmic processing of the face and its images, post 9/11, resulted in a complex of vision wherein colliding vectors of Empire ensured that a network of corporate, state, and citizen actors expanded a field of vision embedded within vigilance and enmity that was greatly affected by pre-emptive logics, forecasting models, and truth regimes about inevitable futures that were grounded more in speculation that proof and evidence. Such a complex was further strengthened by increasingly digital technologies of the self, wherein practices of citizenship fitness involved

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[333] Richard Grusin, *Premediation: Affect and Mediality After 9/11* (New York: Palgrave Macmillan, 2010).

the reporting and monitoring of the self and other citizens in order to reinforce an overall culture of securitization.

Facial Databases and Image-Making Under Ontopower

Broadly, images and image-making during states of exception take on heavy significance and their production and circulation are crucial to maintaining authority and violence. Consider iconic images, such as the twin towers smoking over New York City after the planes hit: such images crystallize the fears and desires undergirding governmentality by reaffirming and centralizing power and/or by identifying and heightening forces labelled as threats, in particular at border sites. Alongside such iconography, images of the face became especially important. Drawing from the discussion of Lévinas in this dissertation's Literature Review, the face is both an invitation to empathy, based on being exposed to the precariousness of another's life, but is also a threat to commit violence, the visage of a potential enemy. Within the context of a post-9/11 environment, empathy at the site of the face is lost within circulations of mediated images so that the enmity of the face, in particular Muslim-presenting faces, are dehumanized ways that not only ignore their precarity and humanity, but also justify truth regimes of securitization and surveillance.[334]

It was these vectors of power interacting at the site of body and the face that provided biometrics, in particular FRTs, the spaces within which to deploy its photogénie and, "objectively" and computationally, reveal the previously unidentified and invisible true face of terrorism. Such desires manifested in the capturing and circulation of massive amounts of faces in facial datasets that would be the foundation of FRTs post-9/11.

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[334] Butler in the title chapter of *Precarious Life*, makes a similar point while expanding on Lévinas's thinking.

Building Facial Databases for the War on Terror

Gate's detailing of the constructing of the "face of terror" after 9/11 proposes, in echo of Massumi's theorizing of ontopower, that FRT was a technology instrumental not only in identifying potential terrorists, but central to constructing a visuality of the terrorist face, granting a face to an enemy purported to be invisible yet omnipresent.[335] She links such a construction to the public production and circulation of watchlists, functioning as facial databases, wherein the faces identified as terrorists generated a biotype for terrorists that was intended not only for law enforcement use but for citizen use as well; unsurprisingly, such predictions were tied to protocols of difference, aligning along a person's race, race, religion and nationality. Further, Finn's excellent chapter "Visible Criminality: Data Collection, Border Security, and Public Display" summarizes how the National Security Entry-Exit Registration System (NEERS) and US-VISIT targeted the mobility of non-citizens, mapping the characteristics of the nineteen 9/11 terrorists onto every face that passed across an American border.[336] The two programs illustrate the strategies which Finn calls inclusive and exclusive. The inclusive US-VIST program collected data indiscriminately, extracting a wealth of information from every non-citizen that was seeking to enter the United States, then again as they exited the country. This strategy aimed to observe and monitor every face to identify and verify that each was not a terrorist while also gathering massive amounts of data to potentially be used in other strategies and tactics of governmentality. The exclusive NEERS applied closer scrutiny to select populations of non-citizens already within the US that were deemed to be

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[335] Gates, "Finding the Face of Terror in Data," *Our Biometric Future*, 97-124.

[336] Jonathan Finn, "Visible Criminality: Data Collection, Border Security, and Public Display" in *Capturing the Criminal Image: From Mugshot to Surveillance Society.* (Minneapolis: University of Minesota Press, 2009): 106-130.

categorically suspicious by forcing them, under threat of fine and imprisonment, to register with the government via call-in registration: based on four calls from September 30 2002 to January 16 2003, 25 countries were identified as requiring extra vigilance, focusing on Arab and Muslim men.

Databases drawn from such enrollment are examples of the ways that ontopower produces the object of its enmity, wherein the faces of the targeted non-citizens become the very faces associated with terrorism and therefore under the most suspicion. In both cases, once the data was gathered, it could be used and re-used as needed, as will be demonstrated later in this chapter's discussion of FRTs within the crisis of the COVID-19 pandemic. Within this complex of vision, images of the face and the computational facial templates within FRTs melded. Specifically, those who presented as male and Muslim were under constant categorical suspicion, consistently categorized and tracked in hopes of its revealing the terrorist underneath its facade.

It is worth repeating that, as this dissertation has argued, images of the face can never be made entirely invisible nor operational, as they continue to bear the markers of their representational protocols. In reality, databases within FRTs are then both images viewable by humans and data-objects intended for computer vision, and their simultaneous deployment and circulation within FRTs are inscribed with a tangle of political, technical, and representational protocols. However, under governmentality, FRTs' effectiveness under ontopower depends on rhetoric that demands a focus on the technical protocols of its image-making, in particular surrounding operative images within large scale databases operating under interdiction, that circulate algorithmically. The supposed objectivity of machines-viewing-machine images within FRTs' acts of pattern recognition or within the building of its AI models are key pieces of the discourses that justify their use in expanded automated fields of vision. This can be seen in

instances where images are included in a watchlist and/or a No Fly list, where a FRT gazes over the whole of the population in order to find what it has already identified as potential threats, with the technology's automated decisions being made far from public view. When FRTs were made into a digital assemblage, with digital facial data, and deployed as mass verification and identification technologies, technically-oriented operative images strengthened the forces of governmentality by leveraging the previous systems that have made citizens legible in order to track and monitor citizens and so as to best manage them during crisis.

Chapter 3 focused on the enrollment of citizens into databases and the ways populations, through the conflation of consent and coercion, are made legible and stored within an ever-increasing archive. Yet, as Finn contends, in the first decade of the new millennium, citizen and non-citizen enrollment and the resulting databases were increasing indiscriminately collected without being marked for a specific use; the bodies within such archives are always potential criminals because "once archived, these inscriptions remain immutable references to innumerable bodies, throughout innumerable contexts, times, and locations. The individual body's identity as normal or deviant changes with the use of the archive and with the visualization of the body."[337] From this, it doesn't matter what the original intent of the data enrolment was, so long as they can be refashioned and repurposed into other biopolitical tactics. Images such as personal photographs, become operative images under the statistical and calculable forces that define Empire; such images are indicative of both how deeply imbedded such practices are within citizen's technologies of the self, but also how wide a field of vision an FRT can cover. States of exception, combined with computer science practices that view data as neutral, increase the field of automated vision by FRTs by re-adopting and re-adapting an incredibly wide range of data

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[337] Ibid., 98.

into its apparatuses. Justified by the state of exception, such re-appropriating from other biopolitical strategies and technologies of the self is core to the functioning and improving of the technology and the ongoing management of citizenship and its resources during and after moments of crisis.

Embracing Flexibility in Facial Databases in Reaction to 9/11's Ontopower

Ontopower reifies the vigilance and suspicion discussed in the previous chapter as central to FRTs historical development and operationalizes it into truth regimes that justify the technology's use as a tactic while also producing and circulating the very threat that it wishes to halt. FRTs and their images are especially useful within contemporary states of exception, as the technology's own probabilistic logics align with the forecasting logics within ontopower, allowing FRTs to be adaptable to many different notions of current and future threat. While the vigilance at the core of such use of FRTs does utilize interdiction, its observation is built more from a constant culture of enmity and insecurity; within such observation, constant crises and threat don't just examine and monitor, but actively shape who the threat is by way of its circulation of images and representational protocols based in difference, as within terrorist databases and watchlists. Ironically, such images are of the past, and so the contradiction within FRTs' images and image-making is that they use past materials to predict future behaviour. This lag between past and future threats is all but ignored during states of exception, where the FRT observer is deployed asymmetrically and both integrates and produces images, in its datasets and then in the computationally processed images the technology produces, that sort threat from non-threat. These actions further parse citizenship by enforcing the representational and political protocols inherent in images of the face, in particular those defined by difference. The resulting

complex of vision creates predictive hierarchies from faces that are then circulated through the entirety of the FRTs operative moment, where political recognition means being identified and assessed in order to be governed accordingly.

Facial databases are therefore fraught in a number of ways: they capture the affective face and flatten the locality from it so as to create computable data-objects; the faces within those databases, acting as data-objects, remain in those databases, circulating and being added to other facial databases, interminably; lastly, as norms and truth regimes change, such databases and their permanent faces are adapted to whatever application of FRTs that is required. Such adoption becomes amplified under Empire, wherein the assemblages of assemblages that contribute to and deploy FRTs provide a multitudinous and expansive infrastrure by which to develop and improve the technology, in eluding though the building of increasingly larger and varied facial databases. From this, faces within databases are not only data-objects linked to identification, but can be used to re-identify individuals and populations once different truth regimes have risen to prominence. This is the heart of FRTs dangerous flexibility: its adaptability to a multiple use cases at a mass scale allow the technology to appropriate faces from other biopolitical strategies and tactics as well as mechanisms of subjectification and then be deployed under whatever the dominant discourses of the time are; in moments of crisis, such discourses usually target citizenship and the social and physical mobility of citizenship in order to return to a stable state of governmentality.

Post-9/11 FRVTs and Cementing FRT Infrastructure

The databases being generated in reaction to 9/11 and then installed into FRTs replicate some of the vectors discussed in Chapter 4's exploration of War on Drugs' impact on the

development of FRTs: the complexes of vision are driven primarily by top-down power that are

a form of domination and surveillance while also operating as a public display of state power.

Post-9/11, the faces of domestic and international drug trafficker that initially powered the

construction of FERET and the FRVTs were augmented by new truth regimes that aimed to

target primarily Muslim males by activating the technology's previous infrastructure and its

representational protocols built upon racial and gendered difference. Whereas the previous truth

regimes were utilizing FRTs primarily to identify and verify those already established as drug

traffickers and/or associated with drug trafficking, the influx of ontopower brought about by 9/11

reimagined the technology as one that would be able to predict the likelihood of a face being that

of a terrorist.

Building from discussions in Chapter 4, the databases within the 2002 FRVT adjusted

both its test-cases and databases to ontopower and the state of exception that arose from 9/11.

The 2002 FRVT introduced a watchlist test, providing experimental results arising from variance

in the size of the watchlist and the number of matches displayed.[338] Importantly, this watchlist is

a probabilistic action grounded in enhanced photogénie, identifying those faces that are above

the accepted thresholds of potential matches, acknowledging the reality of false positives but

cloaking such possibilities in statistical models of acceptable error. As outlined in the previous

chapter, but worth repeating, the central use of the HCINT Data Set echoes Finn's earlier

arguments, as it is composed of 121,589 images provided by the Visa Services Directorate,

Bureau of Consular Affairs of the U.S. Department of State. The 2002 FRVT also began to

grapple with different "demographic effects" as FRTs began to migrate into an increasing

amount of real-world applications that required accurate observation of many different races,

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[338] Jonathan Phillips et al, "Face Recognition Vendor Test 2002."

genders, and ages. Doing so meant re-appropriating a database of 37,437 faces from the Mexican Visa database. This database and the HCInt database both exemplify how a focus on FRTs technical protocols is supported by truth regimes that cast data as neutral while also demonstrating how facial data from one biopolitical tactic are then reappropriated into infrastructuralism and then other biopolitical strategies and tactics. The varying demographic effects found within the FRVT, wherein the age, race, and gender consistently affect how accurate the technology is, amplify the political and representational protocols inscribed into FRVTs which are then exaggerated again when used in real-world situations.

The political and representational protocols, in particular those drawn along difference and citizenship, were foundational and would come to perpetuate themselves into future versions of FRTs, ingraining the predictive logics of ontopower into the real-world applications of the technology and their gatekeeping of citizenship resources. FRTs' abilities to cover large fields of vision while simultaneously focusing on particular faces granted incredible power to those deploying it, further deepening the monopolistic and asymmetrical dynamics within its right to look. From this, FRTs, as observers, act with vigilance that is characteristic of preemptive ontopower in order to examine and catalogue every face it looks at; not only do such actions require that FRTs be used to prove a face "innocent" (i.e. doesn't match a face on a watchlist), it also processes and stores such information for future use and/or circulation to other entities. Necessarily, while such an observer relies on its technical protocols, its identification and sorting rely much more on ingraining and replicating representational and political protocols, in particular those that combine difference and political recognition. In fact, the state of exception demanded the heightening and expanding of such protocols in order to address the security and health of the nation state. Under such vision, all individuals and populations are consistently

monitored, with intersectionally-affected individuals and populations the most vulnerable to mis-

and non-recognition and, therefore, the potential restriction of citizenship resources.

Providing the Groundwork for Big Data and the FRTs of the 2010s

Importantly, 9/11 and the aftermath of the following decade also marked the early forms

of Web 2.0 and a massive increase in the production, storage, and circulation of personal data,

including biometrics such as facial images. In the ten years following 9/11, social media, such as

Facebook (established in 2004), combined with always-on powerful portable personal

computers, such as smartphones like the first iPhone in 2007, produced massive amounts of

digital data. The extraction of that data also normalized such practices within the lives of citizens

so that, by the 2010s, such practices were so common place that other entities would utilize these

technologies of the self in their own biopolitical strategies. This proved to be wildly successful:

as my essay "The Citizen Question: Making Identities Visible Via Facial Recognition Software

at the Border" argues, the U.S. Biometric Air Exit, operating as a collaboration between

commercial airlines and government entities such as U.S. Customs and Border Protection and the

Transportation Security Administration, relied on FRTs because of the fact that "travellers

increasingly use biometrics, such as fingerprint and facial recognition, in their daily lives to

access their mobile devices, apps, and accounts."[339]

The complex of vision that resulted from the state of exception following 9/11 combined

the explosion of personal data with the vigilance that arose from the War on Terror that targeted

the whole of citizenry. The post-9/11 state of exception successfully engendered a watching,

undertaken by media technologies, that was constant, routine, and ubiquitous, operating at a

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[339] Aaron Tucker, "The Citizen Question: Making Identities Visible Via Facial Recognition Software at the Border," *IEEE Society and Technology* 39, no. 4 (December 2020): 58.

mass scale. This was aided greatly by the glut of data gathered from other biopolitical tactics and citizen technologies of the self so that individuals and populations could be better verified, identified, and sorted; as the next section of this chapter will illustrate, when such actions are normalized and then situated in increasingly expansive vectors of Empire, FRTs emerged from the state of exception and ontopower surrounding 9/11 as a nimble and adaptive vision technology that could provide effective automated decisions for a variety of purposes.

The state of exception following 9/11 that instigated such a complex of vision, and has lingered past that initial crisis into our contemporary moment, operated such that its representational and political protocols became incorporated into the daily sites and activities of the lives of citizens. FRTs morphed into a technology capable of patrolling a wide range of automated fields of vision where an individual's legibility, and their mobility, is determined. However, the cementing of FRTs as an automated mass technology was due in large part to the vast improvement of artificial intelligence (AI) by way of neural networks that combined with Big Data practices under Empire. Ten years after 9/11, with the state of the art of FRTs improving dramatically, the technology became even more effective and adaptable, relocating the previous decade's ontopower and predictive logics into the management of citizenship resources, and the gatekeeping of physical and social mobility.

The Integration of AI, Big Data, and the Increased Management of Social Mobility

While nation state entities, like the NIST, drove the first decade of the new millennium's FRT state of the art, Empire became the driving force in the the 2010s development of the technology, focused by a rising presence and involvement of corporate entities such as Facebook and Google. In such examples of Empire, monopolies do not disintegrate, but combine: the Big

Data practices of the monopolistic Google and Facebook can be used to produce massive datasets that enable researchers (at corporations and in government and university labs) the materials to improve the technical protocols of FRTs. These forces, in turn, reverberate back into the spaces operating under the truth regimes of strengthened national security and health, acting under monopolies of political recognition, and thereby expanding the ontopower established in reaction to the initial crisis of 9/11.

When such ontopower gets shifted towards the everyday activities of citizens, the notions of preemption and prediction become increasingly oriented towards capitalistic impulses. Aided by enhanced interdiction capabilities, each citizen becomes a rich data source that can be used to both target specific individuals but also to build larger infrastructures to improve the state of art of FRTs. Shoshana Zuboff's notion of surveillance capitalism illustrates how citizen's are knowingly and unknowingly selling their data in systems of globalized capitalism.[340] Ontopower, when applied under surveillance capitalism, aims to both predict and shape the future at a mass scale at those borders, producing an extractive paradigm that generates and maintains liminal populations, including through the management of social mobility and health care. Returning to this dissertation's Literature Review and the outlining of Critical Algorithm Studies, the work of Safiya Noble in *Algorithms of Oppression* and Virgina Eubanks in *Automating Inequality* illustrates how marginalized groups face a variety of biopolitical tactics and strategies in the forms of data extraction and algorithmic governance. Ontopower then ensures that such effects are both present- and future-facing, wherein threat is not just based in notion of security, but are rooted in notions of "good governance" and "societal health."[341] Cross cut by such logics, the

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[340] Zuboff. *The Age of Surveillance Capitalism.*

[341] Noble, *Algorithms of Oppression*; Eubanks. *Automating Inequality.*

2010s saw major improvements in FRTs' technical protocols. These improvements were due in large part to deep learning techniques that combined Big Data practices within complex AI-training and computational architecture.

Deep Learning and Convolutional Neural Networks

Recalling discussion of FRTs operative moment in Chapter 2 and further expansion of the development of automated FRTs technical protocols post-WWII outlined in the previous chapter, the removal of human elements and the push to automation and decentralization have been key to the improvement of the technology. In terms of FRTs, this has meant the move away from human-centric systems, like Bochmann's at Checkpoint Charlie as detailed in Chapter 4 and "handcrafted" smaller scale mechanisms like Haar Cascades. Replacing such techniques lead to massive advancements in the 2010s, as AI-generated models that were trained to undertake specific tasks, such as facial identification, were created so that they could be imported into a FRT's computational pipeline.

While a history of AI is well outside this dissertation's scope, this chapter's arguments bridge the use of AI models within computer vision systems to thinkers like Marr and Gibson (explored in Chapter 4) who were moving problems in computer vision away from a general AI approach, wherein the goal was to replicate all the senses in combination in order to generate a functioning AI, to the production of focused and compartmentalized AI-trained models of specific activities. Computer scientists working in the 2020s on FRTs inevitably point back to the prior decade and the development of convolutional neural networks (CNNs) as a major breakthrough for the technical protocols of the technology. Wang and Deng's "Deep Face Recognition: a Survey" is a technically-minded but excellent overview of these developments,

tracing the trajectory from the eigenfaces explained in the prior chapter to shallow handcrafted techniques following 9/11 to the deep learning techniques found within the systems of AlexNet in 2012 and DeepFace in 2014.[342] DeepFace, a collaboration between Facebook's AI research team and Tel Aviv University, is credited with producing one the earlier forms of deep learning for FRTs that could match human capabilities while also being an effective example of how Empire operates.[343]

In brief, deep learning systems, like CNNs, are a machine learning technique that utilizes layers of computer "neurones" networked together. As an image is processed by each layer of neurones, the knowledge gets more refined and focused; a more detailed description can be found in Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville.[344] Such techniques rely upon data objects that can be construed as a grid, as with digital images and their composition as pixels, where the data can be translated into numerical values and compared to their neighbours in the grid. CNNs have been found especially powerful for processing images, in particular classifying and identifying objects and people. The result of deep learning is an attempted paralleling of human vision, recalling Marr's understanding of modules, wherein the models produced by CNN training are isolated elements capable of specific tasks that can be exported and combined in increasing complexity within the computational pipeline of FRTs. As stated in Chapter 2, though they work together, it is worth stating that the machine learning

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[342] Mei Wang and Weihong Deng, "Deep Face Recognition: a Survey," arXiv.org (August 2020): 1-31.

[343] Yaniv Taigman et al, "DeepFace: Closing the Gap to Human-Level Performance in Face Verification," *2014 IEEE Conference on Computer Vision and Pattern Recognition* (2014): 1701-1708.

[344] More information on the basics of CNNs can be found at: Mayank Mishra, "Convolutional Neural Networks, Explained," Towards Data Science, August 26th, 2020, https://towardsdatascience.com/convolutional-neural-networks-explained-9cc5188c4939. Though more technically-minded, *Deep Learning* by Ian Goodfellow, Yoshua Bengio and Aaron Courville (Cambridge: MIT Press, 2016) is widely respected as an introductory text to the concepts in this section of this chapter.

training that produce the AI models is separate from actually importing and using those models within a FRT; the ability to "see" is separate from the act of "seeing." That said, CNNs were able to be trained to complete increasingly complex tasks on varied data that, when housed within a FRT, greatly increased the technology's abilities to identify and verify those under its gaze.

The incorporation of CNN-created models into FRTs produced a giant jump in the technical capabilities and protocols of FRTs which resulted in a massive expansion of the technologies' interdiction abilities and their automated field of vision. Not only were FRTs made faster and more accurate, but systems like DeepFace also were increasingly more sophisticated and successful in solving the problems that had plagued FRTs through its history: the generated models better dealt with variability in light, pose, aging, etc within unconstrained images gathered from non-cooperative environments. Models were made more adaptable to different FRT architecture, and, when imported into FRTs, they granted the technologies newfound vision abilities that expanded their potential use cases. As such, these developments were key to expanding FRTs to the whole of citizenship, resulting in its ubiquitous incorporation into the daily activities and biopolitical decision points discussed throughout the whole of this dissertation.

Importantly, there is a tautological relationship between the establishment and advancement of deep learning techniques like CNNs and the extractive Big Data practices under surveillance capitalism and Empire: in order to produce better trained models, a CNN needs more and more data; at the same time, the better a CNN gets, the more data it can potentially extract through data mining when incorporated into an assemblage like a FRT. As such, the 2010s were also important for establishing the massive facial datasets, and their various problematics, that have since come to characterize FRT use in our contemporary moment.

Data Mining the Public and the Building of Massive Facial Databases

One of the major lingering effects of the state of exception brought about by 9/11 was the normalizing of Big Data practices and the complete conflation of consent and coercion within the systems of data enrolment that fed biopolitical tactics like FRTs. Big Data is characterized by boyd and Crawford by the interplay between technology, analysis, and mythology, wherein computational systems are utilized to detect patterns in large-scale datasets, acting on those patterns to make automated decisions under the myth that such datasets offer a supra-human intelligence and objectivity.[345] The use of incredibly large-scale datasets, extracted via data-mining, is key to this knowledge, as the sheer scale of the the information being processed with the aid of AI models transcends human capabilities and therefor offers greater, and more actionable, insights. In the case of FRTs, the improvement of the technology is tied directly to these data practices: the more data that is able to be put into the deep learning databases and the databases used for identification and/or verification, the more effective an AI-enhanced technology gets at predicting, and the more powerful a potential biopolitical tactic the technology can function as.

The collection of large swaths of public data ties directly to the conflation of consent and coercion explored throughout the whole of this dissertation, a dynamic that has only deepened as corporate entities within Empire, such as social media platforms, have taken hold. While prior chapters' discussions centred on the use of identity documents, such as driver's licences, passports, and immigration materials (still very much a part of the exchange of data for access to citizenship resources), the 2010s saw this consent-coercion dynamic change substantially. The

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[345] danah boyd & Kate Crawford, "Critical Questions for Big Data," *Information, Communication & Society* 15, no. 5 (2012): 662-67.

notion of trading data for a service was extended in order to gather data indiscriminately, at all

times; this isn't, of course, limited to facial data, but the constant and insatiable collection of

such data does allow for various corporate and governmental entities to compose datasets

magnitudes larger than those gathered by FERET less that 20 years earlier.[346] The frictionless

acquisition of public data on a large scale, initiated by the crisis of 9/11, has produced an

infrastructure of data mining that is constantly present and always operating. Under these

practices, FRTs is an immensely strong tactic for environments requiring interdiction, wherein

the technology can monitor and control large areas of space without interrupting their flow while

also collecting and storing data from that monitoring. There have been recent efforts, such as

Meta AI's Casual Conversation's massive dataset, which aim to build consent and diversity

overtly in the construction of large-scale datasets. However, the normalization of the conflation

between consent and coercion found in earlier FRTs has taken full effect in the contemporary

moment, with the data being gathered being refashioned into the required massive datasets that

CNNs and other deep learning technique require to improve FRTs' complex of vision.[347]

Again, the circulations of power throughout the whole of a media like a FRT makes clear

that its organization and calculations are defined by top-down and bottom-up forms of power.

Acts of subjectification, tied to technologies of the self, ensure that citizens take on portions of

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[346] This disseration has already mentioned two examples: IBM's Diversity in Faces dataset was discontinued in part after it was revealed that the dataset was composed of faces taken without direct consent from Flickr accounts that had made their photos available under a creative commons licence. Clearview AI and their database is allegedly populated with 3 billion pieces of facial data pulled largely by scrapping social media sites.

[347] "Casual Conversation Dataset," Meta AI, April 8th, 2021, https://ai.facebook.com/datasets/casual-conversations-dataset/. By its own description the dataset "is composed of over 45,000 videos (3,011 participants)…The videos feature paid individuals who agreed to participate in the project and explicitly provided age and gender labels themselves. The videos were recorded in the U.S. with a diverse set of adults in various age, gender and apparent skin tone groups" (para. 1). The database itself requires a massive amount of space to download; the portion I personally downloaded was 10 terabytes.

the responsibilities that biometrics function properly and effective. Gates sees such phenomena present in what she names as the technologically savvy citizen, and one who uses media like FRT as personal security applications as well as for the organization of their personal documents, such as photos[348]; the abilities to unlock one's cellphone and rental car with the user's face is a combination of convenience and security, reliant upon the relocation of the identity documents into the body itself. Such a figure does normalize the technology and allow for the feature creep that results in FRT being incorporated into an increasingly wide range of spaces. However, when building upon this dissertation's prior arguments about the interrogatory powers of a FRT's enhanced photogénie and the centrality of interdiction within its operation, the concept of the technologically savvy citizen does not address the collapse of consent and coercion that occurs within FRT with the presentation of the face, in effect sidestepping the ways in which individuals and populations co-operatively make themselves legible to apparatuses of citizenship. This is especially true of those individuals and populations already been labeled as Other or non-citizen who must perform as a citizen, or a specific version of a citizen, in order to be recognized and given access to citizenship resources, including social mobility.

Big Data, FRTs, and The Management of Social Mobility

Social mobility is a citizenship resource that enables the accumulation of wealth, health, and knowledge so that individuals and populations are given increased agency over their own lives. Management of social mobility under Empire have, as this chapter has explored, been increasingly tied to ontopower and predictive logics centred on risk and preemption, where remnants of the state of exception caused by 9/11 and securitization have combined with desires

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[348] Gates, 126.

for indiction and biopolitics rooted in flow and control. Importantly, however, while previous

forms of ontopower were focused more on nationalistic understandings of borders, the 2010s

signalled a shift to ontopower that became increasing concerned with biopolitics in the daily

lives of citizens, such as health care, jobs, and schooling. For FRTs, understanding such forces

begins with the growth of massive facial database and the ways in which they are threaded with

protocols of difference.

At the same time, the development of FRTs has always depended on narratives that

linked accuracy and efficiency, and therefore improvement, of the technology, to its ability to

identify and verify an increasingly wide range of faces. Expanding this field of automated vision,

however, depends upon the deliberate production of different types of facial images that

combines with the labelling of such faces categorically that then allows the technology to grow

to a mass scale while remaining flexible to the many forms of mobility that need managing that

then spawn multiple use cases for the technology.

Such labelling can be seen in almost every early facial dataset, in particular race and

gender, but was codified in FERET's practices, which, once established as the gold standard,

became the best practices other databases adopted.[349] Katharine Biber, in conversation with Bela

August Walker, rightly critiques such practices as participating in the prescription of monolithic

labels that flatten the indeterminate body and its experiences into too narrow categories, that are

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[349] Within the FERET database, and the later FRVTs, each face is accompanied by an additional file that displays
Gender, Year of Birth and Race for each subject. This metadata is then used to create Montages, which collect up
the images for each facial position as well as a folder labeled "Misc" that groups images together based on gender,
race, and whether the person in the photo has glasses or a beard. These composites of similar types of faces visually
recall earlier photographic practices from Galton and Bertillon, explored in Chapter 3, wherein groups of faces are
clustered together. In addition, such data practices have only expanded in the last two decades, in line with the
extreme growth of facial datasets, to include any number of other data categories, such as within the Chicago Face
dataset which includes attractiveness and emotional states, that can then be leveraged into predictive algorithmic
systems ("Chicago Face Dataset," University of Chicago, March 2021, https://www.chicagofaces.org/).

then activated in further targeting already liminal populations.[350] Wendy Chun links such

practices to the notion of homophily, the notion that similarity breeds connection, producing

pattern discrimination by reinforcing segregation by ways of its generating of boundaries from

categories such as race, "distinguishes and discriminates between allegedly equal nodes."[351]

Scholars such as Lisa Nakamura, Cathy O'Neill, and Ruja Benjamin have demonstrated how the

production of difference and reinforcing of homophily within automated and decentralized

algorithmic systems, like FRTs, have real-world impacts on the gatekeeping of social mobility[352]

This top-down application of power is then amplified when combined with other positivist-

minded systems that unite such categorizes with probabilistic decisions about the inner states and

values of faces under observation and their potential future behaviour(s). This includes

seemingly harmless uses of FRTs, like facial tracking in shopping malls, but is also present in the

managing of public housing, within job interviews, as a plagiarism detector in virtual test-taking

environments, health care, and/or within banking environments.

The integration of CNNs and Big Data protocols, combined with the repurposing of facial

materials inscribed with difference, would be the foundational practices that FRTs would fall

back upon as the COVID-19 pandemic emerged as a global crisis. Ontopower under COVID-19

is about the risks that whole unidentifiable populations pose to previous biopolitical strategies,

while also underlining the fear that such populations would stop being public data mines for

forces of governmentality. As importantly, the state of exception raised by COVID-19 justified

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[350] Katherine Biber, *Captive Images: Race, Crime, Photography* (New York: Routledge-Cavendish, 2006), 20-23.

[351] Wendy Chun, "Queerying Homophily" in *Pattern Discrimination.* (Minneapolis: University of Minnesota Press & Meson Press, 2018), 62. Chun also expands on homophily in her chapter "Homophily, or the Swarming of the Segregated Neighbourhood" in *Data Discrimination* (81-120)

[352] All three authors are discussed in this disertation's Literature Review and powerfully explain the many ways citizens are algorithmically categorized by race, and the dire consequences of such categorization. Nakamura, *Digitizing Race,* 2008; O'Neil, *Weapons of Math Destruction*; Benjamin, *Race After Technology.*

improvement of the previous capabilities of technologies like FRTs, as the crisis was used as a opportunity to strengthen the technologies' abilities to detect, identify and verify occluded faces, contributing to the eventually solving for environments populated by uncooperative subjects. As the introduction to this chapter illustrated, while FRTs initially struggled with identifying and verifying masked faces, the previous infrastructure of testing protocols, large-scale databases, machine-learning, and institutional knowledge worked together to solve the problem quickly. The crisis, and resulting state of exception, showed how governmentality acts within a crisis to remake previously indeterminate individuals and populations back into manageable entities.

FRTs, COVID-19 and Crises of Breathability[353]

Masked faces exist at a contemporary interlocking of forces under crisis. As Yiğit Soncul and Jussi Parikka argue masked faces crystallize the fact that "it is through contexts of immunity and air—breathability—that we come to understand the broader political stakes of the present as well as the histories in which the mask sits."[354] However, the COVID-19 pandemic is not only a crisis of breathability itself, but surfaces "an already existing crisis of air, breathing, and lack of breath" with masks fulfilling their long-held role as "telling tales of social relations as they are revealed but also stretched at the moment of crisis."[355] Such sentiments are further underlined by Eric Garner's and George Floyd's recorded dying cries of "I can't breathe" wherein the human need for air is implicated into systemically racist police practices. In addition, Soncul and Parikka highlight climate catastrophe, and the resultant wildfires, as a further force generating

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[353] Portions of this section of this chapter have been adapted from my previously cited paper "Solving the Conflict Between Breathability and Masked Faces within Facial Recognition Technologies."

[354] Soncul and Parikka, "Masks: The Face Between Bodies and Networks," para. 1.

[355] Ibid., para. 14.

masked faces defined by access to fresh air. The authors 'focus on "breathability" is echoed in

Achille Mbembe's "The Universal Right to Breathe": "the universal right to breath" is "a

fundamental right to existence . . . *an originary right to living* on Earth."[356] Yet, within the

aforementioned crisis contexts, air and breath are distributed as resources, wherein monitoring

and moderating access to breathable air becomes one way to control the life of individuals and

populations.

The underperformance described in the NIST's July report, and the introduction to this

chapter, made visible the ways in which the management of air and breathability collide with

logics of securitization and other rationales that have previously provided the impetuses for

FRTs 'usage. The initial failures of FRTs when applied to masked faces can be better understood

by recalling Chapter 2's discussion of the technology's operative moment and then looking more

closely at FRT as a media technology wherein its image-making is upset by novel combinations

of elemental media such as air, breath, masks, and the medium of the body.

Air, Breath, and Elemental Media

Air is an example of what John Durham Peters in *The Marvellous Clouds: Toward a*

Philosophy of Elemental Media calls "elemental media."[357] There are media like clouds, fire, and

air, Peters contends, that have meaning and are forms of data and communication. Elemental

media, air in particular, are media that other media depend upon, the least of which is the human

body, which Peters names as the most basic medium; from this perspective, media are not pipes

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[356] Achille Mbembe, "The Universal Right to Breathe," trans. Carolyn Shread, April 13, 2020, para. 17, https://critinq.wordpress.com/2020/04/13/the-universal-right-to-breathe.

[357] John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago: University of Chicago Press, 2015).

and channels, but form series of layers that generate interlocking ecosystems and habitats for diverse life. Breath, as air circulating to and from the medium of the body, is a specific form of elemental medium with dense informational variability that is defined by the body's relational dependence on breath, and breathable air, in order to exist.

Yet, Peters makes clear that media are not politically neutral, but rather concentrate power, wherein the use and asymmetrical deployment of a media is indicative of the strategies and tactics of a culture and society. A media is then both a form of informational communication and a resource, often made from many other resources." Breathability" is a concept that draws forth the notion that air and breath are both resources as well as a medium on which the medium of the body depends on. Masked faces within the media ecosystem of the body, air, and breath, remake the relational ecosystems that house them, forcing the forming of novel combinations of media and matter; the masked face under the crises of breathability is a novel conjoining of air-breath-body, and its inclusion disrupts the established protocols and capabilities of FRT as a media technology.

Such thinking is further complicated when recognizing that FRTs most often operate, as this dissertation has argued, as logistical media whose images are deployed under infrastructuralism in service of governmentality. Yet, FRTs representational, political, and technical protocols are formed by a contradiction arising from competing machines: as Galloway explains, "one machine radically distributes control into autonomous locales, the other machine focuses control into rigidly defined hierarchies."[358] This is especially true for a FRT, as its adaptability to different databases and data practices grant it the ability to be deployed within many different infrastructural locales. However, the technologies 'dependence on computer code

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[358] Galloway, *Protocol,* 8.

and uniform data practices force those many uses into standardized and easily repeatable actions that reduce the faces into data; therefore, a media technology like a FRT struggles when presented with new materials outside its prior protocols and practices. In the case of FRTs, while the automated and decentralized forms of control are still available under deployments of the technology during the COVID-19 crisis, the rigid nature of its computational architecture makes it such that masked faces disrupt the media technology.

In general, such failures are almost always temporary as the larger infrastructures housing a media technology, like a FRT, can remain in place working imperfectly, but working nonetheless. For FRTs specifically, this is important as leaving the larger infrastructures in place allows for the solving of masked faces without altering the mechanisms that operationalize the technology. This allows the apparatuses dedicated to biopolitical control to aid in the improvements of the technology so that it can return to its full functionality. Masks are central to various current biopolitical strategies that are tethered to air and breath, from their production, to their distribution to certain populations over others, to the adoption or refusal of masks becoming central to the current culture wars across the globe.

The biopolitics of mask wearing make critiques of biopolitics based in debility and precarity centrally important in 2023: aside from granting a level of nuance that better explains the logics of specific tactics and strategies, the current crises of breathability have been caused in large part by previous biopolitical actions that made individuals and populations statistically more likely to be injured or made ill. The biopolitical management of health care for Latinx and Black populations, for example, are a large part of an intersectionally-tangled host of factors that has produced underlying health conditions that then made them disproportionately susceptible to the coronavirus. To this point, Michael J. Kennedy in "On Breath and Blackness: Living and

Dying in the Wake of the Virus" exposes the many systems based on breathability, from carceral logics to labor practices to monopolistic centralizing of resources, that work together to debilitate black people to the point of extreme vulnerability.[359] In the contemporary moment, masked faces are emblematic of these biological-technological combinations under logics of precarity, representative of both individual protective actions in service of one's own breathability, and also the many forces that underlie the crises that have made widespread mask wearing necessary.

The collision of multiple crises of breathability within often competing infrastructures are also threaded with similar circulations of instances of biopower and ontopower, and FRTs ' failures are due in part to how interconnected the biopolitics surrounding breathability are, wherein if one component fails or is under crisis, it dominoes through other apparatuses. In the case of FRTs, mask wearing is a threat to previously effective biopolitical strategies, as masks short circuit the technology and the circulations of power that depend on the technology as a tactic. Ontopower, in this instance, acts to preserve these dynamics, utilizing the COVID-19 pandemic as a crisis that justifies the improvement of technologies, like FRTs, that can be used to maintain precarity, debility, and the production of liminal populations. The risk that whole populations, including those posing threats to securitization and health, could pass by observing technologies like FRTs undetected and unidentified is enough to deploy infrastructures like the FRVTs and their massive facial datasets to solve for masked faces.

Solving the Crises of Breathability

As the introduction to this chapter explained, the NIST released reports just four months apart in which the first explained the failure of FRTs to detect and identify masked faces while

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[359] Michael J. Kennedy, "On Breath and Blackness: Living and Dying in the Wake of the Virus," *Philosophy & Rhetoric 53*, no. 3 (2020), 286–92.

the second proclaimed that FRT algorithms had massively improved its capabilities as they related to occluded faces. The solving of masked faces relied on the FRVT and NIST testing infrastructure as well as databases gathered under Big Data practices justified by previous states of exception.

In particular, the VISA dataset proved to be especially useful. By its own description, the dataset is composed of "a global population from more than 100 countries involved in immigrant and non-immigrant application processes. The images are of subjects of all ages, including children and infants."[360] While the NIST reports do not go into the specific ways in which the FRT providers adjusted their algorithms or datasets, they do outline the methodology they used to test the FRTs submitted, thereby providing one way in which the problem of masked faces might be solved: rather than grapple with the unique and indeterminate relations created by breathability and the media of masked faces, the FRVT computationally "cooked" itself a new dataset. The report details the systematic addition of masks to the VISA dataset: using the established dlib facial landmarks protocols, a mapping of facial landmarks that operate as rough facial templates, different shapes and shades of masks were computationally added to the existing photos. Further demonstrating the messy re-appropriation of facial data from different biopolitical tactics, the example images of this process utilize the MEDS-II database, a database constructed from deceased individuals' mugshots.[361]

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[360] "Ongoing Face Recognition Vendor Test (FRVT) Part 3: Demographic Effects - Annex 3: Description and examples of images and metadata: Visa portraits," December 19th, 2019, https://pages.nist.gov/frvt/reports/demographics/annexes/annex_03.pdf. Such databases are not publicly available with documentation of specific datasets often buried within other documents. The information for the VISA dataset was found by examining the descriptions of the Annexes within: Patrick Grother, Mei Ngan, and Kayee Hanaoka, "Face Recognition Vendor Test (FRVT) - Part 3: Demographic Effects," National Institute of Standards of Technology, December 2019, https://nvlpubs.nist.gov/nistpubs/ir/2019/NIST.IR.8280.pdf.

[361] Ngan, Grother, and Hanaoka, *Ongoing Face Recognition Vendor Test (FRVT) Part 6B*, 6. The Multiple Encounters Datasets (MEDS) I and II datasets can be found at: "Special Database 32 - Multiple Encounter Dataset (MEDS)," National Institute of Standards of Technology, May 10th 2010, https://www.nist.gov/itl/iad/image-group/special-database-32-multiple-encounter-dataset-meds

The generation of synthetic data within the 2020 NIST report is deeply troubling. At a surface level, the template approach taken is indicative of certain biopolitical impulses toward uniformity and stability, as well as the extreme desire to generate useful data above all else, sidestepping the previous problems caused by the unique media that masked faces present. The popular understanding of the dangers attached to synthetic data is typically understood by way of deepfakes, wherein complex machine learning can produce increasingly realistic, yet fake, media. FRTs, above all, are deeply invested in tethering facial data to a person's real identification and inserting fake data into such a system would typically disrupt the technology. However, the synthetic dataset here is not being used to identify and verify, but rather is being used to establish protocols and infrastructure for future FRTs. The actual people within the photos are incidental; the most effective contribution of the NIST report is the establishment of how other FRTs might begin to strengthen their own abilities to recognize masked faces by following the methodologies detailed. The fact that this synthetic dataset will be used in tests going forward homogenizes, assuring that other FRTs will aim to achieve compelling results based on the NIST's methodology in order to achieve the benchmarks desired by the companies submitting to the FRVT; when combined with the advancements in CNNs and machine learning techniques, these databases become effective ways to "solve" one of the major computer vision problems arising from the COVID-19 pandemic. However, any acknowledgement of the unique combinations of breath-body-air and/or precarity of those liminal populations within the dataset is effaced. The crises of breathability, though very much present in the images, are erased by the core image-making process that leverages synthetic data. Recalling this chapter's earlier discussion of post-9/11 watchlist databases inscribed with protocols of difference, the effects of synthetic datasets is two-pronged: first, the use of immigrant materials and border crossings as

testing materials in their databases erases the lived materiality of those liminal populations; second, the report does not address the crises of breathability and effectively ignores the relational local causes and conditions for the individuals and potentially liminal populations wearing masks in favour of reducing the media of masked faces back into a logistical media, a manageable source under governmentality and prior biopolitical desires.

In late 2021, there were already other datasets that feature people wearing masks that have been generated, with the establishment of the Real-World-Masked-Face-Dataset as well as the Pgu-face dataset being just two examples; the near-future promises a further wealth of databases dedicated to better detecting and identifying the faces previously hidden by masks.[362] These databases have larger implications in relation to those labelled as political dissidents and protesters, but also has the potential to leach into other uses, like the tracking of workers and their productivity in industrial settings that require concealing safety equipment. Like 9/11, while the COVID-19 pandemic is unlikely to generate whole new biopolitical systems, it is likely that it will provide the rationales and justifications to exponentially expand existing apparatuses. It is deeply alarming that the responses to the crises of breathability are using liminal populations to further the biopolitical tactics that reinforce those very populations 'continued debility and precarity. Too, ontopower and the subjective nature of the definition of threat make the improvements of FRTs under the state of exception of COVID-19 capable of effectively observing populations who might have strategically avoided such a gaze by hiding their faces.

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[362] The Real World Masked Face Dataset can be found at: X-zhangyang, "Real World Masked Face Dataset," Github, January 12th, 2021, https://github.com/X-zhangyang/Real-World-Masked-Face-Dataset. Information on the PGU-Face dataset can be found at: Seyed Reza Salari and Habib Rostami, "Pgu-Face: A dataset of partially covered facial images," *Data in Brief*, 9 (2016): 288-291. Research using the Real World Masked Face Dataset is explained in: Walid Hariri. "Efficient Masked Face Recognition Method during the COVID-19 Pandemic," arXiv.org, n.d., https://arxiv.org/pdf/2105.03026.pdf.

Finally, the solving for masked faces provides a template for how states of exception can use and improve technologies like FRTs in future crises. The production of new methodologies that leverage previous infrastructures and materials extracted from liminal populations will likely prove very effective in managing future problems of flow and control, including the near-future of climate catastrophe and resulting mass migration.

<u>Conclusion: FRTs and Future Crises</u>

Writing in 2023, COVID-19 continues to exist worldwide while extreme weather, namely hurricanes and wildfires exacerbated by drought, demonstrate the effects of climate catastrophe and forebears the future problems that Empire will be forced to act upon. Given such an amorphous, uncertain, and omnipresent set of conditions, ontopower can cast such threats as indeterminate and undefinable in a way that allows for the crises that arise to form into hybrid forms of cultural and political crises. Such crises would likely include mass migration exasperated by climate catastrophe and civil wars, with the network of threats and resulting crises amplifying each other and the states of exception needed to address them. Within this, FRTs and other biometrics become central tactics in larger strategies of governmentality inscribed with ontopower where the potential excess mobility of immigrants and refugees are a threat to citizens' resources and social mobility. FRTs then take on the task of sorting, echoing Galton from over a century ago, the desirable immigrants from the undesirable, often relying on subjectification and compliance as key metrics to determine individuals' and populations' potential economic and cultural value.

The predicting of desirability is already taking place in immigration and refugee camps around the world, with biometrics playing central roles in the administration and management of

these liminal populations. The use of technologies like FRTs in this instance is born from rationales that immigrants need to be dealt with efficiently and humanely, and biometrics are a way to do this. However, as mentioned previously in this dissertation, Lex Gill and Petra Molnar's *Bots at the Gate* detail the role of unaudited and opaque automated and decentralized decision making plays in the processing of potential immigrants and refugees.[363] Established in this dissertation's introduction, Molnar's powerful research in *Technological Testing Grounds* demonstrates how the crisis of mass migration is being leveraged to provide sites to expand the capabilities and reach of biometrics, utilizing the populations within as test materials; in a further example, she explains how the fire in the Moira refugee camp in Greece necessitated the moving of those affected, but provided the crisis by which to install advanced surveilling systems into the new centres responsible for those populations.[364]

Knowing this, the move from observing "threats," such as illegal and/or undesirable immigrants, to the observing of the whole of citizenry is made by utilizing the materials and testing done on liminal populations in ways that observe citizens indiscriminately. The iBorderCtrl program is one such example: as an EU-funded system aiming to test and improve automated border control, the system would require the trading of mobility for a citizen's personal information, including their social media accounts; further, on-site integration at border sites would employ an AI entity acting in cooperation with a FACS-like system that would operate on the face to detect whether those under its observation are lying.[365]

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[363] Gill and Molnar, *Bots at the Gate,* 2018.

[364] Molnar, *Technological Testing Grounds,* 2020.

[365] FACS is a system for interrogating facial expressions through the recording and observation of minute facial movements and is explained further in Chapter 4.

What can be done in the face of such a widespread and deeply ingrained set of strategies and tactics? Where might countermeasure and counter-tactics emerge from and what might make them effective in exposing and combating the adaptable circulations of power within technologies, such as FRT, especially under permanent states of exception and crisis?

Addressing contemporary strategies and tactics operating under biopower and ontopower means first an understanding the historical trajectories of the machine ensemble of FRTs and how its construction and evolution has lead to our current moment of the technologies' operationalizing. The following chapter will follow this argument in its exploration of the necessary building blocks and goals needed to intervene into FRTs, tying such arguments to effective examples from artists and thinkers. At the core of such work is understanding how to understand how biopolitical tactics and strategies interact and depend on each other so as to tap into competing desires within machine assemblages, like those that led to the initial failures of FRTs during COVID-19. Doing so can be done by understanding FRTs' operative moment and using that knowledge to expose and "misuse" the technology, in particular via manipulation of technical protocols like CNNs and machine learning, to draw out how the technologies representational and political protocols are constructed, circulated, and affirmed. Further, the production of synthetic data, through Deepfakes and Generative Adversarial Networks (GANs), are ways in which "fake" facial data can be inserted into FRTs operative moments to disrupt its use. Comprehending how such overlaps between tactics and strategies can be used to short-circuit FRTs provides the bedrock for potential longer term changes that will be better able to grapple with future problematics. In addition to technical interventions, Chapter 6 will therefore

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Broad information on the iBorderControl program can be found at "Project Summary," iBorderCtrl, n.d., https://www.iborderctrl.eu/. However, more detailed information is captured in the project's "Letter of Informed Consent" given to volunteers for the program. "Letter of Informed Consent," n.d., https://iborderctrl.no/informed_consent.

outline the need for: public education, art, and literacy into how technologies like FRTs are enabled and operate; the construction of alternate futures and imaginaries that work to project healthy and ethical relational and affective networks of human-humans and human-machines; and accompanying policy and regulation that ensures ongoing transparency and critical biometric consciousness is generated and maintained going forward.

CHAPTER 6:
INTERVENING INTO THE PROTOCOLS OF
FACIAL RECOGNITION TECHNOLOGIES

As detailed throughout this dissertation, the primary strength of FRTs as a biopolitical tactic is its incredible flexibility and adaptability that has allowed the technology to be used in an ever-increasing variety of forms, permeating everyday life by way of managing test-taking environments, movement on cruise ships, access to public housing, bank loans, job interviews, shopping malls, rental cars, alongside the more long-standing use cases aligned with immigration control, border security, and law enforcement. While there is no singular solution to the adaptable nature of FRTs, a simultaneous and multitudinous collection of counter-tactics targeting the technology's interrelated technical, representational, and political protocols can provide the bedrock on which to intervene effectively into the circulations of simultaneous top-down and bottom-up power within FRTs that this dissertation has detailed. Examples of counter-tactics include (but are not limited to): the combination of asymmetrical make-up and haircuts, as demonstrated by CV Dazzle[366]; data pollution strategies that flood an FRT's field of vision with excess images of faces; the constructing of hats and sunglasses that emit light in ways that keep FRTs from being able to detect faces; and the University of Chicago's Fawkes tool, which inserts, at the level of the pixel, noise into photos to make them un-processable to FRTs.[367] This chapter will take up a number of these interventions while also including those generating artwork, such as the works of Trevor Pagan, Hito Steyerl, and Rafael Lonzo-Hemmer, that aim to make the operative moments and political impacts of FRTs visible, transparent, and

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[366] Adam Harvey, "CV Dazzle - Computer Vision Dazzle Camouflage," 2010, https://cvdazzle.com/

[367] "Image 'Cloaking' for Personal Privacy," SAND Labs - University of Chicago, Updated June 5th, 2022, https://sandlab.cs.uchicago.edu/fawkes/

understandable. In addition, there are those like the Indigenous AI research and policy group, Design Justice, and The Algorithmic Justice League that are producing scholarship and white papers with the goal of providing individuals, populations, governments, and corporations with guidelines and recommendations intended to produce effective, robust, and flexible policy and regulation of technologies like FRTs.

Understanding FRTs' symbiotic technical, representational, and political protocols gives potential paths to follow when aiming to raise what Simon Browne calls a critical biometric consciousness, which she defines as "informed public debate around these technologies [such as FRTs] and their application, and accountability by the state and the private sector, where the ownership of and access to one's own body data must be understood as a right."[368] As this chapter will explore in greater depth, public education and knowledge is central to any discussions. As such, research, technical interventions, and artworks that integrate both the histories and contemporary applications of FRTs are essential to making such systems and logics transparent and understandable to a greater public. Following from this, there must be accompanying policy and regulation, operating under more top-down forms power, that ensures responsibility and transparency in the development and deployment of biometrics like FRTs; such ongoing auditing and accounting must address how Empire is essential to FRTs, and then work to pull apart the dense state-corporate networks operating under global and surveillance capitalism, in particular when operating within ongoing states of exception and crisis.

This chapter then concludes by advocating for a critical posthumanism, as theorized by Rosi Braidotti, as a framework to provide future interventions into FRTs. Building from the works of Donna Haraway, N. Katherine Hayles, and Karen Barad, critical posthumanism can be

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[368] Browne, *Dark Matters,* 116.

the scaffolding needed to produce effective interventions into technologies like FRTs because it values relational networks, affect, indeterminate materials, and lived narratives, in particular at the intersection of the biological body and technological assemblages. The promotion and tolerance of indeterminacy, further expounded in critical disabilities studies, is at the core of such thinking, where accounting for the messiness of the body and its affect demands acts of vision that resist the production of determinism and positivism at the heart of contemporary biopolitical vision. Activating critical posthumanism acknowledges the intertwining of political, representational, and technical protocols within a FRT so that opposing forces might target such protocols and the ways that they are co-dependant within a FRT.

Ultimately, countering the dense networks of power within FRTs that have been discussed throughout this dissertation requires thinking that address both top-down and bottom-up forms of power, in particular at sites where citizen consent and coercion are conflated. Making visible, then short-circuiting, such circulations of power is crucial, specifically in ways that value the indeterminate and affective materials of the body, represented by the face within FRTs, that are too often rendered stable and operationalized data within larger biopolitical tactics and strategies.

Resistant Practices Against FRTs

The most effective forms of resistance to FRTs provide templates for opposition to similar technologies by addressing the symbiotic protocols that work to operationalize top-down and bottom-up power simultaneously. In addressing technical protocols, resistant practices utilize the components of FRTs' operative moment against itself, re-routing its rigid computational logics in order to make the technology transparent as well as short-circuit the detecting,

identifying, and/or verifying mechanics at the centre of the technology. Those practices working in opposition to FRTs' representational protocols focus on data enrolment and facial databases in order to make visible the construction and circulation of facial image and image-making in ways that expose the hierarchies based on difference that many FRTs rely upon. Opposing the technology's political protocols highlights the acts of domination present within biopolitical and necropoltical strategies that utilize FRTs, but also foreground the local and affective individuals and populations being observed and managed.

In the case of resistance to all three protocols, the audience of these interventions is implicated, directly and indirectly, in ways that recall the bottom-up forms of power present in subjectification: sometimes the audience's face will be the subject of transformation and categorization; other times, through acts of empathy, the audience will be asked to imagine themselves observed in problematic ways. In this way, the fusion of the individual affective body and the observing biometric technology acts to expose and/or resist the negative aspects of FRTs by highlighting and/or enhancing the intra-related network of entangled and performative materials that provide the groundwork for an active critical posthumanism. Empowered by creativity, countervisualities, and counter-politics, such interventions typically target one of the three protocols specifically, but speak to the relationship between all three in ways that broaden an accessible and actionable base of knowledge. The most effective forms speak to the Browne's critical biometric consciousness by breaking such knowledge away from specialists and turning it public-facing in ways that produce transparency around how FRTs operate.

Intervening with Technical Tools

There are a number of scholars, researchers, and protestors working to make FRTs'
operative moment understandable while also providing strategies and specific counter-tactical
tools to disrupt the technology's automated vision. Most of these tools rely on targeting primarily
the technical protocols of FRTs in ways that expose the those protocols' relationship to their
representational and political counterparts. The most powerful of such tools are those which can
be most easily adapted into widespread public use, while also remaining flexible enough to
maintain their effectiveness within the push-pull of the game of governmentality.

In terms of larger strategies, thinkers like Steve Mann advocate for sousveillance wherein
hardware like wearable computers provide much-needed bottom-up checks on automated
vision's asymmetrically applied authority, in particular in the observing assemblages that arose
post-9/11.[369] Wearing publicly available digital devices, like GoPro digital cameras, empowers
individual citizens to both understand the devices observing them, but to hold the operation of
such asymmetrically-applied technologies responsible for their automated decision making and
invasions of privacy. This then generates a communal and networked vision that Mann names as
veillance, a combination of top-down and bottom-up observation. Such thinking is exemplified
in the form of smartphone footage that depicts acts of domination, such as the killing of citizens
by police forces, and then provides such footage to a wide public forum.[370] Importantly, these
strategies and tactics do not address the historical and contemporary forming of FRTs and their
representational protocols; nor do they remove or disrupt the most harmful versions of automated

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[369] Steve Mann, "Wearable Technology as a Human Right," MIT Technology Review, February 18th, 2014,
https://web.archive.org/web/20140223003225/https://www.technologyreview.com/view/524661/wearable-
technology-as-a-human-right/

[370] Steve Mann, "Veillance and Reciprocal Transparency: Surveillance versus Sousveillance, AR Glass,
Lifeglogging, and Wearable Computing," WearCam, n.d., http://wearcam.org/veillance/veillance.pdf

vision. However, they do harness technological devices in countermeasure to FRTs political

protocols in potentially powerful ways.

Such thinking enables further disruptive strategies, or what Mann names

counterveillance, based on data pollution and technical cloaking measures that produce specific

tools. Most of these tools are built from computer science expertise with a deep technical

understanding of FRTs' detection, identification, and verification mechanisms. DeepPrivacy, for

example, utilizes Generative Adversarial Networks (GANs) in order to produce an AI model that

removes privacy-sensitive information while still producing a realistic face.[371] The results of this

are the Flickr Diverse Faces (FDF), a set of anonymized faces that can be used for FRTs and

machine learning that removes the original identity, and the privacy issues, attached to the initial

image. This synthetic dataset is in conversation with some of my own work into the potential

positive value of Deepfakes and synthetic data, including the anonymizing of witness testimony

in digital video and the production of dramatic reenactments and alternate histories.[372] However,

much like solutions to FRTs rooted in diversity that have been critiqued throughout this

dissertation, FDF does not disarm the political protocols nor representational protocols present in

the technology, in particular in forms of FRTs utilizing top-down domination in its vision; in the

example of the synthetic facial databases produced during the COVID-19 pandemic discussed in

the previous chapter, these data practices can provide ready-made datasets and models that make

it easier for such assemblages to be built and deployed while claiming to be ethical due to its

attention to privacy concerns.

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[371] Håkon Hukkelås, Rudolf Mester, and Frank Lindseth, "DeepPrivacy: A Generative Adversarial Network for Face Anonymization," arXiv.org, September 10th, 2019, https://arxiv.org/abs/1909.04538.

[372] The basis for this work was the paper "The Positive Disruptive Potential of Deepfakes and Synthetic Data." Given at the Canadian Society for Digital Humanities in June 2021. The work was awarded the Ian Lancashire Award for Promise.

FDF's limitations stress that effective interventions into FRTs must be combinational. FDF would, therefore, be more effective in combination with something like McAfee Morph, which also utilizes a GAN structure to change images such that human vision views it as one person, but when observed by a computer vision system, the face appears to be that of a totally different person.[373] While such a system is very resource intensive and not tested on FRTs in the wild (such as highly securitized spaces like airports), the methodology does provide a template for the type of counter-tactic that can leverage FRTs technical protocols against itself. In this way, it is similar to the tool Fawkes, produced by a research team at the University of Chicago, which helps users "add imperceptible pixel-level changes (we call them 'cloaks') to their own photos before releasing them."[374] Fawkes is intriguing in part because the researchers released the code and methodology on Github for the public to use and adopt. The system is constrained by its inabilities to react to live processing of FRT footage, instead focusing on still images. However, its targeting of FRTs' computational logics, and the manipulation of computer-specific vision and image processing are, like McAfee Morph, inspiring initial steps by targeting the technology's technical protocols and then making such knowledge publicly available.

Recalling Chapter 2's discussion of a FRT's operative moment, detection is a key bottleneck within automated vision: if a face cannot be detected, it cannot be verified and/or identified. Interventions that understand that detection works under the assumptions of a single symmetrical face with standardized facial landmarks as templates (i.e. two eyes, a nose, a mouth

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[373] Karen Hao and Patrick Howell O'Neill, "The hack that could make face recognition think someone else is you," *MIT Technology Review,* August 5th, 2020, https://www.technologyreview.com/2020/08/05/1006008/ai-face-recognition-hack-misidentifies-person/. It is worth noting, however, that the NIST has an expanding infrastructure in reaction to this counter-tactic, found under "FRVT MORPH" NIST, September 20th, 2022, https://pages.nist.gov/frvt/html/frvt_morph.html.

[374] Shawn Shan et al, "Fawkes: Protecting Privacy against Unauthorized Deep Learning Models," SAND Labs, 1, http://people.cs.uchicago.edu/%7Eravenben/publications/pdf/fawkes-usenix20.pdf

in a "normal" configuration), will disrupt FRTs by flooding the vision with multiple part-faces or

evading them by rearranging the face under observation into asymmetrical configurations. As an

example, Adam Harvey and Hyphen-Labs' speculative HyperFace project is an extension of

these technical-minded resistance practices, offering a future device that "is a new kind of

camouflage that aims to reduce the confidence score of facial detection and recognition by

providing false faces that distract computer vision algorithms."[375] This distraction is a form of

data pollution that aims to overwhelm FRTs detection mechanisms by giving a surplus of face-

like objects, much like Sanne Weeker's Anonymity scarf that is printed with a series of human

faces.[376] By understanding the operative moment of FRTs, flooding the automated field of vision

shows how vulnerable such linear and compartmentalized vision is to pluralistic and novel

combinations of medium outside its machine learning knowledge base.

Sharif et al's work in "Accessorize to a Crime: Real and Stealthy Attacks on State-of-the-

Art Face Recognition" is a particular useful combination of technical protocols and the physical

body as well as detailed discussion of the different types of attacks on FRTs that are likely to be

the most effective. Their proposed countermeasure is the wearing of perturbed eyeglass frames

that, as a physical device, successfully allow its wearers to "impersonate" other people, such as

celebrities like Mila Jovovich and Carson Daly, when viewed and processed by an FRT.[377] These

eyeglass frames are in conversation with other tactics, such as the the adversarial patches

designed by Thys, Van Ranst, and Goedemé that short circuit detection systems within computer

[375] Adam Harvey, "Hyperface," 2017, para. 1, https://ahprojects.com/hyperface/

[376] Sanne Weeker, "Anonymous," n.d., http://sanneweekers.nl/big-brother-is-watching-you/.

[377] Mahmood Sharif et al. "Accessorize to a Crime: Real and Stealthy Attacks on State-of-the-Art Face Recognition." CCS 2016. October 24-28. https://dl.acm.org/doi/pdf/10.1145/2976749.2978392

vision assemblages so that the wearer remains invisible to computer vision.[378] Like the strategies

of data pollution, these additions to the body in the form of wearable technology strike at the

heart of biometrics desires: while biometric technology rely on the complete conflation between

the body and identity, resistant practices like the Anonymity Scarf and perturbed glasses frames

use the targeting of the body against itself, obscuring it by overwhelming the right to look or by

disconnecting the link between body-identity that technologies like FRTs depend upon and

providing faces that do not match the deterministic facial templates at the heart of FRTs'

operative moments. More so than tools like the FDF dataset, these types of interventions are

more effective instances of sousveillance by acting locally, at the relational and entangled site of

the body, where the fusion of the affective individual meets the technical observation of FRTs.

Following from these examples, "low-tech" versions of such types of resistance practices

can be very powerful in their direct counterveillance tactics, with the added bonus of being more

publicly accessible. Examples include Reflectacles Glasses which use infrared lens and frames to

generate a halo of light that obscures the face when observed by FRT-enabled cameras.[379] As

another example, the aforementioned CV Dazzle, inspired by WWI naval camouflage, is a set of

make-up and haircutting tutorials that utilize the tools of fashion in order to produce

individualized versions of the face that disrupts FRTs's detection mechanism.[380] Like strategies

of data pollution, CV Dazzle counters FRTs' reliance on deterministic templates of the face by

producing make-up and hair that is asymmetrically designed and augmented by contours that

make the face unfamiliar to the predetermined logics within FRTs. While the authors are careful

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[378] Simen Thys, Wiebe Van Ranst, and Toon Goedeme, "Fooling automated surveillance cameras: adversarial patches to attack person detection," arXiv.org, April 18th, 2019, https://arxiv.org/pdf/1904.08653.pdf.

[379] "Reflectacles," Urban Spectacles, n.d., https://www.reflectacles.com/#home

[380] Harvey, CV Dazzle, 2010.

to state that such tactics were designed for Haar Cascades, and not machine learning-enabled

FRTs, the website provides digestible and public-facing explanations about its limitations,

geared in particular to journalists, in a model of how to increase the critical biometric

consciousness.

As an installation and performance by micha cárdenas, Elle Mehrmand, Paul Mpagi

Sepuya, and Zach Blas, *Face Cages* (2014-16) connects the discussions of this section with the

following in how their sculptural pieces, meant to be worn, are both resistant to and mimicking

FRTs technical protocols in ways that reveal the political and representational protocols present

within the operation of such machine ensembles.[381] While the Face Cages deliberately obscure

the face of the wearer, therefore short circuiting FRTs, they do so in a way that dramatizes the

violence that biometric assemblages enact by way of mirroring the computational diagrams such

systems produce; in turn, "these cages exaggerate and perform the irreconcilability of the

biometric diagram with the materiality of the human face itself–and the violence that occurs

when the two are forced to coincide." Blas grounds his involvement in the project with further

writing into what he calls informational opacity: in resistance to imperialist versions of vision, an

individual should be able to remain obscure to the right to look and its authority, in order not to

be acted upon in ways that do violence to those individuals and populations. While such vision

takes place at the site of body, it also operates virtually, in the realm of information and data,

wherein, for example, opacity would resist the enrolment and circulation of facial data under

logics of technological control.[382] *Face Cages*, and their enacting of informational opacity, is a

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[381] Zach Blas. "Face Cages 2014-16." n.d. https://zachblas.info/works/face-cages/

[382] Zach Blas, "Opacities: An Introduction + Biometrics and Opacity: A Conversation," *Camera Obscura: Feminism, Culture, and Media Studies* 31, no. 2 (2016): 155-65. Blas expands on these ideas in: Zach Blas, "Informatic Opacity," in *Posthuman Glossary*, eds. Rosi Braidotti and Maria Hlavajova (New York: Bloomsbury Press, 2018), 198.

public-facing and deliberately provocative tangling of facial affect, materiality, and technological vision, that is simultaneously didactic and artistic. The fact that the sculptures hurt to be worn activates an affective base that brings forth a connection to those oppressed by way of biopolitical tactics like FRTs that then expands the countervisualities, and counter-discourses needed to dismantle and interrupt such circulations of power. Importantly too, their production as art objects allows them to expand beyond some of the more technically-minded tools discussed in this section into a wider public knowledge base.

Countervisualities Through Artwork

Artwork and research creation projects, like Blas's, are particular powerful forms of countervisualities and affirmative politics. Brian Holmes speaks powerfully to this notion, articulating how art can make visible and combat contemporary instances of biopolitical governmentality through affective localities.[383] Working in concert with the thinking of Michel De Certeau and Jacques Rancière, his questioning of the deterministically-inclined governmentality provides roadmaps towards collective and adaptive modes to remake biopolitical imaginaries such that they reflect relational lived and affective experiences. Such tactics leverage the chaotic self-organization of local communities into providing the capacity for coordinating location-specific affect that also re-productively gestures to the experiences and everyday life of those local communities. *Tactical Biopolitics: Art, Activism, and Technoscience* is a useful companion to Holmes's thinking: grounded in their understanding of Tactical Media, the editors Beatriz de Costa and Kavita Philip argue in their introduction that artwork holds the potential for "the inter- and '(un-)disciplinary' exchanges among practitioners and theorists from

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[383] Brian Holmes," Swarmachine: Activist Media Tomorrow," *Third Text* 22, no. 5 (2008): 527-533. See also: Brian Holmes," Artistic Autonomy and the Communication Society," T*hird Text* 18, no. 6 (2004): 547-555.

various backgrounds, [while] always privileging collaboration and coordination with larger strategy-based movements of resistance to hegemonic forces."[384] Artwork provides counterveillance opportunities, but, unlike many of the technical tools discussed previously, often target harmful truth regimes and political protocols more overtly.

Artistic production then is a terrific producer of a critical biometric consciousness because it holds the potential to bridge past histories into the contemporary moment in ways that are evocative and public facing. In this way, artistic production holds the great potential to bring the entanglements of individuals and communities into focus for a broad public while making the systems they are critiquing transparent and legible to that larger public. Further, such work offers greater understanding of the symbiotic workings of FRTs' triad of protocols and the ways in which affect and locality can provide foundational resistant materials.

In practice, such thinking can manifest in the form of longer documentary-minded projects, like *Coded Bias*, which highlights some of the most harmful applications of FRTs in ways that also relate how the technology is built and operates, in particular on those individuals and populations that have been rendered most vulnerable by protocols of difference.[385] It includes those like Jordan Harrod's collection of videos on YouTube that make AI and FRTs publicly understandable.[386] It also encompasses videoart such as Hito Stereyl's "How Not to Be Seen: A Fucking Didactic Educational .MOV File" which blends a history of militarized

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[384] Beatriz de Coasta and Kavita Philip. "Introduction." *Tactical Biopolitics: Art, Activism, and Technoscience.* Ed. Beatriz de Coasta and Kavita Philip (Cambridge: The MIT Press, 2008), xvii.

[385] *Coded Bias.* Dir. Shalini Kantayya. 7th Empire Media, 2020.

[386] Jordan Harrod. "Jordan Harrod - Algorithms - Artificial Intelligence - Technology." YouTube. https://www.youtube.com/c/JordanHarrod/featured

machine vision with a tongue-in-cheek tutorial on how to avoid such vision.[387] This form of

education is essential to, as the following section of this chapter will detail, effective policy and

regulation of technologies like FRTs, in that it gives powerful historical instances,

countervisuals, and affirmative politics from which to identify those most vulnerable to such

machine ensembles while also anticipating the future direction of developments of advanced

digital, AI-enabled technologies.

Establishing Countervisualities

　　While a full accounting of the artists who are provided the groundwork for contemporary

artworks in resistance to biometrics and FRTs is beyond this dissertation, it is worth briefly

mentioning the work of those like Lynn Hershmann Leeson, Jill Magid, Bill Viola, David

Rokeby and Nancy Burson. Hershmann Leeson's near life-long work exploring the

interpenetration of technology into the biological body through performance and multi-media

pieces has provided foundational thinking for resistant practices.[388] Jill Magid's work can be

placed within other artists working with CCTV footage and apparatuses in ways that make such

systems, and their logics, visible; Magid's work is particular effective at adding affective

narrative and humour into her critique.[389] Likewise, David Rokeby, in pieces such as *Gathering*

(2004), *Sorting Daemon* (2003), and *Taken* (2002), challenges the audience to reconsider

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[387] Hito Stereyl. "How Not to Be Seen: A Fucking Didactic Educational .MOV File." Artforum. 2013. n.d. https://www.artforum.com/video/hito-steyerl-how-not-to-be-seen-a-fucking-didactic-educational-mov-file-2013-51651

[388] There are many pieces worth referencing from Hershmann Leeson's catalogue but pieces like *DiNA. Artificial Intelligent Agent Installation* (2004) is instructive in its use of large scale facial animation, AI, and interactivity.

[389] I was considering Magid's early work like *Surveillance Shoe* (2006) and *Lobby 7* (1999) as examples. Jill Magid, "Surveillance Shoe," n.d., http://www.jillmagid.com/projects/surveillance-shoe-2; Jill Magid, "Lobby 7," n.d., http://www.jillmagid.com/projects/lobby-7-2.

themselves within the ever-present surveillant gaze of technologies like FRTs and the ways that

their visibility within such assemblages acts in overt and unseen manners.[390]

More specific to the face, Bill Viola's capturing of extreme emotional states in close-up

of the face expresses the power of Epstein's photogénie in ways that maintain the lived body's

affective and relational nature.[391] Likewise, Nancy Burson's work, in particular *Human Race*

Machine (2000), harnesses digital computing to morph and blend faces in ways that recall

Galton's composite photos, but that, instead, challenge the audience member to think through the

relationship between stereotypes of beauty, race, and computational logics at the site of the

face.[392]

While obviously not a comprehensive list, these artists show how interventions into FRTs

must take multiple forms and deploy a myriad of materials and performances. Further, as there is

no single solution to the negative potentials of FRTs, multiple artworks and artists can take up

different problems within the technology and, when taken as a constellation, provide many

vectors capable of effective resistant practices to the radicalizing and gendering automated vision

that FRTs can provide.

Art projects targeting AI and FRTs produced within the last decade therefore owe a great

debt to the generations before as they provide countervisualities from which to address the

specific mechanics and damages of technologies like FRTs. Artwork making visible the logics of

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[390] David Rokeby, "Gathering (2004)," n.d., http://www.davidrokeby.com/gathering.html; David Rokeby, "Sorting Daemon (2003)," n.d., http://www.davidrokeby.com/sorting.html; David Rokeby, "Taken (2002)," n.d., http://www.davidrokeby.com/taken.html.

[391] I was considering *The Sleepers* (1992), *Reverse Television* (1983), and *The Quintet Series* (2000) as examples of Viola's work that focus on the face, its minute mechanics, and its relationships to consciousness, observation, and thinking.

[392] Nancy Burson, "Human Race Machine," n.d., https://www.nancyburson.com/p/human-race-machine.

image database constructions and their use within machine learning and AI models are an important aspect of raising the critical biometric consciousness. Anna Riddler's *(Myriad) Tulips* (2018) generates an image dataset of tulips in order to "[draw] attention to the skill, labour and time that goes into constructing it, whilst also helping to expose the human element in machine learning, usually hidden by algorithmic processes."[393] The choice of tulips is a gesture to Ronald Fisher's iris dataset, and his influential statistical understanding of categorization and hierarchization within species; Riddler explains how this choice reflects how such understandings were a reflection of Fisher's belief in eugenics. This dataset was then used to train the GAN model used in her *Mosaic Virus 2018* and *Mosaic Virus 2019,* which generates morphing images of tulips that change in response to data drawn from financial markets. Riddler's work expertly connects the vectors of Empire present within machine learning and AI, wherein corporate and state power intersects with discourses centred upon difference, race, and gender that are deeply resonate within systems such as FRTs.[394]

Speaking more directly to FRTs, Memo Akten's "Learning to See" series includes pieces such as "Learning to See: Hello World" (2017) and "Dirty Data" (2017) with the over-arching goal of making computer vision's construction transparent to a larger public. Accompanied by short, digestible videos, the works use machine learning techniques, such as GANs, in order to show not just how automated vision is formed, but how that vision is affected by its data practices.[395] This is most clear in "Dirty Data": the project highlights the practice of removing "dirty" data, those images deemed not of a high enough quality, from databases, wherein GANs

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[393] Anna Ridler, "Myriad (Tulips), 2018," n.d., para. 1, http://annaridler.com/myriad-tulips.

[394] Anna Ridler, "Mosaic Virus, 2019," n.d., http://annaridler.com/mosaic-virus.

[395] Memo Akten, "Learning to see: Gloomy Sunday," n.d., https://www.memo.tv/works/learning-to-see/; Memo Akten, "Dirty Data (2017)," n.d., https://www.memo.tv/works/dirty-data/.

trained on the removed dirty data generate photos that reproduce the visual elements of the original dirty data. Such pieces show the role of not just broad data categorization (i.e. dirty and not dirty) but also how raw data is cooked by sanitizing strategies such as cropping, filtering, and re-aligning. That Akten uses dirty data taken from databases of right-wing politician's images, such as Donald Trump and Marine Le Pen, links the distorted images produced by the GANs to the exclusive and warping political protocols of such political figures.

By comparison, Trevor Paglen's varied work operates as a combination of media archeology and intervention into protocols of the technology by making its inner logics, including its facial databases, understandable to a broader public. Paglen's works aim to pull the machine-to-machine circulations of images from their black-box technologies into the light of public discourse. Recalling Chapter 4, his piece *It Began as a Military Experiment* (2017) reproduces ten photos from the FERET database and reframes them as acts of portraiture, in effect showing the types of faces within the datasets and the visual languages of capturing and processing the face present in the technology's representational protocols; its title references how the civilian volunteers captured in the database are instrumentalized as military materials that are then repurposed into wider assemblages of mass automated vision.[396] A complete cataloguing of Paglen's work is unnecessary, but it is worth highlighting *Fanon (Even the Dead Are Not Safe) Eigenface* (2017), *Machine Readable Hito* (2017) and *They Took The Faces From The Accused And The Dead . . . (SD18)* (2019).[397] Like *It Began…, They Took The Faces…* re-visualizes the faces within the SD18 mugshot database created by the American National Institute for

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[396] Trevor Paglen, *It Began as a Military Experiment,* MoMA, n.d., https://www.moma.org/collection/works/275173.

[397] Trevor Paglen, "Fanon," n.d., https://paglen.studio/2020/04/09/fanon/; Trevor Paglen, *Machine Readable Hito*, 2017, adhesive wall material, 193 x 55 1/8 inches, 490.2 x 140 cm; Trevor Paglen, "They Took the Faces from the Accused and the Dead . . .(SD18)," 2020, 3,240 silver gelatin prints and pins; dimensions variable.

Standards and Technology (NIST); Paglen obscures the faces in the black and white photos, but leaves enough affective material in the photos to show the ways that those labelled criminal are repurposed as materials for advanced technologies like FRTs. His pieces utilize a media archaeological approach in unearthing the often hidden histories, images, and image-making within FRTs and bringing them into contemporary concerns around privacy, data practices, and difference within AI's and FRTs' representational protocols. *Fanon…* and his own self-portrait produced by the same technique (2017), utilizes the technical protocols of eigenfaces, as discussed in Chapters 2 and 4, to produce machine-vision include visualizations of Franz Fanon's face, resulting in a ghostly, shimmering portrait that makes visible the machine logics that generate approximate portraits of those under its observation. *Machine Readable Hito* is much like Riddler's work, in that it makes transparent the hierarchical categorization that is central to FRTs training and operation; the cataloguing of artist Hito Steryl's emotions that are then annotated in similarly fashions as FRTs databases is at once playful and powerfully demonstrative, showcasing the subjective logics that work under protocols of difference to make automated decisions from the image materials of its observation.

Paglen's collaboration with scholar Kate Crawford is, however, an illuminating illustration of the power and limits of critical artmaking. The two produced an interactive web piece titled "ImageNet Roulette" which allowed users to upload images and compare them to the massive ImageSet dataset, wherein the audience would be able to see both the objects, and sometimes humans, detected within the photo along with the data category that ImageNet attached to such an object.[398] Drawing from instances such as Google's image recognition

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[398] The project has since been taken down by information on the piece can be found in: Naomi Rea, "How ImageNet Roulette, an Art Project That Went Viral by Exposing Facial Recognition's Biases, Is Changing People's Minds About AI," *ArtNet,* Sept. 23th, 2019, https://news.artnet.com/art-world/imagenet-roulette-trevor-paglen-kate-crawford-1658305

software identifying black individuals within photos as "gorillas," ImageNet Roulette surfaced the often biased and nonsensical labelling within image databases that often remain dangerously invisible to the average user, whose classification threatens to cascade into the automated decision-making that the technologies are then tasked with.[399] The accompanying essay "Excavating AI" is an artful media archeology of such data practices, complete with articulations of the histories and dangers of such practices.[400]

While a dense and in many ways invaluable research creation project, their inclusion of portraits from facial datasets in the essay and the exhibitions "Training Humans" and "Making Faces," namely a number of faces of Japanese women taken from the JAFFE dataset, drew scrutiny. In reaction, Michael J. Lyons, one of the original researchers who produced the JAFFE dataset, published "Excavating 'Excavating AI': The Elephant in the Gallery" which argued that Paglen and Crawford had broken the consent agreements agreed to by the participants and researchers by showing the work publicly, in turn replicating many of the practices that the two set out to critique.[401] Lyons's critique exposes the need for an understanding that acknowledges the right to look embedded within facial datasets, wherein the reproduction of the images, regardless of the purpose of that reproduction, threatens to recirculate and reaffirm that right to look and its authority. It important then that interventions value the local and affective body within the networks that produce images that are folded into facial databases, especially when

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[399] "Google apologises for Photos app's racist blunder," BBC News, July 1, 2015, https://www.bbc.com/news/technology-33347866

[400] Kate Crawford and Trevor Paglen, "Excavating AI: The Politics of Training Sets for Machine Learning," September 19th, 2019, https://excavating.ai.

[401] Michael J. Lyons, "Excavating "Excavating AI": The Elephant in the Gallery," arXiv.org, December 24th, 2020, https://arxiv.org/pdf/2009.01215.pdf. The facial data from the JAFFE dataset has since been removed from the "Evacuating AI" essay. This example has been very illustrative for my own research creation work in FRTs, and I have used it in speaking to using and researching mugshots in presentations such as: "Working or Not Working with Problematic Data: The Right to Look and the Forming of Political Subjects within Facial Databases," Critical Digital Humanities Initiative, University of Toronto, September, 2022.

image-making is saturated with representational protocols of difference and political protocols operating under top-down power, such as within mugshot databases like SD18. In fact, incorporating the audience's own body into such a network is an effective strategy to produce and expand a critical biometric consciousness, while still going forward in a way that preserves the dignity and equity of those captured by a FRT.

The Complicit Audience

Adam Harvey's piece *Megapixel* asks that audience members make their own faces visible to an FRT in order to understand how data enrolment and facial databases are built in the contemporary moment.[402] After the audience member's face is photographed, it is compared to all the faces within the massive facial database MegaFace (V2) to see whether their face is in fact in said database.[403] Doing so draws attention to how MegaFace, and databases of the like, are built from the conflation of consent, unknowing consent, and coercion: MegaFace is drawn from photos users have labelled as Creative Commons from Flickr. Drawing from truth regimes that see such facial data as neutral, MegaFace vacuums up whole populations of faces without their express consent. Harvey's work then draws attention to such data practices, questioning not only MegaFace's construction but the construction of every facial database and the provenance of the facial data within. That the audience is left to wonder if they themselves are in the database, or any of the thousands of other similar databases, is a powerful outcome of the piece and highlights the forms of bottom-up subjectification present in FRTs' circulations of power that have been discussed through the whole of this dissertation.

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[402] Adam Harvey, "MegaPixels," n.d., https://ahprojects.com/megapixels-glassroom/.

[403] "MegaFace and MF2: Million-Scale Face Recognition," University of Washington, 2015, http://megaface.cs.washington.edu/.

Like Megapixel, Kyle MacDonald's *Sharing Faces* (2014) relies upon the audiences in

Anyang, Korea and Yamaguchi, Japan to cooperate with an FRT, after which their faces would

be matched, across distances, with those in the sister location.[404] Such a repurposing of a FRT is

less about exposing the damages potentially inscribed into the technology's automated vision and

more about recapturing Lévinas's understanding of affect and responsibility within the face.

Taking MegaPixel and Sharing Faces together, the works activate the audience's own body, its

affect and potential sympathy, within a FRT in ways that implicate the audience within the

technology's workings. While this gives rise to the audience imagining how it might feel to be

acted upon by FRTs' dangerous forms of vision, it also demands an acknowledging of another

person, at the site of the face, that they are also an affective, local, and indeterminate human.

Shu Lea Cheang's *3x3x6* (2019) is a more complex in its treatment of the audience's

body and the ways in which the contemporary body is under observation from a myriad of

crosscutting algorithmic systems. When audience members enter into the multi-media exhibition,

their bodies and faces are scanned in ways that recall "the legal and visual regimes that have

formed sexual and gender norms over time"; these scans produce images that are later morphed

away from their original data materials where "gender and racial morphing become queer digital

strategies to disrupt the tradition of colonial and anthropometric identification techniques."[405]

The title of the piece, in echoing the standard measurements of a prison cell, underlines that

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[404] Video documentation of the piece can be found at: Kyle McDonald, "Sharing Faces," n.d., https://vimeo.com/96549043. McDonald has also created a video game, FaceWork, that utilizes FRTs to match users to an occupation in the gig economy. ("FaceWork," n.d., https://facework.app/) and has written powerfully on the use of facial data in research in spaces such as: Kyle McDonald. "Against Face Analysis," *Medium*, October 6th, 2020, https://kcimc.medium.com/against-face-analysis-55066903535b

[405] Taipei Fine Arts Museum, "Shu Lea Cheang's *3x3x6* at the 2019 Venice Biennale Examines Imprisonment in the New Digital Age," *Hyper Allergic*, May 9th, 2019, https://hyperallergic.com/498703/shu-lea-cheangs-3x3x6-2019-venice-biennale-examines-imprisonment-new-digital-age/. There is video documenting the piece at: VernissageTV, "Shu Lea Cheang: 3x3x6 / Taiwan in Venice 2019 / Venice Art Biennale 2019," YouTube, May 23, 2019, https://www.youtube.com/watch?v=MUvqYPKekls.

despite the potential power in changing one's facial data, there are larger systems acting as constraining and ever-present assemblages watching, recording, and acting in which each person is implicated. The foregrounding of biometrics' and FRTs' political protocols is closer to Face Cage's violent treatment of the body and face, effectively drawing out the histories and contemporary powers and discourses operating under harmful logics of difference and thrusting them upon the audience. This demand for empathy resonates, while also providing, through its morphing, potential future paths towards disrupting such vision and its image-making.

Lastly, Rafael Lozano-Hemmer's *Level of Confidence* (2015) pulls together many of the strategies and tactics present within the artworks discussed in this chapter.[406] Lozano-Hemmer has long produced works about the surveilling and transformative observation of biometrics, in pieces such as *Bilateral Time Slicer* (2016), *Redundant Assembly* (2015), *Zoom Pavilion* (2015), and *Pulse Index* (2011) but *Level of Confidence* is worth more attention here[407]. At the core of the piece, an audience member stands in front of a FRT-enabled camera; after their image is captured they are matched to one of the 43 faces belonging to an abducted and presumed murdered student from the Ayotzinapa normalista school in Iguala, Guerrero, Mexico. The two faces are put side-by-side and the audience member is confronted with their connection to the missing student, and their own responsibility to that student. The piece is strengthened by its use of Eigen, Fisher, and LBPH algorithms, typically used for military and policing purposes, wherein the probabilistic logics of FRTs are used to best "match" faces, knowing full well that the two faces will, superficially, likely have little in common. While there are tensions present in

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[406] Rafael Lozano-Hemmer, "Level of Confidence," n.d., https://lozano-hemmer.com/level_of_confidence.php

[407] Rafael Lozano-Hemmer, "Bilateral Time Slicer," n.d., https://www.lozano-hemmer.com/bilateral_time_slicer.php; Rafael Lozano-Hemmer, "Redundant Assembly," n.d., https://www.lozano-hemmer.com/redundant_assembly.php; Rafael Lozano-Hemmer, "Zoom Pavilion," n.d., https://www.lozano-hemmer.com/zoom_pavilion.php

the images of the students that are similar to those used by Paglan and Crawford, Lozano-Hemmer's inclusion of the audience within the piece draws that face and the missing students' faces together, moving them from a lab subject or a portrait from a global news item, into a space closer to the affective body of the audience member. The introduction of this dynamism, rather than just the reproduction of the images of themselves, give them a fluidity that grants them more of an indeterminate performance than images simply pulled from facial databases.

Importantly, the project's software is freely available so that other spaces can set up the piece wherever they may be. While one could replicate the exact piece, the availability of the source code by way of Github makes the piece flexible to the inclusion of other facial databases.[408] Again, doing so would need to acknowledge the right to look within that facial data, and likely not use such materials. However, *Levels of Confidence*'s adaptability to the local interests of specific communities is an effective counter-tactic, encouraging the complex production of entangled networks of individuals, populations, technology, and images that question and dismantle the deterministic logics and confidences within FRTs.

Principles and Policies Behind Designing and FRTs

Tools and artwork are essential to generating an informed public while raising urgent concerns surrounding the use of FRTs and granting potential countervisual tactics. While such bottom-up forms of resistance are powerful, the potential for top-down domination, in particular in conflating coercion and consent within asymmetrical instances of political recognition, demands the addition of top-down forces in opposition, potentially in the form of governmental and corporate policy that ensures consistent and transparent regulating and auditing of FRTs.

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[408] Antimodular, "Level of Confidence," GitHub, November 4th, 2020, https://github.com/antimodular/Level-of-Confidence

These acts of policy would ensure, again, that the general public better understands the limits of technologies like FRTs and are protected from their harmful effects while promoting greater responsibility around the technology's use.

While abolishing the technology in use cases such as law enforcement and immigration and refugee monitoring makes a tremendous amount of sense, the reality is that whole-scale banning of FRTs would be incredibly difficult given its extreme ubiquity in the daily lives of citizens and non-citizens alike. However, it is extremely important to still advocate for abolishment and imagine worlds in which harmful production and deployment of technologies are completely absent. While pushing for abolishment, there must also be policy that address the populations beyond those overtly acted upon in top-down forms of power and domination, wherein FRTs expansive automated field of vision manage social mobility and other forms of citizenship resources in subtle and often invisible ways.

Effective policy must address both design and implementation: as this dissertation has demonstrated, while the deployment of FRTs is the most overt element to critique, the ways in which its protocols are inscribed within its design and computer science are perpetuated through generations of the technology has to be surfaced and resisted. In this way, Abeba Birhane's proposed relational ethics approach to machine learning (ML), and technologies like FRTs that rely upon ML, one that acts upon a shift from "rational to relational - in thinking about personhood, data, justice and everything in between, and places ethics as something above and beyond technical solutions."[409] Doing so then depends on understanding technologies within their histories and contexts in ways that activate wisdom, rather than knowledge, which is

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[409] Abeba Birhane, "Algorithmic injustice: a relational ethics approach," *Patterns* 2 (2021): 1-9.

"ground in concrete lived experience."[410] This contextualizing centres disproportionally

impacted individuals and populations, wherein technologies, like FRTs, must be moved from

logics of prediction to those of empathy and understanding in both their design and deployment.

Doing so questions the patterns and results that technologies surface and the ways in which those

patterns, norms, and historical structures are themselves often inscribed in those technologies.

There have been key governmental interventions into biometrics and FRTs in the U.S.A.:

the Biometric Information Privacy Laws passed by individual states, beginning with Illinois in

2008, was an important step, but also highlighted the fact that there are no federal laws managing

technologies like FRTs despite the introduction, and stalling, of the Commercial Facial

Recognition Privacy Act of 2019, the Facial Recognition Technology Warrant Act of 2019 and

the No Biometric Barriers to Housing Act of 2019[411]; further, when laws are passed at state

levels they take the form of privacy laws, consumer protection laws, and local mandates banning

the police use of FRTs in San Fransisco and Boston[412]. While there are specific provincial laws

in place within Canada, the national Personal Information Protection and Electronic Documents

Act (PIPEDA), last updated in 2019, is a positive start for larger-scope legislation. However, its

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[410] Ibid., 4.

[411] 740 ILCS 14. Illinois State Legislature, *Biometric Information Privacy Act*, October 3rd, 2008, https://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=3004&ChapterID=57; S.847 Commerce, Science, and Transportation, *Commercial Facial Recognition Privacy Act of 2019,* 116th Congress, Introduced March 14th, 2019, https://www.congress.gov/bill/116th-congress/senate-bill/847. S.2878 U.S. Senate - Judiciary, *Facial Recognition Technology Warrant Act of 2019,* 116th Congress, Introduced November 14th, 2019, https://www.congress.gov/bill/116th-congress/senate-bill/2878; H.R.4008 House - Financial Services, *No Biometric Barriers to Housing Act of 2019,* 116th Congress, Introduced November 21st, 2019, https://www.congress.gov/bill/116th-congress/house-bill/4008/text?r=11&s=1.

[412] Kate Conger, Richard Fausset and Serge F. Kovaleski, "San Francisco Bans Facial Recognition Technology," *The New York Times,* May 14th, 2019, https://www.nytimes.com/2019/05/14/us/facial-recognition-ban-san-francisco.html; Ally Jarmanning, "Boston Lawmakers Vote To Ban Use Of Facial Recognition Technology By The City," NPR News, June 24th, 2020, https://www.npr.org/sections/live-updates-protests-for-racial-justice/2020/06/24/883107627/boston-lawmakers-vote-to-ban-use-of-facial-recognition-technology-by-the-city

focus on private sector regulation leaves out the melding of national-corporate power present within Empire and international governmentality.[413] It is also worth noting the non-binding corporation-driven set of initiatives, such as Microsoft's Office of Responsible AI (ORA).[414] Asking corporations to voluntarily opt-in and police themselves presents obvious problems and is an ineffective long-term solution. The slow moving and often unwieldy form of government regulation requires that there must also be more nimble practices, which have begun to manifest in systems of iterative and flexible white papers as well as activist groups generating pressure on governmental and corporate bodies to be more transparent and responsible in their building and deploying of FRTs.

The Design Justice Network (DJN), and Sasha Costanza-Chock's Book *Design Justice* and their essay "Design Justice, A.I., and Escape from the Matrix of Domination," are key examples in which developing empathetic and equity-based principles in designing biometrics like FRTs is achievable and urgent.[415] Focusing on community-led practices, the DJN shows how a mix of technical expertise and tools can be mixed with local concerns, lived experiences, and activism to create versions of technologies that are sustain, heal, and empower communities. DJN outlines their principles on their website, harnessing much of the creativity discussed in this

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[413] S.C. 2000. Senate and House of Commons of Canada, *Personal Information Protection and Electronic Documents Act,* Introduced April 13th, 2000, Last amended June 21, 2019, https://laws-lois.justice.gc.ca/PDF/P-8.6.pdf. On February 2, 2020, the Office of the Privacy Commissioner of Canada completed a set of further recommendations about FRTs in Canada, aimed specifically at Clearview AI. Joint investigation of Clearview AI, Inc. by the Office of the Privacy Commissioner of Canada, the Commission d'accès à l'information du Québec, the Information and Privacy Commissioner for British Columbia, and the Information Privacy Commissioner of Alberta, 2021 CanLII 9227 (PCC), https://canlii.ca/t/jd55x. In Canadian regulatory history, what little work on FRTs have usually fallen under regulating AI, which has, at various times, fallen to: the Department of Communications; the Office of the Privacy Commissioner of Canada; and the Canadian Radio-Television Telecommunications Commission.

[414] "Responsible AI," Microsoft, n.d., https://www.microsoft.com/en-us/ai/responsible-ai?activetab=pivot1%3aprimaryr6.

[415] Sasha Costanza-Chock, *Design Justice,* (Cambridge: MIT Press, 2020); Sasha Costanza-Chock, "Design Justice, A.I., and Escape from the Matrix of Domination," *Journal of Design and Science,* July 16th, 2018, https://jods.mitpress.mit.edu/pub/costanza-chock/release/4.

chapter's previous section, to foreground those individuals and populations most impacted by the deployment of technologies within the design of such technologies. Within such dynamics, the designer acts as facilitator rather than expert, who co-creates and guides within the dense networks of communities and their technologies, in turn sharing the knowledge that they gain with those communities. Costanza-Chock champions the DJN in their book, further advocating for participatory action research and co-design, both of which depend on pedagogical undertakings into design that operate under shared inquiry. Doing so defuses the myth of the single expert designer and instead re-situates the the act of design as one that is communal, intersectional, and responsible to those individuals and populations under its operation. At the same time, the de-centering of authority within the design of a technology like FRTs allows space for co-design and those populations most effected to be actively involved in the development of the technology. Such actions are core to building the grounds of a critical biometric consciousness and countervisualities, wherein knowledge about the three protocols of FRTs are available to everyone and where technical knowledge, in particular, does not provide a barrier for understanding how FRTs might act to promote relational and local networks of technological and biological materials and performances.

Such concerns and principles are expanded by work like that found within the position paper "Indigenous Protocol and Artificial Intelligence" published by the Indigenous Protocol and Artificial Intelligence Working Group.[416] Collecting up a number of essays from a variety of Indigenous perspectives, the paper foregrounds a range of ideas centred on designing AI-enabled technologies in favour of relational paradigms that enforce a sustainable network of biological and technological entities that is rooted in mutual respected and aid. This dissertation's

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[416] Indigenous Protocol and Artificial Intelligence Working Group, Indigenous Protocol and Artificial Intelligence, January 30th, 2020, https://spectrum.library.concordia.ca/986506/7/Indigenous_Protocol_and_AI_2020.pdf

understanding of protocols, outlined in the introduction and Chapter 2, is expanded by the working group: protocols, as repeated actions acting as rights, rituals and customs, exemplify a custodial ethics where customs, lores, and behaviour "guide the observance of traditional knowledge and practices, including how traditional knowledge is used, recorded and disseminated."[417] The resultant Indigenous kinship protocols values relationality and empathy that, when inscribed into AI-enabled technologies like FRTs, "honestly recognize the cultural presuppositions we are encoding, to consciously shape those protocols in directions that will be of benefit to our communities, and to evaluate clearly what kind of relationships we are materializing into the world."[418] This understanding of protocols is particularly effective at exposing and combatting the harmful political protocols that structure a FRT's operative moment, where asymmetrical power under infrastructuralism can be eroded by repeated acts of mutuality and kinship, and where knowledge goes well past technical expertise and instead incorporates in land, nature, people, and technology in forms that are upholds entangled lived experiences over technical solutions. Inscribing these powerful protocols into technologies like FRTs activates the dense networks of entities that are included in a FRT in manners that do not efface affect, but rather empathetically connect those within the network.

    As solutions to FRTs must be combinational, design principles can work alongside groups such as Data 4 Black Lives (D4BL), founded by Yeshimabeit Milner, who focus more specifically on the racializing data practices that are inscribed within the design and operation of technologies such as FRTs. Like the DJN, it works with a de-centralized structure of power, wherein a number of different nodes within its network work to harness "statistical modelling,

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[417] Ibid., 7.

[418] Ibid., 8.

data visualization, and crowd-sourcing, in the right hands, [as] powerful instruments for fighting

bias, building progressive movements, and promoting civic engagement."[419] The D4BL produces

coding work and design and hosts it on their Github while also organizing a series of talks,

workshops, and conferences that give much-needed education and clarity to the historical and

contemporary instances of technologies, like FRTs, targeting black populations. In addition, their

Policy Working Group aims to turn the energy of activists and scholars into actionable programs

that can best address the long history of racialized populations within biometrics and instead

foreground the need to ground regulatory responses in local concerns and alternate forms of data

governance.

D4BL's production of policy alongside critical tools and scholarship, in particular policy

that address specific communities' and populations' needs, is crucial to successfully intervening

into FRTs; local groups and actors must clearly make their arguments to forms of top-down

structures, such as governmental and corporate entities, in order to bring systemic change. This

makes the work by entities like AI Now Institute (AII) at New York University and the

previously mentioned Citizen Lab at the University of Toronto, Canada, as well as white papers

such as "Facial Recognition Technologies in the Wild: A Call for a Federal Office," essential.

AII strives to provide policy and public facing research in the areas of AI and "rights and

liberties, labor and automation, bias and inclusion, and safety and critical infrastructure."[420] A

core portion of their mission is their policy work which "is focused on creating legal and policy

resources helpful to advocates, governments, and others with a stake in AI's development and

use."[421] Their series of papers focuses on how best to foster accountability and responsibility

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[419] "About," Data for Black Lives, n.d., para. 2, https://d4bl.org/about.html.

[420] "About," AI Now Institute, n.d., para. 7, https://ainowinstitute.org/about.html.

[421] "Policy," AI Now Institute, n.d., para. 1, https://ainowinstitute.org/policy.html.

under Empire, where government, public sector, and corporate entities often meld; doing so means mapping past policy precedents and future paths within the existing legalistic frameworks so that regulation and transparency of AI-enabled systems, like FRTs, can occur at multiple regulatory levels. Likewise, The Citizen Lab offers a mix of methodological approaches aimed at making visible the strongest and most effective policy that can emerge from their investigating and documenting of digital espionage, digital free speech filtering, attacks on privacy and security. Doing so advocates for "examining transparency and accountability mechanisms relevant to the relationship between corporations and state agencies regarding personal data and other surveillance activities."[422] This dissertation has repeatedly referenced the work of Citizen Lab authors Petra Molnar and Lex Gill, who write powerfully on the impact of FRTs and other automated decision making technologies within refugee and immigration processes. These examples showcase the powerful local investigations being done that then are framed as the urgent ground from which policy to combat these instances is needed; the suggested policies within the reports then directly addresses the gaps within existing laws and practices and provides powerful connections between the needs of targeted communities and the levers of power that are needed to be moved in order to re-center the affective lived experiences of those disproportionally effected. The focus on citizenship and immigration and refugee procedures extends the same logics and resistance present in previous policy aimed at domestic policing and FRTs.

Within an American context "Facial Recognition Technologies in the Wild: A Call for a Federal Office," co-sponsored by the Algorithmic Justice League (AJL) with its head, the previously mentioned Joy Buolamwini, as co-author, is an exemplary instance of white papers

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[422] "About," The Citizen Lab, n.d., para. 2, https://citizenlab.ca/about/.

that are both practical and future-facing.[423] The AJL's inclusion echoes much of this chapter's

advocacy: the AJL works locally and in bottom-up community based ways to empower citizens

to know more about the harmful functions of FRTs while pushing for those same communities

and corporations to take The Safe Face Pledge and publicly commit to reducing the abuse of

FRTs.[424] The white paper advocates for a specific governmental office dedicated to monitoring

and regulating tools of algorithmic governance; unlike the current systems of scattered, uneven,

and out-dated legislation drawing from many different types of systems of governance

tangentially related to biometrics, a dedicated office would be best able to match the constantly

shifting landscape of FRT and AI development, working to hierarchize FRTs based on the risk

they pose to those under its gaze and use such a framework to assert greater control over the

commercialization and scientific applications of the technology. Such an office would ideally

ensure the building of more equitable facial datasets; enforce unified testing standards; advocate

for continued privacy protection legislation; and push for the abolishment of certain uses of

FRTs that disproportionately impact certain populations negatively. Providing a centralized

office capable of coordinating these concerns is essential: using the US Food and Drug

Administration as an example, the authors argue that an office that can address the whole FRT

ecosystem must be established in order to raise public critical biometric consciousness while

controlling the most harmful applications. As the paper states, principles alone are not enough:

the speed of change within the technology, combined with FRTs' obsessions with technical

improvements over ethical applications, mean that there needs to be stronger over-arching

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[423] Erik Learned-Miller, Vicente Ordóñez, Jamie Morgenstern, and Joy Buolamwini, *Facial Recognition Technologies in the Wild: A Call for a Federal Office,* Algorithmic Justice League, May 29th, 2020, https://people.cs.umass.edu/~elm/papers/FRTintheWild.pdf.

[424] The Safe Face Pledge has since been discontinued by information on the program can be found at: "Safe Face Pledge." Algorithmic Justice League and the Center on Privacy & Technology at Georgetown Law. Feb 2021. https://www.safefacepledge.org/

methodologies for evaluating, auditing, and restricting the technology. In combination with local measures and mandates targeting the specific local needs and affects of communities, such a dedicated office would provide a potentially powerful hub of oversight, information, tools, and strategies to build a critical biometric consciousness and the needed countervisuals to intervene effectively into FRTs.

Advocating for Critical Posthumanism

The preceding examples of counter-tactics to FRTs' symbiotic protocols are as varied and flexible as the technology it is resisting, and carry principles of critical posthumanism that can provide frameworks for resisting the inevitable improvements of FRTs. In particular, critical postuhmanism's foregrounding of indeterminacy and affect at the site of the body grants powerful philosophical materials that can be combined with software, hardware, other bodies and agents, in ways that will continue to be flexible and adaptable to the future of FRTs.

Barad, Entanglement, and Inter-actions

Karen Barad's grounding in Quantum field theory (Qft) and the prior writings of Niels Bohr, provide the backbone from which she champions the inherent instability of the body in relation to itself and the world.[425] Her thinking makes clear the limits of observation and knowledge within traditional scientific discourses, in particular as it relates to representationalism, defined as the notion that the world must be able to be represented in some objective form in order for it to be scientifically "true". It is essential, therefore, to challenge the production of representations in fields such as computer science and computer vision as she

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[425] Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham: Duke University Press, 2007).

argues that any form of knowledge must be understood as a performance of inseparable

discursive practices and materiality that draw from both the physical world and intersecting

political vectors that she calls materialization. She therefore advocates for the study of entangled

phenomena, rather than representations, in causal relationships that she calls agential realism.

Such an approach does not allow for the pure exterior objectivity that generates determinate

boundaries and categories that self-perpetuating forces of governmentality desire; instead there is

an "inseparability of 'observed object' and 'agencies of observation'" that are defined by their

intra-actions.[426]

Within the paradigm that Barad outlines, observation is never an exterior act, but rather

one implicated in the inter-actions and causal entangled phenomena one wishes to observe. Such

thinking works in direct opposition to FRTs' biopolitical vision, and its reliance on

representations and deterministic states that she says defines technoscientific relationships.

Instead, the agency and entanglement of materialization can be understood as the indeterminate

affect and locality produced by the body in relation to the world which can be harnessed in

resistance to the desires for uniformity and stability found within biopolitics and

governmentality.

The Indeterminacy of Affect and Disruptive Relationality

Within the fluctuating game of contemporary international governmentality, biopolitical

tactics and strategies operate to make themselves appear natural, stable, and determined through:

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[426] Karen Barad, "Posthumanist Performativity: Toward an Understanding of how Matter Comes to Matter," *Signs: Journal of Women in Culture and Society* 28, no. 3 (2003): 814. Importantly, such entangled relations between materials can not be frozen in a single state as the constant flux of interacting networks is never static. As such, Barad argues, we should begin to think of "human" and nonhuman" bodies collections of performances that are ongoing, iterative, and fluctuating combinations of both materials and truth regimes.

predicative algorithms that categorize populations and individuals; an overabundance of hierarchical statistics; as well as risk-driven policies, tactics and strategies of security. In turn, such power is rationalized and executed by marginalizing and/or eliminating entities that are chaotic and indeterminate, and whose relational and networked relationships do not fit within the deterministic, predictive, and categorizing logics of a self-perpetuating governmentality.

In contrast, affect, as informational and self-organizing via quantum indeterminacy, permeates all matter and blurs the distinctions between living and non-living beings. It is at these sites of quantum indeterminacy, which network in relationally and specific corporeal (potentially alternate) frameworks, where activists and artists might begin to establish possible strategies and tactics that, within the flux and game of governmentality itself, grant tools and resistance against the damaging aspects of biopolitical and necropolitical assemblages. Further principles for such a framework can be found in Brian Massumi's *The Politics of Affect* where he explains that, at a very basic level, understanding what he calls affective politics makes transparent instances of larger forms of governmentality; affective politics means breaking away from "linear cause-effect" constructions of affect and rationales, and instead embracing nonlinear modulations of flows of affect that are also always incomplete/in-progress.[427] This overlaps with critical disabilities theorists such as David Mitchell and S. Synder's *The Biopolitics of Disability,* who argue for the value of the "leaky and lively materiality" of disability. From this thinking, disability and diverse embodiments are "active switchpoints" that inhabit messy and dynamic

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[427] Brian Massumi, *Politics of Affect* (Cambridge: Polity, 2015). Like Barad, Massumi advocates for an understanding of the world as a procedural flux full of affective intensities wherein affect is inherently reciprocal. The arising politics is "dissensual" in that it holds multiple contrasting alternatives in conversation without hierarchy or primacy of one over the other, accepting life, at the scale of the individual and the population, as a flow of complex situations and networks of indeterminacy.

spaces that resist the superficially deterministic social controls (and identities, security, discipline) of neoliberal normativity and governmentality.[428]

Likewise, focusing on affect and relationality potentially resists settler colonial logics: in René Dietrich's "The Biopolitical Logics of Settler Colonialsm and Disruptive Relationality," builds on the valuing of leaky and lively materiality when the author proposes an alternative to settler colonial biopolitical systems which she calls "disruptive relationality" which she defines as "centering principles of relationality [so that those principles] exceed what officially gets to count as political in settler colonial contexts."[429] Dietrich's call for an incorporation of relationality folds perfectly into the last decade's most effective responses to contemporary biopolitics and governmentality and the focusing on affect and intra-actional entanglement, as disruptive relationality holds at its centre the valuing of interconnected life established in relational networks between human and non-human entities. Further, Loretta Todd makes clear that the consideration of digital media, like FRTs, must contend with Indigenous epistemologies that revolve around universe-wide interconnections under principles of relationality; such a perspective argues that there is no disconnect between virtual and material worlds, and centralizes virtual transformation, via dynamic spirituality and non-hierarchical connection between human and non-humans alike.[430] These sentiments are expanded in "Making Kin with

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[428] David T. Mitchell and Sharon L. Snyder, *Biopolitics of Disability: Neoliberalism, Ablenationalism, and Peripheral Embodiment* (Ann Arbor: University of Michigan Press, 2015), 5-6. In this text as well, as well as *The Matter of Disability: Materiality, Biopolitics, Crip Affect* (Ann Arbor: University of Michigan Press, 2019; co-authored with Susan Antebi), the authors, like Barad, the authors focus on the specific agency of disabled bodies that is rooted in the indeterminacy of matter and the chaos of inter-material relations that are opposed to the human attempts to determinalistically control the world and its bodies/matter/material.

[429] René Dietrich, "The Biopolitical Logics of Settler Colonialism and Disruptive Relationality," *Cultural Studies, Critical Methodologies* 17, no. 1 (2017): 67.

[430] Loretta Todd, "Aboriginal Narratives in Cyberspace," in *Immersed in Technology: Art and Virtual Environment, e*d. Mary Anne Moser (Cambridge: The MIT Press, 1996): 179-194.

Machines": the authors clearly advocate for kinship networks between human and non-human species that engages in "mutually intelligible discourses across difference in material, vibrancy, and genealogy"[431]; this necessitates an extended circle of relations that Indigenous epistemologies of multiplicity and relationality, the authors argue, are already well suited for. Set against extractive behaviours and Western epistemologies of control and security, Indigenous knowledge relies upon reciprocity along with cosmology, mythology and ceremony that bridges between embodied and virtual entities and spaces. Such practices, the authors argue, allow humans to make relationships with the minerals and substances that such beings are made from, encouraging ethical relationships with the materials of digital media technologies. Such thinking links the notion of "non-human" species to biopolitically-generated categories of human and non-human; by doing so, the previous biases and knowledge production and regimes of truth behind technologically-enhanced governmentality are actively resisted as well where machines and other non-human species are not enslaved to humans, but are part of the larger web of relations that make up life. As opposed to the fantasies of bodily abandonment present in many discourses of virtuality, Indigenous epistemologies require embodied presence in both the virtual and physical worlds, and the responsibilities that come with that.

Taking such thinking in combination with Barad demands grappling with the individual differences that each complex body and system of affect creates, alongside the biopolitical manipulation of affects at the level of population as a form of both understanding and resisting biopolitics and governmentality. From this thinking, critical posthumanism emerges as an effective set of ethics from which interventions in technologies like FRTs can take place from.

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[431] Jason Edward Lewis, Noelani Arista, Archer Pechawis, and Suzanne Kite, "Making Kin with Machines," *Journal of Design and Science,* July 16th, 2018, https://jods.mitpress.mit.edu/pub/lewis-arista-pechawis-kite/release/1.

Critical Posthumanism

Barad repeatedly advocates for a posthuman understanding of the world and the

relationship between humans and technological entities, including digital media.[432] Crucially,

Rosi Braidotti's critical posthumanism builds from earlier theorizing on the posthuman,

esblishing a critical posthuman as "a more complex and relational subject framed by

embodiment, sexuality, affectivity, empathy, and desire as core qualities"[433]; the flux and intra-

actions of the biological-technological produce an instability and incoherence that is "the starting

point to elaborate new forms of resistance suited to the poly-centric and dynamic structure of

contemporary power."[434]

She proposes a critical posthumanism that aims to further sharpen previous

conceptualizing of the posthuman that "includes both scientific and technological complexity

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[432] I situate my understanding of the posthuman and posthumanism within Donna Haraway's much-theorized *The Cyborg Manifesto: The Reinvention of Nature* (New York: Routledge, 1991), where the cyborg is a hybrid figure of technological and biological materials that forms its subjectivity from the networks formed by its materialities, in relation to other cyborgs, and by the truth regimes and forces of subjectification interacting with those networks. In this, the discourses that surround the cyborg shape the social reality that then interacts constantly with the biological-technical in ways, echoing Barad, that are completely entangled. Haraway argues, the cyborg is therefore the child of "militarism and patriarchal capitalism" and "from one perspective, a cyborg world is about the final imposition of a grid of control on the planet" (293). The technological-biological, such as that found in biometrics like FRTs, ensures the cyborg, potentially, fits snuggly within strategies and tactics of flow and control under securitization.

Similarly, Hayles argues that her understanding of the posthuman is a reaction to the hierarchical valuing of information over bodily sensation and affect found within first and second order cybernetics, in particular those put forth by the Macy Conferences, wherein humans are cast as data-processors acting under AI-like models of behaviour (N. Katherine Hayles. *How We Became Posthuman.* (Chicago, University of Chicago, 1999)). Her championing of the individual human sensorium and embodied experience within digital media technologies configures human beings so that they can be articulated in collaboration with such machines: this demands attention be paid to the hybrid and rhizomatic forms of subjectivity such constructions enable and produce; this does not, as she argues, dismiss the potential riches that a person might have when embedded into technology, but understands the body as a finite condition of being a human, in turn valuing the novel, individual configurations of technology-biology that are central to digital media technologies. Importantly, the human body must be considered equally within any human-technological assemblage because that body houses and produces political elements that result in power dynamics and regimes of practice; to reduce the human body to its behaviour, as data or as a model, ignores the lived experiences of individuals and the political protocols that network into individuals and populations.

[433] Rosi Braidotti, *The Posthuman* (Cambridge: Polity Press, 2013), 26.

[434] Ibid., 27.

and its implications for political subjectivity, political economy and forms of governance."[435]

Like disruptive relationality, critical posthumanism enlarges interconnections between the self

and others, non-human entities, and the land in order to understand the way that the subject is

formed by multiplicities and networked relationships. Most striking, in comparison to others'

theorizing of the posthuman, is Braidotti's focus on the subject, which she demands in order to

address the specific, grounded locality that is a major force in the forming of subjectivity and the

self, leading her to acknowledge that her project is political at its heart. From this, Nayar

describes critical posthumanism "as an ethical project that asks us to ponder, and act, upon the

acknowledgement that life forms have messy intertwined histories. ... It asks us to acknowledge

that human hierarchization of life forms has resulted in catastrophic effects for/upon animals,

forests, plant life and some groups of humans."[436] Such a focus dovetails with a foregrounding of

bodily affect, multi-species kin, and situated knowledge as the core to intervening into bioplitical

and necropolitical acts of governmentality.

    While thinkers such as David Rosen have proposed useful additions to critical

posthumanism,[437] the strengths of Braidotti's understanding of critical posthumanism, in

particular in resistance to technologies like FRTs, is its attempts to incorporate nonhuman

species and animals into its principles of understanding the local affect and embodied

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[435] Ibid., 43.

[436] Pramod K. Nayar, *Posthumanism* (Cambridge: Polity, 2014), 31.

[437] David Rosen contends that while advocates of critical posthumanism do well to illuminate the socio-political realities and ethics related to the posthuman, he argues that such thinkers lack the theoretical rigour needed to analyze and critique humanism, conflating different humanisms and levelling differences between humans, non-humans, and animals (David Rosen, *Posthuman Life: Philosophy at the Edge of the Human.* (New York: Routledge, 2015)). He does say is complimentary to critical posthumanism, but is most concerned with the future of thinking through posthumanism outside a human-centric viewpoint. Such thinking contends that the posthuman, while not currently actual, may be a future species that will be understand and engage with the world, in whatever forms of embodiment they may have, completely outside of human understanding that requires a non-anthropomorphic humanism.

experiences within larger political and ethical frameworks. Critical posthumanism takes great care to focus on the process of becoming a posthuman subject in relation to other human and non-human species and materials, where an ongoing becoming ensures that the posthuman is not a fixed figure. Building from the previous chapter, this adaptability and flexibility is powerful in reaction to the states of exception that arise from crises, as critical posthumanism can adjust to emergent vectors of power and truth regimes operationalized in ways, as this chapter has discussed, harnessed within specific counter-tactics and strategies. The strengths of critical posthumanism is its blending of discourses and political protocols with its understandings of affect, locality, indeterminacy and intra-actions that keeps it both grounded in the current moment while providing frameworks to anticipate future relationships, discourses, materialities, and vectors of power in dense networks. From this, its theorizing provides an effective ethics to consider the problems of biopolitical tactics and strategies in support of such governance, as its focus on malleability and process can flexibly shift with understandings of citizenship and mobility within the back-and-forth game of governmentality.

Critical Posthumanism's Resistance to FRTs' Automated Vision

As this dissertation has detailed, much of the logics underlying FRTs histories have rooted themselves in Haraway's understanding of the God Trick and invoked humanist views of vision and knowledge that saw technological ways of seeing as tools in service of human rationality. There is a direct correlation between the knowledge gained from such interactions and colonial and intersectional-fused rights to look that generated strategies and tactics reliant upon political recognition that view certain individual and populations as human, non-human, and inhuman. Critical posthumanism, in contrast, allows an understanding of the observer and

the observed that demands a grappling with how entangled automated vision is: it allows space for the consideration of discourses in combination with the technology's operative moment and its political, technical and representational protocols as they come together into an assemblage; but it also demands that the application of such an assemblage acknowledges and values the observed as a unique combination of affect, situated knowledge, materiality, and actions in constant flux and relation. For biometrics in general, critical posthumanism insists that the body cannot be processed as a visible and legible data-object, as the body is an entangled network of intra-actions that cannot be algorithmically captured; in echo of Yanni Loukissas, as well as Lisa Gitelman and Virginia Jackson's work explained earlier in this dissertation, employing critical posthumanism insists that no data is "raw" but, rather, data is always plural, produced by local and situated matter and knowledge.

More specific to the face, FRTs' vision, from a critical posthumanist perspective, echoes Lévinas's arguments in understanding how the technology's observation is incredibly messy, replete with top-down and bottom-up vectors of power that mesh across masses of embodied subjects, themselves in relation to each other as well as the technology itself. Such opposition to representationalism, echoing Barad, resists the representational protocols central to FRTs and rejects the protocols of difference that have undergirded the entire history of the technology by making clear the ways in which those representations are produced, circulated, and upheld in concert with the messy entangled materials of the observer and the observed. Taking from Alexis Shotwell's text *Against Purity*, resisting the deterministic categorizations crucial to FRTs facial data and data annotation practices means remembering that "purity of classification is always imbricated with the forever-failing attempts to delineate material purity—of race, ability,

sexuality, or, increasingly, illness."[438] By demanding that the technologically observed face is always partial, superficial, and affectively connected to the world, the face as data object will never be "pure" or categorizable in simple ways, and FRTs are, at best, incomplete machines operating under reductive and simplistic vision.

Critical posthumanism makes clear how isolated and incomplete computer vision is: not only does it depend on datafying and data practices that circulate and produce static and stable versions of individuals and populations, but it presents itself as objective, grounded in technical protocols that render it capable of being automated and decentralized, and therefore untethered from networks of power and rights to look. Central to this dissertation is the argument that FRTs, powered by computer vision, are a powerful biopolitical and necropolitical tactic because they are wildly adaptive and flexible, fitting into a myriad of strategies in service of self-perpetuating governmentality, in particular those forces driven by flow, control, health, and securitization. By contrast, critical posthumanism answers this flexibility with its own adaptability, with its grounding in ongoing relationality and becoming providing an ethical foundation that, in its valuing of affect and indeterminacy in networks of intra-actions, can produce for the understanding needed to generate a wide variety of tactics and counter-tactics to FRTs.

Further, if critical posthumanism is at its heart a political project, then deploying it in opposition to technologies like FRTs not only makes transparent the technology's mechanisms and its operations, but also provides the ethics need to produce the countervisualities in opposition to forms of domination and unhealthy subjectification present within the right to look that Mizoeff sees as so urgently needed. Importantly, as Mizoeff writes, countervisualities are not simply acts of vision and/or acts of representation that work against the right to look but are

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[438] Alexis Shotwell, *Against Purity: Living Ethically in Compromised Times* (Minneapolis: University of Minnesota Press, 2016), 5.

"the grounds on which such [resistant] assemblages can register as meaningful renditions of a given moment."[439] With the establishment of such grounds, alternate and non-imperial forms of vision and image-making are not only possible, but valued; further, in oppositions to monopolies of political recognition, countervisualities allow for the observed to hold authority over their own bodies and representations of their body, undermining the authority central to the right to look. This thinking activates what Braidotti explains as affirmative politics, wherein there is the potential for localized individuals and populations to respond within the networked contexts and materialities that they exist within. Much like countervisualities, "affirmative politics combines critique with creativity in the pursuit of alternate visions and projects."[440] In response to FRTs specifically, countervisualities and affirmative politics activate alternate becoming in acknowledgement of complex entanglements of materials and actions present within the technology's assemblage, its acts of vision and its image-making. As the prior examples of counter-tactics in this chapter illustrated, this results in mis-uses, appropriations, re-thinking that addresses all three of FRTs's entwined protocols to create a critical biometric consciousness through forms of artwork, public education, effective policy, design principles in acknowledgement of the complex technological-biological relationships outside of biopolitical vision and the racist and misogynist logics that have powered biopolitics and necropolitics under governmentality since the earliest forms of the technology.

Conclusion

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[439] Mizoeff, 28.

[440] Braidotti, 54.

An expansive toolkit of multiple counter-tactics and strategies, from artworks, to technical tools, to potential and real policy and regulation is needed to address the current and future dangers of FRTs. As this dissertation has mapped, areas surrounding the managing of citizenship and citizenship resources, such as physical and social mobility, are especially vulnerable to biopolitical tactics like FRTs; such circulations of power are exacerbated and expanded during moments of crisis under states of exception, in particular when ontopower and risk become the core tenants of global and domestic securitization and health. Technical tools, distributed to individuals and populations, are essential to bottom-up applications of counter-power, wherein individuals and populations can begin to push back against self-perpetuating acts governmentality. Such work can be further enhanced by artwork and other acts of public education, whose raising of a critical biometric consciousness is done alongside the local, affective, and relational concerns of a critical posthumanism. Finally, top-down acts of regulation and policy need to be established and enforced, wherein dedicated governmental entities have to take up the specific entwining of political, representational, and technical protocols within FRTs. Taken together an interlocking set of principles, tools, counter-tactics and counter-strategies, at local and national scales, can provide the adaptability needed to meet the flexibility of technologies like FRTs within the mass-scale push-pull game of governmentality.

Beyond this, there is a tremendous need to imagine what the future of FRTs, and other AI-enabled technologies, might look like and the ways in which they might be used. As the Coda to this dissertation outlines, the rise of autocratic governments within the global landscape, combined with current future crises such as climate catastrophe and the global COVID-19 pandemic demands that current tools and countertactics provide the groundwork for future

countervisualities and interventions into the coming as-yet-unrealized deployments of FRTs. In this way, FRTs are bound up in discussion of democratic governance as much as they are central to the managing of future mass migration caused by rising sea levels and chaotic weather systems. Producing alternate futures and imaginaries are acts that look to the horizon and beyond in order to combat current applications of FRTs while preparing for the inevitable future expansion of problematic operationalizing of the technology.

CODA:
THE FUTURE OF THE FLEXIBLE FACE

In 2019 the tensions between Hong Kong pro-democracy protesters and mainland China-influenced policing was an incredible fertile ground for forces working diametrically with and against facial recognition technologies. On one side, as both *The New York Times* and *The Economist* detail, the protestors utilized various tactics such as: spray painting over CCTV camera lens; shining handheld lasers and their infrared lights into CCTV cameras; and more traditional occluding tactics such as wearing masks and hats.[441] In turn, the police began holding mobile cameras high above the crowds behind the lines of officers and out of reach of protestors, and, in extreme cases, forcing protestor's faces into positions that would render them recognizable to the FRTs that were meant to act as security for their personal devices. When protestor Colin Cheung built a FRT in an attempt to identify police officers and hold them responsible, he was personally harassed and arrested; further, the officers homogenized their clothing, stripped away exterior identifying information, and used tinted helmets and masks when in crowds to enhance their anonymity.

This dissertation has primarily focused on Western histories and applications of FRTs, wherein democratic governance is taken as a given. However, the above example of FRTs and counter-tactics showcase the continuing and expanding battleground of governmentality, in particular as autocratic governments further engrain themselves into the global landscapes of power. This dissertation necessarily needed to keep a manageable focus and therefore left out a

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[441] "As face-recognition technology spreads, so do ideas for subverting it," *The Economist,* August 15 2019, https://www.economist.com/science-and-technology/2019/08/15/as-face-recognition-technology-spreads-so-do-ideas-for-subverting-it; Paul Mozur, "In Hong Kong Protests, Faces Become Weapons," *The New York Times,* July 26 2019, https://www.nytimes.com/2019/07/26/technology/hong-kong-protests-facial-recognition-surveillance.html

great number of non-Western and non-democratic instances of FRT developments and deployments, but the pro-democracy Hong Kong demonstrators acting against the mainland Chinese government demonstrates how both applications of and interventions against contemporary FRTs takes place within contemporary governmentality. The flexibility and adaptability of FRTs is enabled by the technology's entwined representational, political, and technical protocols. Powered by these protocols, the technology can be deployed such that its wide-ranging and unblinking automated field of vision can be an effective biopolitical tactic for those invested in governmentality, such as nation state forces. However, in the recent example of Ukrainians utilizing FRTs to verify Russian soldiers' identities during the Russian invasion of their country, that same flexibility and adaptability can be harnessed in opposition to such uses by citizens and populations, short-circuiting and/or redirecting the technology's vision.[442]

Despite the large gap in resources, there is hope to be found in the example of Hong Kong and China, when an informed citizenry is able to utilize their own expertise in resistant practices against biopolitical tactics such as FRTs. During a presentation at Simon Fraser University's Digital Democracy Institute, I was asked what might be done in the face of nation states and massive corporations like Facebook and Google when there is such an asymmetrical distribution of resources between those larger actors and smaller-scaled groups of citizens and non-citizens. My answer was that it would be difficult for an individual to match the state-of-the-art of FRTs produced by those large-scale actors, but the functional gap between a publicly-available version of the technology and the versions used by corporations and nation states is quite small; as I demonstrate in workshops that I have run and co-run in university and art

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[442] Kashmir Hill, "Facial Recognition Goes to War," *The New York Times,* April 7th, 2022, https://www.nytimes.com/2022/04/07/technology/facial-recognition-ukraine-clearview.html. It is difficult to not be at least a bit suspicious of this instance as it is powered by Clearview AI, an entity this dissertation has critiqued for its massive facial database acquired by indiscriminately extractive and harmful data practices.

gallery spaces, with an afternoon and some computer coding knowledge, a person can generate a reasonably effective FRT themselves, both educating themselves about the technology's operative moment and building a potential tool for themselves.[443] Further, the amount of knowledge about building and improving FRTs that is public knowledge is quite high, as is, importantly, basic public consciousness about the technology's biases and problematic operations. Political and technical knowledge of FRTs are sharp weapons against the technology's dangerous use.

In fact, the more distressing advantage large-scale actors possess is access to massive facial datasets and non-public datasets gathered through other biopolitical tactics rooted in securitization, such as mugshot and immigration application databases. This problem gets at the heart of this dissertation: the conflation between consent and coercion at the site of facial data capture, in mugshots, in border crossing photos, in driver's licences, in social media content, in job application materials, (and on the list goes) fuels an ever-expanding automated vision that relies on such massive datasets in order to adapt and expand the decentralized nature of FRTs' observational power. Such databases, in particular specialized databases like those based in immigration materials and often defined by difference, preserve the right to look and the ability to manage citizenship resources within those documents by ensuring the databases are more likely to be deployed under the logics of governmentality, and used by the same forces to improve the technology for future uses.

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[443] I have run such workshops at Toronto Metropolitan University (TMU) as a member of the TMU Library Collaboratory; with Jae Seo at Inter/Access Gallery in Toronto; and at the Digital Democracies Institute at Simon Fraser University. As further evidence, Sahil Chinoy details building a robust FRT for under 100 dollars U.S. in the article "We Built an 'Unbelievable '(but Legal) Facial Recognition Machine" (*The New York Times,* April 16th, 2019, https://www.nytimes.com/interactive/2019/04/16/opinion/facial-recognition-new-york-city.html).

Still, while the alarming growth of such databases are a troubling trend that will be hard to reverse, the deployment of such databases within FRTs are vulnerable, both technically and politically: when the technology's operative moment is made clear, resistant practices that effectively occult the face at the detection stage of an FRT takes advantage of the bottleneck between detection and identification/verification; too, the growing political will to understand and abolish the use of the technology in spaces where potential biases are most harmful could spread further and further as more and more policy and regulation is put in place. With this hope in mind, this dissertation takes these public conversations beyond issues of diversity, privacy, and surveillance and encourages readers to understand FRTs' symbiotic technological, representational, and political protocols work in order to build tools, art, and policy against the problematics of the technology. Doing so activates the core principles of a critical posthumanism, wherein the local affect and indeterminacy of individuals resists the God Trick of FRTs, and upholds Lévinas's argument that viewing the face is a reciprocal act that demands empathy and an acknowledgement that those viewed as individual fellow humans.

We are at the point where stating FRTs are biased is stating an obvious fact, and pointing at and listing the many examples of harmful uses of FRTs only deals superficially with the real issues with the technology. This means taking the example of Hong Kong and mainland China from the introduction to this Coda and being highly critical of autocratic and non-democratic nations deploying the technology, where the technology is used to sort citizens and identify dissenters. Again, this dissertation doesn't take up China's massive FRT infrastructure, including the Ministry of Public Security's Skynet and Sharp Eyes programs, that is operationalized in ways that serve its national government in a myriad of ways, perhaps most alarmingly in its

sorting of Muslim Uyghur populations in the northwestern parts of the country.[444] A future

project with better access to Chinese history would provide a much needed study that would

expand the arguments made in this dissertation and would allow the core arguments here to

expand to other autocratic and non-democratic countries as, alarmingly, such governance has

risen steadily over the past decade.

However, pointing at past and present examples of damage caused by FRTs is only a

portion of combatting the dangers of the technology. In order to best resist future use of FRTs

there must be anticipatory resistant practices wherein future-facing imaginaries produce versions

and instances of the technology that allows us to grapple with their potential consequences.The

future is undoubtably full of examples of FRTs' incredibly wide automated visual field being

utilized as a very effective tactic for the type of circulations of power that wish to homogenize

and consolidate; such governance will leverage, as discussed in Chapter 2, the massive datasets

within identity documents captured at the crux of consent-coercion within the management and

gatekeeping of citizenship resources and asymmetrical political recognition. It is important then

to imagine sabotage, leaks, and hacking in the face of this, to construct a future where such

resistance is, first, possible, and then, second, achievable. Obviously, as stated in Chapter 6, no

one solution would work, but some combination of technical tools and political knowledge

would begin to drive wedges into the dangerous deployments of FRTs in such instances.

Further, this dissertation's focus on the biopolitical management of mobility as a

citizenship resource also makes clear how we must anticipate a future of mass migration brought

about by combinations of war and climate catastrophe. As this dissertation and Chapter 5

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[444] Paul Mozur, "One Month, 500,000 Face Scans: How China Is Using A.I. to Profile a Minority," *The New York Times,* April 14th, 2019, https://www.nytimes.com/2019/04/14/technology/china-surveillance-artificial-intelligence-racial-profiling.html

illustrate, crisis is the ground on which further expansion of biopolitical and necropolitical

tactics, such as FRTs, are expanded and improved. With FRTs already entrenched at national

borders in the form of passport control and CCTV monitoring, as well as automated immigration

and refugee decision making systems, the technology is already an effective and efficient

biopolitical tactic in service of national security and health; the further use of FRTs in internal

borders, such as the use by U.S. Immigration and Customs Enforcement (ICE) within America,

ensures that those deemed illegal in a country are made increasingly legible and visible. Such

phenomena will only intensify with climate catastrophe, where resources, including basics like

food and drinkable water, will be susceptible to extreme weather and populations; concurrently,

vectors of power that manage such resources will make living in certain geographies untenable,

with rises in guerrilla and state-sanctioned violence as well as civil and international war. The

resulting movement of populations away from such geographies will put incredible stress on

international and national borders; tactics like FRTs, with its decentralized and automated vision,

will be increasingly relied upon to monitor and police citizen and non-citizen mobility.

Importantly too, as has been demonstrated by the facial databases produced by the

American National Institute for Standards and Technology (NIST) discussed throughout this

dissertation, such practices are consistently defined by racial difference and political protocols,

and are vulnerable to harmful biopolitical management; more, the data gathered by such mobility

can, once captured, be re-deployed and adapted into other biopolitical strategies and tactics in

other spheres and acts of governance. In this way, it is not just the use of the technology that

promises future dangers, but the data practices and extractive nature of FRTs' and biometrics'

vision as well. As one example, the wealth of biometric data left behind after the 2020 American

withdrawal from Afghanistan demonstrates this, where data suddenly becomes a valuable

resources for future FRTs and the technology's potential monitoring and sorting in service of governmentality.[445] In action, resistance would involve, on a large-scale, international intervention and regulation and, at the scale of an individual dissertation, would spend time and resources talking with the individuals and populations most affected by the technology and getting more on-the-ground reporting and narratives. This dissertation has been hamstrung in this way by the COVID-19 pandemic, but future versions of FRT research would combat monolithic labels of "immigrant" and "refugee" by speaking with such individuals in order to better understand the specific and local experiences of those under the technology's vision and automated decision making.

Such research would be strengthened, as this dissertation has been, by the three pronged media archeology outlined in the Introduction, that examines the technology's operative moment, bureaucratic materials and histories, and digital image-making practices. As has been repeatedly demonstrated by leaks such as Facebook's 2021 leak by whistleblower Frances Haugen, technological entities within large scale infrastructures, such as governments and/or corporations, compulsively produce and document materials about the own creation, improvement, and the conversations.[446] There is a near-fetishistic impulse to keep preserve the representational, political, and (especially) technical protocols that are used to construct technologies like FRTs, and a media archaeologist can use these traces, these collections of kept data, memos, reports, and publications, to reconstruct the logics of the past while predicting

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[445] Eileen Guo and Hikmat Noori, "This is the real story of the Afghan biometric databases abandoned to the Taliban," *MIT Technology Review,* August 30th, 2021, https://www.technologyreview.com/2021/08/30/1033941/afghanistan-biometric-databases-us-military-40-data-points/

[446] Reed Albergotti, "Frances Haugen took thousands of Facebook documents: This is how she did it," *The Washington Post,* October 26th, 2021, https://www.washingtonpost.com/technology/2021/10/26/frances-haugen-facebook-whistleblower-documents/

future discourses and truth regimes. Such preservation is not just the domain of corporate and government infrastructure, but is also the *modus operandi* of computer science as a discipline, where its positivistic histories demands strict record keeping of experimental materials and results. Future research would then combine the cataloguing of scientific, government, and corporate knowledge surrounding FRTs with the indeterminate untraceable narratives and affect of individuals and populations most at risk when under the technology's observation.

Finally, there must be the construction of alternate futures and imaginaries that work to project healthy, relational, and affective networks of human-humans and human-machines; such acts of empathetic imagination work to project and provide future desires, as opposed to casual logics restricted by "real world" capabilities, that can stimulate the lasting and foundational changes needed to effectively address the adaptable omnipresence of contemporary and future applications of FRTs. Again, we are at the point where it is widely understood that FRTs can easily be constructed to house and perpetuate bias, so producing dystopian future versions of FRTs in media representations and/or artworks seems redundant and could possibly fall into the trap of normalizing and/or aestheticizing the technology. Instead, there can be media representations of abolishment of the technology, of whistleblowers and counter-science, of technological vision that is reciprocal and empathetic. There can be counter and alternate histories of the development of FRTs, where the gaze of the technology is turned upon different populations. We might turn to Zoom's more beneficial qualities that were brought about by a near-global lockdown during the COVID-19 pandemic, where the digital framing of the face in intimate spaces such as one's home, brought genuine connection and recognition of another.

If a Foucauldian understanding of archeologies of power relies on hunting out and examining ruptures in a technology's histories, then future resistant practices can be about

producing past and future ruptures, constructing truth regimes and discourses against the extractive and deterministic desires of FRTs, ones that utilize future imaginaries alongside critique of the contemporary moment to generate alternate pathways through future crises that do not involve harmful algorithmic governance, the conflation of consent and coercion in data practices, and the gatekeeping of citizenship resources. When these imaginaries would be turned public-facing, the rise in the critical biometric consciousness that Browne demands would potentially spread to further regulation and oversight of the technology, and the myriad ways that FRTs might be interrupted and short-circuited by way of tools, art-making, policy would expand and be empowered to meet the future of the technology.

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APPENDICES

Appendix A: Copyright Clearance