Chapter 1
Introduction

1.1   Context

Over the past decade biometric technology has steadily encroached into everyday life. Social media platforms use facial recognition to automatically identify and tag individuals in photographs (Hill, 2012; Murphy Kelly, 2012). Smartphones can be 'trained' to recognize a user's face or fingerprints to unlock tools and features (Nouveau, 2012; Yardon & Sherr, 2013). Cameras installed in the eye sockets of store mannequins gather biometric data on customers for marketing and behaviour tracking(Wasserman, 2012). Computerized billboards have been programed to scan faces for gender, age and race information, in order to determine the type of advertisements to display (Wadhwa, 2012). Law enforcement agencies spend millions of dollars implementing and upgrading biometric systems in order to identify 'persons of interest' and enable greater interoperability and information sharing across jurisdictions (Franzen, 2011; Hildago, 2012; Landon, 2012). Nation-states are managing and policing borders through biometric passports and automated entry/exit systems. Biometric data collection has proliferated across a range of social, technological and juridical spheres. Indeed, biometric systems have become ubiquitous. Scholars of privacy, information, and law have described biometrics as *the* defining technology of our current moment (Acquisti, 2012), while the popular press has described such tools as "commonplace" (The Editorial Board, 2013) and as the impending "new normal" (Levin, 2014). The rapid rise and diffusion of biometric technologies across multiple domains shows mounting social and cultural *reliance on*, and *trust in*, the logic of biometric grouping and sorting. This project takes seriously the unique importance accorded to biometric technology, and seeks to understand how we entered into an age of pervasive bodily surveillance. Writing against claims that biometric technologies are inventions of the post-9/11 era (NSTC Subcommittee on Biometrics and Identity Management, 2008a), and against historical accounts that position the field of biometrics as emerging from a series of isolated and somewhat disconnected technological innovations (NSTC, 2006), this project will situate the field of biometrics within a longer and broader history. The purpose of engaging

historical approaches to the study of American biometrics is to more carefully describe the sociotechnical context from which the field emerged, as well as provide some insights into the social, cultural, technological and political factors that have contributed towards the proliferation of such technologies. To this end, this project will pay close attention to how biometric technologies have developed, how they produce knowledge about the people they track and measure, and how that same knowledge is mobilized by industry and the state. As part of such efforts, this study will both track and trouble industry rhetoric, which describes biometric measurement as a process involving the capture and disclosure of individual identities, by demonstrating that in practice, government agencies and commercial enterprises develop and apply biometric tools in order to construct group-level differences and manage categories of people.

1.2   Biometrics

The American state and its partners in industry commonly define the term "biometrics" as both a measurable biological or behavioural characteristic, and as the process of using automated methods to recognize an individual based on those same measurable biological and behavioural data (Jain, 2013; Smith, 2006). Biometric technologies can take many forms from fingerprinting and iris scanning, through to automated face, voice and gait recognition. Despite such a diversity of available data collection tools and techniques, contemporary biometric measurement always involves the digital capture of bodily features and the translation of those images into machine-readable data. Whether conceived as a series of traits or as a system, the broader project of the state's biometric enterprise is founded on the principle that individual human bodies can be accurately measured and analyzed through computer vision and machine calculations.

Embedded within this core principle of the field are three key assumptions that guide the development of the state's biometric projects. The first assumption is that state-of-the-art image-capture systems, working in concert with complex algorithms and information systems, render objective data on human bodies and behaviours. The second assumption is that biometric information systems can reliably sort and match biometric records against live bodies in order to identify an individual. The third assumption is that by assigning an identity to a body it is possible to manage risk and mitigate threats. In other

words, all of the state's biometric initiatives tend to narrate a similar story: through mechanical objectivity and the "trained judgment" (Daston & Gailson, 2007) built into algorithmic sorting processes, biometric information systems can help security and intelligence agencies sort populations to identify and target threatening bodies. This project seeks to unpack that vision of biometrics, to historicize it, and to probe the technological, social, and political dimensions of using the body as a means to sort and classify people.

Biometrics narrates the body as a terrain of suspicion. Conceptually and practically it draws from a long and complicated history of governments, law enforcement agencies and applied science projects that have used registrations of the body for the purposes of identification, classification, and social control. Beginning in the late-nineteenth century, European and American bureaucrats, scientists, police officers and courts began assembling collections of bodily data, such as facial photographs, images of tattoos, and tables of body measurements, in order to identify individuals (e.g., rogues galleries, mug shots) and to typify specific groups (e.g., criminals, the middle class, etc.). With the advent of programmable computing devices in the 1960s the United States government initiated the first research into developing automated processes that capture and sort the exact same kinds of biometric information that were being collected by states as early as 1870, when Third Republic officials were photographing Paris communards to establish their identities and order their assassinations (Bledsoe, 1966b; Pruzansky, 1963; Przyblyski, 2001; Trauring, 1963). As this thesis will demonstrate, technologies may advance and change, but the fundamental logic guiding the development and use of American biometric systems remains the same: securing the state and its interests against dangers that are *literally* embodied in certain kinds of people.

1.3 Literature Review

Scholarship within the field of biometrics is split between two distinct approaches: technical literature on biometric systems and social studies of biometrics. The majority of such literature resides on the technical side, and focuses on advancing and innovating biometric hardware, software and algorithms. As a field dominated by practitioners with a vested interest in uncovering better ways to apprehend the human body and make sense

of bodily data, biometric research tends to focus on describing methods for automatically sorting people into established categories of being, most often by race and gender. As a recent example, Fu, He & Hou (2014) conducted the first comprehensive review of so-called "race recognition" methods, a biometric sorting technique that uses algorithms and image processing systems to extract racial data from facial images. This meta-analysis examined several hundred published articles, reviewed nineteen biometric databases containing racial data, and ultimately concluded that "race is in the face" (p. 20). Meta-analyses of this nature are rare; most researchers present studies outlining new and more efficient ways to analyze biometric data for the purposes of group differentiation. Ding, Huan, Wan & Chen (2013) describe a process for using oriented gradient maps on 3D renderings of facial images in order to extract ethnicity. Mansoor Roomi, Virasundarii, Selvamegala, Jeevanandham, & Hariharasudhan (2011) have developed an interoperable algorithm and classification method aimed at capturing and sorting racial data from facial images. Chen & Ross (2011) describe a method for using near-infrared and thermal spectral signatures to read gender from facial photographs. Han, Ugail & Palmer (2009) offer a new technique for applying support vector machines to improve gender classification of 3D facial images. Hadid & Pietikäinen (2013) explore how manifold learning can be used to extract gender, age and race information from video surveillance feeds. Guo & Mu (2013) describe differences between various regression analysis methods when attempting to extract race, gender and age information from biometric data sets. The scientists and engineers who develop biometric tools and techniques are strongly focused on developing methods to quantify bodily difference, and on developing mechanisms to sort people into groups based on those same differences.

By contrast, social studies of biometrics tend to avoid discussions of specific biometric tools or techniques, and instead focus on the wider social effects of contemporary biometric systems. As a newer field of inquiry, there are only a small number of studies dedicated to in-depth examinations of the social worlds of biometric technologies. To date, four monographs have been written on this topic. Despite this small number, the methods employed by such studies, and the evidence they call upon to support their claims, is diverse and varied. Magnet (2011) employs a feminist science and technology

studies approach to investigate examples of biometric systems failures. Drawing on a variety of case studies, Magnet's project reveals how biometric systems work to render some bodies as 'standard' and other bodies as 'atypical,' or even 'aberrant.' Significantly, Magnet also demonstrates that the lines between 'standard' and 'othered' bodies break down according to conventional categories of race, gender and ability. Gates (2011) also draws upon case studies in her investigation of biometrics, however she does so following models set out by communication scholarship. Exploring a broad assortment of facial recognition technologies, including CCTV systems, photo tagging and recognition engines in social media platforms, and automated expression analysis, Gates describes a range of processes contributing towards the social construction of biometric technologies. In contrast to Magnet, she suggests that in the case of facial recognition, biometric technology has been tuned towards identifying individual faces rather than capturing types or classes of people. Further she suggests that there is only a "metaphorical" (p.101) connection between group differentiation and biometric sorting, one that is promoted through media accounts of biometrics, but that has no actual relationship to the functions of facial recognition technologies. Nelson (2011) draws upon focus group interviews to examine public understandings of, and attitudes towards, biometric technologies. Her particular interest lays in gauging public acceptance of biometric tools and methods. Nelson's findings suggest that the public has a good understanding of the privacy issues elicited by biometrics, and consequently she advocates for more public input into the development of technology policies. Using critical theory and cultural studies approaches, Ajana (2013) examines the biopolitics of biometrics. Surveying how biometrics systems have become enrolled as tools of governance, she explores social and technical factors that shape concepts like identity, citizenship, and access. She also describes some ways in which biometric tools bring new kinds of communities and identities into being, and then probes the political and ethical dimensions of those new ontologies.

Although more numerous than the monographs, only a small number of research articles focused on the social study of biometrics have been published to date. Among the most cited studies is van der Ploeg's (2003) chapter in Lyon (2003). In this article, van der

Ploeg investigates biometric technologies as sociotechnical systems, with a specific interest in examining how the body came to be understood as an information-bearing entity. She focuses on disentangling the social forces and technological developments that have worked to split embodied identity from physical existence. Further, she argues for including the concept of bodily integrity within normative conceptions of biometric privacy. Alterman's (2003) philosophical argument against the use of biometric technologies has circulated widely. In this study he assesses the ethics of biometrics measurement and argues that the privacy risks posed to individuals by the misuse of biometric technologies may be too great to bear. Muller's (2011) work on the relationship between representations of biometric technologies in popular culture and state practices of risk management has also had a strong impact on the field. Drawing equally from international relations and cultural studies scholars, Muller, like Ajana, investigates the biopolitics of biometrics. Tracing the emergence of biometric borders alongside close readings of popular literary and filmic texts, Muller argues that biometric technologies and popular culture co-constitute one another, and have together brought into being new forms of governance organized around risk and insecurity. Amoore's (2006) well cited study also draws on the concept of biopower and biopolitics to investigate border crossing in the age of biometrics. Using the US VISIT program as a site for analysis, Amoore describes how the rhetoric of the 'war on terror' has enabled states to mobilize biometrics borders as a means to manage and intervene within the lives of travellers and citizens alike.

Each of the studies presented above offer a unique approach to the social study of biometrics. Despite such methodological variation, however, all of this work shares an interest in investigating contemporary articulations of biometric technologies. Although some of these texts nod to the longer history of biometrics—they may mention that scientists experimented with biometric methods in the nineteenth century, or allude to technological developments occurring in the 1960s and 1970s—analytically they take up the field as if it emerged just as the twentieth century gave way to the twenty-first. Such studies tend to frame the American 'war on terror' as the most significant event to occur within biometrics, and take the September 11 terrorist attacks as a kind of 'year zero' for

the field. Although the events surrounding 9/11, and the subsequent social, cultural, technological and legal developments it wrought, have impacted biometrics tremendously, the current state of the field is jut one part of a much longer and larger story.

In contrast to the studies described above, this project takes a longer historical view of biometrics. It does so in order to explore that which earlier studies have ignored: the development of the technical, institutional, and social base—the knowledge infrastructure—that has been erected to support work and action within state-sponsored biometrics. Bowker and Star (1999) have demonstrated that infrastructures develop historically, as the product of multiple actors engaging in numerous negotiations and compromises. Working from this understanding, Bowker et al (2009) suggest that infrastructural analysis must always take into account the "long now" (p. 99) of an infrastructure. In other words, they suggest that studies of infrastructure must take into account the historical development of organizational forms, practices, and institutions. This study will take up the 'long now' of biometrics. It will investigate the historical development of the American state's biometric knowledge infrastructure, in order to see how biometric knowledge is created, exchanged, given currency and authority, in order to understand how biometric knowledge is distributed throughout systems and organizations, and in order to apprehend some of its real-world effects.

In addition to focusing on the contemporary moment, a considerable number of social studies of biometrics explore biometric systems using Foucault's (2003) concept of biopolitics. Such scholarship pays close attention to the mechanisms of the state, and to techniques of governance, in order to understand how specific biometric technologies have been deployed to manage populations and exercise various forms of social control. Researchers within this branch of biometric scholarship are particularly interested in exploring how biopower is exerted through concepts like security, identity and citizenship, and as such, tend to favour the study of biometric technologies at locations where these topics converge: national borders. Such a narrow focus has led to a significant number of studies focusing on how biometric technologies effect and affect

individuals and their relationships to the state, with many texts suggesting that biometric technologies allow the state to re-imagine bodies and remake citizenship. Unfortunately, very few studies offer a clear understanding of how such conceptual transformations occur.

This project shares an interest in understanding biometrics as a form of state power; however, it seeks to do so in ways that differ from earlier studies. Rather than focusing on national borders, individuals, or concepts like citizenship and identity, this project will explore one specific biopolitical technique of biometrics: the construction of categories of difference. Through an historical analysis of the American biometric knowledge infrastructure, this project will foreground the state's interest in generating biometric groups as a means to manage populations, as well as demonstrate how that drive to apprehend difference and construct categories of being has shaped the technological and institutional development of the field. In other words, this project tracks how the American security state transformed biometrics from tools that were mobilized by local law enforcement to catalogue and track *threatening bodies* into layered enterprise systems that facilitate the management *whole populations*. As discussed above, a significant portion of technical research in biometrics is focused on developing new and ever more efficient ways to apprehend difference and order human bodies, yet social studies in this domain rarely address that literature. By paying attention to the ways in which biometric systems construct groups and reify group-level differences this project will address the work of those biometric scientists and engineers who seek to name and literally flesh out categories like race, ethnicity, and gender. This project will also describe how existing categories of human bodily difference are spun out by the biometric knowledge infrastructure into new categories and social identities that seek to capture and organize affective relationships established between populations and the state, for example sorting inhabitants into groups like "friendly" or "adversary." Finally, this project will describe how such categorization and grouping supports and extends state power.

Privacy is a topic taken up by a number of social studies of biometrics, although few offer in-depth analyses on privacy issues raised by such technologies. Most research within the field acknowledges that the use of biometric systems by industry and the state raises a number of complicated juridical, constitutional, and administrative questions; however only van der Ploeg, Neilson and Alterman offer comprehensive discussions of privacy within this domain. No matter how the topic is broached, however, scholarship in this area tends to conceptualize privacy within conventional legal and policy paradigms: biometric privacy is understood as an issue that affects *individual* rights and freedoms. Employing such a framework has contributed towards a large majority of studies focusing narrowly on issues of informational privacy related to biometrics. Most studies seek to unpack biometric technologies' role in producing, circulating, and employing personally identifiable information. Projects of this kind provide interesting insights into issues related to the collection and storage of bodily data, but as van der Ploeg suggests, analyses predicated on informational privacy alone may not adequately capture the full range of privacy questions and issues provoked by biometrics. Following van der Ploeg, this study also suggests that information privacy frameworks cannot sufficiently account for the broad and complex privacy issues raised by bodily sensing and sorting technologies. This project is broadly focused on foregrounding the ways in which biometric technologies create and reify group-level differences, and as such will attempt to think biometric privacy through the biometric group. To this end, this study will experiment with ways to approach privacy outside of the legal and policy definitions offered by the state and its partners in industry, and will actively test and explore the concept of group privacy rights.

1.4   Methods

This is a research project that is, in many ways, messy. It seeks to gather together many seemingly disparate facets of biometrics in order to understand what has contributed towards biometric technologies becoming a ubiquitous part of everyday life, and to explore how the state and industry have mobilized biometric grouping to manage and produce knowledge about people. Specifically, this project explores three key periods in the history of American biometrics: the emergence of the field of biometry, the transformation of biometrics into tools of state power, and the emergence of ubiquitous

biometrics. To this end, this study seeks to engage with the technological and institutional history of American biometrics in order to explore the development and operations of its knowledge infrastructure, to consider the sociotechnical processes and implications of biometric grouping, and to think about privacy beyond the individual and outside of the normative definitions offered by liberal democracies. There is no single research method that can adequately account for these various trajectories, their resonances, and their distributions across space and time. As such this project employs what Law (2004) describes as "a method assemblage" (p. 13), a gathering of tools, practices, and perspectives that together produce modes of knowing that are as messy and partial as the sites under study. To apprehend a range of questions elicited by biometric technologies, and to address a wide variety of issues including privacy, ideology, difference and power, this study employs a multi-method approach that makes use of critical making, document analysis and historical methods. I use historical methods to track large shifts in the scope and scale of American biometrics that have occurred over time, and follow the development of the state's biometric knowledge infrastructure. I use document analysis to map and make sense of the large network of actors that led biometrics to become a tool of state power. I use critical making as a means to experiment with notions of privacy within biometrics and reimagine the concept outside of the ideological confines of the state.

1.4.1 Historical Methods

To study the origins of biometrics I consulted a range of primary sources produced between 1840 and 1910, the period during which biometry emerged within Europe, and then travelled to the United States. Drawing upon newspaper accounts, research articles, textbooks, monographs, conference papers, and literary texts, I describe the theoretical frameworks from which the field of biometrics emerged, I follow the development and uses of various early biometric information systems, and I discuss public understandings of this field and its practices. Gathering together such a wide variety of primary sources allowed me to tease out some the specific ways in which the technical and social aspects of biometrics have produced one another. By tracing out a constellation of actors and events, their relationships, and changes that have occurred over time, it became possible to see how scientific discourses have influenced cultural representations of biometric science, how popular cultural texts have shaped what became 'common-knowledge' of

biometrics, and how creative renderings of scientific practices, combined with public perceptions of biometry, have influenced the development and use of biometric systems. In other words by historicizing biometrics it became possible to see its development as a sociotechnical system. Moreover, such an approach also opened up opportunities to see how the concerns of late-nineteenth century biometry, particularly those related to naming and grouping based on physical and social difference, established the terrain with which contemporary biometrics still contends.

1.4.2 Document Analysis

To understand how biometrics became enfolded within the workings of the American state, I consulted published academic research on biometric systems a well as a range of grey literature produced by both federal agencies and industry between 1960 and 2000. It was during these four decades that the executive branch collaborated with private industry groups to develop a national biometrics enterprise, as well as a commercial biometrics industry. Drawing upon journal articles, technical documentation, task force and committee reports, public opinion surveys, policy documents, memos, press releases, conference proceedings, requests for proposals, patents, standards and best practices, I attempted to follow and make sense of the large network of actors that shaped the technological, institutional and social development of the United State's biometric knowledge infrastructure.

Very little research has been published on the layered social, technical, and institutional systems that support American biometrics, particularly those systems that emerged during the second half of the twentieth century. This is due, in part, to the fact that a majority of biometric research occurring at this time was executed in tightly controlled environments, and emerged as highly classified projects, and as proprietary systems and instruments. Further complicating research into the state of the American biometric knowledge infrastructure during the late-twentieth century is the fact that the range of organizations, people, and technologies that supported its growth and expansion is large and complex, and tended to shift significantly over short periods of time. In order to apprehend the shape and structure of this somewhat-veiled and complex system I turned

to grey literature to supplement the information made available through traditional scholarly communication channels. Specifically, to make sense of the large shifts in the scope and scale of American biometrics at the end of the twentieth century I employed document analysis techniques, combined with historical approaches to the study of primary literature.

In practical terms, this meant that I consulted all of the reports, memos and other documents that I collected as "social facts" (Atkinson & Coffey, 2004) in their own right. These materials do not and cannot offer stable views into the people, organizations, or technologies they seek to capture or address; they do not objectively document what occurred within a given organization or project. Rather, they offer documentary evidence of localized perspectives and practices, as well as lay bare an organization's efforts at self-presentation and self-fashioning. I approached the body of grey literature that I assembled as a tool for disentangling the scale and intricacy of the network of actors involved in collecting, producing and sharing biometric information, and as a means to unravel the values, commitments and politics that structure technologies, work, and action within the field. By approaching such documents as "situated products" (Prior, 2003) that carry with them complicated histories, rich contexts, and varied fields of action, it became possible to better understand the assumptions, questions and problems that have been made to matter within the American biometric knowledge infrastructure, and indeed understand the unique *power* accorded to the tools and practices of this particular domain.

My document analysis process began by focusing on content. I read the literal text on the page, noting the words, concepts, technologies, places, and other phenomena that are directly addressed by the materials in order map out a network. Next, I investigated the 'life' of the document, determining who authored it, which federal agency and/or industry group were involved in its production and dissemination, I noted where it was published or posted, and I paid attention to the documents that this text referenced, as well as those documents that referenced the text under study. Adding this secondary level of analysis allowed me to make sense of the relationships between actors, as well as better

understand how the field developed, shifted, and expanded over time. Moreover, working through these two stages helped reveal some of the actual workings of the biometric knowledge infrastructure, disclosing where and how biometric knowledge is produced, what concepts and categories are given currency, how that knowledge circulates, how that circuit changes over time, who is involved in shaping its new forms, and some of the implications of those refashioning efforts.

1.4.3 Critical Making

To investigate the emerging ubiquity of biometrics within United States, I consulted published academic research on biometric systems, as well as a range of grey literature produced by both federal agencies and industry since 2001. In the early twenty-first century biometric science came to the forefront of American political culture and public life, and privacy emerged as a key area of concern for biometric initiatives. Once again, drawing upon journal articles, technical documentation, task force and committee reports, public opinion surveys, policy documents, memos, press releases, conference proceedings, requests for proposals, patents, standards and best practices I worked to disentangle the specific actors and events that contributed towards the incorporation of quotidian life into the American biometric knowledge infrastructure. Through such document analysis activities I found that as biometric technologies were introduced to the public, privacy discourses came to occupy increasingly prominent positions within legal, policy, and best practice frameworks developed by industry and the state. Yet, at the same time, these groups were enacting technologies and policies that were radically reshaping privacy rights. Furthermore, industry and the state worked hard to frame biometric systems as tools that authenticate and verify *individuals*, while in practice, these groups tended to mobilize biometric tools in order to construct group-level differences and manage categories of people. I found such tensions interesting, and I wanted to explore biometric privacy and biometric group formations more deeply.

To pursue questions related to biometric privacy and group formation I needed to employ new research methods. So much of American biometrics is locked behind proprietary and classified designations, and as such it is very difficult to gain access to documents and other resources that may describe or explain state and industry technologies and

practices. To work around this problem of access I decided to forgo documentary evidence and explore biometric privacy and group formations conceptually and materially. Although I could not acquire information detailing the operations and decision-making processes related to specific biometric systems and projects, I could access the materials that form biometric technologies and explore intersections between those resources and the history and concepts I had already assembled as part of my research process. In other words, I could draw on "critical making" methods to analyze how privacy, groups, and categories are articulated within biometrics.

Critical making is an interdisciplinary research methodology developed by Ratto (2011) that combines theoretical investigations of texts with design and building processes. The goal of a critical making project is to unite critical thinking activities with the hands-on development of physical objects. Ratto suggests that such a practice "theoretically and pragmatically connect[s] two modes of engagement with the world that are often held separate" (p. 253)—thinking and doing— and further proposes that by combining these seemingly distinct modalities it opens up a space for new forms of knowledge to emerge. Such an approach has strong affinities with the 'learning-by-making' practices of constructionist pedagogies (Harel & Papert, 1991). Like constructionism, critical making posits playful engagements with materials—often the materials of computing—that lead to the construction of tangible objects, among the most effective means to produce and acquire new knowledge. Despite such interest in the development of technological things, critical making strongly emphasizes process over product. The goal of a critical making exercise is, as Ratto explains, "shared construction, joint conversation and reflection" (p.253), and not the creation of functional or purposive devices. By emphasizing the importance of both material and conceptual experimentation, critical making emerges as an open-ended approach to research that results equally in the production of new ideas and of new objects to think with. By seeking to strategically fuse theoretical, technical, and creative aspects of academic inquiry, critical making methods also resonate with the emergent practices of research-creation, an umbrella term that includes a variety of activities that seek to integrate the creative development of artworks or objects with academic research (Chapman & Sawchuk, 2012). The emergence of critical making as a research methodology demonstrates increasing interest, across a range of subjects and

disciplines, in critically exploring the history and materialities of media and information technologies (Shade, 2013).

For this project I used critical making methods to develop a prototype biometric system I came to call *The Blinking Eye.* My goal was to build an object that explicitly engaged with the privacy and grouping logics of state and industry tools, but in ways that trouble those same paradigms. Specifically, I wanted to develop an object that draws upon the technologies of bodily sensing and sorting while also acknowledging the politics and values built into those same tools. Employing defamiliarization and play as design tactics, I experimented with ways of decentering the individual within biometric measurement and exploring what group privacy rights within biometrics might entail.

1.5   Research Questions

Biometric technologies have become a ubiquitous part of everyday life for people living within, or seeking to enter into, the United States. Quotidian activities like travelling, shopping, working, banking, acquiring a drivers' license, collecting welfare or social security benefits, and visiting the doctor have, one by one, come to involve biometric measurement and classification (Directorate of Terrorist Identities, 2013; Magnet, 2009; Singer, 2012). The diffusion of bodily sensing and sorting technologies across such diverse domains discloses mounting legal, social, and cultural reliance on, and trust in, the logic of biometric grouping and sorting. This project seeks to understand how we entered into an age of pervasive bodily surveillance. Accordingly it seeks to describe the technological and institutional history of American biometrics in order to explore its development, operations, and various expansions of its knowledge infrastructure. To this end, this project is organized around five interrelated research questions: What are the technical, social, and conceptual origins of American biometrics? What contributed towards the emergence of a national biometric knowledge infrastructure? What kind of knowledge does this edifice produce and circulate? How has biometric knowledge been mobilized by the state and its partners in industry? And, finally, why did biometric privacy become a matter of concern for the industry and the state?

1.6   Project Description

The section describes in more detail how I pursue the research questions listed above, and provides further descriptions of the specific technologies and concepts that I draw upon to inform my analysis of the technological and institutional development biometrics within the United States. This study begins with an account of biometry's origins in late-nineteenth century racial science, and then moves chronologically through to the post-9/11 security state. I purposely engage with a longer history of American biometrics in order to investigate the social, political and technological conditions that contributed towards large shifts in its scope and scale, and that resulted in the development of a national biometric knowledge infrastructure.

Chapter two seeks to describe the technical, social and conceptual origins of American biometrics, and describes the kinds of knowledge produced and circulated by this burgeoning field. This chapter begins with an exploration of Mark Twain's story *Pudd'nhead Wilson.* This serialized narrative introduced the American public to the scientific practices of fingerprinting, and offers one of the earliest instances of popular culture working to shape public perceptions and expectations of biometric science. Twain's story indelibly linked biometric data collection with the operations of law and order, and helped establish some of the social frameworks that would lead biometric technology to be associated with the naming, sorting and tracking of threatening bodies. Chapter two continues with a description of the origins of the field of American criminology and accounts for how practices of biometric grouping and sorting entered into various local policing and administrative contexts. This chapter ends with descriptions of key information systems that were developed to make sense of collected biometric data, and shows how the cultural, scientific, and sociotechnical aspects of late-nineteenth century biometrics established the terrain with which contemporary American biometrics still contends.

Chapter three describes what contributed towards the emergence of a national biometric knowledge infrastructure. It also describes the kinds of biometric knowledge that became important as biometric tools became centralized and administered through the state. This

chapter moves forward a century, and traces a number of late-twentieth century technological, institutional, and policy innovations that contributed towards the emergence of a national biometric enterprise, as well as the emergence of a biometric technology industry. Paying attention to the relationships that developed between federal agencies and private industry, and to the changing national security landscape, this chapter describes how the goal of biometric surveillance shifted from tracking *threatening bodies* to tracking *bodies in general*, and demonstrates how and why group-level sorting became a target for the state's security apparatus. This chapter concludes by examining public understandings of biometrics at the end of the twentieth century, paying close attention to privacy debates that emerged from the state's first large-scale and public test of automated facial recognition technology.

Chapter four accounts for the increasing proliferation of biometric tools into everyday life and describes some ways that the state and its industry partners leverage and apply biometric knowledge. Additionally, this chapter explores discourses of biometric privacy emanating from industry and the state. Paying attention to the ways in which privacy debates have developed following the September 11 terrorist attacks, this chapter explores the disconnect between the "privacy talk" (Igo, 2013) emanating form the biometric industry and enactments of privacy occurring through actually-existing practices and technologies. Industry rhetoric describes biometric measurement as a process involving the capture and disclosure of individual identities, however this chapter demonstrates that in practice, private industry and the state mobilize biometric tools in order to construct group-level differences and manage categories of people. This chapter concludes with a critical making exercise that explores biometric group formation and attempts to rethink privacy rights in term of group rights.

Chapter five summarizes my findings on the history and development of the American biometric knowledge infrastructure, and offers several avenues for further research into privacy, social sorting and group rights within biometrics. In this chapter I argue groups and group-level differences matter within biometrics, and that researchers should pay attention to how such categories are produced by, and circulated within, biometric

knowledge infrastructures. I also suggest that the concept of biometric privacy cannot end with the securing of personal data; it cannot be technologized as a function of information security. Rather, biometric privacy must be conceptualized to take into account the multiple ways in which biometric systems use individualized data to construct groups and to enact practices of social sorting. Finally, I suggest that there is value in using a multi-method approach to study sociotechnical systems, suggesting that 'method assemblages' better equip researchers to gather together tools, practices and perspectives that empower them to make sense of large and complex knowledge networks and knowledge infrastructures.