2 Documentary government and mathematical identification

On the theoretical significance of African biometric government

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Africans today find themselves on the cutting edge of a global turn away from the forms of documentary government that have dominated most societies for the last millennium.[1] Viewed in the aggregate, and especially at the level of entire countries, what is striking about the contemporary digital systems of identification on the African continent is that they deploy cheap biometric-capturing devices to generate unique numerical templates and linked identity numbers that support rapid, integrated, and potentially universal data processing (Gelb & Diofasi Metz 2018; Clarke 2017). I have argued elsewhere that this delinguistic, mathematical quality was key to Francis Galton's original interest in fingerprinting, that it formed the main justification for the use of fingerprinting as an alternative for written forms of identification for Africans, and that it remains—in the proliferation of encrypted and cryptic smart card devices—inaccessible, especially to ordinary users, by careful design (Breckenridge 2014, intro, Chapters 1 and 4, 2018). Shifting the lens of research away from the experience of individual users (and officials) to the comparative and historical study of state, semi-state, and private biometric identification technologies reveals them not as elements of an administrative continuum but as alternatives—indeed as antidotes—to the older paper-based forms of documentary registration. The written registration of the key elements of personhood (births, deaths, marriages, probate inheritance etc.) and property (especially of the ownership of land, debts, and moveable assets) has formed the foundations of bureaucratic states and citizenship in almost all other regions and periods (Breckenridge & Szreter 2012; Lund 2016). In many African countries—especially, but not exclusively, Ghana, Kenya, Nigeria, and South Africa—biometric identification systems linked to new systems of creditworthiness are displacing older and faulty infrastructures of paper-based registration (Breckenridge 2010, 2011, 2018, 2019).

To see the significance of this movement, it is helpful to draw out the differences between documentary and biometric administration and, especially, their different effects on the agency of ordinary people. Where

Weber (1978, pp. 956–1005), Foucault (1977, pp. 184–194), Goody (1986), and Scott (1998, Chapter 2) (and a host of lesser-known scholars) have all stressed the aggrandizing forms of bureaucratic control, accumulation, discipline, and simplification that writing has fostered over the past five centuries, I want to begin with a discussion of the basic political virtues of written government in contrast with biometric identification as it is conventionally imposed.

The political virtues of documentary government

Four coercions—taxation, debt service, military recruitment, and religious inquisition—have been impressively consistent in the development of written forms of government in widely differing societies across the globe over the last millennium. Clanchy's (1979) foundational study of the slow expansion of written government in England from the twelfth century shows how property registration and forgery fashioned enduring bureaucratic techniques of documentary registration, hierarchy, and control. Goody (1986) expanded the scope of Clanchy's argument to include the literate societies of the ancient Middle East, and he set up a romanticized contrast between the complexity (and flexibility) of the oral societies of West Africa and the hierarchies of documentary bureaucracies, including the military ones that took control of much of West Africa in the 1970s. More recently, Groebner (2007) has shown that the rise of literary government in Europe between the eleventh and sixteenth centuries produced the key characteristics of our modern surveillance politics—an ever-increasing obligation to register individual identities through writing coinciding with a widespread imperative to deceive by means of the same technology. His study carefully reconstructs the documenting enthusiasm and bureaucratic innovation of the Catholic Church. When these developments are viewed globally, the brutal confessional struggles in the seventeenth century—in Japan, many parts of Europe, the Americas, and even in China—produced an impressively similar general effort to capture souls on paper. It was this sacred conflict that drove the logic of paper-based registration away from estates, households, and lineages to the systematic documentation of the lives and deaths of individuals (Saito and Sato 2012; Szreter 2012; Looijesteijn and van Leeuwen 2012). And there is much in this transformation that can account for the forms of hierarchy and inequality that dominate the contemporary world (Clanchy 1979; Goody 1986; Groebner 2007).

Yet the documentary bureaucracy, and the written documentation of personhood and property in particular, has some important basic political virtues. With the possible exceptions of ancient Egypt and medieval Ethiopia (Ade Ajayi 1996, p. 12), documentary administration has also been characterized by highly dispersed and delegated forms of power, with the justices of the peace in Corrigan and Sayer's *Great Arch* (1985),

the provincial notaries of French civil status (Rosental 2012), and the Confucian magistrates of imperial China (von Glahn 2012; Woodside 2006) serving as typical protagonists of enduring and similarly dispersed forms of local government. Precisely because the documentary bureaucracy was routinely concerned with debt, property, and contracts, and motivated and resourced by the operations of courts, it was dialogical and obsessed with proving consent. It is no accident that contract lies at the core of the liberal tradition of justice.

Notice, also, the limits on the work of assembling documentary authority. Writing may be the trickiest 'sign of the sign,' shot through with excesses of meaning, uncertainty, and duplicity—the special concern of bureaucrats everywhere. It is also slow and difficult. Reading is laborious and exhausting and never-ending. Archives—far from being the engines of control and hierarchy imagined by Sekula (1986)—are costly, fragile, always decaying, chronically easy to disrupt, and prone to catastrophic episodes of housecleaning, renovation, and destruction. The educational skills required to make documentary government work and shape its politics have expanded unevenly but also very widely since the early decades of the nineteenth century. Indeed, as Gandhi observed, one of the obvious motivations behind the enormous cost and effort of education is the ability to engage with and shape the rewards of literary documentary regulation: 'If that were not so,' he explained—a little defensively—to the readers of *Indian Opinion,* 'there should be no need of education' (Gandhi 1908, p. 178). And, as the biographies of two very ordinary South Africans—Luisa Mvemve (Burns 2006) and Kas Maine (van Onselen 1993)—have both shown, there is truly abundant evidence that people who have not been to school, or mastered literacy, routinely deploy the basic techniques of documentary government to defend themselves (Breckenridge 1999, 2006). It is helpful to think of these writing and archival practices as the tacit skills of citizenship, and—because they mobilize consent—they are key to the successful operations of states, and the formation of citizens, everywhere.

I realize, of course, that this is something like the opposite of what we might call the ethnographers' view, most famously proposed by Goody and Scott, of the tyranny of writing. I am not persuaded, to put it mildly, by the pathos that informs these arguments. I think the disdain for writing and its effects reflects the anthropologists' distaste for and disapproval of the bookish and scholastic and institutional obsessions in Cambridge and New Haven. This privileging of the real world of experience over the literary archive has powerful historical roots and contemporary motivations in the modern university. Derrida (1998) was certainly right in arguing that a persistent 'logocentrism and metaphysics of presence' (p. 49) that debases writing is foundational in the Western scholarly tradition (although we may wish that he had explained himself more straightforwardly). In short, viewed from a university based in Johannesburg—where something like an

intellectual revolution has taken place over the last generation—it is obvious that literacy is a powerful driver of the good society. Nor are these virtues confined to the recent past.

Over the course of the nineteenth century, the population with the literary skills required to engage the bureaucracy on their own terms expanded enormously and writing, as Eddy Higgs (2011, pp. 112–116) has shown, became agent and measure of the achievements of democratic citizenship. In Southern Africa in the second half of the nineteenth century, this expansion of popular literacy, especially amongst rural people in the Eastern Cape, was strikingly similar to the transformation of working-class literacy in England (Rose 2001; Switzer 1993; Malherbe 1925). The same broad expansion of the skills of writing meant that the objects of the documentary bureaucracy—letters, contracts, certificates, cheques—were beset by carefully worked out campaigns of forgery, interception, and uttering (Breckenridge 1995, Chapter 1).

These literary skills lie at the core of the interpersonal practices of registration and recognition that, as Lund (following Honneth 1996) argues, have supported both state-building and practices of citizenship globally—this is what I mean by the good society. The act of documentary registration as 'mutual recognition constitutes a contract, one might say (pace Rousseau), that links property and citizenship to political authority in society' (Lund 2016, p. 1206). Of course, as Lund (2013) and many others (Boone 2014; Weitzberg 2015) have now shown, political authority can also be fostered by denying people access to the mechanisms of registration, especially for property and personhood, by making them intensely conditional, or by allowing entirely parallel and segregated arrangements of recognition. We need not endorse the Hegelian (and teleological) elements of Honneth's argument about the 'struggle for recognition' (1996, p. 144) in order to grant his broader point about the social and psychological importance of recognition between individuals and institutions and in law. Writing, and literary bureaucracy, has long been the driver of the contracts that form the basis of the alliance between registration and recognition. After the First World War, British (and Belgian) colonial rule functioned by denying Africans access to the documentary tools that were required to make registration and recognition work in the (contractual) common law courts and the paper-based bureaucracy, as skeletal customary government expanded from South Africa and Nigeria (Ake 1981, Chapter 4; Berry 1993, Chapter 2; Mamdani 1996, pt 1; Young 1994, Chapter 4; Chanock 1985, Chapter 6).

Mathematical character of biometric identification

Biometric systems, especially the fingerprinting techniques that were developed by Francis Galton and Edward Henry, have their roots in the same middle-class disdain for popular literacy that Jonathan Rose (2001) sees at the root of twentieth-century modernism: the creation of 'a body

of literature and art deliberately made too difficult for a general audience' (p. 393). In South Africa, fingerprinting was specifically designed and used to cleanse the writing of educated Africans from the state administration at a time (before the 1920s) when the proportions of mission educated black people significantly out-numbered educated settlers. Biometric identification aimed at all adults was also the only general form of registration aimed at Africans, as the state deliberately foreclosed existing projects for civil registration and land titling that progressives and the churches had fostered in the nineteenth century. This pattern was repeated with varying institutional investments and tenacity throughout East, Central, and Southern Africa leaving many of the ex-colonies—including Botswana, Malawi, Namibia, Tanzania, Uganda, Zambia, and Zimbabwe—with national identification registers effectively capturing all adults and authenticated by means of fingerprints, and very weak, or non-existent, infrastructures of civil and property registration.[2] Unlike the coercive identification projects aimed at minorities that are used in the regulation of US welfare or the European Union's Schengen migration programmes—African biometric registration is generalized and distinctive: it is often the only registration process that is properly endorsed by the state and available to all citizens. On top of this unusual architecture of registration, many layers of cross-cutting biometric registration—almost all aimed at identifying adults—are now being imposed by donors, or aid agencies, or different departments of the state (Gelb & Diofasi Metz 2018).

Some of the contrasts between written and biometric government—historically and in the present—are obvious. Where literary bureaucracy works, as Foucault (1977) observed, by placing individuals inside a 'network of writing … a whole mass of documents that capture and fix them,' (p. 189), biometric government works through radical abstraction—it is intrinsically, functionally, an ethereal, mathematical enterprise. From the very beginning, Galton (1892) intended fingerprinting to work as an antidote for the faulty and cumbersome forms of literary documentation, especially in the colonies where British officials governed 'natives … characterised by a strange amount of litigiousness, wiliness, and unveracity' (p. 185). Biometric identification works by generating very large possible numbers—whether from the extraction and combination of unrelated minutiae points from a fingerprint or an iris or the possible combinations of the classification of patterns and ridge counts. It is the unlikeliness of a match out of these very large pools of possibilities, which supports the claim that finger or iris prints can be used to identify single human beings out of populations of millions, or billions.

The causal influences between statistics and biometrics ran in both directions. Statistical uniqueness, in opposition to the correlation errors of Bertillonage, was the original virtue of Galton's fingerprinting and the originary moment of English statistics. Biometric measurement and analysis, and eugenics—their application to the study and direction of

human reproduction—were also the central problems in the development of the mathematical analyses that sustained twentieth-century computing. The key functions of modern machine learning—correlation, regression, inference—all derive from Galton's efforts to find a unique physiological identifier and, importantly, his effort to apply the predictive tools of the normal distribution to the analysis of human descent (MacKenzie, 1981; Stigler 1986, Chapters 8 and 9, 1989, 1997, p. 103). Humanists—especially historians and anthropologists—prefer to ignore these stochastic methods because they are almost always bewildered (and afraid) of mathematical arguments. This means that social science tends to ignore the heavy reliance on purely statistical processes of decision-making—inferential, provisional, instantaneous—in contemporary data processing, especially in credit surveillance and on-line advertising. The direct connections to the techniques of Pearson and Galton are, for example, unmistakable in neural networking's use of the gradient descent function to limit the errors of prediction (Domingos 2015, Chapter 4).

This movement into the ether has taken a long time, and it has been littered with failures—but that should not blind us to the intrinsically mathematical nature of biometrics and its powers, or the consistency and tenacity of the biometric protagonists. After a century of struggles over the classification and storage of fingerprints, the current systems are now entirely automated and paperless. Because the informational freight and the form of biometrics are mathematical—and *not* archival documents—the physical qualities also contrast starkly with the ordinary workings of documentary government. A host of manufacturers now produce standardized, commodified, and exchangeable devices that generate mathematical templates from simple jpeg images of fingerprints or irises. The extreme physical parsimony of biometrics can be gathered from the size of these templates: the data points of a single iris—sufficient to identify an individual out of the total human population—can be converted into an encrypted string measuring 500 bytes. It is this slightness, amounting almost to immateriality that also encourages designers to develop highly centralized systems around single points of surveillance and reporting.[3] Unlike paperwork in every respect, biometric data is instantaneous, enduring, and unique. They are also—again in contrast with writing—involuntary. And because the sensors used to generate fingerprint and iris templates have been thoroughly absorbed into the mainstream of computer engineering, biometric systems have become feedback devices, like those that drove the automation of the workplace in the twentieth century, but now writ large across the landscape of entire societies (Noble 1984, Chapter 3 and esp. 4; Beniger 1986, pp. 295–310; Zuboff 1988, Chapters 7 and 9; Wiener 1960).[4]

It is the combination of these qualities—of informational parsimony, rapid and cheap processing, the standardization and commodification of sensors—that have given the existing biometric systems a consistent set of political features (which, once again, contrast starkly with the cumbersome

and vulnerable regimes of paperwork). All of the large biometric architectures on the African continent share common features of centralization around a single-point of control (and of failure), usually a commercially developed and maintained population register, which acts as 'the single source of truth' about identification (Breckenridge 2008, 2010, 2019). They also replace the older forms of written agency and insurgency with automated tests of presence, answering questions about identification, location, and timing without the active participation, or the knowledge, of the subject. And, perhaps most importantly, they substitute the trace of the fingerprint for the older written forms of registration and recognition: the contract and the signature. These changes are more important than they might initially seem because the centralized biometric population registers that are developing outside of the West are all tightly linked to—and resourced by—the surveillance of creditworthiness. The combination of centralized biometric identification and credit scoring is also producing new, one-sided forms of property in unsecured debts and informational collateral. In part, because of the weaknesses and administrative lethargy of African states after colonial rule, it is possible to see much that is valuable in the adoption of biometric administration—and this ambivalence, as Woolgar (2002, p. 9) has rightly urged, can do much to forestall hysteria—but it is also clear, especially because legal and political debates about privacy scarcely exist on the continent, that a harsh new African cybernetic world is awakening.

This is to insist on the application to the African continent of some of the arguments and insights of the school of economic sociology that runs from Castells (1996) to MacKenzie (2006, 2008), and especially Poon's (2007) work on the financial market–making effects of the data gathering and scoring pursued by the credit rating agencies. The Anglophone scholarship sometimes invokes the authority of Michel Callon's (Muniesa, Millo & Callon 2007; Çalışkan & Callon 2009, 2010) work on the translation effects of devices on the development of markets, but it is also noticeably less preoccupied with the French and American pragmatist reconstruction of successful economic arguments from first principles, or with the invention of new nouns, and more interested in the old Marxist worries about capital, accumulation, and exploitation. This is sociology of finance—in contrast with the contrived innocence of ANT (Actor Network Theory)—that is formed by history and by economics. There is also an undeniable technological determinism in this work, attributing new methods for extracting value and fostering capital accumulation to the network, the devices, and the mathematical algorithms for measuring risk that combine them. The scholarly and the political problems, to be clear, lie in the forms, trajectories, and limits of capitalism and bureaucracy on this continent, and not in the politics of the Enlightenment or Reason in general.

It is, of course, true that the new forms of biometric financialization—like the finance economy in general—can be fruitfully studied using the tools of linguistic and philosophical analysis (Appadurai 2015). This has been

the object of the Human Economy project that Keith Hart established at the University of Pretoria (Schraten 2018). The key local protagonists of what can be called the biometric revolution—Serge Belamant of Net1 in South Africa, Nandan Nilekani of Aadhaar in India, Mwende Gatabaki of the National Digital Registry System in Kenya, or Chris Onyemenam of Nigeria's National Identification Management Commission—all offer philosophically competent explanations of what they are trying to do. The same can be said of the more obviously entrepreneurial global advocates, like ID4Africa's Joseph Atick. But—especially in relation to the engineering plans and innovations—these philosophical justifications are also trite and forced (usually presenting some well-known version of de Soto's argument about the miracles of virtual capital for poor countries). They have, at best, a tenuous link to the causal drivers of the expansion of biometric administration. The general drivers are the ongoing expansion of populations, the opportunities for profit in providing credit, and, in global terms, the unchecked ascendancy in government and in business of what Porter (1995) calls 'trust in numbers,' and the global proliferation of the Internet in attenuated mobile forms. The proximate drivers are all engineering projects that combine credit scoring, network security, and biometric identification. The combination of these general and proximate causes draws us back to the explanations offered by MacKenzie's earlier materialist sociology.

The current excitement about biometric registration on the African continent belies its long history and obscures the fact that the very weak forms of paper-based administration were nurtured by the colonial state's ability to use fingerprinting to control identification at the gate of the mine, the harbour, or the city. This genealogy links to the South African institutions in Congo, Kenya, Sierra Leone, and Zimbabwe—where the colonial states drew directly upon experts and practices from Pretoria—and across the continent, indirectly, through the influence of the South African precedents for lethargic and abstinent forms of indirect rule.[5] The more recent institutional linkages between South Africa and the rest of the continent are much more direct and substantial, as I have shown elsewhere (Breckenridge 2010, 2011, 2019).

The history of biometrics in South Africa makes several important points, which may be worth repeating here: the roots of philosophical and technological innovation lie in India and Africa, and not in Paris, London, or Washington, DC, both in the technology and in the political arguments; the opposition between writing and biometrics has a long history of colonial politics; but the politics of biometric registration is strikingly open-ended. One urgent theoretical conclusion requires particular stressing. This requires us to discard Foucault's forced circling of the 'will to power'—Nietzsche's undeniable claim that philosophical truths are also claims to power. Foucault insists, with the sweeping rhetorical enthusiasm that is common to his arguments, that the opposite is also true. 'Power and

knowledge directly imply one another,' Foucault declared, repeatedly: 'there is no power relation without the constitution of a field of knowledge' (1977, p. 27). This argument is unsustainable and it is confusing, as our contemporary politics shows: for it is entirely possible, and indeed quite frequently the case, that political power can be built in opposition to or in contradiction of the dominant forms of knowledge. Explicit suspicion and self-conscious rejection of knowledge have frequently served as the basis for successful political transformations (especially outside of France and Sweden, the rather strange countries Foucault understood well). Drawing on the outpouring of research about the politics of knowledge claims, often focused on the universities, in the pragmatist tradition that runs from Dewey to Latour, the conviction that power implies knowledge has been surprisingly influential and, sometimes, politically destructive.

The history of biometrics shows that it is entirely possible to wield power by deliberately fostering an informational void. Biometric registration, in South African history and in much of the world now, deliberately curtailed documentary government and official curiosity—as it deliberately undermined the literary agency of the colonial subject, especially educated Africans. The advocates of biometric government worked in alliance with the most reactionary elements of customary authority to justify the official refusal to gather scientifically mandated vital information—through registration and the census—on the births, deaths, and marriages of black colonial subjects, by resisting the official registration of private and collective land titles, and, as Sol Plaatje's critique of the 1913 Land Act showed a century ago, by expelling Africans from the paper-based contractual struggles over labour and property in the courts (Breckenridge 2016). Biometrics, in Foucault's own terms, was an instrument for limiting biopolitical government around the settler population, and, because it endorsed the suppression of the capillary forms of literary government, fingerprinting was both cause and effect of Berry's 'hegemony on a shoe-string' (1993, Chapter 2).

Hegemony on a digital shoe-string

What, then, about the politics of the dozens of biometric identification schemes that are currently underway on the continent? These systems—after five generations of failure and refinement—now exhibit a common set of technical features. They generate statistically unique forms of identification which, at least formally, can isolate individuals out of populations running into hundreds of millions. They deploy the logic of feedback control systems to replace the old written logics of comprehension and consent with a new, radically simplified claim about the presence and implied consent. This reliance on the trace increasingly commonly works to control the agency of both the governed subject and the bureaucratic agent by requiring live biometric data from both parties for every significant transaction. After

20 years of struggles over platforms and proprietary software, the technical systems have been standardized and commodified, and it is possible (although still unlikely) to share information across different contractors' sensors, databases, and networks. Biometric data is immortal: once individuals have been identified in the camps of the UNHCR in Cameroon, or the World Food Programme in Zimbabwe, or by the Bank Verification Number in Nigeria, they cannot retract that information and it will not expire. The identifications will persist in the functional databases and few restrictions currently exist for preventing multilateral agencies, African states, companies, or organizations from sharing or centralizing the information. Because biometric registration is also closely tied, across the African continent, to banking, credit surveillance, cash transfers, and SIM card registration—and specifically aimed at the identification and exclusion of the unworthy and the delinquent—it introduces a new and ambiguous form of hierarchy, with new rewards and disciplines. The most important point in thinking through the politics of these new systems is that biometric data is cryptic, explicitly resistant to linguistic engagement both in its use of media (like the smart card) and its encrypted form. Biometrics are materially designed to resist the editorial or authorial interventions of their owners. They are machines designed to prevent writing.

Many of the most ambitious schemes of biometric surveillance—Ghana's E-zwich, the Kenyan NDRS, the South African HANIS project, or, most obviously, India's UID—are being driven by conspicuous progressive intellectuals. These are political activists committed to large-scale projects of social engineering and social transformation. This is the same pattern that has long been associated with the history of biometric registration as social reformers look for mechanisms to address the failures of capitalist expansion. Progressives—as the rich US historiography has long shown—are impatient social engineers, looking for tools to reform the behaviour of both the economy and its most obvious victims. They are impatient, or explicitly hostile, towards the slow and cumbersome operations of the law and fiercely critical of the bureaucratic and political intermediaries who, over time, have assumed the control of the state's existing redistributive functions. Modern progressives—and here Nandan Nilekani is exemplary—are also targeting the collective identities and entitlements, like tribe and caste status, that postcolonial states have used to control the flow of redistributive resources for much of the last century. Biometric registration can transcend the limits of the colonial administration of vital registration and titling to insert a powerful individualizing logic into this collectivized architecture.[6]

Automated campaigns of biometric registration—even voter registration, which is typically expensive and wasteful—can help to drive the process of bureaucratic rationality and documentary government. This has certainly been the case in South Africa since 2002, and there is evidence to suggest that similar processes of inclusion and political mobilization are underway

amongst the long excluded populations of Somalis in Kenya. Biometric registration can work to foster the forms of distributed agency that will significantly improve the local processes through which African states know their citizens. But whether these projects will do that is very much an open question, and the heart of an increasingly bad-tempered debate amongst the advocates of identification and registration.

Most people who live in Johannesburg or Nairobi (to say nothing on behalf of those who live in Kinshasa or Lagos) would be pleased to swop the dangerous and chaotic world we currently live in for the biometric panopticon that Nandan Nilekani and the advocates of Indiastack are currently developing in Bangalore. This idea—that an effective biometric superkey can precisely lace together the many entitlements, transactions, assets, debts, and behaviours of law-abiding citizenship—is immensely attractive to those who live with the daily violence and disorder of the African postcolony. IndiaStack, of course, also proposes to control all the financial obligations owed to citizens and to gather the hidden treasure of unpaid tax while simultaneously eliminating the corrupt intermediaries who steal from the poor. Who, confronting the informational inadequacies of the existing postcolonial state, could oppose such a plan?

Unfortunately, there are few signs of this shiny new biometric panopticon, and the reality looks very much like the old pattern of skeletal and brutal administration that Africans have long had to endure. Whether it is South Africa's national moral panic over the proprietary credit scoring and microlending by Net1 (the company commissioned to deliver social grants to 13 million people), the E-zwich's coercion of salary recipients in Ghana, or the blacklisting of defaulters using the Kenyan population register, the biometric order that is developing on the continent looks to be 'hegemony on a shoe-string' revisited (Berry 1993, Chapter 2). This is strange, and sad, because the core economic and administrative problems on the continent, and their remedies, are now well understood. There are very few signs in the new biometric systems of the integrated, devolved, capillary, user-generated digital information that would allow African individuals and firms to demand what they need from the state and from each other and, simultaneously, create formal assets. In its place are growing radically simplified, automatic, proprietary systems for deciding on worthy and delinquent borrowers.

Notes

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2. For a representative detailed study, see The World Bank (2016, p. 6).

3. The arguments about the politics of centralization and devolution run through all of the key debates about privacy and security. In Science and Technology Studies, see Winner (1985); For European legal opposition to centralization, in the aftermath of the Third Reich, see Cate (1997, chap. 4); Perhaps most influentially, in Computer Engineering, see Anderson (1993).
4. It is not necessary to accept Beniger's arguments about the biological imperatives of control to understand the significance of this history.
5. For a discussion of this history in Kenya, see Breckenridge (2019).
6. On the development of the Nehruvian categories and collective affirmative action, see Dudley-Jenkins (2003); For the opposition to caste reservation and affirmative action, see Part 1 of Nilekani (2008).

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