Nile Articulations

Producing irrigation as science in colonial Egypt

> "Science has been defined as the medium through which the knowledge of the few can be rendered available to the many; and among the first to avail himself of this knowledge is the engineer. He has created a young science, the offspring, as it were of the older sciences for without them engineering could have no existence."[1]

Colin Scott-Moncrieff, Address of the president to the Engineering Section of the British Association for the Advancement of Science, South Africa, 1905.

In 1905, Colin Scott-Moncrieff, a renowned British irrigation engineer, delivered an address on the history of irrigation to an audience of engineers. In the address, Scott-Moncrieff recounted irrigation's history and the triumph of the British colonial bureaucrats that became its engineers in the late nineteenth century. Beginnings are telling, none more so than Scott-Moncrieff's own or his description of irrigation as young science. Born in Scotland in 1836, the trajectory of Scott-Moncrieff's life followed the pathways of British Empire and specifically those that produced British irrigation engineers during the second half of the nineteenth century. Scott-Moncrieff was posted to India during the 1857 Indian rebellion. Fresh from the British East India's Company's college at Addiscombe, India made Scott-Moncrieff a colonial irrigation engineer, a role that he would play in India for more than two decades before moving to Egypt to serve as Inspector-General and then Under-Secretary of the Egyptian Ministry of Public Works.

Following the 1882 occupation of Egypt, British engineers, many of whom began their careers in India, moved to the Egyptian Ministry of Public Works. These irrigation engineers supervised the management of the Nile flood; they allocated irrigation water; most significantly, they designed irrigation works, primary among them the 1902 Aswan dam. In each of these tasks, colonial engineers developed tools through which to imagine, interpret, and augment the Nile River, the agricultural environments that lined its banks, and the infrastructure used to move this river to agricultural land. This piece, "Nile Articulations,"

explores the production of knowledge about irrigation in colonial Egypt and the fraught endeavors to produce this knowledge as scientific abstraction. It represents a much-condensed draft of a chapter of my current manuscript project, *A New Nile*, which chronicles the history of the 1902 Aswan dam. The chapter from which this paper stems presents the first approach (of five) to the manuscript's framing question: How does one write the history of a dam? *A New Nile* explores that question from a range of vantage points including that of the production of knowledge, the transformation of motional material environments, the emergence of new physical human subjectivities, and varied manifestations of state form.

Engineering worlds of empire (Indian beginnings)

On March 25, 1859, a young Colin Scott-Moncrieff penned a letter to his aunt from the banks of the West Juma Canal, "My life on the canal has been solitary and wild enough, but very engrossing, and it is satisfactory to feel that I am really engaged in a beneficial work, for this irrigation is the life of thousands, without it all the country near here would be a desert."[2] Civil engineering, as a civilian craft, was still in its infancy when the British began to grow a colonial administration in India in the middle of the nineteenth century. In the eighteenth century, British and French engineering made great leaps with military conflict and the drive to develop means of advantage, specifically ship building. On the seas, the British navy reigned supreme, dominating the French during the Napoleonic wars. In 1809, the British East India Company established a military seminary at Addiscombe to train officers for the East India Company's army, among them military engineers. While the Institute for Civil Engineers was established in London in 1818 and civil engineers directed the construction of bridges and canals within England, the training of British civil engineers was largely confined to the military until the middle of the nineteenth century.

The colonization of India posed new challenges for British bureaucrats. Extensive networks of irrigation canals, originally constructed during the Mughal period, crisscrossed northern India. As the British possessed no expertise in irrigation, India's rich history of irrigation and the desire to intervene in its management left the British scrambling. During the second half of the nineteenth century, northern India became a kind of pilgrimage site for British bureaucrats working in irrigation. A British institution to train engineers, the College of Civil Engineering, later renamed the Thomason College of Civil Engineering, was established in 1848 in Roorkee. The initial intention of the College of Civil Engineering was to support the construction of the Ganges Canal, completed in 1854.[3] Later, the school would be closely linked to the Public Works Department of the colonial state.[4] In 1871, the institutional context for training colonial engineers further expanded when the (British) Government of India established an engineering school at Cooper's Hill in England.

For the British engineers who made their way to Egypt in the 1880s, learning irrigation was a process more complex than the act of moving water to agricultural land. Irrigation is spatialized politics; as such, learned irrigation in British India was always, already bound to coloniality and its hierarchies of power. The endeavors of British bureaucrat engineers to impose their own authority over northern India's irrigation systems produced conflict with local elites. As British engineers possessed rather little knowledge or experience in this realm compared to northern Indian cultivators, the colonial management of irrigation in India involved the separation of the governance of infrastructure and its correspondent forms of knowledge from those who had known, namely colonized subjects.[5] Historical thinkers - mostly famously Karl Wittfogel - have long theorized irrigation as a political matter.[6] While a number of scholars have troubled Wittfogel's insistence on the correlation between complex irrigation systems and despotic state authority, irrigation's political embeddedness persists. For British irrigation engineers working in India, knowledge of the

Indian "environments" supporting irrigation extended beyond the strictly material to include the historical and political relationships that comprised these worlds.

An environmental state

Like India, Egypt possessed its own august history of irrigation that long preceded its nineteenth-century occupation by the British. Until the nineteenth century, most crops cultivated in Egypt were winter, or *shitawi*, crops. Winter crops, among them wheat, were watered with a form of irrigation known as basin irrigation. Under basin irrigation, the Nile Valley was divided into series of basins and during the annual flood, cultivators directed the waters of Nile through large manmade canals connected to basins where floodwaters would soak the soil before being drained back into the Nile. Cultivators then planted crops in these soils after the recession of the flood. During Egypt's Ottoman history, stretching from the sixteenth to the eighteenth century, its agricultural products, wheat in particular, were vital to the health of the empire. While the Ottoman state in Istanbul was keenly interested in matters of irrigation, as Alan Mikhail artfully illustrates, local village officials and Egyptian cultivators were responsible for the upkeep and expansion of their own irrigation infrastructure during the long eighteenth century.[7]

In the early nineteenth century, Egypt's strong Ottoman governor, Mehmed Ali, constructed a "modern" state apparatus marked by the formation of centralized state institutions, an extensive bureaucracy, and a conscripted military.[8] Agriculture was one realm in which the nineteenth-century Ottoman-Egyptian state deployed its bureaucratic heft. Long-staple, export-oriented cotton cultivation was introduced in regions of the Nile Delta in the 1820s, and sugarcane cultivation expanded in regions of central Egypt. The Ottoman-Egyptian state mandated cotton production in large swathes of the delta and purchased the crop from cultivators at below-market prices. The state then reaped the profits of cotton sales

in European markets.[9] Egypt produced ever-larger quantities of cotton annually; much of this production travelled to British textile mills.

A summer crop, cotton's growing cycle did not match the temporality of flood-based agriculture. Cotton needed watering during the dry season of flood agriculture when the Nile River sunk to its lowest level. Historically, the cultivation of summer, or *sayfi*, crops, including cotton and sugarcane, had been limited to small stretches of land adjacent to the Nile where cultivators could lift irrigation water to these crops during the scorched early summer months. As cotton began to colonize the fields of the Nile Delta, so did new irrigation practices take root. Mehmed Ali sponsored a public works initiative to construct extensive networks of deep irrigation canals to carry water from a low Nile to cotton fields.[10] This form of irrigation - perennial irrigation - facilitated the watering of summer crops and the cultivation of more than one crop during each annual cycle.

The spread of perennial irrigation and cotton cultivation was matched by the development of a new institutional framework to manage Egypt's irrigation infrastructure. The nineteenth-century state codified local irrigation practices as law in the *la'ihat zira`at al-fallah wa tadbir ahkam al-siyasa bi-qasd al-najah*. The new code dictated local irrigation practices and assigned government officials specific duties in the management of irrigation, including the cutting of basin dikes to flood the land, the supervision of drainage when the flood season drew to a close, the cleaning of canals during winter, and the maintenance of irrigation implements for their region.[11] When called upon by the state, local officials also provided corvée, or state-mandated labor, for public works projects.

In 1830, the state centralized the supervision of public works with the establishment of a public works ministry, *Diwan al-Abniyah*.[12] In 1837, Louis-Maurice-Adolphe Linant de Bellefonds, a Frenchman, was placed at its head.[13] The appointment of a European to the Public Works Ministry reflected emergent knowledge networks tying Egypt to Europe and to

France specifically. During his reign, Mehmed Ali appointed Europeans to positions of prominence within his government and sent Egyptian delegations to France for education. One of the institutions that Egyptians were sent to study at was the École Polytechnique, established in 1794 near Paris. Both the French École Polytechnique and Egypt's own Polytechnique produced Egyptian engineers, trained in the notions of science and mathematics prominent in France during this period.

Ali Pasha Mubarak embodied the nineteenth-century evolution of engineering in Egypt. Originally from the village of Birinbal al-Jadida, Ali Mubarak was sent by Mehmed Ali in 1844 to study engineering at the École Polytechnique where he completed his studies with distinction, even serving a brief stint in the French army. Following his return, his career in Egypt included a number of posts, including one as the Minister of Public Works. In the second half of the nineteenth century, there was an infrastructural boom in Egypt. The Suez Canal was completed in 1869 as were railway lines linking Cairo to the canal and to the thriving Mediterranean port of Alexandria. Agricultural infrastructure also proliferated. Ever-extensive networks of irrigation canals and agricultural railways crisscrossed that fields that bordered the Nile. As Minister of Public Works, Ali Mubarak directed the construction of a new section of Cairo, Isma`iliyya. Modeled on Haussman's reconstruction of downtown Paris, with its wide streets, traffic circles, shopping arcades, luxury apartment buildings, and cafes, Isma`iliyya was intended to establish Cairo as a capital among capitals, visually representative of the traits that marked the nineteenth-century cosmopolitan city.

Ali Pasha Mubarak wrote prolifically in addition to his government service. These writings are one means of charting the legacies of nineteenth-century Egyptian engineering. His most well-known work was *al-khitat al-tawfīqiyya al-jadīda li misr, al qāhira mudunha wa bilādiha al qadīma wa al-shahīra*. The *khitat* is a classical Arabic form that embodies an amalgamation of history and geography. Twenty volumes in length, Ali Mubarak's *khitat*

demonstrate a masterful knowledge of Egypt's late nineteenth-century geography. He presents lengthy descriptions of the urban geographies of Cairo and Alexandria and rich inventories of the agriculture, history, and monuments of Egypt's towns and villages including the particularities of local communities and their residents.

Encountering Egypt

In 1882, the British occupied Egypt. The Finance and Public Works Ministries were the first targets of British colonial "reform:" Egypt was in debt to its creditors; the British colonial administration argued that agriculture was the means by which Egypt would rise from its financial troubles. Colin Scott-Moncrieff - the same Scott-Moncrieff with whom this piece began - was appointed Inspector-General of the Egyptian Ministry of Public Works. The British left the Egyptian ministerial system in place following the occupation, appointing British "advisors" and high-level officials to the different ministries. Scott-Moncrieff lobbied for the appointment of an additional four British irrigation engineers from British India to serve under him, among them William Willcocks, Hanbury Brown, and Justin Ross.[14]

The first generation of British irrigation engineers sent to Egypt faced a crisis of expertise. While these individuals expressed boundless confidence in the hierarchies of empire and in their skills as engineers, Egypt was an alien world. That Egyptians had managed their own irrigation practices for millennia rendered this world's foreignness even more daunting. Until the nineteenth century, cultivators and local elites effectively deployed local expertise and vernacular science to manage Egypt's complex irrigation infrastructure. Moreover, the institutions of Egyptian public works engineering predated the emergence of engineering institutions in the British Empire by nearly two decades. With the coalescence of a centralized state in Egypt, Egypt possessed a formal institutional framework through which Egyptian engineers trained both in France and at Egypt's own Polytechnique.

When the first generation of British irrigation engineers joined the Ministry of Public Works, Egypt was not a tabula rasa, nor would these engineers introduce "modern" infrastructural forms. Rather, this first generation of engineers confronted the task of proving their expertise in a terrain in which they possessed no real experience. Moreover, they would direct the staff of an institution with a deep historical footprint. In a move reflecting the spirit of Mubarak's *khitat,* the newly arrived British irrigation engineers made tours of Egypt's countryside. They then wrote of their travels, a kind of testimony to their acquisition of local expertise. Soon after his arrival in Egypt, Scott-Moncrieff traveled south to the town of Aswan. In his letters to family and friends, he boasted, "All the year 1884, I was in Cairo, or traveling on the Nile. My inspectors were constantly traveling. They learned Arabic very quickly …"[15] Hanbury Brown, one of this first round of appointments, echoed this sentiment:

> During the latter half of the year 1883, Sir Colin 'went throughout all the land of Egypt' to make himself acquainted by personal inspection with the condition of the problems with which he had to deal. Within twelve months from the date of his appointment his staff of four engineers of the Indian Irrigation Service had joined him.[16]

The act of traversing Egypt's agricultural landscape was a means of acquiring expertise; the citation of this travel in the text worked to establish authority and demonstrate to readers that these men were not cast in the mold of the detached colonial bureaucrat.

Among this initial group of engineers, the idea of the field and the expertise that it connoted was especially important to William Willcocks. The son of a British irrigation engineer, Willcocks had grown up in India and was educated at the Thomason College of Civil Engineering in Roorkee. Willcocks followed Scott-Moncrieff to Egypt, where he first served as irrigation inspector in the "second circle of irrigation" in the Nile Delta. [17] A child of empire, Willcocks sought to establish his unique proximity to the colonized subject and environment. Letters to friends and family capture Scott-Moncrieff's reflections; Willcocks reports his encounters in a memoir. Memoir produces the autobiography of a colonial engineer.

While Scott-Moncrieff was content to limit himself to straightforward descriptions of travel and his impressions, the narrations of William Willcocks' narrations were rather more graphic. In one anecdote, he describes the process of literally dirtying himself with his work:

> For ten shillings I persuaded an Arab to walk over the slimy bed with me, and though we started early it was after sunset when we reached our destination. I was left with only my shirt having got rid of everything in the desperate efforts I had to make when above my knees in slush. By rolling round and round, going on all fours, being helped by the stalwart Arab and using all my resources I just got across…[18]

Stories like this one perform Willcocks' intimate knowledge of place and the humbling motions that were required to obtain this knowledge. More than other colonial bureaucrats, Willcocks sought to attest to his unique knowledge of irrigation and the complex human and material geographies in which it was situated. This testimony involved more than travel with its correspondent acts of witnessing and traversing territory; Willcocks' testimony of local knowledge also sought to demonstrate the importance of encounter with the materialities of this territory.

Producing commensurability

This first generation of British irrigation engineers appointed at the Egyptian Ministry of Public Works quickly set to establishing their expertise through the act and performance of traversing the new territories under their control. Demonstrating expertise also involved positing a field in which they could demonstrate expert knowledge. Northern India, and specifically the intellectual community that formed in Roorkee, molded the British irrigation engineers who migrated to Egypt during the early years of the occupation.[19] India was the space in which British irrigation engineers first were exposed to irrigation and thus its systems, with their embedded histories, social relations, and material particularities, helped to constitute their ideas of irrigation. That these engineers did not know Egypt well meant that they rendered this world commensurable with the world that they did know, that of northern India.

In the early literature on Egyptian irrigation, British irrigation engineers often included explicit comparisons to Indian irrigation. In 1884, Colin Scott-Moncrieff published "Note on the Irrigation Works of Egypt and the Improvements to be Made to Them" in which he details the state of Egyptian irrigation works and offers suggestions for improvement. For British technocrats interested in expanding Egypt's cash crop economy, the provision of summer water to sustain cotton and sugarcane crops was a prime concern. Scott-Moncrieff writes, "I believe that even in low Nile, with proper water-distribution as now prevails in northern India, there is water enough for 400,000 acres of additional cultivation."[20] Citing success in India was a means of demonstrating expertise in Egypt.

Northern India not only testified to British irrigation expertise; as the field that shaped British expertise, it formed the material realm from which British technocrats thought irrigation and generated ideas. In this vein, the British (colonial) experience in northern India was cited as a comparison: The specific trajectories of British empire – and the experiences that they produced – marked the development of a British knowledge of irrigation, and its coalescence as science. In the same 1884 publication, Scott-Moncrieff outlines a future plan for the upkeep and improvement of the Delta barrage. Completed in 1862, the barrage was intended to regulate the water supply to the rich cotton-producing lands of the Nile Delta in the provinces of Bahira, Minufiyya, Gharbiyya, Qalubiyya, Sharkiyya, and Dakhaliyya. Soon after its completion, one portion of the barrage gave way. By the 1880s, repairing the barrage had become a priority for British engineers. Scott-Moncrieff's characterization of possible improvements is telling: "Following a well known Indian system suggested for this very work a few years ago by Mr. John Fowler C.E. Mr Willcocks has prepared a design for a second or Supplementary barrage…"[21]

While India was the basis for comparison and the field from which material ideas were generated, the environments supporting agriculture in northern Egypt and northern India

were not striking in their similarities. Agriculture in northern India was both flood-based and rain-fed. In Egypt, rainfall is incredibly sparse and consequently, agriculture depends almost exclusively on irrigation from the Nile. As northern India constituted the primary frame of reference for British engineers, northern India and Egypt were *made* similar through the pathways of colonial expertise that carried British irrigation engineers and readings of the environment from India to Egypt. The act of abstraction and the comparisons that it enabled did not emerge fully formed. Abstractions possessed historically and geographically situated roots. As British engineers began to physically travel from place to place, and to make explicit comparisons, so did irrigation engineering detach from the sites that produced it, and acquire new forms of abstraction.

Trickling up

In the reports of the Ministry of Public Works and the Irrigation Department, British engineers wrote of irrigation. The practice of irrigation was rooted in particular understandings of the material worlds in which agriculture was situated; the most significant element of these worlds was the river itself. These technocrats wrestled with the process of producing the Nile River as an abstract space that they could measure and manipulate. The first report produced by the Ministry of Public Works following the British occupation, Scott-Moncrieff's "Note on the Irrigation Works of Egypt and the Improvements to be Made to Them," is telling in its omissions: Unlike the reports that would follow it, this report is composed entirely in English and contains no Arabic terms. By the 1890s, this characterization was no longer accurate as British technocrats deployed many of the practices and terms that Egyptian cultivators and bureaucrats themselves used to understand the Nile. Ministry reports of irrigation rarely credit Egyptian engineers or cultivators with expert knowledge. Nonetheless, the manner in which Egyptian engineers and cultivators organized

irrigation and the precision of this organization mark the reports of the Ministry of Public Works. Languages spoke the Nile, among them Arabic.

The centrality of the flood's temporality did not diminish with introduction of perennial irrigation and the provision of summer water in the Nile Delta and portions of central Egypt. While perennial irrigation facilitated the cultivation of more than one crop during each annual cycle, the cultivation of those crops continued to depend on the character of the Nile's flood. Mr. E.W.P. Foster, director of the third circle of irrigation, describes the state of the flood in the province of al-Bahira, "For reasons given under 'Sefi irrigation', this season began badly."[22] Foster's use of the term "sefi" to refer to summer irrigation, or the irrigation that preceded the arrival of the flood, was only one example of the use of Arabic terms among British engineers to describe the Nile's seasonality. In addition to flagging a particular transmission of knowledge, the use of "sefi" also marked the continued existence of multiple notions of agricultural temporality. Historically, three seasons demarcated the agricultural calendar in Egypt: summer, flood, and winter. The British notion of summer, and its links to a quadripartite agricultural calendar, did not bring with it the same precise temporal connotations.

In the same 1891 report, Foster notes, "When it was found that the rise of the Nile was not sufficient to complete 'Tamam Rayy', the Girzah head sluice was closed on the shore side …"[23] Foster's description, and that of many other technocrats, testifies to the continued practice of filling a basin to local notions of "tamam rayy" or the necessary full irrigation level. Moreover, tamam ray was a local determination as different basins possessed different "tamam ray" levels. The use of this measure, and the terminology that described it, persisted despite the objections of some British engineers. Lieutenant-Colonel Justin Ross, Inspector General of Irrigation in 1891, writes, "It must also be noted that the system of bringing to

'Tamam Rayy' or full level late in the season, is much practised in Gizah. I do not approve of it myself but the custom is established and requires reform."[24]

That Arabic continued to articulate the Nile early in the occupation extended to the terms used to record the river's temporality. Nile seasonality was reflected in the materiality of the river itself. The changeable nature of the Nile - and its intersections with a surrounding world that included sediment, animal life, bacteria, and minerals - was one means of measuring the river. The water's color, its smell, and its height - these were the measures that Egyptians had historically employed to calibrate the agricultural calendar. In August, at the beginning of the flood, Nile water was colored red, charged with the rich, fertilizing sediment of the flood's beginning. Justin Ross adopted this language, complaining that the 1891 flood "was most decidedly low in August during the time of the best red water."[25] August's rich waters contrasted starkly with the composition of river water in the summer, before the arrival of the flood. In an 1894 report, W.E. Garstin, then Under-Secretary of State at the Ministry of Public Works, states that some believed the Nile waters at Khartoum to be poisonous during the month of May, when the Nile dropped to its lowest level.[26]

The composition of river water, specifically its color, was only one means of measuring the Nile. The records of the Egyptian Public Works Ministry contain detailed charts recording the height of the Nile as it was measured at Aswan, near Egypt's southern border, and at Rodah, near Cairo. The practice of measuring the Nile at Aswan and Rodah was an old one; political administrators and technocrats had long used the measurements of Nilometers as means of marking the annual rise and fall of the river. British technocrats also adopted annual markers of a changing river. The date on which the Nile was supposed to reach its peak, the *salib,* was September 26th.[27] After the *salib*, the emptying of the basins, or the *sarf*, began. Depending on the size of the flood, the *sarf* took between twenty and forty days.[28] The terms *sarf* and *salib* pepper the reports of British irrigation engineers.[29]

Irrigation and its performances of authority

Irrigation was only in part about providing water to agricultural land; it was also politics. The British irrigation engineers who cut their teeth in India before coming to Egypt learned irrigation as environmentally material and colonial. Justifying Britain's occupation of Egypt, especially during its contested early period, necessitated the denigration of local elites and the forms of governance over which they presided. Stories of corruption, oppression, and insufficient knowledge nearly always laced memoirs of the field. In these tellings, colonized elites were both childlike and tyrannical. Colonial bureaucrats including Evelyn Baring, Consul-General and de facto ruler of Egypt for nearly two and a half decades (1883-1907), devoted long segments of the colonial texts that they composed to this theme.[30]

Among the crimes of the Egyptian elite, technocrats like Willcocks and Scott-Moncrieff defamed the abilities of elites to maintain Egypt's complex irrigation infrastructure. In his personal memoirs, Willcocks recounts an anecdote in which he is traveling in a boat with an Egyptian engineer named `Abd al-Fattah when one of the boat's towing ropes catches and they are nearly sucked under a gate of the Delta barrage. When Willcocks (in his own telling), acted to free them by cutting the rope, he says that the Egyptian engineer "threw himself upon him and threatened to cling to my legs and drown me if I cut it."[31]

While Willcocks writes the Egyptian engineer as lacking in practical knowledge, Scott-Moncrieff depicts government officials as reigning terror over the local countryside. These officials appear in colonial texts as demonstrably emotive, irrational, and perpetually seeking to cement their own advantage. Scott-Moncrieff claims of the engineers that he appointed, that "they very soon had inspired such confidence in the natives that the latter used to beg to have their cases in dispute to them rather than to their 'Mudirs' to whom they would

have naturally referred."[32] These stories performed a double move: The denigration of local authority affirmed the need for colonial intervention while establishing the colonial narrator as humble, practically knowledgeable, and appropriately detached from the local political conflicts that ran rife among elites and the subalterns over whom they presided. Technocrats, like other colonial bureaucrats, positioned themselves as the champions of the oppressed peasantry.

In Egypt, no subject more aptly typified the endeavor of colonial technocrats to establish colonial rule as humane as the struggle over corvée labor. The state demanded corvée, or state-mandated labor, from Egypt's cultivators each year. Before the nineteenth century, peasants fulfilled their corvée labor obligations in or around their own village. Although mandated by the state, local corvée represented one practice through which Egyptian cultivators participated in agriculture as labor often involved the construction and maintenance of irrigation works that augmented their own agricultural production. Mehmed Ali's desire to construct larger pieces of infrastructure decoupled corvée labor from local agricultural environments. Many Egyptians were forced to travel long distances to labor; this travel and the arduous work that awaited them presented grave economic and physical challenges. By the late nineteenth century, as a result of the transformation of Egypt's irrigation infrastructure, nearly 60,000 corvée laborers spent five months of the year maintaining irrigation canals and clearing them of silt.[33]

William Willcocks adopted the cause of ending use of the corvée by the Egyptian Ministry of Public Works. In his memoirs, Willcocks described these laborers toiling at the Rayah Beherah Canal:

> They received no payment except in blows; they provided their own tools, carrying wet earth on their bare backs when they were too poor to provide baskets; they brought their own sack full of dry biscuits on which they existed; they slept out of doors on the bare ground in all weathers, with the bare sky above their heads both day and night. The Government did absolutely nothing for them except punish and imprison them when their stock of food failed and they ran away to beg or steal.[34]

Writing in 1905, Sidney Peel asserted, "Since 1889, all earthwork maintenance has been done by voluntary or paid labour."[35] By 1909, wage labor had carried the day. On its face, Willcocks' campaign was a success.

The debate over corvée labor is well-worn historical ground within the historiography of colonial Egypt. The campaign against the practice was consistent with a familiar colonial refrain enabling colonial bureaucrats to position themselves as social reformers. Peel's suggestion that some of the labor that replaced corvée was "voluntary" highlights the coercive networks that bound cultivators and laborers to large landholders and the state. Nathan Brown, and more recently Anne Clement, have argued that while the colonial disdain for corvée was important in spelling its demise, large Egyptian landholders whose estates depended on a ready supply of cheap labor - labor that had been tied up by the government under the corvée system - supported this transition.[36] In addition to freeing up a ready supply of labor, for colonial irrigation engineers, the debate over corvée served another purpose: It provided a colonial triumph independent of technical expertise. Irrigation involved questions of spatialized politics - what type of labor would be used, how that labor would be organized, and who would direct it – British irrigation engineers choose to weigh in on the political (and colonial) aspects of their position during a period in which they were still learning Egypt's agricultural environments and the irrigation infrastructure that supported them. When British technocrats could not yet demonstrate expertise in the more technical aspects of Egyptian irrigation, they performed its colonial authority.

Civil engineering's expanding worlds

During the 1890s, British colonial engineers and bureaucrats began to bandy about the idea of constructing a dam on the Nile. For British colonial officials, basin irrigation was associated with a number of disadvantages, among them the limitation of cultivation to those

crops whose growing cycles coincided with the calendar of the Nile flood and the vulnerability of Egyptian agriculture to annual fluctuations in the length and intensity of the flood. A dam would expand the surface area under perennial irrigation, facilitate land reclamation, and help insure the summer cotton crop. On the 26th of February, 1894, Sir Benjamin Baker, Monsieur Auguste Boulé, and Signor Giacomo Torricelli assembled in Cairo and prepared to journey to Upper Egypt. The task of these engineers was to survey a set of sites spread between Cairo and the Sudanese town of Wadi Halfa that William Willcocks had proposed as possible locations at which to construct a dam. They also examined a potential site for a reservoir, Wadi Rayan in the oasis of al-Fayum. In addition to considering questions of location, the commission debated possible designs for the dam and the potential "sanitary" impacts of such a construction.

The composition of the assembled commission reflected the increasingly global nature of the circuits of knowledge that comprised civil engineering. Civil engineering had begun to expand beyond the (porous) boundaries of empire. In the late nineteenth century, British technocrats often refer to Italian expertise in irrigation. French civil engineering had a relatively deep institutional history; French engineers had constructed a number of public works in France and in their colonial possessions, Algeria among them. In the late nineteenth and early twentieth centuries, British engineers also began to travel throughout the British Empire to advise increasingly dramatic projects. After leaving Egypt, Willcocks had a robust career in this world of empire, including stints in South Africa and Iraq. In thinking irrigation as science, irrigation engineering was becoming global, increasingly detached from the specific environments that produced this knowledge.

The composition of the committee sent to examine sites for a dam reflects this emergent global character. Its report also reveals manner in which these exchanges could be fraught. One of the conflicts dividing the three engineers was that of language: Auguste

Boulé complained that while he did not speak English - Baker and Torricelli's common language - the British engineers employed by the Egyptian Ministry of Public Works did not speak French, the language of government in colonial Egypt.[37] While a single anecdote, it gestures to the uneven role of empire in guiding circuits of knowledge.

This issue of language similarly haunted interactions between British engineers in Egypt and the Egyptian engineers who staffed the Ministry of Public Works. In his letters to family and friends, Scott-Moncrieff claims that his initial four appointees at the ministry learned Arabic quickly. The historical record contains no suggestion that any of these engineers ever became literate in Arabic. Before the occupation, Egyptian engineers were more likely literate in French than in English: Technical education was in French and French and Arabic were the languages of the Ottoman-Egyptian state. While engineering knowledge trickled up from the Egyptian engineers who engaged British technocrats in the field, this process of knowledge transfer had depended on the space of the field.

Building futures with dreams of the past

At the conclusion of their trip, two of the commission's members - Benjamin Baker and Giacomo Torricelli - submitted a report supporting the construction of a reservoir at the Nile's first cataract, near the town of Aswan. The third committee member, Auguste Boulé, concurred with the committee on several points, including the necessary design for a dam on the Nile, but rejected the possibility of constructing this dam near the city of Aswan as its construction would flood the Ancient Egyptian Philae Temple. When discussions of building a dam began, European Egyptologists fumed at the possibility that the temple would be flooded. In the lead-up to the dam's construction, Captain Lyons, an Egyptologist, surveyed the temples of Philae. In preparation for their partial flooding, the foundations of the temples were shored up with money from the Public Debt Commission.[38] Ultimately, the holding

capacity of the dam's reservoir would be reduced from the size initially proposed so as not to entirely flood the temple.

Philae was not the only remnant of Ancient Egypt that haunted the debate surrounding the construction a dam. The idea of constructing a reservoir in the Wadi Rayan depression was an idea with roots in the ancient past. A handful of British irrigation engineers, Willcocks among them, argued that in ancient times a lake, Lake Mœris, had existed at the site. In a 1904 publication, *The Assuan Reservoir and Lake Mœris*, Willcocks asserts that Mehmed Ali, enamored with the legend of the lake, sent his chief engineer, Linant de Bellefonds, to investigate the possibility of reconstructing the lake. While Linant Pasha argued that the project was cost prohibitive, the prospect of building a reservoir at the site of an ancient lake continued to be viable until the completion of the 1902 dam.

For British technocrats in Egypt, irrigation had a history that began with the great civilizations of Ancient Egypt. These technocrats saw themselves as reconstructing a landscape that they imagined at its most glorious under the Pharaohs. European fascination with ancient civilizations - especially as manifest by the profession of Egyptology and the restoration of ancient Egyptian ruins - thrived in the late nineteenth century. Most European tourists of this period encountered Egypt through Nile cruises that stopped at various ancient Egyptian sites. Images of Egypt from the period, especially its south, present an Egyptian environment, dotted by ruins, and inhabited by peasants living through historical practices dating back thousands of years. Both Egyptologists working on restoration projects in the south and anthropologists of the period raced to record the lifestyles and habits of southern Egyptian peasants as they read them as the living embodiments of an ancient past.[39]

Ancient Egypt formed the backdrop for many biblical stories and thus the imagining of Egypt as a biblical scape and the fixation on a distant past were intertwined. For many Europeans, the process of discovering Egypt in the late nineteenth century was intimately

connected to the imagination of a more ancient biblical landscape. This emotional relationship to the Egyptian environment as the historical backdrop for an imagined biblical past fueled the popularity of tours to Egypt among Europeans during the nineteenth century. The desire to associate nineteenth-century Egypt with Christian beginnings was not limited to tourists; for colonial officials of many stripes, biblical history functioned as a touchstone for their encounters with nineteenth-century Egypt. These individuals sometimes doubled as amateur biblical scholars, dabbling in archeology, particularly its more speculative aspects.

Environmental descriptions are never neutral; in the late nineteenth and early twentieth centuries, they were embedded in the forms of (hi)story telling that helped to constitute colonial projects. Diana Davis has written eloquently of the endeavors of French scientists to assign a history to Algeria's natural landscape, one in which aridity overtook agricultural abundance as a result of the supposed abuse of invading and eventually resident Arab populations.[40] This colonial (hi)story strategy was stitched to the project of empire: In colonial tellings of the past, European intervention was often figured as an endeavor to restore the glories of ancient civilizations.

In late nineteenth-century Egypt, the fixation on Ancient Egyptian history and its irrigation works facilitated the construction of an historical narrative that de-emphasized plentiful and much more recent accomplishments in irrigation. In an 1859 letter home from India, Colin Scott-Moncrieff wrote, "As long as I fight with Nature, there is no objection to the work, but, in my dealings with the natives …[41] For Scott-Moncrieff and other irrigation engineers of the period, irrigation was heroic work in that it configured a battle between the engineer and "nature." However, in both India and Egypt, the struggle with an untamed and fetishized Romantic nature was not the daily work of irrigation; rather these engineers were confronted with complex irrigation systems and the political hierarchies in which they were embedded. The making of myths about ancient civilizations allowed British technocrats to

push an already constructed irrigation infrastructure into the shadows, casting themselves as the redeemers of a glorious ancient past.

Centers of knowledge

The historian of South Asia, David Gilmartin, argues that, "India, not London, was the centre from which new ideas in irrigation spread in the decades before World War I, around the Indian Ocean and beyond."[42] Yet, the work of British irrigation engineers in Egypt begs the questions: Did irrigation knowledge have a center in the decades before World War I? Moreover, what would it mean for knowledge to have a center?

As British irrigation engineers moved from India to Egypt, the attempt to produce commensurability was only one means of producing knowledge about irrigation. Notions of commensurability lived side by side with other knowledge practices that included multiple temporal frames and spatially specific irrigation practices. In the late nineteenth century, British irrigation engineers received training in mathematics and the principles of abstract modeling.[43] However, even with the turn to abstraction, local environments, including the cultivators and engineers that populated the British Empire, intimately formed engineers' knowledge of irrigation. To argue that irrigation knowledge had a center is to suggest that methods of abstraction and mathematical forms of modeling had carried the day. It would be to suggest like Colin Scott-Moncrieff that irrigation was indeed a young science and as science might exist in the realm of the general, apart from the spaces that produced it. As the nineteenth century waned and irrigation knowledge became increasingly global, British irrigation engineers continued to wrestle with questions of the particular and the tension that these questions produced within a modern imagination of what irrigation might be, as science.

[1] Colin Scott-Moncrieff "Irrigation" *Science* 22 (Nov 10, 1905): 577.
[2] "Colin Scott Moncrieff to his aunt Mrs. Elmsley," March 25, 1859 in Mary Albright Hollings, *The Life of Sir C. Colin Scott-Moncrieff K.C.S.I., K.C.M.G., R.E., L.L.D., etc* (London: John Murray, 1917), 58.

[3] The British East India Company constructed several prominent canals in India during the first half of the nineteenth century, the Ganges among them.
[4] Arun Kumar, "Colonial Requirements and Engineering Education: The Public Works Department," in *Technology and the Raj: Western Technology and Technical Transfers to India, 1700-1947*, ed. Roy MacLeod and Deepak Kumar (New Delhi: Sage Publications, 1995), 216-32, cited by David Gilmartin, "Imperial Rivers: Irrigation and Visions of British Empire" in *Decentring Empire: Britain, India, and the Transcolonial World* (New Delhi: Orient Longman, 2006), 80.
[5] See David Gilmartin, "Scientific Empire and Imperial Science: Colonialism and Irrigation Technology in the Indus Basin," *The Journal of Asian Studies* 53 4 (Nov 1994): 1127-1149.
[6] See Karl A. Wittfogel, *Oriental Despotism: A Comparative Study of Total Power* (New Haven: Yale University Press, 1957).
[7] The negotiations of the Istanbul-based Ottoman state with local Egyptian officials and peasant cultivators over matters of irrigation is one topic explored by Alan Mikhail in *Nature and Empire in Ottoman Egypt* (Cambridge: Cambridge University Press, 2011).
[8] In *All the Pasha's Men,* Khaled Fahmy details the state's Foucauldian means of producing new subjectivities through a conscripted military and this institution's manipulation of bodies. Khaled Fahmy, *All the Pasha's Men: Mehmed Ali, his Army, and the Making of Modern Egypt* (New York: Cambridge University Press, 2002).
[9] See Roger Owen "The Introduction of Long-Staple Cotton, 1820-1837" in *Cotton and the Egyptian Economy, 1820-1914: a study in trade and development* (Oxford: Clarendon Press, 1969), 58-88.
[10] Kenneth Cuno, *The Pasha's Peasants: Land, Society, and Economy in Lower Egypt, 1740-1858* (New York: Cambridge University Press, 1992), 115.
[11] Ibid, 241-242.
[12] *Diwan al-Abniyah* oversaw public works and public schools as public works staff engineers were educated at the School of Engineering (*Polytechnique*). In 1837, the government reorganized the ministry and the administrations directing general engineering services and work on barrages formed its own division.
[13] Helen Anne B. Rivlin, *The Agricultural Policy of Muhammad Ali* (Cambridge: Harvard University Press, 1961), 242-243.
[14] William Willcocks, Hanbury Brown, Justin Ross, William Garstin, E.P. Foster, and Major James Weston were among the engineers appointed to the Egyptian Ministry of Public Works in the early years of the occupation.
[15] "Colin Scott Moncrieff to Mr. Frederic Seebohm," December 1883, in Hollings, 178.
[16] Hanbury Brown, "Irrigation in Egypt under British Direction," *Journal of the Royal Society of the Arts*. 56 2886 (March 13, 1908): 417.
[17] With the British occupation, the Egyptian Ministry of Public Works was divided into eight irrigation circles or districts. The duties of each inspector put in charge of a circle included distributing water from the headworks of the main canal to smaller canals, the maintenance of canals and drains, and the protection of the district from flood. Directors also settled disputes over water, determined how often land would be watered, and decided whether private canals could be constructed and pumping stations installed. Tignor, *Modernization and British Colonial Rule in Egypt*, *1881-1914* (Princeton: Princeton University Press, 1961): 115.
[18] William Willcocks, *Sixty Years in the East* (London: Blackwood, 1935), 106.
[19] Despite the establishment of engineering colleges in India, most British civil engineers in positions of prominence within the Government of India were trained in Britain. Gilmartin, "Imperial Irrigation," 80.
[20] Colin Scott-Moncrieff, *Note on the Irrigation Works of Egypt and the Improvements to be Made to Them* (Cairo: Britannia Press, 1884), 14.
[21] Ibid, 6.
[22] Lieutenant-Colonel Justin Ross, Inspector General of Irrigation, Egypt, Public Works Ministry, *Report of the Department of Irrigation for the Year 1891* (Cairo: National Printing Office, 1892), 4.
[23] Ibid, 7.
[24] Ibid, 6.
[25] Ibid, 1.
[26] W.E. Garstin, *Note on Perennial Irrigation and Flood Protection for Egypt* (Cairo: National Printing Office, 1894), 20.
[27] In 1892, the *salib* was on September 26th. W.E. Garstin, *The Nile Flood in 1892* (Cairo: National Printing Office, 1893), 11.
[28] Ibid.
[29] William Willcocks, *Report on Perennial Irrigation and Flood Protection for Egypt* (Cairo: National Printing Office, 1894), 68.
[30] See the Earl of Cromer, *Modern Egypt* (New York: Macmillan Company, 1916), volumes I and II.
[31] Willcocks, *Sixty Years in the East*, 92.

[32] "Colin Scott-Moncrieff to Mr. Frederic Seebohm," December 1883, in Hollings, 178.
[33] Scott-Moncrieff, *Note on the Irrigation Works of Egypt and the Improvements to be Made to Them*, 9.
[34] William Willcocks, *Sixty Years in the East,* 89.
[35] Sidney Peel, "Irrigation in Egypt" *Political Science Quarterly* Vol. 20 No. 3 (Sept, 1905): 530.
[36] See Nathan Brown, "Who Abolished Corvée Labor in Egypt and Why?" *Past and Present* 144 1 (1994): 116-137 and Anne Clement, "Rethinking 'Peasant Consciousness' in Colonial Egypt: An Exploration of the Performance of Folksongs by Upper Egyptian Agricultural Workers on the Archeological Excavation Sites of Karnak and Dendara at the Turn of the Twentieth Century (1885-1914)," *History and Anthropology* 21 2 (June 2010): 73-100.
[37] W.E. Garstin, *Reports of the Technical Commission on Reservoirs* (Cairo: National Printing Office, 1894).
[38] D.S. George and W.E. Garstin, "Descriptive Note," *The Nile Reservoirs Works at Aswan and Asyut*, Cairo: 1902.
[39] Winifred Blackman's text, *The Fellahin of Upper Egypt*, is the most notable of these works. Between 1920 and 1926, Blackman spent a considerable portion of each year performing fieldwork near Asyut, in central Egypt, and in the oasis of al-Fayum. In *The Fellahin of Upper Egypt*, Blackman argues that peasant practices derive from "ancient" tradition. The last chapter of her text is devoted exclusively to discussing the parallels between early twentieth century peasant life and ancient Egyptian customs. Winifred Blackman, *The Fellahin of Upper Egypt* (Cairo: The American University in Cairo, 2000). First edition printed in 1927.
[40] See Diana Davis, *Resurrecting the Granary of Rome: Environmental History and French Colonial Expansion in North Africa*, (Athens: Ohio University Press, 2007).
[41] "Colin Scott Moncrieff to his aunt Mrs. Elmsley," March 25, 1859, in Hollings, 58.
[42] Gilmartin, "Imperial Rivers," 78-79.
[43] Ibid, 79-82.