Hidden Pharaohs: Egypt, Engineers and the Modern Hydraulic

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Introduction

"For the first time, nature becomes purely an object for humankind, purely a matter of utility; ceases to be recognized as a power for itself, and the theoretical discovery of its autonomous laws appears merely as a ruse so as to subjugate it under human needs, whether as an object of consumption or as a means of production."

-Karl Marx[1]

Egypt and the Nile

Every organism ceases to exist without water; as for nations, even in the antique writings of Homer, the river and land of Egypt were notionally one and the same being. Linguistically they were distinguished by gender alone: used in the masculine, *aigyptos* (αιγυπτος) signified the waters whose annual flooding ensured the fertility of an earth, denoted by *aigyptos* in the feminine. Deified by Pharaohs, revered by the Jewish and Christian writers who claimed Paradise as its source, so awesome was the Nile that Arabic texts held that when *al-nil al-mabruk* went up, all other rivers on earth would fall. If there is any element that could act as a unifying factor throughout the written history of Egypt, a history that testifies to the rise of pyramids, to the fall of world conquerors, to fabulous wealth and to disasters of biblical proportions, it is that those inundations have been something of a *sine qua non*; Egypt without the Nile would be inconceivable.[2]

One could, like the poets, extol the generous virtues of a body of water, but in equal if not greater measures the Nile was an entity to be feared. It could bring a deluge so vicious that it left only famine and death for untold numbers in its wake. As a matter of survival, the ability to intervene in some way, to deflect or even harness such a force of

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[1] Karl Marx, *Grundrisse: Foundations of the Critique of Political Economy (Rough Draft)*, *Pelican Marx Library.* (London: Allen Lane; New Left Review, 1973).

[2] "Nile River." (2006). *Encyclopædia Britannica*. retrieved April 28, 2006, from Encyclopædia Britannica Online **http://search.eb.com/eb/article-9108302** and J.K. Kramers, "Al-Nil" in *The Encyclopaedia of Islam.*

tribulation would seem an imperative. By the age of early Islam, Ibn ‘abd al-Hakam reported that the Caliph ‘Umar had finally been able to abolish the yearly sacrifice of the Nile Bride. Instead of casting a young virgin into the waters to obtain a good flood, he threw in a letter of request calling on the river to rise if God so willed.

Until recently, human survival in Egypt depended on a singular idiosyncrasy in the river’s temperament. At the height of summer when lesser streams slow to a trickle, the Nile begins its tempestuous surge. Equatorial monsoons batter the mountainous highlands around Lake Tana before draining into the Blue Nile and ‘Atbara tributaries. Having joined the White Nile in the Sudan, by the time the force of this confluent trinity arrives at Aswan in September, the Nile enters Egypt at up to fifteen times its former size.[3] Before the age of the dam whose monumentality signified a kind of hydraulic conquest, the annual torrent would overwhelm the riverbanks and transform the Nile Valley and Delta into a vast lake. As the Nile expended its hydraulic charge and slowly receded, it bequeathed to Egypt the pulverized vestiges of Ethiopian volcanoes, endowing an otherwise barren desert with an astonishing fecundity.

Egypt is perhaps the most famous irrigated agricultural society in world history. The people of Egypt survived and prospered from this bounty by diverting the Nile’s mighty floods with earthen barriers. The continuous downward incline of the land from Aswan to the Mediterranean allowed the water to be captured and then routed to several basins along the slope. Upon the silt deposited by the floods, Egyptians could easily sow their seeds and await the harvest without much further effort. Cultivation in these

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[3] Alan K. and Eugene Rogan Bowman, "Agriculture in Egypt from Pharaonic to Modern Times," in *Agriculture in Egypt: From Pharaonic to Modern Times*, ed. Alan K. Bowman, Eugene L. Rogan, and British Academy. (Oxford: The British Academy by Oxford University Press, 1999), 2.

conditions is comparatively easy; it is the practice of irrigation that demands serious attention. The kinetic flow of the river resembles a pitched battle waged between the twin forces of erosion and embankment; the Nile traces this epic narrative all the way until the sea. To avoid uncertain catastrophe the dykes and basins must be solemnly maintained, but doing so requires an organisation that exceeds the capacity of the solitary individual. As a social endeavour irrigation therefore entails a political dimension, "it leads in all cases to communal reorganization, to new patterns of human interaction, to new forms of discipline and authority."[4] Perhaps this result was initially startling, an outcome not wanted but that dire necessity seemed to require. Or perhaps controlling water was the deliberate intent of a calculating individual, one pursued in the face of protest and defiance. Could a mastery of the Nile come to mean a mastery over its people as well?

A Hydraulic Despotism

The peculiar mystique of the Egyptian environment has historically informed the creation its own sociological category, the hydraulic civilisation. This concept derives from the two seemingly self-evident premises mentioned above: Egypt entirely abides by the waters and alluvium obtained from the Nile; since it can bring feast or famine, the people must control the river to ensure their survival. From the roots of this existential predicament one of the strongest and most centralized states in history developed in the Nile Valley; it commanded the forces of production- the process by which people extract from nature their subsistence and wealth- on the basis of its control of water.

One person who has sought to understand the dawn of Egyptian civilization as essentially a question of hydraulic management is Karl Wittfogel, the author of the

[4] Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West*, 1st ed. (New York: Pantheon Books, 1985), 20.

controversial work, *Oriental Despotism: A Study in Total Power*. Wittfogel claimed to have discovered a particularly repressive form of political authority, a "common substance in the various Oriental societies."[5] Like Marx, Wittfogel saw a specific 'Asiatic Mode of Production' at work in the East that prevented the emergence of a socioeconomic structure found in Western societies. The material preconditions of private property, the formation of a class of landowners, the temperance on autocratic government, all these developments were forever precluded by singularly hostile environment. Wittfogel observed that the West emerged in a temperate climate where agriculture was fed by rainwater. The "Oriental society", on the other hand, developed in regions characterised by aridity:

> Where agriculture required substantial and centralized works of water control, the representatives of government monopolized political power and societal relationships, and they dominated their country's economy. By preventing the growth of strong competitive forces, such as feudal knighthood, an autonomous church, or self-governing guild cities, they were able to make themselves the sole masters of their society. It is this combination of hydraulic agriculture, a hydraulic government, and a single-centred society that constitutes the institutional essence of hydraulic civilization.[6]

Ancient Egypt was a prime example of the Oriental society for Wittfogel who found the fullest expression of his ideas in the corvée, the Pharaoh's untrammelled abilities to command labour teams to undertake the grand works of engineering upon which his rule was based. The social hierarchy of the totalitarian Pharaonic political-economy was potently expressed in the pyramids, an enduring symbol whose aesthetic he described as "a minimum of ideas and a maximum of material…little more than a huge pile of

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[5] Karl August Wittfogel, *Oriental Despotism: A Comparative Study of Total Power* (New Haven: Yale University Press, 1957). 1.
[6] *Ibid,* 153.

symmetrically arranged stones."[7] The 'Oriental' or 'Asiatic' society was nothing more, Wittfogel believed, than "synonyms" for the hydraulic society: it was upon the water distribution system from which the civilizations of the Near East, India and China first emerged and always the control of water that formed their common social essence.[8]

Such reductionism has fallen from favour for good reason. Summarizing the consensus among archaeologists today, Fekri Hasssan states, "the emergence and maintenance of Egyptian civilization was not a function of centralized management of irrigation. Egypt probably survived for so long because production did not depend on a centralized state."[9] In a curious way, however, Wittfogel and many others have assumed that the civilisation of ancient Egypt emerged from centralized social organisation to manipulate the Nile where the evidence to support such an account either does not exist or is openly contradictory, yet when the historical record of a more recent vintage is far more suggestive, theoretical analysis of the significance of water control to Egyptian society remains largely unexplored. One study on water distribution and social organisation in *contemporary* Egypt claims that "the present irrigation system, in accordance with the techno-centric approach to development...is one that seeks to locate all authority and control, over the distribution and supply of irrigation requirements, firmly at the top and remove any meaningful authority and involvement at the local level."[10] When did water control in Egypt make this transition? Is it possible that at the roots of such a 'techno-

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[7] *Ibid,* 44.
[8] *Ibid,* 3.
[9] Hassan, Fekri 69. "The Dynamics of a Riverine Civilization: A Geoarchaeological Perspective on the Nile Valley, Egypt." (1997) *See also* Karl Butzer, Early Hydraulic Civilization in Egypt: a Study in Cultural Ecology" (1976) and Christopher J. Eyre. "The Village Economy in Pharaonic Egypt" in *Agriculture in Egypt* (1999).
[10] Radwan, Lutfi Salem 33. *Irrigation and Social Organisation in Egypt*. DPhil Thesis University of Oxford, 1994.

centric' approach to development, a perceived relationship between Egypt and the Nile contains elements whose presuppositions rely on little more than myth? If we are to accept the critique of Edward Said's *Orientalism,* we must then pursue its contentions beyond literary representations and search for its consequences on a material level. I propose to understand the history of modern Egypt by considering a shift in its major mode of production that was itself accompanied by a particular ideology to which Karl Wittfogel is profoundly indebted, of elements in a colonial program pursued and actively applied.

A Napoleonic Precedent

Wittfogel was the first scholar to theorize a system of hydraulic despotism; he was not, however, the first to portray Ancient Egypt as a society built on water. Two decades prior, the popular author Emil Ludwig invoked similar assumptions with characteristic brio and concision: "Necessity created on the Nile the first group of men, centralization, and obedience…. Canals are their epics, dams their dramas, the pyramids their philosophy."[11] To find the roots of this line of thinking in both general opinion and serious scholarship we must turn to the man who has until recently been seen as the causal agent for modernity itself in the Middle East: Napoleon Bonaparte. It was he who first recognized that the Nile afforded the government of Egypt a source of unusual power, as he said, "for no man could, from Paris, influence the rain or snow falling in Beauce or Brie, but in Egypt, man could directly influence the consequences of the flood."[12] Beyond articulating such an idea, Napoleon also conducted the invasion and

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[11] Emil Ludwig and Mary H. Lindsay, The Nile: The Life-Story of a River (New York: The Viking press, 1937), 19, 22.
[12] In *Ibid,*318.

occupation of Egypt (1798-1801) that was designed to turn the country into a French colony while preparing the way for a thrust to British India. Although the Egyptian conquest was a brief and unsuccessful military affair, at the level of ideas and influence, a Napoleonic occupation of the intellect lived on for generations.

The French presence in Egypt was marked by the attempt to impose a system of government based on consciously rational principles. Following in the footsteps of his *Armée de l'Orient*, Napoleon had assembled a corps of *savants* to record all they saw, heard and felt in order to inform government plans to 'restore' Egypt's agricultural productivity. Napoleon's *savants* believed that an underlying constant throughout Egyptian history was that government was strong when it successfully managed the Nile and that the hydraulic system had once been governed justly through a centralised distribution of water. But far from encountering an overarching and ordered hydraulic hierarchy, the *savants* found distinctive regional irrigation systems in place that were highly autonomous from one another. Instead of seeing the Egyptian relationship to the Nile as an agent for diverse interactions and a multiplication of practices, the *savants* reasoned that such variety was itself a symptom of a decline from an ancient unity. These intellectual activities were documented and incorporated into the crowning legacy of an otherwise abortive failure, the *Description de l'Égypte.* While the Expedition failed to turn the country into another province of France, the work of erudition was significant as the inaugural moment of the professionalized study of Ancient Egypt on the one hand, as well as government schemes to modernize the hydraulic infrastructure of Egyptian agriculture on the other.

The view that Egypt has always been and therefore *should* again become a society with a bureaucratic irrigation grid emerged within this milieu of French engineers and continued under the reign of Muhammad ‘Ali Pasha, the so-called ‘Founder of Modern Egypt.’ Under his rule, Egypt attempted to convert to a form of water control that made large-scale cultivation possible throughout the year by means of a centralized apparatus of state. The perennial irrigation system required the construction of deeper canals, longer dikes, and new techniques to regulate the height of the Nile. In terms of personnel to effect such intentions, Muhammad ‘Ali made ready use of European engineers and initiated the program to send young members of the ruling Ottoman household to France for training. This academic relationship was made possible due to the assistance provided by the former *savant,* Edme Jomard. In the course of the nineteenth century a perennial irrigation system was gradually constructed in Egypt at the cost of considerable disruptions in rural life. In its favour, perennial irrigation made possible the extended cultivation of cash crops like cotton and sugarcane destined for export to European markets. The monetary value of Egyptian agriculture increased greatly as a result and, by the end of the century, the ostensibly ‘ancient’ techniques of basin irrigation were reduced to occupying a fraction of the Egyptian terrain before eventually disappearing altogether. They had come to be considered “technically primitive and economically wasteful,” an “adaptation to, rather than of nature,” a hindrance that “limited agriculture to one-third of the year.”[13]

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[13] Hamdan, Gamal. "Evolution of Irrigation Agriculture in Egypt." In *Arid Zone Research XVIII A History of Land Use in Arid Regions*, edited by L. Dudley Stamp: UNESCO, 1961. 125.

A New Landscape

The new regime of water produced a new Egyptian landscape. Subjecting the temporal dimension of water's flow to human intervention, perennial irrigation aimed to supply the land with water when the flood was absent and deny it with the flood present; it sought to invert the Nile. Where once the river dominated the valley with a seasonal deluge that turned the land into a vast lake from which only the slim banks of levees emerged, the Nile would now follow a different rhythm. In numerous interventions, the Nile was "trained", placed on a program of behavioural modification and made to act predictably. Embanked by permanent levees, imprisoned by reservoirs, impounded by dams, the Nile became what it is in our own day: a river apparently tamed.

Roughly one century after this process had first begun, the geographer Jean Lozach observed the following scene during his travels in the Delta:

> The farmland is no longer transformed in lakes for a quarter of the year; villages rise up from here and there at the level of the plains; numerous trees stand along the roads and the canals. These canals themselves have multiplied, beside the most ancient that twist and turn protractedly; they go straight to the end, long rectilinear incisions seeming to have been drawn by a ruler.[14]

The kind of imagery that Lozach reads into the canal is no whim of his poetic imagination but an integral element to its technical function. The uniform construction of the canal's dimensions and slope allow for the more accurate calculations of its forces; the precise geometry enables him to picture the canal in his mind as a mathematical abstraction and facilitates the rendering of statistical models and the development of techniques to isolate and domesticate the key variables of water that might be expressed numerically. One such measurement is "duty" of water, the volume necessary to satisfy

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[14] Jean Lozach, *Le Delta du Nil: Étude de géographie humaine. Publications de la société royale de géographie d'Égpyte* . Le Caire; 1935. 56.

the irrigation requirements of a given crop in a given area. The canal is like others he has encountered throughout Egypt; it is a standard and rational object created by the state. Its design is simplified into a rule-based science, interchangeable and comparable with others; such a simplification reduces the complexity of the local environment for someone foreign like Lozach or the state irrigation officer; it allows them to understand the canal just as well if not with greater ease by simply looking at a map. The new water regime exhibits this aesthetic order by design; one of its virtues is legibility to the outsider.

This exactitude of water, distributed through "incisions seeming to have been drawn by a ruler," suggests nothing more than a profoundly managerial relationship towards a biologic need. It is the outward sign of an inscribed worldview in which humans and nature have been systematically arranged. The Nile and its flow is an instrument of state in the service of commercial agriculture, an administered life force, acutely separated from its immediate surroundings and made to flow firmly on the straightest line towards maximum yield and maximum profit.

A New Order

The thesis of this dissertation is that a new form of water control helped lay the foundations for modern Egypt. Where once the Nile had been the godly gift of an Osiris, its flow was made to follow the demands of the market. What kind of order was needed to achieve such a Promethean conquest? Far from accepting the view that Egypt has always been essentially a hydraulic civilisation typified by a systematic control of water, this thesis argues that Egypt was deliberately transformed into a society with new forms of communal association and discipline suited to systematically recasting the

environment for the efficient operation of a perennially irrigated commercial agriculture. The river Nile was simplified, its regional diversity was reduced, and its hydraulic force reoriented along its principal longitudinal slope to facilitate a singular control. The increasingly centralised distribution of water required a corresponding human revolution: a capacity developed to read the new order in the Nile and the executive authority to operate such a "public work". Egypt was to become the kind of society organized for the intensive manipulation of water, which is to say that it became what Donald Worster has described elsewhere as a *modern hydraulic* society: "a coercive, monolithic and hierarchical system, ruled by a power elite based on the ownership of capital and expertise."[15]

A River's Revelation

When writing an environmental history about Egyptian irrigation in the nineteenth century there is no need recapitulate a theory of hydraulic determinism. One point of departure is to consider water control more deeply and assess the stakes involved in a presumed conquest of nature so total. What Heidegger called 'technology' were those procedures that questioned the world and exposed it to manipulation.[16] More than simply the scientific way of acting on the natural environment, technology also means a way of seeing; it is a mode of what he called 'revelation'. For the French engineers the Nile's water was revealed in terms of a web of causalities related to the question of agricultural production. The Nile came into focus and became amenable to intervention by a narrowing of vision, by techniques designed to isolate key variables that might be

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[15] Worster, *op.cit.,* 7.
[16] Martin Heidegger. *The Question Concerning Technology and Other Essays.* New York: Harper & Row, 1977.

expressed numerically. Focussing on only certain aspects of the human relationship to water, such as the potential profit to be made from it, allowed *savants* like Girard to characterize the population in elaborate new ways such as the "ordinary force of the men in Egypt." Such formulations reduced the complex reality of the human relation to water and allowed the engineers to gain precision and analytic power. So represented, the Nile could become an object amenable to control.

But something else had happened as well; "that which does not reduce to numbers…becomes illusion; modern positivism writes it off as literature."[17] Modern technology, Heidegger held, revealed certain things but condemned us to only see reality in such terms. He found the epitome of this process in his own time, in his own river:

> The hydroelectric plant is set into the current of the Rhine. It sets the Rhine to supplying its hydraulic pressure, which then sets the turbines turning. This turning sets those machines in motion whose thrust sets going the electric current for which the long-distance power station and its network of cables are set up to dispatch electricity. In the context of the interlocking processes pertaining to the orderly disposition of electrical energy, even the Rhine itself appears as something at our command…But, it will be replied, the Rhine is still a river in the landscape, is it not? Perhaps. But how? In no other way than as an object on call for inspection by a tour group ordered there by the vacation industry.[18]

Heidegger's point was that, in addition to achieving its own prescribed end, the hydraulic dam condemned the Rhine to be understood *only* for its value as a thing to be 'commanded,' its meaning only in its ability to accomplish some other end. More than just a form of knowledge, modern technology "sets upon" the world, and represents only those terms that enable the world's exploitation; it aims ceaselessly to bring humans and their surrounding into a stark configuration for useful ends. Napoleon's *savants* treated all things Egyptian, its *antiquites*, *état moderne*, and *histoire naturelle*, with "objectivity".

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[17] Theodore Adorno & Max Horkheimer, *Dialectic of Enlightenment.* London: Verso, 1972. 7
[18] Heidegger, *op. cit.,* 16.

They expected to impose order on all data; to "process" all entities, human and nonhuman alike; to derive laws from observations and devise solutions for every kind of problem; to get things under control. One generation later, Egypt in the era of Muhammad 'Ali was "the country which demands the most to be governed, its material existence, the conservation of its soil, and thus of its population, calls for vigour and continuity in the power which directs it."[19] Heidegger called this 'demand' a "challenging" or active force that "gathers men into ordering;" it is "the way in which the real reveals itself as standing-reserve."[20] Heidegger named this summoning *das Gestell*, 'enframing'.

Legibility and the State

Enframing is the constitutive event of Timothy Mitchell's *Colonising Egypt:* the principle that spreads throughout Egypt in the nineteenth century to produce the effect of the conceptual realm as a place of higher meaning, as the site of something more true than the reality it represented. What was meant by 'reform' were those organizational techniques taken from European inspiration that focused on the physical confinement of human groups, the continuous monitoring of their behaviour, the detailed management of their movements and the careful construction of hierarchies. Together these practices made obvious the appearance of a structure

> that seemed to exist apart from, and prior to, the particular individuals or actions it enframed. Such a framework would appear, in other words, as order itself, conceived in no other terms than the order of what was orderless, the coordination of what was discontinuous, something suddenly so fundamental to human practice, to human thought. This effect was something new.[21]

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[19] A. B. Clot-Bey, *Aperçu général sur l'Égypte*, 2 vols. (Paris: Fortin Masson, 1840). vol. 1, 169. *my translation.*
[20] Heidegger, *op. cit.,* 19.
[21] Timothy Mitchell, *Colonising Egypt*. Berkeley; London: University of California Press, 1991. 14.

Order as a particular visual aesthetic comprised those methods of government seeking to inscribe the social and natural world with a new legibility to be read by the Pasha in Cairo, giving him more knowledge about his domain and making possible more discriminating interventions into the lives of his subjects. What distinguished this kind of order from the simplifications and categories that humans have perhaps always employed to understand the world around them was that this new realm of abstracted order was used by reformers to achieve the domination of people and resources from the *outside*, helping to create the conditions by which political power could be exercised constantly. It is through such practises of simplification and legibility that the river Nile became an object of governmentality endowed with an order all its own. It is a discursive *effect*.

A Complex Achievement

The new regime on the Nile proved a far more complex achievement in practise than any restoration of the past; the social upheaval it unleashed was staggering. "Give me regulators at the heads of the canals and I am master of Egypt," Muhammad 'Ali proclaimed.[22] In basic respects, the hydraulic revolution was a historical process marked by the failures of human ambition, unexpected consequences, and only tenuous management. The crux of the problem was increasing the value of agricultural production by building an irrigation infrastructure whose maintenance cost did not outweigh its own benefit. The initial strategies to extend the river's flow in low season by deepening the canal beds proved an impossible contest, defeated by the Nile's perpetual ability to nullify greater depth by the continuous depositing of silt. Instead of lowering the

[22] *in* Willcocks, William. *Egyptian Irrigation*. London: E. & F.N. Spon, 1889. 830.

elevation of the water conduit, the Pasha then tried raising the level of the water by erecting barrages and regulators to block its flow. Both these efforts involved the conscription of hundreds of thousands of peasants into an army of forced labour to dig canals further and deeper, to enlarge dykes, and to maintain the exploding demands of an increasingly cumbersome hydraulic apparatus. The astronomic outlay of capital and labour, inexperience with the scale of the new undertakings or their techniques, and the inability to maintain rigid obedience, gradually compromised the Pasha's autocracy in the name of financial solvency and delegated rule. In attempting to change and control a dynamic environment, irrigators themselves changed.

An Aristocracy of Water

In the course of his career as Ottoman viceroy, Muhammad 'Ali, who first seized power in Cairo in his capacity as a military commander, increasingly came to rely on a new techno-economic aristocracy of water. This elite would rise to power based on their access to the spaces opened up by perennial irrigation and a new strategy for conquering the Nile. The battle would bring new actors to the centre of public affairs in Egypt. One the one hand, the engineer became a civil servant, lending technical expertise to state power and determining the destiny of water's journey. On the other hand, at the receiving end of the canal downstream, a wealthy but dependent minority prospered from their ability to provide the capital investments to maximize agricultural production. One of the most salient developments in this period was the emergence of large-scale landholdings, a product of compromise between the Pasha and his men who shared a desire to maximize agricultural production. Placing the responsibility of indebted villages into the hands of individual members of the Pasha's civil bureaucracy was initially a method to

offset fiscal deficits. Allegiance to the Pasha could be lucrative for both parties. At the vanguard of the mechanization of Egyptian irrigation, the owners of these concessions were the first to benefit when the Pasha became the largest importer and retailer of mechanical hydraulic equipment in the country.

Can one speak of an ideology for the hydraulic society to be found among members of this rising elite? Consider the writings of one of its most prominent representatives, a man of technical expertise, the engineer, government minister, educator and writer, ‘Ali Mubarak (1823/4- 1893). A member of Muhammad ‘Ali’s educational missions to France, Mubarak was among the first Arabic-speaking Muslim Egyptians to achieve a position of influence within a governing body whose ethnic composition and cultural outlook was profoundly Ottoman. He was also a member of the first generation of Egyptian intellectuals to enunciate ideals of nationalist patriotism defined in large part by the country’s Pharaonic heritage. What ‘Ali Mubarak knew about Ancient Egypt came in large part from the European authorities on the subject whom he quoted. In his book *Nukhbat al-fikr fi tadbir Nil Misr,* Mubarak adopted an understanding of Egyptian history that emphasized “periods of great prosperity, when the rulers were attentive to the primacy of agriculture based upon a properly functioning irrigation system; when rulers became unjust and pleasure-loving the country deteriorated and frequently fell under foreign domination.”[23] As Darrell Dysktra has shown, ‘Ali Mubarak propounded a theory of Egyptian civilisation that coincidentally reflected the interests of a social class founded on instrumental reason and specialised knowledge:

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[23] Dykstra, Darrell. A Biographical Study in Egyptian Modernization: 'Ali Mubarak (1823/4- 1893). 393. and ‘Ali Mubarak *Nukhbat al-fikr fi tadbir Nil Misr*. 52, 59, 189, 191.

> The ancients also had a system of canals which provided for irrigation in summer, at low-Nile season, i.e., a *sayfi* or perennial irrigation system. Centuries of neglect had led to the condition which prevailed in the early nineteenth century, when all canals were *nili*, carrying water only during flood season….The appreciation of ancient Egypt and the assessment of Egypt's status as a progressive nation in the present world were tied to concepts of the state and the nature of good rule, an administrative and technocratic vision, which certainly served Mubarak- the quintessential administrator and technocrat- as a form of personal justification.[24]

Egypt abandoned basin irrigation to become rich, at least for some. Things never did quite go according to plan, however. The volume of available water oscillated unpredictably, peasants refused to follow orders. Beyond the realm of the human, a wide cast of previously unaccounted for actors began to occupy centre stage. The water grid proved highly porous and difficult to maintain, its power challenged by an array of organisms and substances transgressing its stark boundaries to sow disorder. Step by step the new hydraulic empire came to confront a mounting ecological crisis. In attempting to change and control a dynamic environment, irrigators themselves changed. A hybridic social and natural order would be the result.

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[24] Dykstra, Darrell. "Pyramids, Prophets, and Progress: Ancient Egypt in the Writings of Ali Mubarak." 63, 65.

Chapter I: The Origins of the Myth of the Hydraulic Society

«C'étoit jadis un pays d'admiration ; c'en est un aujourd'hui à étudier. »

" L'Égypte" *-L' Encyclopédie de Diderot et D'Alembert*

Where did the idea of an Egyptian hydraulic society come from? This chapter examines the cultural milieu in which a plan to "modernize" the country's irrigation system first emerged, namely, a matrix of imperialism and enlightenment. Napoleon's occupation of Egypt (1798-1801) was invested with a particular juridical justification. The French claimed they were in Egypt to end the corruption of Mamluk rule because it was lawless. Promising to emancipate Egyptians by establishing the rule of law, the French legitimized their own regime by appealing to Egypt's Pharaonic heritage as the original source of Western legal reasoning. In this guise, the French defined their invasion and reform program as nothing but the restoration of an ancient code.

Of the many ways the military government sought to demonstrate the truth of such claims, a discourse of improvement figured prominently. The fertility of Egypt, the French assumed, had long declined because of government incompetence. They indicted the Mamluks as parasitic despots, content to feed off of Egypt's wealth while doing nothing to encourage its proper administration. The French valued Egypt for its agricultural potential and saw agriculture as a question of irrigation. Egypt's economic improvement thus took shape in terms of subjecting the hydraulic system to a rational program. The most rational hydraulic administration, they believed, was one that maximized profits. As the French would argue, certain factors inhibited the Egyptian cultivators from undertaking these projects by themselves; only a strong government could establish the infrastructure that provided cash crops with water year-round. Without

a centrally administered system of water distribution, Napoleon's *savants* felt the waters of the Nile could never be properly exploited. Of course, in line with the broader rationales of France's project they were only restoring the enlightened laws by which Egypt's ancient civilisation had always abided.

"Soldiers, forty centuries are observing you"[25]

On the first day of July 1798, thirty-six thousand men aboard four hundred ships dropped anchor at the harbour in Alexandria. Three weeks later, after trekking across the scorching desert in their alpine uniforms, the French army massacred the Mamluk cavalry at the Pyramids. Within four days Cairo had fallen. In their own minds, the members of Napoleon's Expedition set sail for Egypt with loftier goals than simply military conquest; they were making history. For many later commentators, Napoleon's invasion inaugurated the beginning of the modern era in the Middle East. For Edward Said, "the occupation gave birth to the entire modern experience of the Orient as interpreted from within the universe of discourse founded by Napoleon in Egypt."[26] Whatever its pretensions, the occupation was a surprisingly brief affair that the French were forced to abandon after three years. The specific conceptual lens that framed the incursion as an encounter between East and West endured far longer. Combining military dominance with a political program, the Expedition was the original *mission civilisatrice.* France would colonise in order to liberate.

The French occupation of Egypt was one of the first instances of an imperial venture claiming humanitarianism as its goal. In the words of its founding fathers, the engineer, Egyptologist, civil administrator, Joseph Fourier, Egyptians were "crying

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[25] *Correspondance de Napoléon I,* 3 thermidor VI (21 July 1798). iv, no. 2816.
[26] Edward W. Said, *Orientalism*, 1st Vintage Books ed. (New York: Vintage Books, 1979). 87.

…under the most improvident and arbitrary of authority yet to exist on earth." [27] The ruling Mamluk households in Egypt were self-serving and "deprived of prudence and enlightenment"; they did not know "how to consolidate their power" but instead indulged in luxury, "oppressing all industry… abandoning or destroying the canals and public monuments." [28] Colonialism was meant to turn Egypt into what Fourier called "a natural appendage" of France. It would free Egyptians from repressive government and release their stifled economic potential by giving them a just and rational system of rule. Fourier laid out the goals of the program as follows:

> To abolish the tyranny of the Mamluks, spread irrigation and culture, effect continuous communication between the Mediterranean and the Arabian Gulf, found commercial establishments, offer the Orient the practical example of European industry, and, finally, give the inhabitants a better life and provide them with all advantages of a perfected civilization.[29]

Two months before the invasion, Napoleon had managed to persuade over one hundred and fifty men, mostly scientists, to join him and his army for the secret invasion. The engineers, mathematicians, naturalists and artists gathered by the general were an entourage unprecedented in scope. This move reflected the epistemological requirements of the kind of highly centralized bureaucratic administration Napoleon hoped to implant in Egypt. It also recognized that the existing European knowledge about Egypt was completely insufficient: the military maps used in the invasion, for example, were amateurish and mistaken; their most detailed information came from the likes of

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[27] Fourier, J B.. "Préface historique," in Edme Jomard et. al 1821-1830. *Description de l'Égypte: ou, recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de L'armée Française.* In, 2e éd., C.L.F. Panckoucke, vi.
[28] *Ibid,* vii.
[29] *Ibid,* viii-ix.

Herodotus and Strabo.[30] To fill these lacunae, Napoleon had worked through academic bodies in Paris to quietly gather young men to form an *Institut* in Egypt where they would conduct scientific experiments and gather facts to formulate government policy. The *savants* were employed, above all, to provide *practical* information to the military occupation that would enable them to regulate the mechanisms of Egyptian society and revise existing juridical categories. Their labours bequeathed the greatest legacy of the colonial endeavour, a "great collective monument of erudition" published between 1809 and 1828 as the colossal twenty-three volume *Description de l'Égypte.*[31] Over a span of three years, the scientific expedition intended to turn Egypt into one of the most minutely inspected terrains on earth; "to make," writes Said, "out of every observable detail a generalization and out of every generalization an immutable law about the Oriental nature, temperament, mentality, custom, or type; and, above all, to transmute living reality into the stuff of texts."[32]

Ancient Egypt as the Source of Law

As a project of the Enlightenment, the French Occupation attempted a complete reconstruction of Egyptian society on the basis of rational principles. In France, the revolutionaries "gave a name to what they had abolished… They christened it the *ancien régime.* In doing so they were defining not so much what they had suppressed, but more what they wanted to create- a complete break with the past, which was to be cast into the shadows of barbarism."[33] If the French were going to abolish Mamluk tyranny, they first endeavoured to understand it. The line of reasoning Fourier pursues throughout the

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[30] Charles Coulston Gillispie. 466. "Scientific Aspects of the French Egyptian Expedition 1798-1801."
[31] Said, *op. cit.,* 43.
[32] *Ibid,* 86.
[33] François Furet, *Revolutionary France 1770-1880*, *History of France.* (Oxford: Blackwell, 1992). 3

Préface historique attempts to show that although the situation in contemporary Egypt was indeed tyrannical, the rules of government had at one time existed. They were simply forgotten. At one time, "under its first kings" Egypt obeyed "invariable maxims; a persevering wisdom guarded the preservation of laws, customs and morals."[34] How had Egypt managed to lose the eternal order and justice expressed in the enlightened rule of its founding fathers? Foreign invasion. The Arabs, "so confident of their oriental doctrine, rejected the arts and customs of the conquered people"; their Islamic religion retarded "useful knowledge;" now "they are completely ignorant of the art of government, and what serves to found and perpetuate empires."[35] But all was not lost for the French Expedition. Within the remnants of a once perfected civilisation now almost extinct, Egypt had conserved all the secrets of its ancient glory. Not only had Egypt possessed laws at one time, it had also served as the seat of learning for a European civilization. Fourier reminds us that it was Egypt where the legendary lawgivers of Sparta and Athens, Lycurgus and Solon, had studied; it had been, in fact, the original source of a European civilisation once "lacking constant mores and laws [of its own]."[36]

Under Fourier's helm the scientific expedition in Egypt could define and transform Mamluk tyranny by a contrasting study of Ancient Egypt in order to discover the eternal laws of the enlightened pharaohs. From these traces, the "precious seeds of a new prosperity" would sprout again when "fertilized by the genius of Europe."[37] If Fourier could be said to be applying the *mission civilisatrice* to Egypt, in this context the ideology became something more complex. While foreign invasion was taken as the

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[34] Fourier, *op. cit.,* vi.
[35] *Ibid,* xxiv, xxvi, xxvii.
[36] *Ibid,* iv; xvi.
[37] *Ibid,* liv.

source of Ancient Egypt's downfall, the French were defining their own as a kind homecoming: "the sciences, after a long exile, would see their homeland again, and prepare to beautify it."[38] The ancient could be understood scientifically, in fact could only be understood by men of science, because it had originally been built according to scientific principles. Egyptian antiquity presented the Expedition with something of a rational civil code. A once glorious civilisation had united "the study of natural phenomenon, and at the same time intellectual and physical; revealing to a few wise minds the abstract principles of morality, it offered them to everyone in sensible forms: it regulated the actions and the thoughts, severely restraining the people, and lending to the civil institutions the support of an immutable authority."[39] Through the analysis of observed facts, the engineers would interpret the mute vestiges of ancient Egypt to discover the lost principles needed to plot Egypt's renaissance. Viewing their work as a violent rupture with the present for the sake of a broader historical continuity, the French moderns defined themselves as nothing less than the true heirs of the Pharaonic mantle.

Styles of Representation

The ideology of Napoleon's colonialism in Egypt suggested that contemporary tyranny could be both demonstrated and reformed by uncovering a more ancient and rational order. If they were to treat Egypt comprehensively and faithfully, the central task of the *savants* was to give Egypt a scientific representation. Historians and specialists of Oriental languages and culture were comparatively minor figures in the Expedition of Egypt. As Symcox observes, "it was the engineers, rather than the learned Orientalists,

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[38] *Ibid,* lxxii.
[39] Fourier, *op. cit.,* p. xiii.

who came to speak on behalf of Egypt."[40] In a literal sense, the *Description de l'Égypte* is above all else a work of engineering: the civil engineer, du Bois-Aymé, wrote a *mémoire* on Bedouin tribes; Edme Jomard, the topographical engineer, wrote about demography, critiqued Herodotus and analyzed the Pyramids; the chief engineer, Girard, wrote about commerce, industry and agriculture.

These men were united in a common training and professional ethos that lent the *Description de l'Égypte* a particular style of representation. The Expedition's leaders, Fourier and Monge, dedicated their professional lives to reducing questions about the physical world to mathematical relationships for instrumental knowledge: Fourier became famous for describing numerically how heat is propagated in material compounds; Monge pioneered the descriptive geometry, a method of depicting three-dimensional objects as two-dimensional drawings on paper. Their combined influence on the pedagogy at the École polytechnique where most of the *savants* had studied, and now in Egypt endowed their pupils with a basic idiom to describe and model all they observed. Order and regularity were sought from the analysis of facts. Such facts were best described as numerical objects, which could then be tabulated, classified and compared. The reform of Egypt could proceed by deducing from these self-evident facts rational principles, which is to say the rational principles assumed to have once guided the ancients.

Putting Water to Work: Fertility and the Potential of Egyptian Agriculture

Fourier viewed the fertility of Egypt as having always been a matter of water control but that something had happened to cause a recent decline. "The agricultural

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[40] Symcox, 37.

works," he writes, "consist principally in irrigation: But today the distribution of water is irregular and imperfect. The canals which bring it are designed without deliberation and without art; they arrive in some places with a superfluous abundance while other lands remain exposed to a long sterility."[41] To rectify the situation, the engineer, Le Père, called for a comprehensive treatment of the Nile "regime" that would enable the French to improve canal navigation and regulate water for agricultural use more effectively. He defined this regime as a measure derived from the river's water volume, the slope of the riverbed, the speed at which the waters moved, the seasons and lengths of its flood, and the stability of the riverbanks in relation to the eroding power of the current.[42] Le Père believed that the idea of calculating the "regime" had once been the practises of the ancients who had used Nilometres to form an "abstraction" of the Nile.[43] Engineers were to study irrigation in all its aspects in order to "gather the ancient laws, which, though fallen into disuse, could be put back into vigour immediately".[44] These expeditions tried to frame the question in several regards. On the one hand they considered the problem of Egypt's material prosperity synchronically from the contemporary practises of how water was utilized under Mamluk rule; from the factors affecting the behaviour of the Nile; in terms of labour productivity and crop cycles; morally, as a study of peasant psychology. On the other hand, they tried to relate all this information diachronically in comparison with the material traces of an ancient civilization presumed to be the epitome of rational government. This practise had the result of representing the two terms as a contrasting

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[41] Fourier, *op. cit.,* li.
[42] Le Père, M. p. 562. "Mémoire sur La Vallée de Nil et le Nilomètre de l'ile de Roudah. [sic]" *Description de l'Égypte*. EM XVIII vol. 1. 555-638.
[43] Le Père, *op. cit.,*598.
[44] Le Père, *op. cit.,*584-585.

binary: what the French perceived as deficiencies in the modern system they presumed had once existed in the ancient period.

Stasis and Passivity

The engineers believed that almost all aspects of rural life had remained "stationary."[45] This was because the *savants* viewed Egyptian cultivators as essentially passive. Chabrol, for example, observed how the *fellah* was using the same kind of plough that he had sketched from a Pharaonic tomb painting nearby. Girard claimed to discover how agrarian measures, crops and cultivation techniques, with few exceptions, had remained unchanged from antiquity. The major exception to this overall picture of stasis was the hydraulic system. Chabrol's remarks are typical: "the modern Egyptians, in the manner of their ancestors, employ irrigation for the cultivation of land: but this ingenious technique, which the ancients had carried to such a high point of perfection, has under the moderns lost its usefulness."[46] Instead of maintaining the supposedly ancient laws of hydraulic order, the engineers believed that the peasants were passively responding to the amount of available water. In his study of the seven ancient tributaries of the Nile Delta, Dubois-Aymé concluded that the cultivated land was only half what it had once been under the ancients because of "anarchic governments". In an earlier, less benighted era, "the many efforts, sagely conceived, which the ancient Egyptians brought

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[45] Girard, PS M. 397. "Mémoire sur l'agriculture, l'industrie et le commerce de l'Égypte." *Description de l'Égypte*
EM XVII. 1- 436.
[46] Chabrol, M. de. 316. "Essai sur les Mœurs des Habitans Modernes de L'Égpyte." *Description de l'Égypte* EM XVIII. 1-333.

to the irrigation of their lands and the conduct of water into the great canals alone could maintain the seven branches of the Nile in a constant state throughout Lower Egypt.[47]

Instead of subjecting the Nile to suit the demands of their agriculture, the engineers witnessed that the peasants calibrated their crop cycles and planting patters according to the time of the flood and its extent. With a high inundation, lentils were preferred instead of beans or barley. If the land was too inundated, one could plant flax or choose to leave the ground for pasture. The *shitawi* (winter) crop sown in October and November immediately after the basins were drained consisted of mostly cereals. Chabrol calculated that the entire land of Egypt would render 133 million francs in profit from wheat alone. But, more importantly, he wondered why Egyptians had failed to take advantage of more lucrative crops like sugar cane and indigo that could reap sixteen times the profit of wheat.

French engineers like Girard were able to demonstrate that the contemporary agricultural practices in operation in Egypt were irrational because the irrigation system was not being used to grow the most profitable plants. While cereals like barley and wheat comprised the most important crop for peasants in terms of area of cultivation, they were typically much less profitable than sugar cane, indigo, cotton, and rice. Cash crops, however, differed from cereals because their growing cycles demanded the continual application of water throughout the year. While these crops were cultivated throughout Egypt, especially in the Delta and the Faiyum, they required the use of devices such as the *shaduf* and *saqia* that lifted water from the Nile at its low-levels and deposited it on the fields. As a result of the technical limitations and increased labour

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[47] Bois-Aymé, M. du. 49-50. "Mémoire sur les anciennes branches du Nil et ses embouchures dans la mer." *Description de l'Égypte*. AM VIII. 49-210.

inputs, the cultivation of such water demanding crops was generally restricted to small plots of land, located on levees by the edge of the canal- a small fraction of total farming.

In his study on Egyptian agriculture, Girard drafted a rational plan for increasing Egypt's fertility by means of quantifying its productive powers. He tailed several military campaigns, journeying into Upper Egypt, the Faiyum depression, and the Nile Delta in the quest to measure the profit that an intelligent control of hydraulics and agriculture could render to "colonial capitalists."[48] Girard attempted to deduce the principles of Egyptian agriculture by striving to express all important information numerically. For example, he attempted to measure the various kinds of work performed by humans and farm animals per unit day: the volume of seeds a man can sow, the volume of harvest he can reap, the volume of earth he can dig, and the volume of water he can lift onto his field. Beginning in Asyut and moving around Upper Egypt before proceeding to the Faiyum, Girard calculated the expenses and revenues involved in growing different kinds of crops in the various agricultural cycles of the year. One of the problems Girard identified was that since the Nile's annual flood left Egypt's land so fertile and provided the post-flood *shitawi* crop with all its water resources, the required labour input required provided no basis to arrive at Egypt's potential fertility. In Girard's view, the *shitawi* crop was too easy; the cultivator did not, he said, "suffer fatigue."[49]

The true measure of the labour power of the peasant, according to Girard, occurred only with the artificial irrigation that required them to raise water onto their lands. He wrote, "It is in measuring the work of this watering that we can evaluate the ordinary

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[48] Girard, *op. cit.,* 188.
[49] *Ibid,* 398.

force of the men in Egypt."[50] Girard found that the Egyptian worker, using the *shaduf,* could lift 49.27 litres of water in 60 seconds to a height of 2.88 metres. This, Girard remarks, is "far below the force of an ordinary man."[51] Girard hypothesized that this deficiency was the result of the tropical climate, a poor diet and a lack of resolution to work hard. In contrast to Girard, Chabrol's study found that the average Egyptian peasant was stronger than his French counterpart. Although Egypt was more fertile than France and its peasants more robust, Chabrol argued that the Egyptian failed to plant the most profitable crops because his psychology and even physiognomy had been so fully distorted by Mamluk oppression that he no longer had any desire to satisfy anything beyond the minimum requirements for his survival. In this respect, the Egyptian *fellaheen* could no longer be expected to behave as regular peasants; they no longer "resemble the peasants or farmers of other countries at all."[52]

The Need for Government Intervention

The central problem for the engineers was that despite the calculations corroborating the claims of Herodotus and Strabo regarding Egypt's fertility, Egyptian cultivators could not be expected to behave rationally if left to their own devices. So traumatic were the centuries of oppression that the *fellah's* condition is only "misery, debasement and degradation"[53]. They were a class "that had only physical force" [54], they were "the most timid of men"[55], they were completely passive. They would sooner prefer to rely on the technologically simpler and less strenuous form of subsistence agriculture

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[50] *Ibid,* 398.
[51] *Ibid,* 19-20.
[52] Chabrol, *op. cit.,* 317.
[53] *Ibid,* 319.
[54] *Ibid,* 378.
[55] *Ibid,* 317.

than undertake the "grands encouragements" needed for perennial irrigation. Of all administrative responsibilities, "of all the works that a sage and enlightened government could do for the greatest advantage of the land," it was "the annual maintenance of dikes and canals [that was] the fundamental base of the physical existence of this land."[56] In Chabrol's assessment, irrigation, which was the "ingenious procedure which the ancients had brought to such a point of perfect, had completely lost its usefulness under the moderns."[57]

The Decay of the Hydraulic and the Independent Variable

Le Père concluded that the most rational plan would be for a "paternal" government to spread water with "economy" to the most distant places during weak floods while finding ways to dispose of too much water.[58] But far from proving this hypothesis, the hydraulic system that engineers like Le Père, Girard, Martin and others discovered did not appear to follow an overarching plan to be utilized by a paternal government. Instead, it presented them with a range of highly localized and differentiated patterns of water use and agricultural practises. Although all based on the manipulation of dikes and water-catchment basins to contain the yearly flood, Upper Egypt, the Faiyum and the Delta each presented their own unique environments whose topography, water-tables and position vis-à-vis the Nile gave rise to hydraulic systems with varying complexity. These factors influenced the dimensions of irrigation canals, the schemes needed to maintain them, the water-lifting technology employed and, thus, the crops chosen for cultivation.

Upper Egypt from Aswan to Edfu functioned without large-scale manipulations;

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[56] Le Père, M. Gratin.. "Extrait d'un Mémoire sur les lacs et les déserts de la basse égypte." *Description de l'Égypte*. EM XVI. 199-266. 223
[57] Chabrol, *op. cit.,* .316.
[58] Le Père, "Mémoire sur La Vallée de Nil et le Nilomètre de l'ile de Roudah." 594, 584.

small dikes (*jisr*) and short canals (*tura'*) running transversally from the river generally proved sufficient. Short canals perpendicular to the Nile were small enough and did not deprive basins downstream of access to the river to require more than local management. In the province of Qina from Edfu northwards, larger, more complex canal systems that branched off from the Nile's west bank and ran north, roughly parallel to the river, were typical. As the Nile descended towards the Mediterranean, diversions and multiplications of canals would ramify like capillaries between the two branches of the Nile delta north of Cairo. The lower elevation here allowed some canals to be watered year-round; the higher water table enabled the widespread use of wells to supply water for lifting machines as well.

From Qena where the Nile valley widened, communities having to share canals and dikes became more typical as the topography of the terrain accommodated larger catchment basins. These works required more sophisticated arrangements. If a canal fed several basins along its trajectory, regulation was necessary in order to ensure that the people located downstream did not lose their share of water from overly zealous cultivators upstream. Local customs tried to synchronize the opening of the dikes, often using secondary canals and co-ordinating the draining of basins upstream so that their run-off served basins downstream. While sharing and interdependence sometimes gave rise to violent, face-to-face confrontations, engineers like Girard and Martin observed that peasants preferred to ensure their water rights by guarding their local sections of the dykes and canals while letting the *sheikh* named by the *multezim* settle their disputes by

arbitration. [59] A *khuli*, elected by the peasants, was delegated executive powers to decide on the time of planting, how land would be partitioned and when the hydraulic works were to be maintained either by village labour or by contract. Village customs rather than codified laws were the basis of the irrigation system.[60] As Patrick Maury suggests, if there could be a "true manager of the hydraulic system" it was the *multazim* whose concession on the land's harvest surplus ensured that lands under his jurisdiction received water; it was he who undertook the engineering projects in the 18th century.[61]

The largest canals in Egypt, *sultaniyya,* were a series of waterways running northwards from Girgeh in Upper Egypt until the Delta. At the highest level of abstraction, these canals -the Baghura, Suwadi, Bahr Yusef, and Asara- could be seen as offering a virtually continuous water channel at a longitudinal axis a few miles west of the Nile. Each canal, however, was a separate and autonomous unit entrusted to the local provincial authority, each devising their own schemes for maintenance. They could charge a separate tax or allow each village served by the canal to subtract a portion from their fiscal contribution to pay the maintenance costs.[62] If one could generalize about the irrigation systems in Egypt, they tended to be structures that fostered a high degree of interdependence at the local level, within the area served by a particular canal. On a broader scale between the canals, however, they were highly autonomous. Upper and Lower Egypt were not connected within a single hydraulic system. The diversity of canals and the predominance of local administrative functions suggested that Egyptians

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[59] The *multezim* is the holder of an *iltizam;* a tax-farmer or one who has bought the right to collecting fiscal revenue on the government's behalf.
[60] Girard, *op. cit.,* 11. *also* cf. Jabarti, II, 124, trad. IV, 233.
[61] Maury, Patrick. "Irrigation et agriculture en Égypte à la fin du XVIIIe siècle." in *L'homme et l'eau en Méditeranée et au Proche Orient: L'eau dans L'agriculture,* 85.
[62] Maury, *op. cit.,* 84. cf. Estève *Description de l'Égypte*, XII, pg 80, 237, Jabarti, II 163, trad. V, 36

practiced de-centralized styles of water management.[63] Girard's investigations did not yield a pattern the government could simply restore: a generalized 'plan' did not exist. Girard interpreted this to mean that the ancient knowledge had been forgotten, the contemporary hydraulic system belonging to a people "who seem to have just left the state of savagery."[64] Le Père lamented: "we have searched in vain for the ancient regulations, they have disappeared; everything is subject at present to usages alone, which have the force of law."[65] The ambition to discover the regulating principle by which the whole hydraulic system could be encapsulated seemed destined for failure.

The irony of the *Description de l'Égypte*, which intended the systematic and comprehensive representation of Egypt, is that its crowning achievement was largely unintended. As Forgeau suggests, "rather than the result of a pre-existing plan, the passionate archaeological orientation which certain missions took was largely the fruit of circumstances; "above all," she argues, "of the enthusiastic personality of a few engineers.[66]" The *Description de l'Égypte* is justly held to inaugurate the beginnings of modern Egyptology as a specialized, professionalized discipline of study. If this was the effect, such Egyptology was precisely what the *Description* was not: written about by everyone but not formally differentiated as an academic field of its own within the Institut, Ancient Egypt remained for the *savants* an ever-present, open-ended and therefore undefined field of knowledge. The antiquity of Egypt was not an end in itself

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[63] Maury, *op. cit.,* 84. cf. Girard, DE, XVII, 12
[64] Girard, *op. cit.,* 405.
[65] Le Père, *op. cit.,* 582.
[66] Annie Fourgeau, "Le repérage des sites de l'Égypte pharaonique par les membres de la commission des Sciences et des Arts." in *L'invention scientifique de la méditerranée: Égypte, Morée Algérie.* 32-33.

for the engineers, the past was the filter through which they viewed the future; it was, in other words, completely utopian. The discovery of Lake Moeris is a case in point.

Perennial Anachronisms

The *savant,* Martin, was curious to follow up on the investigations of his colleague, Jomard, who had earlier asserted that the Faiyum depression contained the remains of an ancient reservoir mentioned by Herodotus. Herodotus had famously written about an expansive lake measuring 3600 furlongs in circumference that was the work of the great King Moeris.[67] It is reported that King Moeris decided to create the lake in order to mitigate the problems associated with excessive flooding. For as long as basin irrigation has existed in Egypt, the perennial worry since antiquity has been too much water. An inundation that was too high could overrun the dykes used to contain water in the basins; the floods would also lay waste to human settlements, drown livestock, and spoil food and seed stores. Herodotus claimed that King Moeris had built a reservoir to absorb such excess water from the Nile during its high flood. Jomard suggested that the king had created the lake by means of the Bahr Yusef canal and that the reservoir, whose precise location had hitherto remained unknown, was to be found in the Faiyum's much smaller modern-day remnant, the Birket-Qarun. Lake Moeris had shrunken over the years, Jomard asserted, because the Bahr Yusef canal was allowed to silt up since the Persian invasion until "arriving at the state of degradation where we find it today."[68]

Jomard also believed that he had finally found the answer to the perplexing statement reported by Herodotus that King Moeris needed a flood of only eight cubits to

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[67] Herodotus, *The History of Herodotus.* trans. George Rawlinson. II, 101 and 148-49.
[68] Jomard, Edme. 182. "Mémoire sur le lac de Mœris comparé au lac du Fayoum" *Description de l'Égypte*. AM VI 155- 226.

satisfy Memphis when in Herodotus' own time fifteen cubits were required. Jomard argued that the regulators installed at Lahun allowed Moeris to fill the lake and then release it back into the Nile when the river level decreased. Instead of simply appreciating the value of Lake Moeris as an outlet for water during the high floods, Jomard believed this was not the main point: "This king", he announced, "had executed a work whose object was precisely to supply the low floods."[69] Following his own reconnaissance survey Martin declared, "everyone is in agreement on this point, that Lake Moeris had the appearance of a vast sea, and that it had long been of great use to absorb the waters of floods that were too large, and to fertilise the valley of Egypt during the decrease in the river.[70] A national system had indeed existed for Martin and the other *savants*; this was true because of the "mathematical proof" furnished by their exact measurements.[71]

Studies conducted on the Faiyum in the two hundred years since the publication of the *Description de l'Égypte* have exposed the idealism behind the *savants'* views as highly implausible. Lake Moeris formed naturally during the late Pleistocene epoch when melting African glacial sheets caused the Nile's water level to be about 18 metres higher than today.[72] Bell argues that a lasting series of low floods during the First Intermediate Period caused the Bahr Yusef branch of the Nile to run dry and no longer connect the river with the Faiyum. This link was restored during the 12th Dynasty with the

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[69] Jomard, *op. cit.,* 182.
[70] Martin, *op. cit.,* 61.
[71] *Ibid,* 65-66.
[72] Barbara Bell. "Climate and the History of Egypt: The Middle Kingdom." In *American Journal of Archaeology* 79. no. 3. 251.

intervention of Amenemhet I, known to the classical world as King Moeris.[73] According to Bell, "only the most fragmentary remains have been found, there is no agreement about exactly what he built or about the particular of his irrigation and or reclamation works, or even about the approximate level of the lake in these years"[74]. While Amenemhet had likely decided to restore the connection between the Nile and Faiyum as a means of flood protection, considerable evidence would suggest neither he nor any of the pharaohs before the Ptolemaic period were concerned with increasing water supplies for irrigation during the low stage of the Nile. The *savants* assumed that the "ancients" wanted to use Lake Moeris to irrigate Lower Egypt in low season. But as Butzer observes, "the necessary technology for large-scale perennial irrigation was unavailable until the nineteenth century A.D. when the traditional, basin or paleotechnic system...began to come to an end[75]".

Practising irrigation during the low Nile poses a considerably more complicated challenge than the basin system of yearly inundations. First, it requires that canals be lower in order to carry water during the low Nile. Second it requires devices to lift water from the canal onto the fields. During the period of the Old Kingdom, buckets and manual transport were the only means to bring water onto fields outside of the flood season; more sophisticated technologies like the *shaduf* and *saqia* were only introduced in the 18th Dynasty and the Ptolemaic period respectively.[76] With limited means to transport water from canals to fields, artificially irrigated crops during the low season

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[73] Bell, *op. cit.,* 250.
[74] *Ibid,* 250.
[75] Karl W. Butzer, *Early Hydraulic Civilization in Egypt: A Study in Cultural Ecology*, *Prehistoric Archeology and Ecology* (Chicago: University of Chicago Press, 1976). 43.
[76] *Ibid,* 46.

were likely circumscribed to watering private gardens. In addition to lifting the water, the pharaohs would have found it technically almost impossible to dig deep-level irrigation canals because of the manifold problems associated with removing the almost instant accumulation of silt. Indeed, this drawback would plague the first attempts to implement a wide-scale perennial irrigation system soon after the French left.

Whatever the technological limitations likely to have stymied any efforts by the pharaohs to irrigate during low Nile levels, the crops varieties which could profit from such year-round water supplies were mostly non-existent: "Egypt lacked its cash crops and its key summer cereal as late as the Ptolemaic era."[77] Sugar, cotton and rice, were only introduced into Egypt after the coming of Islam. The staggered agricultural calendar comprising flood, winter and summer crop cycles could take shape *after* the introduction of the *saqia* and its usage within a functioning gravity-fed, high-waterhead canal system. Indeed, perennial irrigation did exist in the Faiyum- but only beginning with the Ptolemies.[78] Martin and Jomard were correct in assuming that the ancient Lake Moeris played a role in Nile control, but it was originally used for the adjustment of a high-water Nile in the context of the annual basin irrigation system rather than supplementing the low Nile for a perennial irrigation scheme.

As Butzer has argued, the kinds of irrigation methods used by those the *savants* referred to monochromatically as the "ancients" likely consisted in strengthening naturally formed levees, dividing basins into more manageable units, transferring water in and out of basin subunits by piercing dykes and digging small canals, and dredging and

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[77] *Ibid*. 50.
[78] *Ibid.* 48.

damming naturally occurring water channels.[79] Moreover, the gradual downward gradient of the Nile is poorly suited for the kind of radial canalization below a high water-head that would most likely suggest centralized control: beyond the level of local or perhaps regional canals, whatever was done in one flood basin could not deprive other basin systems downstream of their access to the Nile.[80] The absence of any pre-Ptolemaic dynastic records for these or any other duties incumbent upon a hydraulic bureaucracy suggest that this work was the concern of peasants not pharaohs. Far from the *savants'* scientific investigations furnishing the proof for the presumed decay of Egypt's hydraulic system since the age of the pharaohs, "all the evidence converges to suggest that, at the social and administrative level, flood control and irrigation continued to be managed locally, by the mass input of the total, able-bodied rural population of a basin unit, much like during the Mamluke era."[81]

Conclusion

The proposition that Egypt's hydraulic system declined from one of ancient centralization to modern regional decentralization is contradicted by all available evidence. The French *savants* gave rise to this misconception because it valorised their own assumptions as the most rational system to increase the profitability of Egypt's agricultural economy. But the myth of a Pharaonic utopia emerged not simply by accident or chance but by design: it was part of an ideological apparatus rationalizing the logic of colonialism.

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[79] *Ibid.* 48.
[80] *Ibid.* 109.
[81] *Ibid.* 109.

The French plan to liberate Egypt from tyranny required a foundational contradiction concerning the meaning of "law." As Fourier argued, an Eastern invasion had robbed Egypt of its ancient law. Since the taproot of Western civilisation stemmed form Egypt, the French could be said to simply restore to Egypt what it had always already been. To recast invasion as return, Egypt was split in two. It was the representation of Egyptian history as a binary opposition between ancient and modern, between liberty and tyranny, between order and anarchy.

An important leitmotif in the Expedition is that of reason and rationale. In 1798 Napoleon had formed his battalion of intellectuals as part of the *Armée de l'Orient* on the assumption that a government of occupation required a cognitive mastery of the terrain as much as it did a martial hegemony of violence. The reconnaissance and documentation carried out by the *savants* typified an aspiration for procedural rigour and epistemological totality. Their knowledge was interested and useful. As scientists, they worked to foster the information that would serve Egypt's 'enlightened rule.' As Frenchmen and products of the European experience of the 18th century, they expressed a notion of government made possible by statistics or "a science of state, in which the operation of government was to be made possible by the accumulation and tabulation of facts about the domain to be governed."[82]

The engineers who came to speak about Egypt invoked an idiom of mathematical quantification to remove uncertainty and facilitate the logical rigor of practical analysis. This was rational, Fourier argued, because Ancient Egypt followed rational laws- unified, immutable and abstract- that could be discovered by means of empirical investigation.

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[82] Nikolas Rose and Peter Miller, "Political Power Beyond the State: Problematics of Government," *The British Journal of Sociology* 43, no. 2 (1992)., 307.

Swayed by the aesthetic monumentality of the material traces of antiquity, could the engineers be faulted for assuming that the powerful civilization of the pharaohs must have also established the centralized control of a hydraulic system on which the agriculture of the country, and thus its tax base, so clearly depended? Perhaps this was reasonable within the restricted terms of their own calculus of profitability as the ostensible irrationality of the contemporary system originated from their belief that the Egyptian peasant did not have the means nor the attitude of a capitalist and their agriculture would not be devoted to growing the most profitable crops like sugar cane and indigo without a strong hand from the government. Whatever its logic, the historical record shows that the French engineers interpreted the Pharaonic past in the anachronistic light of the present, projecting their own technical capacities and governing biases to fill in the gaps of a theoretically immaculate antiquity.

The engineers failed to find the ancient secret of the Nile's regime that would increase Egypt's fertility according to a general plan and the Occupation failed to turn Egypt into another province of France; nevertheless, its effects lived on. On the one hand, their efforts brought forth the discipline of Egyptology and the intellectual appropriation of Egypt's past. On the other hand, their ideas marked the beginning of government schemes to overhaul Egypt's hydraulic infrastructure in favour of a perennial irrigation system. The view that Egypt had once been and therefore *should* become again a society with a centralized and bureaucratized water grid emerged within this group of French engineers and spread to the French reformers who lingered on in Egypt as the administrative retainers of Muhammad 'Ali Pasha. The next step in the modernization of Egypt in general and of its hydraulics in particular is the subject of the next chapter. It is

a story of how Egypt was made to resemble its representation and of the costs dearly paid for that "concordance between the mind of men and the nature of things."[83]

[83] Theodor W. Adorno and Max Horkheimer, *Dialectic of Enlightenment* (London: Verso, 1972). 4.

Chapter II: Reading and Inscription

"The builders of the modern nation-state do not merely describe, observe and map; they strive to shape a people and landscape that will fit their techniques of observation."

- James Scott[84]

Incontrovertible Facts

The notion that there can only be only one relationship to the Nile for the manipulation, distribution and consumption of its water and that this relationship requires a centralised hierarchy is one of the most enduring achievements of the *Description de l'Égypte*; it is an *idée reçue* that has even found its way uncritically into standard works of scholarship on Egyptian history. In the first page of her influential study of Muhammad 'Ali's agricultural policy, for instance, Helen Rivlin begins her investigation with the following assumption:

> The Nile not only determines the existence of Egypt itself, but it also in many ways fixes the type of government and institutions the Egyptian people can have. For example an incontrovertible fact of Egyptian life is that there must always exist a highly centralized administration to direct the distribution of water from one end of the country to the other.[85]

In a popular "revisionist" reading that goes farthest in disputing Rivlin's characterization of Muhammad 'Ali's reforms as a complete break with the past, Kenneth Cuno maintains a stated assumption that goes largely unexamined, namely, that "throughout Egypt's history the ecology of the Nile valley has influenced the patterns and rhythms of rural life."[86] The ensuing discussion then goes on to demonstrate the degree of continuity of agrarian administration, landholding practises and urban-rural trade. Despite treating

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[84] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, *Yale Agrarian Studies* (New Haven; London: Yale University Press, 1998). 82.
[85] Helen Anne B. Rivlin, *The Agricultural Policy of Muhammad 'Ali in Egypt*, *Harvard Middle Eastern Studies, 4* (Cambridge: Harvard University Press, 1961), 1.
[86] Kenneth M. Cuno, *The Pasha's Peasants: Land, Society, and Economy in Lower Egypt, 1740-1858*, *Cambridge Middle East Library; 27* (Cambridge: Cambridge University Press, 1992), 17.

"ecology" as an independent variable, *The Pasha's Peasants* assumes it is static enough to warrant an end to any further deliberation. "While not immutable," Cuno concludes, "the basic features of the rural economy and society of the Ottoman era were inherited from earlier times and would endure in the nineteenth century."[87]

Between 1820 and 1850 the ruling household in Egypt attempted to create a hydraulic apparatus that regulated the Nile's flow in a way that maximized the distribution of water under a centralised authority. This policy was deemed reasonable because it was assumed to be the only kind of irrigation system that could ever exist in Egypt. Such is the argument of one of Muhammad 'Ali's most sycophantic European chroniclers, Antoine Barthélemy Clot (1793-1868):

> The prosperity of Egypt and the increase in the number of its inhabitants depends on the management of the waters of the Nile…. To serve such important interests with constant surveillance and assiduous care, there must be one thought and one governmental force, always unified. Egypt is thus the country which demands the most to be governed; its material existence, the conservation of its soil, and thus of its population, calls for vigour and continuity in the power which directs it. But, by an ironic fate no country has been more poorly governed for the last one thousand years; none have seen in such succession, in such short periods of time, such barbaric powers as destructive in their instincts as indolent and unintelligent in their administration.[88]

In irrigation even a causal observer like Clot, the pioneer of Egyptian 'public hygiene', could proclaim, "more than anywhere was felt the need for order, unity and centralisation."[89]

The government attempted to impose this conception of hydraulics onto the people and land of the Nile Valley. Maintaining the material production of the agrarian

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[87] *Ibid.* 17.
[88] A. B. Clot-Bey, *Aperçu général sur l'Égypte*, 2 vols. (Paris: Fortin Masson, 1840). vol. 1, 169. *my translation.*
[89] *Ibid.* vol. II. 467-468.

economy through biophysical manipulation was, of course, in itself nothing new; agriculture by definition is "the radical reorganization and simplification of flora to suit man's goals."[90] What was new in the nineteenth century, however, was the application of techniques designed to facilitate a form of bureaucratic management that transformed the physical and social environment of Egypt to serve the interests of an outside observer ultimately sitting in Cairo. The river Nile was simplified to match the abstract unity of its representation; the extraordinary variety in its regional conditions was reduced, and its hydraulic forces reoriented along the Nile's principal longitudinal slope to facilitate a singular control. But far from remaining a timeless "incontrovertible fact of Egyptian life," the new order of Egyptian hydraulics was founded upon revolution.

Muhammad 'Ali Pasha

In the wake of the French departure from Egypt a junior commander in the Albanian contingent of the returning Ottoman militias succeeded in exploiting popular discontent in Cairo, cunningly eliminated his rivals within the military and civil administration, and rose to become the Sultan's viceroy in 1805. After destroying his opponents and expropriating the land titles, Muhammad 'Ali would gradually impose his agents as the sole intermediaries between the Egyptian cultivator and the world market, a process that "during the first half of the nineteenth century… would be the immediate factor for change in the lives of the Pasha's peasants."[91] Eliminating all obstacles between himself and the cultivator offered clear benefits for the Pasha's war chest in terms of a greater share of the taxes derived from the land. But Muhammad 'Ali went

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[90] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, *Yale Agrarian Studies* (New Haven; London: Yale University Press, 1998), 2.
[91] Cuno, *The Pasha's Peasants: Land, Society, and Economy in Lower Egypt, 1740-1858*, 2.

further, taking the initiative to direct the economic life of Egypt more forcefully by managing the volume of the country's agriculture production, increasing or decreasing the amount of a crop grown according to how well it was selling in Europe and introducing new breeds and species which he thought offered the most lucrative prospects.

The crop that was to capture his attention decisively was a strain of long-staple cotton developed by Louis Alexis Jumel (1785-1823), a French textile engineer that Muhammad 'Ali had placed in charge of his spinning mills at Bulaq.[92] From 1821 onwards, the Pasha presided over a hydraulic transformation with the objective of creating the conditions best suited to the growing of long-staple cotton. Upon his command, between 100,000 to 150,000 *feddans* of land along the eastern bank of the Damietta branch of the Nile were planted with cotton. Doing so required Muhammad 'Ali to dredge and deepen canals, build protective dikes around the cultivated land, erect *saqiyas* to lift the water on the fields, sell oxen to power these devices to the cultivators on future tax credit, and provide them with seed.[93] Over the course of the nineteenth century, cotton would spread over Egypt and become a fixture in the crop rotations sown in every province of the Delta before moving south to Middle Egypt and beyond.

The land would no longer lie dormant for half the year but be subjected to an almost continuous schedule of production. The old winter cultures that had constituted the base of Egyptian agriculture on the eve of the nineteenth century would eventually be replaced by a system favouring the growth of plants like cotton. In its favour, perennial

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[92] Roger Owen, *Cotton and the Egyptian Economy, 1820-1914: A Study in Trade and Development* (Oxford: Clarendon Press, 1969), 28.
[93] *Ibid,* 29.

irrigation greatly increased the monetary value of Egyptian agricultural production by expanding the area and season devoted to the cultivation of cash crops. With pull from the markets, Muhammad ‘Ali and his descendants commanded an economy whose express purpose was to wrest from the land the maximum possible production volume and value of cotton.

A New Egyptian Landscape

The precondition for growing Jumel’s cotton as well as the other plants whose production came to dominate the Egyptian economy in the nineteenth century was a new regime of water. Egypt’s systematic conversion to perennial irrigation under Muhammad ‘Ali marked the first attempt to create such a hydraulic environment on a wide scale. Instead of surviving from the annual inundation of the Nile, these cash crops required several discrete applications of water in timed succession; three waterings at minimum for cotton but seven or eight to prosper.[94] Where it existed in Egypt at the time of the French expedition on approximately one-ninth of cultivated land, perennial irrigation occurred largely as a result of local decisions to exploit particularly advantageous situations in the Nile’s floodplain topography. As the seasonal inundation overflowed the banks of Egypt, the water’s current gradually lost speed and deposited greater levels of silt sediment nearest to the bank, spawning naturally formed levees and bestowing on the Nile’s flood pattern a characteristically ‘convex’ shape. Cotton as well as sugarcane and indigo had long grown upon these elevated strips of land between the river and the basin plain. There, they bordered a source of water that could be lifted; there, the higher elevation made it easy to shield the plants from the Nile’s rising waters while they were

[94] David S. Landes, *Bankers and Pashas: International Finance and Economic Imperialism in Egypt*, *Kingswood Books on Social History.* (London: Heinemann, 1958), 261.

still in the ground. In a country where land was cultivated by means of basins built to capture a single yearly inundation, the perennial form of agriculture is a more demanding and secondary intervention.

Early Failures

Rather than automatic, establishing perennial irrigation was an affair initially characterized by a prolonged and difficult struggle to master the Nile's current. Although the time of the yearly flood was easy to predict, determining the actual quantity of water to be available at high and low Nile was little more than guesswork. This uncertainty made central economic planning difficult. From the beginning, "despite the growth of cotton exports and high prices," Cuno observes, revenues calculated in "constant" piasters declined by 12 percent from 1822 to 1825-26, because of the low floods of 1824 and 1825."[95] Even discounting the question of inflation, the statistics for cotton production speak for themselves: after the initial surge in production between 1821 and 1824 when the volume of the harvest rose from a miniscule 99 *qintars* to 228,078, by 1828 production had plunged to less than 60,000.[96] As quality deteriorated, the prices that *jumel* fetched on the European markets sunk like a stone.

A wide variety of factors, both human and ecological, seem responsible for frustrating the methodical expansion of perennially irrigated commercial agriculture. Canals silted, people resisted, the river responded to human modifications in unanticipated ways. With water available for cultivation throughout the year the demand for Egyptian labour exploded. The agricultural calendar under the new scheme now

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[95] Cuno, *op.cit.,* 119.
[96] Yaqub J. Artin, "Essai sur les causes du renchérissement de la vie matérielle au Caire dans le courant du 19ème siècle (1800 À 1907)," *Mémoires de l'Institut Egyptien* V (1908).

meant over eight months of working in the fields compared to the five-month cultivation pattern of basin irrigation.[97] In addition, unlike the regular *nili* canals that only carried water during the flood season to help irrigate catchment basins, the floors of the new *sayfi* canals were some four metres deeper in order to carry water when the level of the Nile was at its lowest. Because perennial irrigation in Egypt occurred alongside older forms of basin systems, to supply water for both practises, the deeper *sayfi* canals necessitated the installation of barriers at spaced intervals that would raise the level of water during the Nile's flood to feed the catchment basins that lacked water-lifting devices. The decrease in velocity, however, caused the silt load carried by the water to fall to the canal floors, not only depriving the basins of the annual alluvial deposit whose refreshment had long made their fertility famous, but also rendering the canal perennially useless unless re-excavated annually.

To rectify this problem, the residents of Egypt were conscripted into labour teams and made to toil, for the first time, in unfamiliar settings away from their villages. Under Muhammad 'Ali's command, "the whole corviable population" worked in four shifts. Each group participated on canal maintenance and construction for forty-five days until, after 180 days, the job was completed.[98] The ordeal, to be repeated every year, could only be characterized as Sisyphean. "On a cold December day," recounted one eyewitness in later years,

> I had before me a deep trench some 25 metres wide, 15 metres deep to the tops of the banks, out of which 3 metres in depth of slush and mud were being removed by a gang of 3500 naked labourers. Some were standing knee deep in slush, out of

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[97] Afaf Lutfi Sayyid-Marsot, *Egypt in the Reign of Muhammad Ali*, *Cambridge Middle East Library* (Cambridge: Cambridge University Press, 1984), 118. Al-Sayyid Marsot gives 150 days of annual labour for basin irrigation compared to 250 for perennial.
[98] William Willcocks, *Egyptian Irrigation* (London: E. & F.N. Spon, 1889), 274.

> which they were grubbing up double handfuls of the stuff and putting the chunks of mud on the bare backs of others, who supported the wet, cold, slimy stuff with their arms folded behind their backs, walked up the slopes and threw it over the reverse side. At every ten metres or so on either bank stood a man with a long, thin cane which he used on the bare backs of the corvée.[99]

Seldom fed and sometimes unpaid for their efforts, most workers were kept alive by their wives and children who camped at the site of the canal. Alleaume estimates that in 1820, between 300,000-400,000 men were required to work for three months to maintain canals and dikes, or around 30 million days of labour; six decades later, the amount of labour measured in working days would double despite the technical advances in dredging that tripled the average volume of earth moved per man.[100] "For part of each year," Owen notes, "almost the entire population of the Delta was involved in government works. Meanwhile, routine agricultural activity was brought to a standstill."[101]

Even when the irrigation system seemed to function properly for growing the crops he desired, the Pasha discovered the people of Egypt who cultivated the land had ideas of their own. Instead of cotton, the large majority of cultivators preferred grain and took advantage to crop cereals several times a year instead.[102] The logic of such behaviour ought to be evident when we consider that cereals provided a basic livelihood and demanded less attention; that at least with crops they could eat, the peasants could avoid all the treachery of dealing with the Pasha's agents who consistently cheated them

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[99] William Willcocks, *Syria, Egypt, North Africa and Malta Speak Punic, Not Arabic: In Egypt During the Forty Years of the British Occupation* (Caire: Imprimerie de L'Institut français d'archéologie orientale, 1926), 21.
[100] Ghislaine Alleaume, "Les système hydrauliques de l'Egypte," in *Itinéraires d'Égypte: Mélanges offerts au Père Maurice Martin S.J*, ed. Christian Décobert and Maurice Martin (Le Caire: Institut français d'archéologie orientale, 1992)., 340-1. *my translation.*
[101] Owen, *op.cit.,* 48.
[102] Al Sayyid-Marsot, *Egypt in the Reign of Muhammad Ali*, 156.

on the cotton's weight and price.[103] According to Sir John Bowring the Pasha's "excuse alleged for forcing a particular cultivation in Egypt is, that the lazy habits of the fellahs would induce them to abandon cultivation altogether, or at all events only to produce the articles necessary for their own consumption, and such as required the smallest application of labour, were not the despotic stimulant applied."[104]

Following a disastrous flood of 1824 that had adversely affected the crops, Muhammad 'Ali decided to personally assess the situation. When the Pasha announced his plan to visit the territories in his domain, he informed the provincial governors that his motives were to remedy the "lack of attention and of precision from the department heads (*mamurun aqsam*), and especially a lack of attention given to the growth of new imported crops."[105] The Pasha proceeded on a tour of inspection, observing the various actors in the echelons of his governing apparatus. "I will gather them in the middle of the land that has been neglected," the Pasha promised ominously, and "will order a hole dug and bury them alive." [106] Perennial irrigation, the Pasha decided, demanded perennial control.

The Farmer-General

In previous eras of Ottoman and Mamluk rule in Egypt, crops were grown, goods traded, alms given, crimes punished and ethics instilled through a variety of practises that had little to do with what could be called a state. In the nineteenth century, however, the way the people of Egypt interacted with the countryside as a means of production and subsistence, and how they interacted with those who claimed their labour became the

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[103] Sir John Bowring, *Report on Egypt 1823-1838: Under the Reign of Mohamed Ali; with Notes, Index and Bibliography*, New ed., *Triade Exploration's Major Reprint Series; 1* (London: Triade, 1998), 55.
[104] *Ibid,* 41.
[105] Amin Sami, *Taqwim an-Nil*, vol. VI (Cairo: A.H. 1334-1355 (1916-1935)), vol. II, 320. in Al-Sayyid Marsot, *op.cit.,* 101.
[106] Amin, *loc.cit.*

focus for a new set of regulatory interventions. Water control was at the centre of these concerns.

During the second quarter of the nineteenth century people of Egypt were taken captive in their own homes.[107] A decree in the official gazette from January 1830 announced that they would be confined to their districts and forbidden to leave without permit from the government. Cultivators were "checked daily and watched night and day to prevent them from abandoning the village."[108] In the fields they watered and tilled the soil under the scrutiny of an inspector; in the village they resided under armed guard (*ghaffir*). Wherever they looked they were observed, whatever they did they were instructed. If they moved from the village it was because they were taken, either as conscripts for the corvée and the Pasha's new army, or they became fugitives and joined the many thousands who had abandoned their homes to escape a life of virtual imprisonment.

Instead of a carceral society, however, for the man who soon became Egypt's chief hydraulic engineer, Linant de Bellefonds, rural Egypt appeared as something more benign:

> By the nature of its soil and of its type of cultivation, which is either due solely to the periodic rising of the river or artificial irrigation during low waters, Egypt, we say, cannot be assimilated to another land. One could compare it to a great farm of which the viceroy, the Chief of State, is the farmer-general. It is he who must direct it and develop the conditions for the happiness of everyone, and everyone in this great rural exploitation must work in order to produce as much as possible.[109]

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[107] The following account is indebted to Timothy Mitchell, *Colonising Egypt* (Berkeley; London: University of California Press, 1991). 34-43; Rivlin, *The Agricultural Policy of Muhammad 'Ali in Egypt*. 89-98.
[108] Rivlin, *op.cit.,* 99.
[109] L. M. A. Linant de Bellefonds, *Mémoires sur les principaux travaux d'utilité publique exécutés en Egypte depuis la plus haute antiquité jusqu'à nos jours* (Paris: Arthus Bertrand, 1872)., 41.

In a manner of speaking Linant's characterization is apt, not because it exonerates this system of forced labour by making it seem more familiar, inevitable, 'natural' and therefore acceptable, but because, indeed, by 1830 the people of Egypt were citizens insofar as they were peasants; agriculture was no longer their vocation as much as their legal obligation.

A Modern Penal Code

In 1829, the Pasha's son, Ibrahim, had presided over a conference in which provincial officials and the principal officers of the civil and military departments met to discuss the problems with cotton: the reasons behind the fall in yield quality; why peasants were choosing to use perennial irrigation to grow grain rather than cash crops demanded from them. The congress produced a small, sixty-page booklet called the 'Programme for Successful Cultivation by the Peasant and the Application of Government Regulations' (*La'ihat zira'at al-fellah wa-tadbir ahkam al-siyasa bi-qasd al-najah)*. The following year, its provisions would make their way into what became known the 'Law of Cultivation' (*Qanun al-Filaha*), Egypt's first "modern" penal code.[110]

The fifty-five provisions contained in the edict list the specific activities the rural population and local administration were expected to engage in along with the various punishments they could expect to receive for their failure to perform each task appropriately. Its expressed aim was to increase agricultural production, its proposed method: constant supervision and forced labour.

> If a *shaykh* discovered a *fallah* had failed to cultivate his fields as required, he punished him by whipping him twenty-five times with the *kurbaj*. Three days later the *shaykh* inspected the *fallah's* fields once again and if the peasant had not

[110] Hiroshi Kato, "Egyptian Village Community under Muhammad 'Ali's Rule: An Annotation of Qanun Al-Filaha," *Orient* XVI (1980), 183.

> yet completed the necessary cultivation the *shaykh* was authorized to whip him fifty times. An inspection took place after another hundred days and this time the negligent *fallah* received one hundred lashes.[111]

The productive lives of the people of Egypt would now be meticulously regulated through a pyramid of observation that extended from the village through cantonal (*nahiya*), district (*khutt*), departmental (*qism*), regional (*ma'muriya*), and provincial (*mudiriya*) chains of command before reaching Cairo: "a carbon copy," writes Robert Hunter, "of the Napoleonic prototype."[112]

The documentary practise that gave expression to the surveillance and regimentation of the Egyptian countryside spelled out in the law code was the *jurnal*. A translation from the French, the *jurnal* was a register of daily administrative 'events'. Every week the local village inspectors submitted these reports to the regional bureaux for inspection. The Pasha's council (*ma'iyyah*) expected to receive the *ma'mur's* reports on a monthly basis along with any *ad hoc* technical reports (*jurnalat mustaqilla wa faniyya*) on matters of irrigation.[113] The *jurnal's* log followed a pre-ordained schedule and contained slots for useful information on the peasant's performance and quotas.

These reforms aimed to ensure that the largest area of land was cultivated by the most profitable crops, that peasants surrendered their entire harvest to the government's warehouses, that they paid their land-tax accurately (which itself depended upon the method and extent of basin or perennial irrigation available), and that they remained in their village unless required to serve in the army or corvée. Before every growing season, the regional council notified the district official (*hakim al-khutt*) of the quota of crops to

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[111] Rivlin, *op.cit.,* 96.
[112] F. Robert Hunter, *Egypt under the Khedives, 1805-1879: From Household Government to Modern Bureaucracy* (Pittsburgh, PA: University of Pittsburgh Press, 1984), 22.
[113] Al-Sayyid Marsot, *op.cit.,* 105.

be cultivated within his jurisdiction. In turn, the district official assembled his own subordinates, the village *shaykhs* and the *qa'immaqam* of the canton, and relayed the instructions while ensuring that irrigation devices like *saqias* and *shadufs* were properly distributed within the districts. The *shaykhs* and *qa'immaqam* were responsible for direct management of the agricultural production, overseeing the operation of the local canals and dikes, and collecting payment from the local inhabitants for the labour, material and associated costs of upkeep. At the time of the flood the *qa'immaqam* assembled the *shaykhs* to assign them tasks to regulate the filling of the basins. After draining the water, the *qa'immaqam* decided the areas of land to be sown with specific crops as required by the *ma'muriya* council; he supervised the process as set forth precisely in the ordinance. The *qa'immaqam* then filed a report to his superior, the departmental chief (*nazir al-qism*) as well as the *ma'mur*. When cultivating the perennial *sayfi* crops, the *qa'immaqam* and *shaykhs* watched over the *saqiyahs* and *shaduf*s to make sure they worked, to prevent vandalism and to guarantee that all land within the hydraulic reach of the irrigation machines was indeed cultivated. If the water-raising machines were inadequate, the *shaykhs* informed the *hakim al-khutt* for assistance to ensure that the cultivators could not claim an inability to meet their tax or crop quota due to insufficient water.[114]

Overseeing all of this was the district chief, the *nazir al-qism*, who supervised the *qa'immaqam* in regard to agricultural production and reported back to the *ma'mur*. It was the *nazir'*s duty to inform the *ma'mur* where workers should be transferred to other parts of the *qism* to assist in canal cleaning. At harvest time, the *nazir al-qism* delivered sealed scales and measures to the *qa'immaqam* to calculate the yield; he then dispatched

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[114] Rivlin, *op.cit.,* 241. cf. clauses 33, 45, 37, 46 in the *La'ihat zira'at al-fallah*,

spies (*basasin*) to make sure the crops were weighed correctly. The *nazir* communicated all details concerning public works and agriculture to the *ma'mur*. The highest authorities on matters of regional production, the *ma'mur* coordinated these reports filed by the *nazirs* with the orders emanating from Cairo. It was his responsibility to instruct the Pasha's council on the canals, dikes or small dams that could be built profitably to benefit cultivation.

The *Qanun al-Filaha* pays particular attention to hydraulic behaviour it considers criminal. If the actions of the *shaykhs* or *fallahs* had led to land left dry or submerged by the floods, they could be sentenced to life imprisonment. If the *shaykhs* or *fallahs* had decided purposely not to irrigate their lands at the time of the flood or drain it afterwards in order to evade the land-tax, they, along with the *qa'immaqam,* were punished and the tax imposed anyway. If a *shaykh* or a *fellah* under his authority damaged, destroyed or stole parts of a *saqiya,* "he will be conscripted into the military service if he is a young man; if he is an older man, he will be employed in the compulsory labour at the factories (*al-abniya al-miriya*) in the *ma'muriya* for one year, with his legs in chains."[115] If the inhabitants of one village diverted the water in a neighbouring village's basin without the order of the *hakim al-khutt*, the *shaykhs* and *qa'immaqam* were punished with 500 stripes of the bastinado.[116]

At each step in the chain of command, people were made to feel aware of a superior presence that watched and governed with a monopoly of force. Punishment was severe but designed to avoid serious injury from minor infractions so that peasants could not be prevented from working. "Thus it is required that the beating with the *kurbaj* be

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[115] cf. Hiroshi, *op.cit.,* 200.
[116] *Ibid,* 204.

applied only to the legs and the buttocks and within the regulated times."[117] Precise specification and mutual supervision, it was hoped, would temper the *excesses* of the *shaykhs, qa'immaqam* and *hakim al-khutt*. If the *shaykhs* were negligent in their supervision of the peasants they were warned on the first occasion, before being flogged with two hundred strokes for the second, and three hundred for the third. The district official too was watched by the *ma'mur*, and his negligence was met by an initial warning to be followed by a flogging if repeated. The office of the *ma'mur,* called *al-diwan al-khidiwi,* functioned as a branch of the Ministry of the Interior located in Cairo; it was to Cairo where the *ma'mur* addressed his reports. If neglectful, he could expect personal reprimands like this from the Pasha: "we order you and your subordinates to make sure of the proper functioning of the irrigation system and to work diligently to protect and maintain the dykes and to see to it that the waters are not unnecessarily wasted. Should any dyke show a crack or a break, or be emptied of its waters, [the official in charge of the district] will merit execution."[118]

Simplification and Legibility

In previous eras the vast majority of hydraulic interventions occurring in Egypt were unrecorded local affairs. Cultivators used many techniques to influence the flow of water by small-scale manipulations like raising embankments or excavating distributary channels. "The system," Rivlin writes, "had previously always functioned on cooperative principles regulated by customary usages."[119] In fact, practices involving the manipulation of water's flow were diverse and likely far from systematic. Projects were

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[117] *Ibid,* 202.
[118] I Ma'iyya 'Arabi, 16 Rajab 1253, no. 21, pg. 21. Also 3 Ramadan 1253 cited in Al-Sayyid Marsot, *op.cit.,* 114.
[119] Rivlin*, op.cit.,* 241.

often undertaken without regard to their effects in other places and were prone to subversion, either by natural seepage or human diversion. As social enterprises, they could be far from egalitarian enterprises; sometimes they led to violence. Nevertheless, as custom, we are wise to follow James Scott in understanding irrigation in Egypt as "a living, negotiated tissue of practices…continually being adapted to new ecological and social circumstances."[120] It was precisely the lack of an apparent overarching 'system' that had once befuddled the French savants. This was because Egyptian irrigation depended in large part on regional variations in the Nile's floodplain topography. The logic of these arrangements appeared almost incomprehensible to engineers bent on organizing the hydraulic apparatus according to the demands of the central government they hoped to construct. The *La'ihat zira'at al-fellah,* which was incorporated into the *Qanun al-Filaha,* was the first attempt to regulate irrigation practices by assigning specific tasks to members of a government hierarchy. Water control as depicted there did not accurately represent the Egyptian relationship to water when issued in 1830, but that was never the point. It represented only that slice of hydraulic reality that interested an observer ultimately sitting in Cairo.

It is useful to understand these reforms as processes of inscription and reading, in terms of a problem of what Scott calls 'legibility'.[121] The virtue of both the *jurnal* and the law code lies in its principle, i.e., on the application of an objective standard throughout the lands of Egypt regardless of local context to produce a uniform and unambiguous map of responsibility. When this map is given the force of law, it acquires the capacity to remake the reality it claims to represent. The basis of such power is a lack of detail; its

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[120] Scott, *op.cit.,* 34.
[121] *Ibid,* 2.

application is universal. By means of a 'Law of Agriculture' the Pasha's men were taking exceptionally complex local practices and creating a standard grid whereby water and its flow could be centrally documented, monitored and manipulated according to the broader interests of fulfilling production quotas. The simplification of irrigation is one of many such instances including the standardisation of weights, the application of a uniform land tax (*kharaj*). All seek to make the natural and human environment, its products and workforce more susceptible to measurement and calculation, documentation and surveillance, control. A simplified agrarian landscape, whose people and products work in predictable, recognizable ways, is easier to manage because officials can combine the observations of similar and specific phenomena; it permits an aggregate picture; it achieves a "synoptic view of a selective reality."[122] Such hydraulic standardisation helped the Pasha know more about his subjects, their wealth, yield and locations; they provide him with the knowledge necessary for more localized and precise manipulations.

Managing the hydraulic infrastructure of the rural economy according to a unified standard of behaviour and highly schematic knowledge helped coordinate production between different districts and regions to maximize the profitability of the agrarian economy. As the final node on water's journey from river the field, the *saqia* provided a particularly useful index for a wide variety of governmental concerns. Muhammad 'Ali ordered that the location and identification of every *saqia* in the Delta in addition to the quantity of land it irrigated be faithfully entered into local registers. Working from certain assumptions, for instance, that the average *saqia* could water three quarters of a *feddan* in twenty-four hours and that each *saqia* needed replacement every five years, the

[122] *Ibid,* 11.

government statistics gained a high degree of formalism on the one hand and analytic power on the other:

> Each sakia may be estimated as having three oxen (say 150,000 oxen) and two men (being 100,000 men in all). They work, on average, 180 days in the year, the oxen costing 1.5 piastre each, making 40,500,500 piastres, or 405,000 £; the men at 1 piastre, making 18,000,000 piastres. A sakiah costs for erection an average of 1,200 piastrees; so that 50,000 represent a capital 60,000,000 piastres. An ox is worth 900 piastres, which represents a capital of 105,000,000 piastres; thus the interest of 165,000,000 piastres, which must be calculated at 12 per cent. per annum, M. Linant estimates in all at 65,520,000 piastres, or 650,000 £. sterling per year- an enormous outlay for the charges of irrigation alone.[123]

Under new laws, *shaykhs* and *qa'immaqam* were given the prerogative to seize the land of cultivators who could not afford to build hydraulic machines like the *saqiya* and allot it to those who could. Additionally, they were responsible for supervising the supply of animals and seed to these people, transferring supplies from village to village within the district to make up for deficiencies. They even arranged for the import and export of people, relocating them in different districts when needed to cultivate irrigated land. All these activities were facilitated and indeed made possible by practises of documentation and standardisation.

What fell outside this vision were things that had little to do with the land as a source of tax and commodity production; intangible qualities like the value of subsistence or peasant opinion about the new labour requirements. The results of such oversight could be deadly. In 1829, the Pasha had intended to sell the wheat harvest to the European market. Following unexpectedly low floods, the people of Lower Egypt were forced to eat bread made from cottonseed. Cuno estimates that between 1820 and 1826 there were at least five peasant revolts serious enough to warrant the attention of the

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[123] Bowring, *op.cit.,* 38.

Pasha's new army, a force whose conscription the peasants were willing to mutilate themselves in order to avoid.[124] Unable to pay the rising land tax under the 'monopoly' system, the Egyptian cultivators abandoned their homes by the tens of thousands, moved to the margins of territory beyond the government's full reach or left Egypt altogether for Syria and Palestine.[125]

Recasting the Physical Environment

Along with the regimentation of human labour in rural Egypt the government was also at work simplifying the natural environment of Egypt. Even in Upper Egypt where perennial irrigation had yet to make inroads at this time, Ghislaine Alleaume has demonstrated that the Pasha's engineers were busy recasting the irrigation network to produce a "singular motor for hydraulic regulation."[126]

Water flow is a question of topography, a function of movement from higher to lower levels of elevation. In addition to the north-south longitudinal slope of the Nile Valley there exists between Gebel Silsila and the sea a *transversal* slope for water circulation, beginning from the raised banks bordering the Nile where the heaviest silt is deposited by the flood and descending as the basin spreads outwards:

> Stronger than the principal slope and easier to master in small-scale modifications, this transversal slope has served for the construction of irrigation systems…. Until the end of the eighteenth century, in any case, examples abound of a network (*quadrillage*) organized for the east-west circulation of waters….Conflicts which occurred sometimes in relation to water-sharing [between] upstream and downstream, saw confrontations between littoral villages by the river and neighbouring villages by the desert.[127]

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[124] Cuno, *op. cit.,* 125.
[125] Mitchell, *op.cit.,* 60.
[126] Alleaume, *op.cit.,* 307.
[127] *Ibid,* 304.

After 1820 this kind of transversal hydraulic network was gradually replaced by a series of homogenous, topographically stacked "chains" of catchment basins arranged to feed from a distributary canal (*tur'at warid*) running parallel to the Nile. Traversing the basins from south to north this central hydraulic artery, Alleaume observes, "defines the chain of basins which it feeds, and it is this *disposition* which explains their name, more precisely "basins columns" (*'amidat hidan*) as they are called in Arabic."[128]

The construction of a uniform succession of identical catchment basins helped the government to monitor from afar certain activities that had hitherto escaped its gaze. Traditionally south of Girga, families did not work fixed portions of land; according to Rivlin, this was because "variations in cultivable land caused by the floods made it difficult to establish separate boundaries."[129] Instead cultivable land was distributed anew after every flood in accordance with the area of land irrigated and the abilities of each family to cultivate. In a similar manner in which the ownership and distribution of *saqia*s provided a key metric to permit a more efficient system of cultivation, the standardization of the basin chains made activities like tax-collection more finely tuned and easier to monitor. With fixed spatial dimensions and regulations for basins, the amount of cultivable land and the amount of tax due on it were easier to measure and collect.

Vision and Displacement

These modifications in the social and natural environment were the material preconditions for the operation of a formalized hydraulic bureaucracy: they made people and places easier to document and manipulate from a distance. The conformity in irrigation basins reduced the variability in hydraulic systems and aided outside officials to

[128] *Ibid,* 307.
[129] Rivlin, *op.cit.,* 23.

evaluate the local environment with greater ease. The singular reorientation of the Nile's hydraulic force also made it possible to use protocols with a wide application across the countryside. In time, the basins themselves did not need to be seen by those who decided on its hydraulic needs, they could ascertain this information from their charts and maps. From the early 1830s Linant convened groups of engineers to make decisions for hydraulic works for all of Upper Egypt. These provincial councils prepared reports and proposals on suggested projects for the Grand Council in Cairo. From the basis of these reports the Pasha would personally issue *firmans* to the provincial governors. In 1834 the method was introduced in Lower Egypt as well with the establishment of a permanent council, again chaired by Linant, who by this time was appointed chief engineer for all of Egypt.[130] Within two years the chief engineers of each province would assemble under Linant to discuss the public irrigation works to be carried out; they now had the power to issue orders directly.

The implementation of what Clot called "the need for order, unity and centralisation" proved easier in theory than actual practise. At every step government policies led to consequences that outstripped their original intentions, that forced original plans to be modified. Extending the river's flow in low season by deepening the canal beds proved an impossible contest, defeated by the Nile's perpetual ability to nullify the greater depth of canals by continuously depositing silt on them. In addition to claiming so much of the labour required for the maintenance of the irrigation system, the *sayfi* canals led to graver consequences involving changes in the Delta's hydraulic equilibrium. By 1833, it was clear that the amount of water flowing into the Damietta branch of the Nile,

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[130] *Ibid.,* 242-3.

where most *sayfi* canals had their head, was steadily decreasing and running into the Rosetta branch instead.

The Delta Barrage

Instead of lowering the floor of canals to carry the Nile further, a new plan was conceived to raise the level of the Nile. When it was started in 1834 the Delta Barrages project was the largest hydraulic work in the world. It was to consist of a pair of regulating barriers that could be opened and closed to re-distribute water from the Rosetta branch of the Nile into the Damietta branch at will. Each barrage was to remain open to allow the yearly flood to pass but selectively closed at low Nile, to hold back the river, increasing the water depth so it could be directed into three canals to be dug upstream. Manipulating the water level of the Rosetta and Damietta branches would allow government officials to direct specific quantities of water to each province of the Delta as they required.

Nothing ever proceeded quite as planned, however. To the surprise of Linant and his entourage the single most imposing barrier to damming the Nile was not a question of calculating the thrust of the water, the weight of the dam or the pressure exerted by its proposed foundation. In the first instance, building the Delta Barrages first required convincing an ill-equipped, malnourished, and seditious corvée force numbering in the tens of thousands to do their bidding. When Linant issued his first orders that the workers commence digging an immense pit "with their hands" to serve as the foundation for each barrage, lacking food, proper tools, heating or shelter, the corvée rebelled and disintegrated. One witness recalled "veritable combat between the deserters and their

guards."[131] When the engineers tried to institute a system of social control borrowed from military models to ensure the corvée was "better treated, watched more easily, and disciplined with severity," [132] members of the Pasha's council cautioned Muhammad 'Ali that Linant's ambition was to command an army rather than just dam the Nile: "all that was needed, since the engineers were going to be officers in two regiments and even colonels, was to name M. Linant the general."[133] Throughout construction, Linant complained bitterly about the lack of proper tools and executive authority: without his knowledge the Pasha decided to send dredging machines that proved useless within the constricted space of the working environment; when Linant asked Muhammad 'Ali to import large planks of wood to serve as a sheet pile for a cofferdam that would prevent water seepage, he was instructed to fashion them out of smaller pieces conjoined together- an experiment that failed. In February 1835, the bubonic plague appeared, killed indiscriminately and brought all work at the Barrages site to a sputtering stop.

Throughout this period, the Nile's flow had caused a progressive widening of the riverbed at the worksite such that the project's engineers were forced to revise their earlier calculations and estimates. New committees met to reconsider the project and evaluate its future prospects. In 1838 a commission ordered by Muhammad 'Ali answered conclusively that raising the Nile's water instead of lowering canals was the only solution to establishing perennial irrigation in Egypt. Barring the Nile at the Delta's apex, the report asserted, would regulate the Nile's flood and supplement water for all provinces in all seasons; it would improve the navigation of silting waterways like the

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[131] Enfantin Prosper, cited in Philippe Régnier, *Les Saint-Simoniens En Egypte (1833-1851)* (Gize-Le Caire- Egypte: Amin F. Abdelnour, 1989), 63. *my translation.*
[132] *Ibid*, 63
[133] Linant, *op.cit.,* 442-443. *my translation.*

Mahmudiyya canal which connected Alexandria with the Nile; it would furnish water for Cairo, and fill the ancient canal at Ra's al-Wadi on the way to Suez; it would irrigate 3,800,000 *feddans* of land in Lower Egypt without recourse to water-elevating machines and extend perennial cultivation as far north as Cairo; it would enable the construction of *sayfi* canals to be abandoned in favour of a return to the *nili* canals that only required a depth of only three to four metres; it would bring an end to the era of *shaduf*s and *sakia* which would soon "suppressed"[134] to free the human and animal labour needed to power them for more profitable activities; it would treble agricultural productivity while reducing the maintenance demands of the hydraulic system by approximately 10.5 million workdays; it would put the Nile itself to work by building a series of factories to utilize its measured thrust, "equivalent to 12,000 horsepower working 213 days a year." The total cost of the project was estimated at 155,163,280 piastres. Its potential benefits, under the commissions working hypothesis of the monopolies remaining intact would have brought in approximately 217,500,000 piastres into the Pasha's coffers annually.

According to the minister who presented the report to Muhammad 'Ali, the official response was that "the Commission was perfectly right, that all that they had said was evident and justly presented; but that he did not want the Barrages anymore."[135] The Pasha's decision to abandon the project has been variously interpreted. According to Bowring, the early recklessness and expense had left the Pasha thoroughly disillusioned. According to Linant, the Delta Barrage project was doomed because Muhammad 'Ali's advisers were jealous and cast aspersions against his real intentions. According to Clot, the war in Syria and political occupations distracted the Pasha's attention. Regardless of

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[134] Linant, *op.cit.,* 445-455.
[135] Régnier, *op.cit.,* 69. *my translation.*

intention, the project was cancelled and the Barrage worksite was dismantled to salvage the material. When construction finally commenced again, the Delta Barrage was undermined by the Nile itself. Flawed in design, it remained barely operational for the better part of the nineteenth century; the perennial white elephant that haunted the Pashas of Egypt. It would spend the better part of the century employed as a simple but imperfect distributor of water between the two branches, its foundation too weak to hold back the full force of the Nile.[136]

Conclusion

The reign of the Ottoman Viceroy, Muhammad ‘Ali Pasha, witnessed concerted efforts to establish an apparatus that regulated irrigation under a bureaucratic governmental authority. Such a project was motivated by the Pasha’s desire to monopolize the cultivation and sale of crops in ways that maximized the monetary value of the Egyptian rural economy: by expanding the area of land devoted to perennial irrigation, he hoped to create the hydraulic environment required by the most profitable cash crops like cotton. To accomplish these ends, the Pasha’s regime worked to reduce the extraordinary variety of hydraulic conditions in each region, standardising irrigation practises across the land and reorienting the Nile’s force solely along its principal

[136] In 1842, the French engineer, Mougel Bey proposed resurrecting the project by citing the strategic potential of turning the Nile’s bifurcation into “the military capital of Egypt.” Work was again sanctioned to begin. In the time elapsed since the project was first conceived, however, the Nile’s erosion pattern had caused the apex of the Delta to shift northwards by forming a new island of sand at Chalagan. It was now decided to build the barrage foundation directly in the riverbed to enable the two respective barrages to stand closer together. But the Nile continued to dump silt into the foundation pits. As a consequence the piles used to support the structure were inserted at insufficient depth. When the foundation’s concrete was poured much washed away in the Nile’s current. As costs ballooned Mougel was replaced. When construction was fitfully completed under the authority of Mazhar Bey in 1861, the flawed foundation and barracks had been completed; the barrage on the Rosetta branch was equipped with its mechanical gates but could not be operated; the barrage on the Damietta had yet to receive its opening; locks were functional to allow for the passage of riverine navigation; the excavation of the three irrigation canals destined to channel the raised waters for all the perennial irrigation in the Delta had yet to begin.

longitudinal slope. These changes all helped produce more uniform patterns of activity that could be monitored from Cairo and permitted a much greater degree of economic coordination.

Contemporary participants in this project as well as more recent scholars have generally assumed that the Nile is an entity beyond history, that is to say, that a singular form of river control has always existed and can be simply reinstated. This view overlooks a profound change in the human relationship to water in nineteenth-century Egypt. The systematic transition to a perennial mode of irrigation was a crusade to surmount hydraulic limitations in time and space. The season and spaces for cotton cultivation were to be extended and the Nile's hydrology became an obstacle in need of inversion: augmentation when low, reduction when high. Instead of revolutionary, contemporary observers appreciated the new management of water as something of a restoration for a country who "by an ironic fate… has been more poorly governed for the last one thousand years" and where "more than anywhere was felt the need for order, unity and centralisation."[137] Complete, centralised hydraulic control, "an incontrovertible fact," was the guiding image to be imposed on the land and people of Egypt, whether they liked it or not.

Of central importance here is the role played by material technologies and what Bruno Latour has called 'centres of calculation' to document and inscribe, to read and write a new order into the Nile that translated what was once ideal into a much broader, more chaotic social and ecological arena.[138] In a way, Egypt could become the farm and

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[137] Clot-Bey, A.B. *op.cit.,* 2:467-468.
[138] Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, Mass.: Harvard University Press, 1987).

personal laboratory of just one man, as Linant imagined it to be, through the deployment of a multiplicity of governmental rationalities. Documentary techniques combined with a Byzantine network of hierarchic supervision allowed a selective aspect of an otherwise diverse and unwieldy reality to come into focus. When administrative practises were given the force of law, they actively helped create the Nile as an object more amenable to their vision of its management; through these processes the Nile became an object of governmentality.

Surveillance, inspection and incarceration, Foucault tells us, are hallmarks of the modern state. Power is not simply a question of knowledge but also of an apparatus or *dispositif* for its exercise.[139] It is not simply that reforms such as the *Qanun al-Filaha* failed to reflect an existing empirical reality of Egyptian hydraulics; much of this was by design. Representations of the social and physical world relevant to the government's conception of water control did not merely describe some pre-existing reality so much as anticipate it; it was "a model for, rather than a model of, what it purported to represent."[140] Catchment basins *were* modified in ways that destroyed more localized systems of irrigation dependent on a transversal slope and gave the government command of a singular hydraulic force; laws to standardise irrigation practises and assign them to the Pasha's functionaries *were* instituted across the land; a centralized bureaucracy for water control *did* begin to materialize.

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[139] Michel Foucault, *Discipline and Punish: The Birth of the Prison* (London: Allen Lane, 1977). see Latour's discussion of Foucault in T. Crawford, "An Interview with Bruno Latour," *Configurations* 1, no. 2 (1993).
[140] Winichakul Thongchai, *Siam Mapped: A History of the Geo-Body of a Nation* (Honolulu: University of Hawaii Press, 1994), 310.

Myths like the Nile's eternal calling for a given style of management allowed administrators to imagine themselves entitled to a control of the natural and human environment than they hardly ever enjoyed in actual practise. Throughout the transition to perennially irrigated commercial agriculture, the government discovered that both the Nile and the people of Egypt found ways to mitigate or resist its impositions. When looked at within the historical context, the hydraulic revolution was a struggle won through force but whose conquest of nature was far less total than most observers were willing to admit. The Pasha's initial strategy using the deeper *sayfi* canals waged a forever losing battle against the Nile's silt in an effort that conscripted the whole population into seasonal armies of forced labour to dig canals deeper and enlarge dykes. These conquests, bought with the lives of the thousands who died building such works, increased the water supply and brought more land under cultivation, but also absorbed labour and capital in such outlays that cultivation itself was threatened. Instead of lowering the elevation of the water conduit, the Pasha then turned to raising the level of the water, by trying to erect a barrage to block its flow. Inexperience with the scale of the new undertakings and even personal rivalry led to postponements that prevented the project from properly coming to fruition. Once construction of the Delta Barrages recommenced, the Nile's own activities of erosion and deposition had sufficiently altered the terrain to prompt a total modification in the barrage design that eventually proved catastrophic: laying the foundation directly in the riverbed could not properly foresee the dangers of seepage that structurally comprised the barrage foundations and reduced their capacity to withstand the full thrust of the river's water.

For much of his reign Muhammad ‘Ali had preferred direct, not delegated, control of the Egyptian countryside: having Egypt remain his “personal farm” and growing crops to sell on the world market brought him the lion’s share of revenue. By the late 1830s, however, the Pasha confronted an economy he could no longer micromanage: peasants continued to fall into tax-arrears, abandon their land, and escape the corvée; subordinate officials exploited the system for their own benefit; the *sayfi* canals and defective Delta Barrage absorbed human and capital expenditures in ever increasing outlays. These factors all contributed to a fiscal crisis that helped compromise the autocracy of the Pasha’s rule in the name of financial solvency and delegated management. The dynasty founded by Muhammad ‘Ali, who first seized power in Cairo in his capacity as a military commander, came in the course of time to rely on a new kind of techno-economic elite, an aristocracy of water, whose power grew from their ability to direct hydraulic flow. Their appearance coincided and was linked to a new technological stage in Egyptian water control, mechanisation. It is the subject of the chapter that follows.

Chapter III: An Aristocracy of Water

"The total domination of nature inevitably entails a domination of people by the techniques of domination"
- André Gorz[141]

A Hydraulic Settlement

In the age prior to the eventual conversion of the entire Egyptian landscape to suit the perennial water regime, where the older catchment basins still prevailed the agricultural population lived a semi-nomadic existence.[142] Twice a year cultivators vacated the highland of their village and descended unto the plains of the basin to live in small thatched shelters (*'izba*). In the autumn after the Nile's floods had begun to recede and the basins had been drained, the people descended with their animals to graze freely on the clover that speckled the earth. Camping in the *'izbas*, they tended their flocks, milked them and churned butter before returning to their permanent houses to pass the winter nights. Again in the spring when the cereals had matured, they moved to the fields to live and work. Near the *'izbas,* the peasants reaped, threshed and winnowed the grain. The temporary shelter provided by these huts helped cultivators ensure the security of their animals and made work less burdensome by saving on the transportation of crops. After the harvest, the land lay fallow, cracked and rejuvenated by exposure to the sun and air. When the Nile rose to reclaim their basins, the people had returned to their villages and were safely ensconced beyond the reach of the inundations.

In the second half of the nineteenth century the '*izba* acquired a new meaning and started to refer to a settlement associated with the spread of perennial irrigation. Instead

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[141] André Gorz, *Ecology as Politics*, trans. Patsy Vigderman and Jonathan Cloud (Boston: South End Press, 1980).
[142] Jean Lozach and Georges Hug, *L'habitat Rural En Égypte* (Le Caire: Impr. de l'Institut français d'archaeologie orientale du Caire pour la Société royale de géographie d'Égypte, 1930). 156-157.

of thatch and plant detritus, the '*izba* signified a permanent accommodation of dried brick made from mud and straw; instead of a provisional form of shelter suggestive of transience, this *'izba* was characterized by fixity, housing imported workers from neighbouring provinces. The two French scholars who in later years visited such a settlement were struck by the order of its design, of "an intelligence exercising liberally its activity over virgin lands, without being stopped by any obstacle, either material, social or psychological."[143]

This new *'izba* was a type of hydraulic colony. Attached to the canals and drains that always preceded them, the *'izba* was anchored by the steam pump that oriented and commanded the terrain. The inhabitants living on the '*izba* were imported in direct numerical proportion to the population required to work the lands watered by the machines. For approximately four hundred *feddans* of cotton a group of small houses is built; each lodging is built next to others in a regular series of aligned cellular blocks; they are separated from one another by rectilinear roads of five or six metres in width; each series contains seven or eight families; a grouping of three or four of these series forms the typical pattern. If more pumps are installed, two or three lines of houses for workers can be introduced without upsetting the harmony of the overall structure.[144] Each is one of many, a settlement designed to be as generic as possible, as just one instance of a broader system found elsewhere.

The logic of the *'izba* betrays its origins in a blueprint where space is measured and formatted for function, where interiors are visible from the exterior. Within the *'izba*

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[143] *Ibid.* 55 *My translations.*
[144] *Ibid.* 49.

cultivators live and work in an environment of exactitude and calculation.[145] Every wall, every road, every room is measured in precise magnitudes of space per person decided according to the dictates of the "most modern of agricultural science." It was designed, said the visitors, to make "the surveillance of personnel easier;" the landowner, inspector or engineer can traverse the estate, assess the situation more quickly, give orders, monitor performance and "stimulate the indolent workers."[146]

The *'izba* helped inaugurate a phase of Egyptian agriculture that was understood and written about in terms used to describe a factory, a world of rigorous organisation suited to systematically recasting the social and physical environment for the efficient operation of perennially irrigated commercial agriculture. The advantage of this settlement was a simplified aesthetic promoting modularity: standardization of the landscape aided visual recognition and the acquisition of statistical information that can be used to measure the productivity of workers; it offered more kinds of knowledge and better kinds of control to coordinate production.[147] "Their spatial distribution suggests a concern for human resource management and a reduction of time lost in the movement of workers," Ghislaine Alleaume writes, and "in this sense, the *'izba*s constituted the social counterpart of the rationalisation of the countryside."[148]

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[145] *Ibid.* 40.
[146] *Ibid.* 202.
[147] Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley; London: University of California Press, 2002). 47.
[148] "An Industrial Revolution in Agriculture? Some Observations on the Evolution of Rural Egypt in the Nineteenth Century.," in *Agriculture in Egypt: From Pharaonic to Modern Times*, ed. Alan K. Bowman, Eugene L. Rogan, and British Academy. (Oxford: The British Academy by Oxford University Press, 1999). 343.

The emergence of the *'izba* coincided with the growth of large landed estates that dominated the rural landscape by the end of the nineteenth century.[149] Those who built and managed the *'izba* constituted a rising class who profited by their access and ability to open up space to the hydraulic flow. The appearance of this class was the clearest sign of a dawning age of devolution, an era when the control of the agrarian economy became both the prerogative and burden of those armed with the capital, expertise and vigilance to expand the harvests and pay their taxes. The cultivators who work on the *'izba* are fieldhands. They have no land of their own to which they can escape, no corvée gang to which they must enlist; they serve only the estate manager, filling the ranks of a rural proletariat kept alive by the most meagre of wages, reluctant foot soldiers on a campaign to comprehensively exploit the gifts of the Nile:

> With these wage employees, the modern domination of water becomes most vividly and unmistakably translated into hierarchy. Those who rule in that situation are not only those who hire and pay but also all those who take part in designing and controlling the hydraulic means of production. Workers serve as instruments of environmental manipulation; rivers, in turn, become means of control over workers.[150]

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The preceding chapter described some of the first attempts by the ruling Egyptian household of Muhammad 'Ali to regulate irrigation in the Nile Valley. These efforts met with serious failures: the outlay of capital and labour required to maintain the productive apparatus, the engineering flaws in the Delta Barrages and summer canals, the peasants who fled from the government's surveillance to avoid its inhumane demands; these factors conspired to unleash a fiscal crisis that helped compromise the Pasha's autocracy.

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[149] Mitchell, *op. cit.,* 71.
[150] Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West*, 1st ed. (New York: Pantheon Books, 1985). 51.

By granting landed concessions to individual members of his ruling bureaucracy, Muhammad ‘Ali delegated management and defrayed the costs of managing the rural economy. Until recently several generations of scholars have understood this signal event as the starting point for a historical trajectory culminating in private property rights.[151] But private property did not signify the emergence of rights for everybody so much as a qualified emancipation that served the interests of those who owned the largest estates; a right they were forced to accept at the behest of an insolvent government. The proliferation of large estates was a process significant for three reasons: it was an arrangement created by the government that brought order to the system of landholding;[152] large estates were spaces of capital accumulation and sites for the deployment of disciplinary rationalities to make wage-labourers out of Egyptian *fellahin*;[153] they were willing instruments for a new strategy encouraged by the government to transform the hydraulic apparatus with the power of steam.[154]

A Short History of Landholding

In earlier times it was customary for farmers to grow mostly food and pay part of the harvest to the authorities responsible for law and order. When Muhammad ‘Ali decided to take advantage of the lucrative opportunities to sell Egyptian crops as commodities on the European markets, persuading cultivators to grow plants they could

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[151] For the classic account see Yaqub Artin, *The Right of Landed Property in Egypt, Trans. By E.A. Van Dyck* (London: 1885). For more critical scholarship see Kenneth M. Cuno, *The Pasha's Peasants: Land, Society, and Economy in Lower Egypt, 1740-1858*, *Cambridge Middle East Library; 27* (Cambridge: Cambridge University Press, 1992).
[152] Cuno, *The Pasha's Peasants: Land, Society, and Economy in Lower Egypt, 1740-1858*.
[153] Timothy Mitchell, *op. cit.*
[154] Ghislaine Alleaume, "An Industrial Revolution in Agriculture? Some Observations on the Evolution of Rural Egypt in the Nineteenth Century.," in *Agriculture in Egypt: From Pharaonic to Modern Times*, ed. Alan K. Bowman, Eugene L. Rogan, and British Academy. (Oxford: The British Academy by Oxford University Press, 1999).

not consume but deliver to the government for cut-rate prices involved an element of compulsion. Under his watchful eye village life assumed the dimensions of a police state. The Pasha commanded the economy and agriculture became a legal duty for his subjects; they were inspected and disciplined to follow instructions, to grow specific crops, and to sell the entire harvest for whatever the Pasha decided to pay. When not cultivating, these people were forced to assist the government wherever it decided to extend the reach of the Nile. The better part of the rural population spent a chunk of their year working to build and maintain canals from which they derived no personal benefit. They travelled far from home because the infrastructure of the irrigation system- raising water by a defective barrier at the Delta's apex and lowering the floor of silt-laden canals to transport it- demanded such an extraordinary number of human workers to sustain.

During the nineteenth century government policy sought to bring difficult areas into cultivation on the one hand, while maximizing the payment of the land-tax, the principal source of government revenue, on the other. These two principles were evident as far back as the cadastral survey of Lower Egypt (1813-1814) when Muhammad 'Ali attempted to impose the land tax on all cultivated land directly by dispossessing the intermediary tax-farmers (*multazim*) while at the same time allowing reductions in tax to individuals who could bring uncultivated land into production. Such lands were too distant or elevated to receive water without certain investments. They were therefore entered into the land registers as *ib'adiyya* and made available for richer peasants to take on and make profitable before having to pay taxes on them.

For the most part, however, taxes were assessed on individuals in proportion to the area of land they held, the number of *saqia*s they operated and population of animals

they owned. Both communal tax responsibilities and tax exemptions were largely the exception. Although grants of tax-free estates had long been awarded to members of the viceregal family and entourage as *çiftlik*, notably from areas in Upper Egypt conquered directly from Mamluks, such occurrences were initially relatively minor given the Pasha's preference for direct fiscal control. Following the low floods of 1824 and 1825, a revenue shortfall had compelled Muhammad 'Ali to take special measures. The Russian consular agent in Cairo, Bokty, first reported that the Pasha and the provincial governors had begun to transfer the tax of land untouched by the floods and whose cultivators therefore could not meet their obligations, onto more fertile territories with the effect that the arrears of one villager were made the responsibility of another able to pay.[155] But such systems of tax solidarity were "extraordinary and counterproductive measures."[156] Little could be done to mitigate the fiscal deficit when solvent cultivators were burdened with the debts of others, when their own taxes were raised, and when they were forced to sell their harvests to government monopolies at depressed prices. Such measures only helped drive peasants into debt and off the land in greater numbers than ever before.

By the late 1830s, in the wake of the failed Syrian campaign, growing incidences of tax arrears and the prolonged difficulties with the Delta Barrages, concessions of land became more prevalent as a means to raise credit and reduce debts. Between 1837 and 1842, *çiftlik*s, *ib'adiyya* and other concessions were effectively made the property of their holders who could bequeath and sell their holdings.[157] Muhammad 'Ali encouraged this process by granting more *çiftlik*s and placing the administration of

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[155] Cuno, 139. *op. cit. cf.* Cattaui, *Archives russes,* II, part 2, pp. 137-138.
[156] *Ibid. 200.*
[157] *Ibid.* 182.

lands where farmers were no longer able to meet their fiscal obligations into the custody of high officials and army officers, a concession called *'uhda*. These functionaries were assigned control over the land in return for their assumption of the tax liability of its inhabitants. In addition to maintaining tax revenue, this was also a way for the Pasha to pay the salaries that he himself owed his subordinates. As guarantors (*muta'ahhid*) these officials were expected to pay the tax decreed by the Pasha and supply the working capital the *fellahin* needed to improve cultivation. In return they gained their own portion of land tax-free (*usya*) along with the right to requisition a quota of unpaid labour from the locals who would hereafter be exempted from military service and the corvée.[158]

Land granted in the form of *'uhdas* and *çiftliks* occurred with increasing frequency, especially as a means for the Pasha to preserve his control over the harvests after his legal monopolies were forcibly ended by the Treaty of Balta Liman (1838).[159] Six years later, 1,205,559 *feddans* had been placed as *uhda*s; of this figure approximately 912,559 *feddans* were under the control of Turkish officers and high officials, 120,000 *feddans* were taken by the Pasha, 98,000 by his son, Ibrahim, and 75,000 to other members of his family.[160] By 1846 over seventy percent of the land held as *ciftlik*s, including the best land for growing cotton, belonged to Muhammad 'Ali himself.[161]

Economies of Scale

As control over large tracts of land was entrusted to members of the government bureaucracy, they devised new techniques of scale to manage their personal estates. In 1846 Ibrahim Pasha hired the French civil engineer, D'Arnaud, to draw up plans for the

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[158] Alleaume, *op. cit.* 334.
[159] The treaty was only imposed in Egypt under threat by the British and Ottoman military after 1840.
[160] Helen Rivlin, *The Agricultural Policy of Muhammad 'Ali in Egypt.* 65
[161] Cuno, *op. cit.,* 266.

"reconstruction" of some of the villages recently placed into his domain. Arnaud made plans to rebuild the village of Kafr al-Zayat in the Delta on the basis of a survey the inhabitants were instructed to complete, listing such facts as their human and animal populations and any profitable activities in which they engaged. When the village's renovation was completed, the people moved into houses built in specific accordance with their family size and social rank. The house for those at the low end of the class ladder, for example, could now be visualized with the Euclidean rigour of a precise architectural formula:

> (1) of a courtyard of which the floor is raised 0.10 m above the level of the street, 8 m long by 4.34 m wide and thus able to accommodate, at night, at least three large animals and three small… (2) of a room on ground level, of which the floor is raised 0.10 m above the floor of the courtyard, and thus 0.20 m above the level of the street, 4.35 m long by 3.70 m wide, illuminated by two windows: one high up, barred, overlooking the street, the other plain, overlooking the courtyard; containing at the rear a *divan*, large enough for two beds end-to-end… (3) of a room on the first floor, with a small covered balcony overlooking the courtyard…[162]

The geometric procession of spatial dimensions continued for all aspects of village life, assembling the people of Kafr al-Zyat into a hierarchical grid of numeration. The mathematical quantification of the village was useful because it could be repeated, as it was in other villages in neighbouring Neghileh and Ghezaier in Menufiyya. Repetitive uniformity promoted standardization from village to village and house to house; it made the people who inhabited them instantly intelligible to the interested observer who could compare productivity and isolate the key variables that hindered production.

Villages like Kafr al-Zayat were becoming consigned to government subordinates and re-built along lines of an ordered modularity to help solve a labour problem. Those

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[162] D'Arnaud, "Reconstruction des villages de l'Egypte', p. 280 in Timothy Mitchell, 44. *Colonising Egypt.*

whom the Egyptian Government called 'absconders' remained a perennial concern from the 1820s onwards. Even after they were made prisoners in their own villages and forbidden to leave without a passport, desertions continued. Such fugitives did not pay their taxes, they did not serve in the army or corvée, and they could start rebellions. A superior system surveillance, it was felt, would help prevent this from happening on the large estates.

Fixing and Displacement

When the government apparatus built by Muhammad 'Ali was at its strongest, the interests of merchants or landed notables were subordinated; while never extinguished, they lay prostrate. Following the fiscal crisis, the collapse of the state monopolies, and the rising costs of maintaining the irrigation system, opportunities presented themselves for holders of the larger concessions to gain control of the government machinery to further their own interests. "Where many of the larger landholders themselves were high state officials," Cuno writes, "the arena where the struggle for land was played out shifted to the state, and its results were expressed in legislation."

Between 1847 and 1862 legislative measures were passed to aid owners of large estates to acquire the land on which Egyptian peasants had recently been forced to abandon.[163] According to Cuno, "the real novelty in these laws was the requirement that land transactions be recorded in documents using official, stamped paper, and in the new procedures for land cessions. These measures extended the government's supervisory role in land tenure, in order to facilitate taxation and the adjudication of disputes."[164] Four of the six articles contained in the first decree from 1847 had the effect of restricting the

[163] Cuno, *op. cit.,* 268
[164] Cuno, *op. cit.,* 193.

claims of those who had already deserted their lands and limiting the reimbursement of those who had returned to land recently assigned to someone else. In 1855, a year after becoming the new viceroy, Muhammad Sa'id Pasha further amended the regulations of land claims to curb entitlements further, giving peasants who had returned to land they abandoned for over fifteen years no more than a subsistence plot measuring three acres. In 1858 the grace period was reduced to five years after which deserters lost all rights. The net results of these laws, traditionally seen as the emergence of certain privileges, cannot be understood in terms of social emancipation. The legislation enabled private estates to encompass more land into their domains, bringing its people into an environment where they could be watched more closely and prevented from leaving. "Far from representing a gradual accumulation of rights by the individual," Timothy Mitchell argues, "the land laws of the mid-nineteenth century represented a series of attempts to compel individuals to remain at work on the land and to confirm the seizure of land from those who fled."[165]

Landholding legislation had the effect of placing more land into the hands of elites with capacities to maintain social control and ensure the payment of taxes. But these estates were more than just an expression of clientalism or means to remove peasants from certain places and fix them on others; large estates became the primary instruments to moulding the biophysical environment for the continued expansion of perennial irrigation. Alleaume writes:

> At each phase of its development, this vast restoration of infrastructure was supported by large estates. The geometric rationalisation of space which such hydraulic management schemes called for was all the more efficient and easier to achieve when applied to large surface areas…. The new grid which the irrigation

[165] Mitchell, *op. cit.,* 61.

> network imposed on the countryside favoured the constitution of larger units of production. The property grants generally involved difficult or less productive lands; the larger scale facilitated the intervention of engineers or agronomists.[166]

Large private estates with '*izba*s were estimated to have spread to roughly one-seventh of the total cultivated area in Egypt by the time Isma'il Pasha became viceroy in 1863. Across the Atlantic that year, the American civil war raged and a dogged Union naval blockade of the Confederate ports was depriving English merchants of half their usual supply of slave cotton. As the price of cotton doubled, acreage planted with cotton proliferated across the Egyptian countryside with a scale and speed unprecedented. [167] Alexandria was well equipped with the servants of European capital to join hands with the Egyptian Government and rich cultivators to fuel to the fires of economic expansion. What took decades seemed possible in mere months. With the market bullish and Isma'il at the helm, Egypt entered a period of overdrive.

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The Cotton Boom

For many later commentators Isma'il Pasha epitomized the extravagant squanderer who inherited a wealthy country and left it impoverished; for others he was a visionary armed with only the sincere desire to improve his country. In the beginning at least, Isma'il presented promise. *The Times* correspondent in Alexandria reported on the young Pasha's accession with only satisfaction and high-flown praise: "if his intentions are carried out in their integrity, Egypt, besides advancing in civilization, will

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[166] Alleaume, *op. cit.,* 338.
[167] David Landes, *Bankers and Pashas: International Finance and Economic Imperialism in Egypt*, *Kingswood Books on Social History.* London: Heinemann, 1958. 125.

unquestionably rise to a state of prosperity that may justly render her the envy of the world."[168]

Isma'il's reputation had come from his assets. Before coming to power, he was known as "the model farmer" who had increased the area of his holdings by a factor of three, their income by a factor of five.[169] Isma'il clearly believed his personal initiative was needed to accelerate cotton production in the midst of the boom: by the end of 1863 he had added 200,000 *feddans* to his holdings; six months later, he was said to own between one-ninth and one-eight of the total cultivated area of Egypt.[170] Some of this land was acquired from the estates of other members of his family, some of it was reclaimed from the deserts and marshes through the use of the corvée; much was expropriated with the applied use of hydraulic force. According to a German engineer resident in Egypt at the time, "were the sale of a particularly desirable patch fail to materialize on account of the present occupants' stubbornness, the latter could suddenly find his *fellahin* went missing and the canal upon which his life depended, run dry. Even the most obstinate were turned docile."[171] Through such tactics Isma'il soon *decupled* his already extensive holdings from the time he entered the viceregal office.[172] To work his private estates (*da'ira saniyya*), the Pasha made liberal use of the *corvée*. Manging these lands on behalf of Isma'il was a special administration apparatus comprised of experts whose technical proficiency served to regulate the processes that maximised crop

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[168] *The Times*, Thursday, Feb 5, 1863, pg. 9.
[169] Owen, Roger. *Cotton and the Egyptian Economy, 1820-1914: A Study in Trade and Development*. Oxford: Clarendon Press, 1969. 98. *Cotton and the Egyptian Economy*, see Colquhoun, 4 June 1860: F.O. 78/1522.
[170] Owen, *op. cit.* 117.
[171] Max Eyth, *Lebendige Kräfte: Sieben Vortrage Aus Dem Gebiete Der Technik* (Berlin: J. Springer, 1905). 213 *my translation.*
[172] Landes, *op. cit.,* 189. also see Max Eyth, *Lebendige Kräfte*, 213.

production. They helped make the quality of the Pasha's cotton renowned, his new sugar refineries a marvel of technical sophistication.[173]

Sickness, Steam and the Société Agricole

Fate did not treat Isma'il with undiluted kindness. As the markets beckoned, a catastrophe befell the hydraulic system. The plague struck in spring 1863, only a few months after his accession. Sometime that June in the province of Beheira, cattle had taken ill with a mysterious contagion that killed within hours. At first few took heed but soon the canals were beginning to stink: they were clogged with rotting ox carcasses. By summer, the Government had dispatched officers to the villages to burn the dead and quarantine the remaining herd. The Viceroy called on agents from the financial house of Edouard Dervieu et Cie in Alexandria to fan out across the Mediterranean, to Marseille, Trieste and Odessa in search of new animals for import.

The pestilence attacked indiscriminately, forcing peasants to irrigate by the bucket and drag the plough themselves. "In many districts," a witness reported in August, "there are no animals left to turn the water-wheels, and the plants have been without water."[174] By autumn, the animals Isma'il had purchased to replace the decimated stocks began to arrive from Europe but they too fell ill; the Ukrainian herd even brought their own diseases with them. After a brief respite, the cattle murrain came back to finish off the remaining survivors by the end of the year. Isma'il himself estimated that 700,000 animals perished in 1863.[175]

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[173] *Ibid.* 129.
[174] *The Times* August 29, 1863, pg. 6
[175] Owen, *op. cit.,* 99.

In July of that year, perhaps before he was fully aware of the severity of the plague creeping across his country, Isma'il had been approached with a business proposition. An Austrian engineer who had resided in Egypt since the reign of Muhammad 'Ali had plans to help Egypt conquer what he felt was its greatest obstacle to happiness and prosperity. According to Antoine Lucovich and his calculations, a well-watered field serviced by a hydraulic steam pump would yield up to one thousand kilograms of cotton per hectare, five times more than a poorly irrigated field of the same size.[176] Lucovich wanted to form a company that would replace the human and animal power expended to raise the Nile and provide cheaper water by installing mechanical pumps. Customers would purchase the machines simply by paying instalments calculated according to how much water they lifted. The Pasha patently refused to countenance the idea.

Lucovich was adamant. He sought no concession, he argued, no obligation or even subsidy from the government, simply the permission to establish a joint-stock enterprise under Egyptian jurisdiction. Besides, Lucovich pointed out this was nothing new since the Pasha had just approved the incorporation of the Egyptian Commercial and Trading Company. Pinned down by precedent, Isma'il relented and grudgingly conceded his authorization on July 21, 1863.

Eleven days earlier, Lucovich had approached one of Isma'il's personal bankers, the man who was underwriting the Pasha's import of cattle, Edouard Dervieu, for financial backing. In due time, Dervieu succeeded in bringing onboard the pick of Alexandrian venture capital; they wrote statutes and prepared for the incorporation of the

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[176] A. Lucovich, *La Société Agricole et Industrielle d'Egypte* (Paris, 1865).

Société Agricole et Industrielle d'Egypte.[177] When Isma'il got word of what had transpired, he was incensed.[178] Beckoning Dervieu to Cairo, the Pasha ordered him to cease and desist: the investors were to withdraw and the Pasha's government would now consider the earlier authorization annulled, Lucovich could no longer operate in Egypt. The Société Agricole was to be disbanded.

Lucovich could not be deterred. He moved to Europe in search of funding and eventually succeeded in organizing the company for a second time with himself in charge of operations and Dervieu and as one of the investors. In the end, however, it seems the tail wagged the dog. Isma'il managed to convince Dervieu that their business relationship would best be served "if the company abandon all interest in irrigation" and settle for other contracts with the Ministry of Public Works.[179] In due time the Agricole was officially taken over by Edouard Dervieu et Cie and the stubborn Austrian deposed. Two years after forming, the brainchild of Antoine Lucovich was in shambles, a "monstrous corporate creation of the cotton boom, a hapless, rudderless firm."[180]

What role did Isma'il ultimately play in this fiasco? Landes concludes thusly,

> In the presence of conflicting testimony, the best explanation would seem to be that he feared the trespassing of the company on what for six thousand years had been the most valuable prerogative of the ruler of Egypt: the control of water. In the tradition of his predecessors, Ismaïl had built up his fabulous fortune in large part by judicious rationing of irrigation. He could not afford now to let Lucovich set up his machines along the canals and rivers of Egypt, establishing with each one a right enforceable by all the power and influence of the Western nations.[181]

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[177] Landes, *op. cit.,* 261-269.
[178] *Ibid.* 263.
[179] *Ibid*, 264.
[180] *Ibid*, 261.
[181] *Ibid*, 263.

Strictly speaking, this explanation takes for granted a domination of nature that neither the Pasha nor his predecessors ever fully enjoyed. Landes is substantially correct, however, in identifying the stakes involved.

On July 11, a week prior to Lucovich's first application to Isma'il, the Pasha issued an edict banning the construction of hydraulic devices without the approval of his own engineers. According to the British Consul, "the ostensible reason given for this measure was that pumps and bridges involved the private use of what was public water."[182] Isma'il likely wished to avoid any roads that led to foreign commercial rights over sensitive areas; he was too familiar with the horrible indemnities that litigation with Europeans inevitably seemed to entail. But further to this, he had his own ideas. Although he denied it when questioned by the French Consul at the time, Isma'il had decided to enter business for himself.

To Civilise and Enrich

Market competition as much as foreign interference conspired to sink the Agricole. While Lucovich was scouring Europe for investors after his initial rejection, the Pasha began to import hydraulic steam pumps and sell them to rich cultivators of his own accord. The Egyptian Government actively encouraged the mechanisation of irrigation as the best possible solution to lifting water following the problems with the Delta Barrages and the death of Egypt's cattle herd. The reporter from *The Times* found that both Isma'il and his heir-presumptive, Halim, spoke about steam power as if it were a moral crusade:

> The effect of all this is telling on the natives. I lately heard that Halim Pasha, in conversing with his farm labourers, had found the intellect of the lads who had grown up since the introduction of the new mechanical appliances was greatly in

[182] Colquhoun, 4 Aug. 1863 F.O. 78/1755, in Owen, 115-116

> advance of the men who had reached manhood under the former primitive systems of cultivation, when the ox was the all-in-all to the fellah, and when his mind had no stimulus and no cause for thought or inquiry. The Viceroy has also expressed his conviction that, although the cattle murrain has been a grievous present calamity the adoption of an improved system will civilize his people while enriching them.[183]

Isma'il became the largest importer of hydraulic steam engines in Egypt and, from 1863 onwards, a wealthy stratum of cultivators, themselves members of the ruling bureaucracy, prospered as his first customers. Within a little over a decade, 421 *pashas, beys*, and *effendis* who staffed the civil service possessed one-third of the total cumulative horsepower of the mechanical pumps in operation throughout the country. When this measure is included with the horsepower operated by domains directly controlled by the viceregal household such as *çiftlik*s, the *da'ira saniyya*, or '*uhdas,* the figure rises to over half.[184]

The combined horsepower of the hydraulic pumps installed along the route of every canal in Egypt as well as the length, width and capacity of each canal are all precisely documented. They can be found in the nineteenth volume of *Al-Khitat al-jadida al-tawfiqiyya,* a technical survey that grew to become "the first large encyclopaedia of the history of modern Egypt."[185] Its author was 'Ali Mubarak, chronicler of the mechanisation of Egyptian hydraulics, and perhaps its leading exponent; a man dedicated to the 'regeneration' of Egyptian civilisation through its modern mastery of the Nile.

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[183] *The Times*, March 29 1864. pg. 4.
[184] Alleaume, *op. cit.,* 340; 'Ali Mubarak, *Al-Khitat Al-Jadida Al-Tawfiqiyya Li-Misr Al-Qahira Wa Muduniha Wa Biladiha Al-Qadima Wa Al-Shahira* (Cairo: 1886-1889). XIX.
[185] *Ibid,* 340.

Managing the Nile: The Spirit of Technocracy

Can one speak of an ideology of the hydraulic society that can be found in Egypt during the late nineteenth century? A member of Muhammad ‘Ali’s academic missions to France, ‘Ali Mubarak was among the first of a generation of Arabic-speaking Muslim Egyptians to achieve a position of influence within a government whose ethnic composition and cultural outlook was thus far profoundly Ottoman. The Pasha required men of expertise to execute the technically demanding projects that made the Egyptian economy more lucrative. Mubarak was a product of the system, an engineer who owed his prestige and influence to the government that trained him, a man who loyally served it and profited.[186]

Mubarak had first risen to prominence during the reign of ‘Abbas who granted him three hundred *feddans* of land for his services as director of the *École polytechnique* (*Muhandiskhana*). While the tides temporarily turned for Mubarak under the reign of Sa’id, his career reached a high-water mark under Isma’il, whom he impressed by successfully using the Delta Barrages, despite its flaws, to divert more water into the Rosetta branch in 1863. Over the following two decades Mubarak would be in charge of several of the most important administrative portfolios in the country.

In the winter of 1867-68 Mubarak returned from a trip to Paris on behalf of the Egyptian government, and proceeded to transfer the Bureaux of Endowments (*diwan al-awqaf*), Public Works (*diwan al-asghal al-‘umumiyya*) and Schools (*diwan al-madaris*)

[186] My account of the life and thought of ‘Ali Mubarak is indebted to Darrell Ivan Dykstra, "A Biographical Study in Egyptian Modernization: 'Ali Mubarak (1823/4- 1893)" (University of Michigan, 1977). All translations of Mubarak’s writings are his.

to his newly acquired mansion in Cairo.[187] For the next six years, with few interruptions, Mubarak attended to his business personally from the confines of his palatial residence on Darb al-Gamamiz. That year Mubarak opened the new Preparatory and Engineering schools, a School of Administration and Languages, a School of Surveying and Accounting. The following year he inaugurated the School of Ancient Egyptian Language and hired the Egyptologist Henri Brugsch to teach there. Between 1863 to 1873, 'Ali Mubarak fulfilled these functions as well as managed the railroads and spearheaded Cairo's 'modern' reconstruction- all while planning the development of Egypt's irrigation system.[188]

'Ali Mubarak was one of the earliest Egyptian intellectuals in the nineteenth century to enunciate ideals of patriotism and progress based on a glorious vision of Egypt's Pharaonic past as a model for its future development. He came to know Ancient Egypt in large part through European authorities such as Champollion, Belzoni, Lepsius, de Sacy, Volney and the *Description de l'Égypte* from which he quoted extensively. For example, Mubarak adopted the argument put forth by Edme Jomard, that the pyramids were a symbol of Egyptian scientific expertise, a monumental emblem whose dimensions were based on units of measurement not only mathematically related one another, but which corresponded precisely to a degree of the earth's latitude.[189] As the epistemological foundations for geometry and engineering, Mubarak believed that the

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[187] Timothy Mitchell, *Colonising Egypt* (Berkeley; London: University of California Press, 1991). 65, cf. *al-Khitat*, 9:50.
[188] Dykstra, "A Biographical Study in Egyptian Modernization: 'Ali Mubarak (1823/4- 1893)". 212.
[189] cf. Edme Jomard, "Exposition du système métrique des anciens Egyptiens contenant des recherches sur leurs connaissances géométriques et astronomiques et sur les mesures des autres peuples de l'antiquité." ; 'Ali Mubarak, *'Alam Al-Din*, vol. 4 (Cairo: al-Hay'ah al-Misriyah al-'Ammah lil Kitab, 1993). 3 :913-40. ; Darrell Ivan Dykstra, "Pyramids, Prophets, and Progress: Ancient Egypt in the Writings of Ali Mubarak," *Journal of the American Oriental Society* 114, no. 1 (1994). 62.

pyramids helped indicate that Ancient Egypt was the *first* civilisation in history to develop irrigation and agriculture, "the fountainhead of the sciences of the world, and the mine of most of its good things."[190]

Mubarak's technocratic ideas about hydraulics was most forcefully expounded in *Nukhbat al-fikr fi tadbir Nil Misr [Selected thoughts on the administration of the Nile of Egypt]*. In this book he argued that ancient Egyptian civilisation emerged on the basis of its mastery of technology and that its greatest periods of history occurred when material prosperity was greatest, "when the rulers were attentive to the primacy of agriculture based upon a properly functioning irrigation system."[191] Of the branches of the Nile that numbered seven in antiquity, Mubarak asserted only two had occurred naturally; the other five were all creations of the Pharaoh's engineers. "When the old, just and equitable laws prevailed," Mubarak believed, a vast network of canals, embankments and reservoirs such as Lake Moeris had helped provide irrigation throughout the year.[192] Muhammad 'Ali's efforts to establish a system of perennial irrigation were therefore not "something newly invented… for the ancients preceded us in this."[193]

Nukhbat al-fikr is devoted to finding the method of water control that permits the greatest productivity of the Egyptian rural economy. Mubarak calculated that the 650,000 *feddans* serviced by perennial irrigation in the Delta at the time of his writing could be enlarged by a million *feddans* if water was distributed more effectively. According to

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[190] 'Ali Mubarak, *Nukhbat Al-Fikr Fi Tadbir Nil Misr [Selected Thoughts on the Administration of the Nile of Egypt]* (Cairo: 1297/1879-1880). 5.
[191] Dykstra, Darrell. 393. A Biographical Study in Egyptian Modernization: 'Ali Mubarak (1823/4- 1893) On Ancient Egypt as a model see 'Ali Mubarak *Nukhbat al-fikr fi tadbir Nil Misr*. pgs. 52, 59, 189, 191. *all translations of Mubarak are from Dykstra.*
[192] Mubarak, *'Alam Al-Din*. 3:993.
[193] Mubarak, *Nukhbat Al-Fikr Fi Tadbir Nil Misr [Selected Thoughts on the Administration of the Nile of Egypt]*. 191.

Mubarak's estimations, Egypt needed to lift twenty-five million cubic metres of water per day from the Nile, triple the existing supply.[194] Mubarak's plan was to make hydraulic steam pumps available to more than just the wealthy landowners of Egypt, by having the government install huge pumping stations at specific points in the Delta where they could be utilised most effectively for the prosperity of all. But the real solution to quenching Egypt's thirst was to follow the Pharaohs and create a permanent reservoir to hold back part of the Nile's flood in order to release it during the summer months when the river was lowest. Such a method would be "the greatest of all methods to control the water of the Nile."[195]

Ancient precedent convinced 'Ali Mubarak that government control of the Nile must be total. The downfall of Egyptian civilisation, Mubarak held, was foreign invasion and centuries of negligent rulers who allow the canals to silt up and thus carry water only during the time of the flood. The government's 'natural' role was therefore one of direct involvement in the rural economy and Mubarak urged the state to invest in major hydraulic projects such as recreating the seven Nile outlets by widening and deepening canals, assigning the work of the corvée to private contractors to mechanise hydraulic maintenance, and forming permanent councils of agronomists to supervise fertilisation and crop rotation, which he felt could no longer be left to custom. Rural conditions had changed, Mubarak argued, and agriculture had declined. It was the task of Government to direct the country with a firm hand, to instruct the peasants in civilisation and cultivation, to return Egypt "to its ancient influence, forcefulness, and esteem."[196]

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[194] *Ibid,* 93.
[195] *Ibid,* 187
[196] *Ibid,* 184.

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'Ali Mubarak did not attempt to analyze the great changes in the social relations of production and landholding that swept across his country during the course of his long and illustrious career. For him, there were two actors in the rural economy: a benighted but redeemable farmer who tilled the soil and an enlightened government as his saviour: "guidance and direction must come from above."[197] As Darrell Dykstra argued, "it was fully accepted and nowhere challenged, that it is the business of the government to concern itself actively with the administration of the fundamental water resources of Egypt."[198] Had he delved a little deeper, however, Mubarak might have discovered that irrigation in Egypt entailed far more than simply learning from the ostensibly ancient precedent of hydraulic dominion.

The development of large-scale landholding was a product of compromise between the Pasha and his men who shared the desire to maximize agricultural production. Placing the responsibility of indebted villages into the hands of individual members of the Pasha's civil bureaucracy was initially a method to offset fiscal deficits. In time, with the coming of free-trade, the values of these concessions became manifest: from 1849 to 1852 the annual yield of cotton rose from 119,965 cwt. to 670,129; the grain trade surged between 1854-1856.[199] Allegiance to the Pasha could be lucrative for both parties. At the vanguard of the mechanization of Egyptian irrigation, the owners of these concessions were the first to benefit when Isma'il became the largest importer and retailer of mechanical hydraulic equipment in the country.

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[197] *Ibid*. 168.
[198] Dykstra, "A Biographical Study in Egyptian Modernization: 'Ali Mubarak (1823/4- 1893)". 475.
[199] Landes, *op. cit.,* 77.

The stage of devolution that the *'izba* irrigation colony on large-estates signified was in some ways a more efficient form of state control. Assigned to officials and servants of the viceroy as a means to extract the revenue from land and organise the labour, machinery and other resources, estate holders also had the power to maximise production for their own benefit as well. Instead of serving in the corvée as forced labourers the inhabitants of the large estates remained there permanently; their new masters paid others to maintain the larger canals so they could tend full-time to the hydraulic agro-colony.[200]

In what Ghislaine Alleaume has called the "rationalisation of the countryside," a simplified agrarian system took shape that was designed for maximum yields.[201] This process of simplification sought to make the people and land of Egypt more legible and disposed for measurement, comparison and coordination. The social and spatial conception exemplified in the '*izba* permitted a kind of modularity that could be repeated from village to village, uniting them in with a single standard, disseminating regimentation across the land. The *possibility* of large estates as economies of scale emerges from this simplification; it permitted an aggregate picture that made "the surveillance of personnel easier," a synoptic view that transforms living labour and space into objects under "the exchange values and sign systems of capital."[202] Like an army, the biophysical environment is hierarchically organized from above to fulfil a unique purpose: to be at the disposition of a singular commander who in time would not even

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[200] Nathan J. Brown, "Who Abolished Corvee Labour in Egypt and Why?" *Past and Present* 144 (1994).
[201] Alleaume, *op. cit.,* 343.
[202] Mitchell, *op. cit.,* 79.

have to watch his minions, who could simply read them from the maps and plans which purported to represent them.

Such techniques enabled analytic power as well as a more nebulous sense of blind faith. It was the fancy of such control that helped inspire Isma'il to mortgage the lives of his subjects on the cotton boom. Yet, a controlled environment was never total and the Nile would not so easily surrender to a singular authority. The extension of perennial irrigation up the Nile Valley and the stringing together of different hydrologies led to unexpected consequences that contributed to undermining the Pasha's rule.

1863 witnessed the highest flooding of the century. By the end of August the waters stood fourteen feet above the level of the year previous. Although the Government took special precautions to safeguard the dikes, on the night of September 25, six miles above the remodelled village of Kafr al-Zayat, the Nile breached the embankments. The countryside was overwhelmed; the recently harvested cotton lay captive. Tides of water flooded the land, cut the railroad between Cairo and Alexandria and laid waste to twenty-five thousand bales of cotton and tens of thousands of bushels of grain. No natural disaster could stop a persevering Pasha from cashing in, however, and Isma'il worked double-time, taking out more loans from the financiers to bring in more animals, as well as steam pumps and emergency food stocks.[203] His extraordinary measures to save the harvest and ferry it to market ensured a cotton crop fifty percent larger than the year before.

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[203] Landes, *op. cit.,*149.

But the inclement inundations of 1863 had marred the country's food production and Egypt became a net importer of grain in the following two years.[204] To compound these problems, in 1864, a year of more high flooding, Isma'il collected tax on the lands that most of the smaller peasants cultivated (*kharaj*) at a rate that was triple what was paid by the *ushuri* holders of the gilded estates. Such fiscal policies were soon felt in the spring of 1865: with food imports yet to stanch the famine, with their cattle long gone, people starved to death by the thousands.[205]

At the same time that the floods of 1864 had breached their dikes and were wreaking havoc around the town of Jirja, the Pasha was busy taking over the plantations owned by his late brother Ahmad in Naj' Hamadi, a short distance upstream.[206] Isma'il had come to spread the gospel of perennial irrigation in Upper Egypt beyond its current limitations on the elevated fringes bordering the Nile. The Ibrahimiyya was the largest public work in the Nile Valley and reported to be the longest canal in the world. It was to service an area enclosed between the river and a newly constructed embankment (*muhit*) running parallel. In between the massive dike and the Nile, a narrow band 5 kilometres wide and 220 kilometres long would become part of the Pasha's personal estate. All of this was to be achieved by forced labour.

Isma'il was not willing to let starvation foil his grand plans but, at last, he overplayed his hand. In February 1865 the government decreed a levy of fifty thousand tons of stone to repair the dikes at Jirja and fifty thousand workers to continue with the Ibrahimiyya. As Mitchell reports it, within a month the people around Jirja took up

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[204] Owen, *op. cit.,*102.
[205] Mitchell, *op. cit.,* 66.
[206] Until the mysterious railway crash that killed him six years before, Ahmad had been the heir apparent to follow Sa'id Pasha. see Landes, *op. cit.,*129.

arms.[207] Flames of rebellion soon spread northwards for forty kilometres until Asyut. The gravity of the situation compelled the personal intervention of Isma'il as well as his secretary of war who both travelled to Upper Egypt to put down the uprising. Statistics from the bloodshed are hard to come but rumoured fatalities ranged somewhere from "several dozens to sixteen hundred."[208] According to the British Consul at the time, the revolt erupted because of the corvée. The food crisis had helped inflate the prevailing local wage in the area to ten piasters a day- four times the going rate Isma'il would pay them.[209] But the Pasha attributed the problem to negligence and had the governor of Jirja purged. From now on, he would pay special attention to his estates, separating his Upper Egyptian holdings from those in the Delta, and assigning a new inspector to supervise the operations.

Regardless of who he appointed or what law he passed, Isma'il's project to expand perennial irrigation up the Nile Valley was plagued by difficulties; neglected factors came back to haunt and undermine his single-minded focus on maximum production in minimum time. The source of the troubles was not the Nile's lawless whim so much as a much deeper problem whose effects would haunt engineers in Egypt well into the twentieth-century. According to Alleaume, food shortages were the symptoms of a systemic regional imbalance in the Nile's hydrology stemming from the homogenization and "progressive wear" of a once diversified hydraulic apparatus. She writes,

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[207] Mitchell, *op. cit.,* 64-66, itself compiled from 'Ali Mubarak's *al-Khitat al-tawfiqiyya* 11:82, 14:53, 94-5 *et al.*
[208] Mitchell, *op. cit.,* 64.
209 Cole, Juan Ricardo. *Colonialism and Revolution in the Middle East: Social and Cultural Origins of Egypt's °Urabi Movement*, *Princeton Studies on the Near East*. Princeton: Princeton University Press, 1993. 196.

> The persistence of irrigation systems reliant on the transversal slope of the flood valley in Upper Egypt led to the accumulation of alluvium, accelerating the elevation of the soil. This put a growing area of farmland beyond the reach of the highest floods and led to a progressive reduction of cultivated land and harvests…. On the other hand, the reduction in the flow of water to the canal system in Upper Egypt meant that too much water flowed into Lower Egypt, which resulted in the growth of lakes and swamplands.[210]

Cholera is a water-borne organism that kills people by dehydration. It usually proliferates when untreated sewage contaminates drinking water. In May 1865, shortly after the political fires around Jirja had been mercilessly stamped out, the flagella-propelled parasites came twirling into town. They arrived in Egypt from Bengal by way of the Red Sea route to Mecca. In Egypt, those fortunate enough to draw theirs waters directly from the Nile did not fall sick; those who drank from the still, stagnant perennial pools that filled the summer canals were not so lucky. "Shaikh Yusuf laid the mortality at Kena to the canal water," wrote Lady Duff-Gordon, "which the poor people drink there."[211] The highest mortality rates were in the areas around Jirja and Asyut but these were only the first stops on the parasite's free ride up Isma'il's hydraulic highways. Egypt's re-engineered river would form the perfect launching pad for cholera's European tour that year. Before leaving Egypt, the cholera killed sixty thousand people. A month after it first appeared, the parasite travelled the Nile downstream to Alexandria, sparking mass hysteria. Within two weeks, a throng of thirty thousand of the city's European residents squeezed on board any ship they could find to vacate the country. Among them cholera found willing hosts to bring the pandemic across the Mediterranean. It was June:

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[210] Alleaume, *op. cit.,* 337-8.
[211] Lucie Duff Gordon, *Letters from Egypt* (London: Virago, 1997). 270, *in Mitchell, op. cit.,* 65.

the cotton bourse in Alexandria had been brought to its knees and the last Confederate armies had just surrendered to the United States of America.

Although the crisis eventually passed and high finance returned, cotton reached a speculative peak and crashed within a year. Throughout this period Isma'il continued to spend, digging canals, laying rail and amassing more land. When the loans he had taken to finance the imports during the cattle murrain crisis came due, the Pasha borrowed more to defray the interest payments. And so began a heady vortex of borrowing that deferred but only compounded the problem. Under Isma'il, Egypt's national debt rose from £ 3,300,000 to £91,000,000 in thirteen years. By 1876 the government of Egypt was bankrupt and on the brink.[212] In his desire to turn Egypt into a European nation with an empire on the Nile, Isma'il would soon achieve just the opposite: six years later Egypt became an African colony of the British crown.

[212] Hunter, 38-40. *Egypt Under the Khedives* 1805-1879, Landes, *op. cit.,* 128.

Conclusion and Epilogue: Desire and History

"The critical power of the moderns lies in this double language: they can mobilize Nature at the heart of social relationships, even as they leave Nature infinitely remote from human beings; they are free to make and unmake their society, even as they rend its laws ineluctable, necessary and absolute."

-Bruno Latour[213]

Beholden to an idea, the makers of Modern Egypt fashioned a world in their own image and confronted a reality unexpected, an ambivalent creation whose monstrous consequences outstripped any original intentions. How far could an Orientalist fantasy play out in *defiance* of history?

Myth resides at the heart of Egyptian hydraulics; however misconceived, it served a purpose. From the glimmering chimera of monuments half-buried in sand, Napoleon's army discovered the tools to stage an occupation of the mind. They downplayed their hegemony of brute force by announcing a magnificent expedition of scientific truth; they justified foreign domination by claiming only to restore a benighted land to its own antique splendour. The golden age of the Pharaohs as grand stewards of the Nile was an eminently useful fiction. It resolved contradictions and made an unknown world of bewildering complexity a little more comprehensible to visitors armed with little more than the classics.

However short-lived the French military presence, however much in vain the *savants* searched to "gather the ancient laws, which, though fallen into disuse, could be put back into vigour immediately," the Napoleonic Expedition succeeded in occupying the minds of the generations to come. On the one hand, it heralded the intellectual appropriation of Egypt's past. On the other, it marked the birth of Egypt's hydraulic modernisation, a project executed by foreign engineers and the young members of the

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[213] Bruno Latour, *We Have Never Been Modern* (New York; London: Harvester Wheatsheaf, 1993). 37.

ruling Ottoman household sent to Europe for technical training.

A new form of water control laid the basis for a new Egypt. Over the course of the nineteenth century, the country converted to an irrigation system that made large-scale cultivation possible throughout the year by means of a centralized apparatus of state. The river Nile was simplified; the extraordinary variety in its regional conditions was reduced, and its hydraulic forces reoriented along the Nile's principal longitudinal slope to facilitate a singular control. New semiotic powers- networks of surveillance and documentation- propagated across the land to stabilise the flow of state power over water.

A pattern took shape with new forms of communal association and discipline; one better suited to systematically recasting the environment for the efficient operation of perennially irrigated commercial agriculture. The new regime on the Nile proved a far more complex undertaking than any restoration of the past; the social and ecological upheaval unleashed was staggering. "Society," writes Donald Worster, "even in its so-called triumphs, inescapably came to bear the mark of the desert and of its own efforts to overcome the environmental exigencies there."[214] In basic respects, the hydraulic revolution was a historical process marked by failures, compromise, and concession. By the late 1830s, the Pasha had gone as far as he could as 'Farmer-General' and in the midst of crisis he gradually acceded to a new era of partial devolution. A class began to emerge, a nobility of capital and expertise, possessing the means to utilize the Nile for maximum profits.

A simplified agrarian system took shape that was designed for maximum yields. This process of simplification sought to make the people and land of Egypt more legible

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[214] Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West*, 1st ed. (New York: Pantheon Books, 1985). 22.

and disposed for measurement, comparison and coordination. The social and spatial conception exemplified in the '*izba* permitted a kind of modularity that could be repeated from village to village, uniting them in with a single standard, disseminating regimentation across the land. The *possibility* of large estates as economies of scale emerges from this simplification; it permitted an aggregate picture that made "the surveillance of personnel easier," a synoptic view that transforms living labour and space into objects under "the exchange values and sign systems of capital."[215] Like an army, the biophysical environment is hierarchically organized from above to fulfil a unique purpose: to be at the disposition of a singular commander who in time would not even have to watch his minions, who could simply read them from the maps and plans which purported to represent them.

What is meant by 'rationalisation' refers to this transformation of the Nile into an efficient instrument for economic exploitation; but rather than such diluted terminology we are wiser to see something more Faustian in the Nile's disenchantment. Like Heidegger's Rhine, the Nile is no longer fearsome or particularly respected, it is understood only for its value as a thing to be 'commanded,' only for its ability to accomplish something else. It therefore means something only when it can be translated into so many cubic metres per *feddan* per day, so many *qintar*s of cotton; "to think in terms of mere weight and number, to make quantity not alone an indication of value but the criterion of value- that was the contribution of capitalism to the mechanical world-picture."[216] The rationalisation of the Nile was produced by the kinds of environmental simplifications that bestowed great power through a narrowing of vision a process called

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[215] Timothy Mitchell, *Rule of Experts.* 79.
[216] Lewis Mumford, *Technics and Civilization* (London: G. Routledge, 1946). 25.

'enframing'. In the relentless concentration on the goals of production, however, what lies beyond this sharp calculus fades into the shadows for only so long.

What economists call an externality is an outcome of a decision that affects someone else whose own interests are not taken into account by the maker of the decision. Externalities can be both good and bad and in the case of Egypt's hydraulic revolution, nobody, not even the Pasha benefited from perennial irrigation quite like *schistosomiasis*. While it resided in the Nile Valley for perhaps as long as the pyramids, blood fluke was far from prevalent until the nineteenth century. The hydraulic revolution launched by Muhammad 'Ali created the ideal chemical environment for the snails in which the parasite lives part of its life to thrive. Although precise data are impossible to come by, one study suggested that the conversion from basin to perennial irrigation increased the prevalence of *schistosomiasis* by at least one thousand percent; this was considered a conservative estimate.[217] By the beginning of the twentieth century few had any idea that perhaps as much as half of the entire Egyptian population would become chronically infected with the flatworms that drained their strength, and left them prey to bladder cancer, hypertension, liver failure, kidney malfunction and nerve lesions. "No other people on earth," writes John Farley, "suffer the ravages of bilharzia to the extent of the Egyptian *fellaheen*."[218]

How are we to understand the infections and the seepages that not only transgressed the stark boundaries of the hydraulic grid to sow disorder and wreak havoc,

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[217] See M. Khalil and M. Azim, "Further Observations on the Schistosomiasis Infection through Irrigation Schemes in Aswan Province, Egypt," *Journal of the Egyptian Medical Association* 21 (1938); J. A. Scott, "The Incidence and Distribution of the Human Schistosomes in Egypt," *American Journal of Hygiene* 25 (1937).

[218] John Farley, *Bilharzia: A History of Imperial Tropical Medicine*, *Cambridge History of Medicine* (Cambridge: Cambridge University Press, 1991). 45. Bilharzia is the name for the immunological reaction to the *schistosomiasis* parasite, it is the disease proper.

but who also profited from it most spectacularly? Putting the Nile to work in the nineteenth century was an experience from which neither the people or landscape of Egypt emerged completely unscathed. The hydraulic society was a *hybridic* society; natural and social orders shaped and were defined by each other.

Yet, the British who came to the country in 1882 as occupiers again preferred myth to reality. As if it was a century earlier, the Nile's calling for mastery became once again a useful illustration of just how far Egyptians had fallen:

> It is certain that in the old days there must have been native engineering talent of the very highest order, and when we read of such and such a king restoring public works in a long and glorious reign, there must have existed a continuous supply of good engineering talent which had *carte blanche* from the ruler of the day. But owing to many causes the native talent has sunk so low that without modern scientific aid the Egyptians could not work their own canals.[219]

In the ensuing years of occupation short of finance itself, no area occupied British attention more than irrigation. Behind its 'rejuvenation' lay the key in pumping up cotton yields to pay off Egypt's debt. If colonialism was partly a moral endeavour, the ultimate authority of the European's right to rule lay in his technological prowess. In the words of the man who designed the Aswan Dam, "the white man's real burden lies in replenishing the earth and subduing it."[220]

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[219] Justin Ross, in William Willcocks, *Egyptian Irrigation* . London: E. & F.N. Spon, 1889. vii.
[220] William Willcocks, *Sixty Years in the East.* Edinburgh; London: W. Blackwood, 1935. 72-3.

Appendix

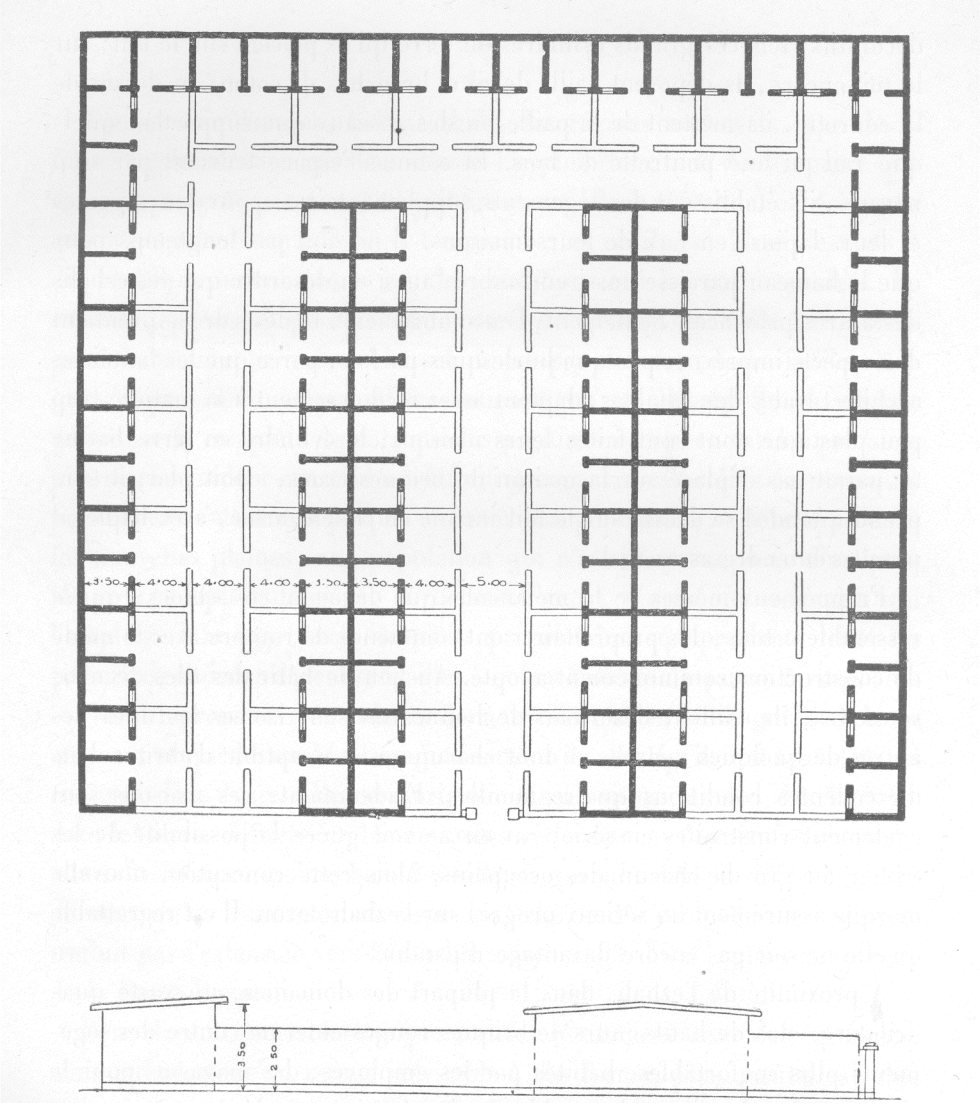

Figure 1 Plan of a Modern Izba.

Source: Lozach and Hugs, *L'Habitat Rural en Égypte.* 51.

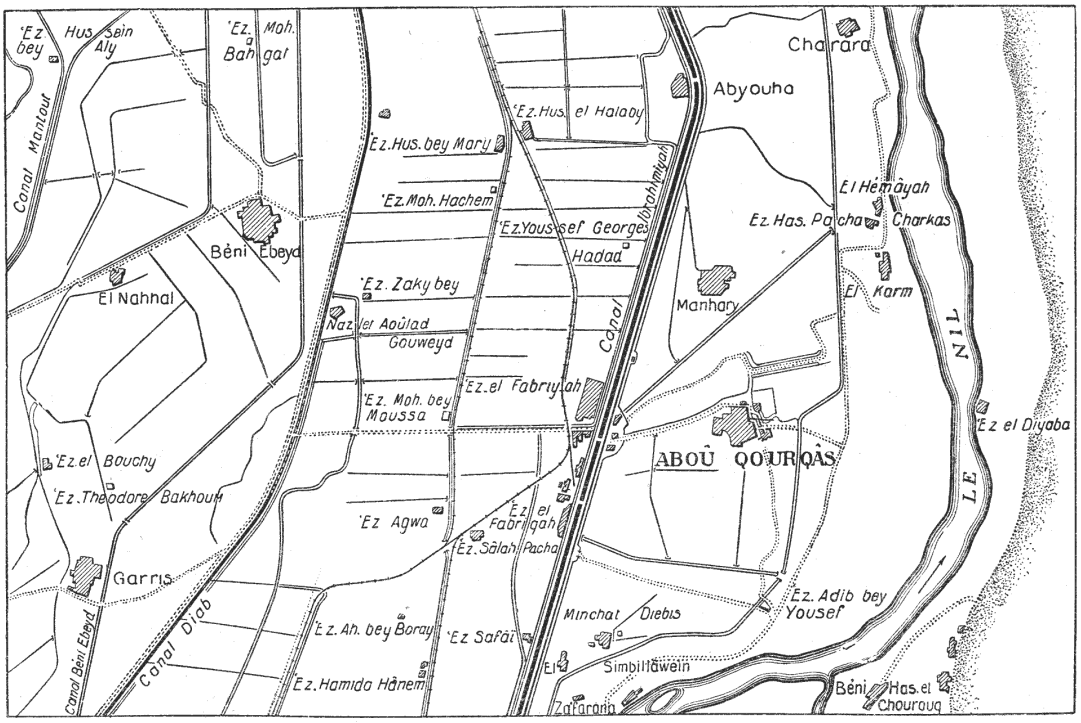

Figure 2 The Rationalisation of the Countryside. Compare the spread of perennial irrigation in the middle to the older basin systems on the right.

Source: Lozach and Hugs, 181.

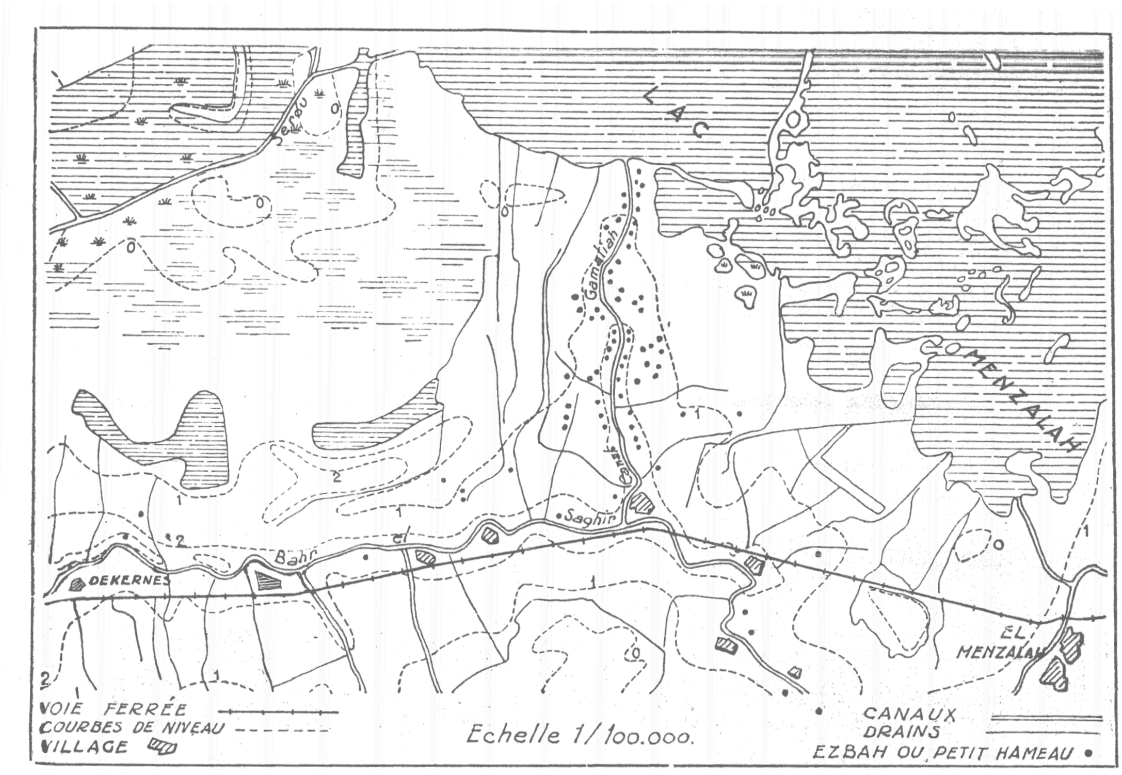

Figure 3 The Influence of a Canal on Population Distribution in the Lower Delta. Source: Lozach and Hugs, 48.

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