“Diguo shiji: qianxiandai Zhongguo di jishu huitu yu tongzhi” (Imperial designs: technical drawing and governance in Late Imperial China)

Imperial designs:
technical drawing and governance in pre-modern China

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In his book *Seeing Like A State* (Figure 0) James Scott discusses the relations between farming landscape and governance in the modern world. Scott suggests that the urge of modern planners to generate simple, legible landscapes stems from "a certain *aesthetic*, what one might call a *visual codification of modern rural production and community life*". The archetypal modern rural landscape (Figure 1), and the technologies that go with it, have colonised much of the globe over the last 150 years. This farming system has been successfully endorsed by agronomic institutes, national governments, international development programmes, and institutions like the World Bank as ***the*** modern and efficient way to farm. This aesthetic of landscape, and the capitalist logic that it embodies, are still conquering new territories: now that Bulgaria has joined the European Union, for example, plans are afoot to "rationalise" its small farms to conform to this model.

The powerful tractors and huge fields of Figure1 are not simpy the logical outcome of value-neutral technical progress. The global success of the John Deere tractor company reflects a world-wide internalisation, by government policy makers and supermarket customers as well as by farmers and engineers, of an aesthetic of landscape which encodes very specific concepts of efficiency and value. What we recognise as the visual grandeur of this landscape is shaped by a broader industrial logic: the drive to raise the productivity of capital, and of human labour, through mechanisation and other technological substitutes for human sweat and skills. A farm is construed as a business. The fewer the farm-workers, the more efficient the farm. Land is valued in terms of the economic profits it can generate, place is reduced to space, and farmers as a national constituency, although they may be sentimentally regarded as the salt of the earth, actually count for very little in political terms compared to the transnational agri-businesses and giant retail corporations for whom they provide the labour. The principles of global competition have sculped the contours of this gigantic, depopulated farm-scape.

It is hard to imagine a farming landscape more different from Figure 1 than the densely populated patchwork of tiny fields in this thirteenth-century painting (Figure 2). This late imperial Chinese farming landscape appears natural, spontaneous and organic by contrast with the vast, straight swathes cut by the combine-harvesters. Yet the landscape depicted here is also an archetype, and a political artefact. It too is shaped by an aesthetic that encodes specific ideals and techniques of governance. In late imperial China, between about 1100 and 1900 AD, the rulers and officials of a powerful centralised state worked steadily to transform as much as possible of Chinese imperial territory into this ideal landscape.

In my talk today I want to discuss the forms of technical drawing that were used to promote the goals and values of the Chinese empire. I shall focus in particular on the interplay between two distinct types of technical drawing which worked in tandem to

construct and propagate this characteristic Chinese landscape, comprising both a physical system of farm production, and the basic social principles of imperial rule. But first, I shall begin with some more general reflections on technical drawings of different kinds, and the kind of work they do.

What is a technical drawing?

A key factor propelling scientific and technological advances in the West since the Renaissance was the development of a discipline of technical drawing. Technical drawings in the conventional sense of patent applications, blueprints for machinery (Figure 3: ground roll baler) or ammonium production, have all been critical vectors of change in the modern farming sector. Yet these are not the only technical images that have shaped our assumptions about what a productive, efficient farming system looks like – nor are they able, unaided, to bring such a system into being.

In very general terms, what does a technical drawing do? It conveys some kind of specialist knowledge or understanding to the viewer. It may show how a technical device is to constructed (Figure 4: selenium dome tweeter); how it works; why it works; or how to use it. An architectural design, a blueprint or an instruction manual are good examples of this (Figure 5: sewing machine manual). Other kinds of technical drawing lay out the principles of how things or processes relate to each other. A map or plan shows where one place is located in relation to another. A genealogy lays a pattern of kinship over time. Technical drawings simplify complex and messy processes or patterns in order to highlight their essential elements and show how they are related (Figure 6: efficiency of steam engine). And they are produced for a purpose. They are designed as pedagogical or transformative devices, paths to understanding or blueprints for action: it is intended that the viewer should be changed by the viewing. Understanding a technical drawing involves active engagement on the part of the viewer: what the philosopher Roger Ames calls "performative looking".

The technical drawings of science and engineering help construct what Scott calls the *simplicity and legibility* of modern scientific knowledge systems. They function as what Bruno Latour calls "immutable mobiles", explanations or artefacts that can be transferred through space or time without requiring modification. The design for a fertiliser plant drawn up in London should translate into an efficiently functioning plant anywhere around the world. Characteristically a technical drawing today is expected to be an impersonal abstraction, disembedded from the particularities of context which might interfere with the processes of pure reasoning, or with its universal applicability. In the drawings that illustrate chemical experiments in school-books we do not see the hand, let alone the face and expression, of the person holding the test-tube. We understand the objectivity of such scientific graphics as a stark contrast to the subjectivity of advertisements. Advertisements may explain the technical features of a washing machine, but the way they work their magic, we feel, is not by rationally convincing us of the superiority of the eco-wash, but by generating desires, impulses and expectations.

And yet, I would argue, the diagrams can't work without the advertisements. In order to fulfill its instrumental purpose, the most abstract of technical drawings has to be decoded and reinserted into a real-life environment. The viewer has to be able to

make sense of the diagram, to imagine whether and how the abstraction will *apply* in the world she inhabits. So the framing of expectations, the providing of context, is an essential condition for abstract technical images to work. All of us, including scientists and engineers, pick up defining ideas about about which kinds of technology are useful, and how they fit into our lives, from advertisements and other illustrations and images, in books and in the media – and of course from our daily, personal observations of how the world looks.

This (Figure 1 again) is not a technical drawing in the usual sense we give to the term today. Yet it can usefully be thought of as a technical drawing in a different register. Images of this type, which we come across routinely in geography books, TV programmes and newspapers, play an essential role in establishing the larger technological framework within which we operate, convincing us of the rightness, the normality of a particular type of farming technology. They predispose us to accept that advances in mechanisation and scale, and the depopulation of the farming sector, are the logical way for agriculture to proceed. From the perspective of governance, if we ask which images have been most effective in convincing not only engineers and farmers but also policy makers, bankers, school children and supermarket shoppers that this is what modern farming should look like; if we ask which visual forms operate most effectively to consolidate this sociotechnical system and its corresponding aesthetic; then we see that realistic, pictorial representations of the landscape and its products provide an essential cultural anchor for the abstract graphics of blueprints or handbooks. They too work as technical drawings: even if the technical knowledge they convey is not precise, as it would be in a blueprint, they work at a deeper level to shape our technological perceptions and predispositions.

The agrarian roots of imperial rule in China

The Chinese empire, like almost every other pre-modern empire, drew the major part of its wealth from agriculture. The cosmological and political principles of an agrarian empire in which "agriculture is the foundation" were established in China in very early times, probably around the time of Confucius in the fifth century BC, and endured well into the nineteenth century. Each peasant couple of working age paid taxes to the state, calculated as a notional tenth of the grain and cloth that they produced each year. "Promoting agriculture" was a primary duty of the ruling elite, whether in the emperor's palace or in the local magistrate's court.

"Promoting agriculture" was a symbolic and moral as well as a practical endeavour. In the cosmos the male and female principles, yang and yin, combined in fertile and harmonious congress to generate the natural order and the myriad things (Figure 7, *Taiji tu*). Farming represented a human effort to harness cosmic forces. In the countryside peasant men and women's labour combined, like yang and yin, to generate the order of the imperium: the taxes that supported imperial rule, the food and cloth that sustained the population, and the proper performance of gendered roles ("men plough, women weave") that underpinned the social order. In border regions magistrates would make good Chinese subjects of the local barbarians by teaching men to plough and women to weave *in Chinese fashion*. Each spring the emperor, as the Son of Heaven who mediated between his subjects and the macrocosm, ploughed a sacred furrow outside the imperial city (Figure 8), to attune human efforts with cosmic rhythms.

The governing class strove to promote peasant welfare while raising production. The Ministry of Agriculture worked with local magistrates on large-scale and small-scale projects of all kinds. (TABLE) Officials saw their role as that of teachers "instructing the peasantry". They did not usually produce new technical knowledge themselves, but they carefully recorded the practices they observed, and used these observations to disseminate knowledge of efficient practices around the empire. The earliest farming books we know about, dating back perhaps as far as the fourth or fifth century BC, were extensively quoted in treatises on government. Many important guides to farming followed, becoming steadily more detailed and technically precise in their language. It seems that texts rather than drawings were the principle resource for early Chinese officials trying to develop farming techniques. While written texts could be copied without too much danger of error, in the pre-printing era the mass dissemination of drawings of any kind was not easy. In certain domains, however, technical images (a visual category known in Chinese by the term **tu**) played a very important role in early Chinese governance.

Technical drawings (tu 圖) and government in early China

The word *tu* originally signified placing things in their proper position – that is to say, charting the relations between elements in a system. These elements might be points in space, as in a territorial or celestial map; they might be transformations in time, as in an almanac; sometimes they were groupings and hierarchies, as in charts depicting genealogies or ranks of nobility; some traced itineraries of understanding, as in mathematical diagrams or Buddhist mandalas. Whether it was the actual creation of a *tu* by drawing, or following the trajectories it traced through what Ames calls "performative looking", these acts of positioning were symbolically very powerful. They changed the person who drew or who contemplated the *tu*, by leading them on an ordered trajectory of transformation. And at the same time the act of drawing or of contemplation exercised mastery over the object of depiction. In early China, if the army of state A captured the territorial maps of state B, then state B was deemed to have lost its authority to govern those territories.

Tracing processes at microcosmic level through *tu* was a technique for setting in motion or inflecting macrocosmic forces. Cosmograms – diagrams representing the cosmic forces of creation and change which shape the natural world and its processes, including history and individual human destiny – played a prominent role in early Chinese governance. The burial chamber of the first emperor, Qin Shihuangdi, whose terracotta bodyguard we know so well, was surrounded and protected by a magnificent model of the universe. According to Sima Qian, a historian writing a century later in about 100 BC: "All the country's streams, the Yellow River and the Yangzi, were reproduced in quicksilver, and by some mechanical means made to flow into a miniature ocean. The heavenly constellations were shown above and the regions of the earth below." This working model of the Qin imperium and its place in the cosmos was intended to guarantee eternal rule for the dynasty (which in fact survived its founder by a mere three years). Cosmograms were considered so powerful that they were dangerous in the wrong hands: the Tang Legal Code of 653 AD made it illegal, under penalty of two years' forced labour, for private households to make or possess drawings such as the Yellow River Chart (Figure 9).

In the era before printing, when texts or graphics were copied by hand onto wooden strips or silk scrolls, it was not easy to mass-produce technical drawings or indeed images of any kind. This did not interfere with the role of cosmograms in governance, however, because cosmograms operated as a technique of rule *not* through the individual instruction of large numbers of Chinese subjects, but by radiating their influence from the centres of rule throughout the imperium, through a process of cosmic resonance. As in Stanley Tambiah's "galactic polity", an exemplary centre of rule can thus govern through action at a distance. The kinds of hands-on technical knowledge involved in architectural design or farming practice, however, were not inscribed or transmitted in graphic form until the resources of woodblock printing became available.

The earliest known examples of printing, which date back to the 7th century, are of Buddhist sutras and images. Other forms of document for which there was mass demand, like almanacs, soon followed sutras into print form. The commercial printing industry was flourishing by the late tenth century. Almost as soon as it came to power in 960, the Song government made extensive and creative use of printing, for scholarly and for administrative purposes, and for the education of ordinary people. With woodblock printing, texts could be cheaply mass-produced. Farming treatises, medical works and moral primers were among the works printed in official presses and given out to magistrates and physicians.

The printing era brought many new possibilities for creating and disseminating images (Figure 10, Four unknowns). The official elite believed that *tu* were a highly efficacious medium for conveying technical knowledge to the illiterate, often paired with a simple rhymed explanation. The educated elite also produced *tu* for each other. Some explored philosophical questions or illuminated cosmic processes; some were designed as tools of government;. A new form of representational technical drawing developed, similar to what we think of today as a technical drawing: images paired with text that illustrated the features of medicinal plants, or explained how devices were constructed (Figure 11, Su Shi's astronomical clock; Figure 12, Pan Jixun's hydraulic plans of Yellow River). Typically these *tu* were created by officials, working with craftsmen. They documented important technologies of rule like astronomical instrument-making or the construction of official buildings, and they were intended for other officials, to disseminate these standardised forms of knowledge throughout the empire.

Now let me turn back to China's agrarian polity, and a fundamental geographical shift which roughly coincided with the transition to a print culture.

The branding of a southern landscape

The early Chinese dynasties had their heartlands in the dry regions of the North, where millet, wheat and barley were the staple food crops, and hemp or silk were woven into cloth (Map A). The northern plains soon became crowded, and there was a steady flow of farmers migrating south to join local populations in the bountiful "lands of fish and rice" along the Yangzi River and beyond (Map B). From 610 AD the Grand Canal was used to ship tax rice north.

The Northern Song dynasty came to power in 960AD. As well as consolidating "rule by print", the Northern Song government was remarkable for the efforts it put into developing farming. With Tartar, Tibetan and Mongol armies massed along its northern and western frontiers, the Song state was in continual need of increased revenues, and it undertook many technical projects to increase output in the rice regions as well as the north. They included extensive land-reclamation schemes and the introduction, in 1020, of quick-ripening rice varieties from Champa in Vietnam, which could be alternated with a winter crop of wheat. But, curiously, there were no technical treatises describing southern farming methods until the 1140s. All the agronomic treatises published and circulated by the Northern Song government dealt with northern farming methods – and none of them were illustrated.

In 1126 the long-awaited catastrophe struck: the Tartars captured the Song capital in Kaifeng, and the government, along with the nobility and huge numbers of peasant refugees, fled south to the Yangzi valley. There they established a new capital in Hangzhou, which soon became the brilliant city which Marco Polo described as "beyond doubt the noblest and finest in the world". The impressive resurgence of the Southern Song was largely due to the efficiency with which the state stimulated rural production in the rice-farming regions. Little formal knowledge about rice-farming had hitherto been recorded, but the Song ruling elite rapidly *branded* a new vision of the productive landscape, which magistrates throughout the realm were encouraged to reproduce.

The farming landscapes of the north, in the few depictions that have come down to us, were shown as long strips of grain-fields, worked with large teams of animals (Figure 13). A productive southern landscape looked totally different. The work which crystallised the visual ideal of the southern rice-and-silk landscape was the *Gengzhi tu*, "**tu** (or technical images) of ploughing and weaving" (Figure 2). It was produced by a magistrate called Lou Chou, who was serving in Yuqian County, about 40 km from the new capital of Hangzhou, just half a dozen years after the fall of the north in 1132-34. According to Lou's nephew:

> Lou Chou was genuinely concerned with the common people's lives. He felt deep sympathy for the hard toil of farmers and women weavers, and investigated every aspect of their tasks ... For farming he depicts every step, from soaking the seeds to storing the grain in the granary, twenty-one steps in all; for sericulture there are twenty-four steps, from washing the eggs to tailoring the cloth. Each task is minutely and clearly portrayed. Although local practices vary in their details, all the main principles are correctly set out here … Soon after the work was completed, an imperial envoy on his tour of inspection gave a report of it to the emperor who, on the advice of his trusted ministers, summoned Lou Chou for an audience. The paintings thus came to court. The emperor praised and rewarded Lou, and gave orders for the scenes to be painted on the screen of the Inner Court, with Lou Chou's name on them

The emperor then had the *Gengzhi tu* engraved on stone, so that rubbings could be made and distributed to officials around the empire. It soon came out in printed form as well. According to Lou Chou's grandson, "the pictures were so vivid, and the poems so expressive, that at court and through the country they were passed around and learned by heart". New printed versions came out, and the work was incorporated

into farming treatises or household encylopedias. There were Japanese versions and Korean versions. The motifs entered the decorative vocabulary of artisans as well as artists, and appeared on fans, porcelain vases, lacquer screens and New Year prints. In the course of the eighteenth century, seven hundred years after Lou Chou created the *Gengzhi tu*, the Kangxi, Yongzheng and Qianlong emperors all commissioned new versions, for which they themselved composed and inscribed new sets of poems.

All the Chinese writers who mentioned the *Gengzhi tu* emphasised its pedagogical value, and tell us how useful it was for the official enterprise of "promoting agriculture". This – together with the vivid detail contained in the pictures – has led historians of technology to treat these images as "technical drawings" in the modern sense of images designed to teach the practical details of farming processes. Lou Chou had clearly informed himself meticulously about the technical details of rice and silk production. But although many such details are accurately portrayed in his paintings, the paintings are very much genre scenes: they portray ploughs buried in the mud , looms half hidden by a wall; they dwell lovingly on passing old ladies and dogs (Figure 14, Figure 15). Although technical poems offering practical instructions in clear and memorable rhymes were common at the time, Lou Chou's poems contain almost no technical information. Instead they are elegant and artistic evocations of mood. Several emphasize the complexity and sophistication of the processes involved, but as an object of marvel and admiration rather than a process to be explained. In his poem on the drawloom, for example, Lou Chou writes: "hand and mind work in *obscure resonance*, before the eyes a colourful pattern grows". I will come back in a minute to the kind of message Lou Chou's pictures conveyed.

Chinese blueprints

We find a very different approach to technical drawing in the **Illustrated register of farming tools** (*Nongqi tupu*), part of a general farming treatise written by another official, Wang Zhen, and completed in 1313. In 1313 China was just recovering from another crisis, the prolonged and devastating wars of the Mongol invasion. Wang Zhen was a firm believer in technology transfer. He documented every piece of farming equipment, from ploughs to water-mills to straw sandals; and all the equipment used by women to produce textiles – including the special gins and spinning-wheels required for processing cotton, a foreign crop just beginning to gain ground. Wang's hope was that officials would use his work to introduce more advanced technology to backward regions, and to introduce various items of labour-saving or helpful equipment to areas where they were unknown. Wang Zhen incorporated all the best written materials on farming practices into his treatise, including the meticulously detailed prescriptions for rice farming published by Chen Fu, just a few years after the *Gengzhi tu* was completed, in 1149. His most original contribution was to illustrate his treatise.

For his Illustrated Register, Wang Zhen applied to farming the principles of technical representation that had already been developed for building and other technical fields: he paired a schematic image of the tool or machine with a step-by-step textual description of how it was constructed and used (Figure 16). Wang Zhen's technical depictions contrast with Lou Chou's in showing all the components of the implements, and in showing humans only as operatives (Figure 17, Figure 18). Only occasionally do non-functional elements figure in his illustrations. Wang began by

having farmers or craftsmen assemble and disassemble pieces of equipment while he took notes and made sketches. (His fellow magistrates all thought he was mad!) Wang's pairing of text and graphics was intended to provide the equivalent of a blueprint, allowing the reader (a fellow official) to reconstruct the equipment with the help of a skilled carpenter.

Although Wang's style was so different from Lou Chou's, however, it expressed the same aesthetic of landscape. None of the techniques, field systems or implements that Wang advocated using on southern farms would have disrupted the peasant-based small-farm system which Lou depicted. Like Lou, Wang portrays a gendered division of labour in which women's textile work is presented in full detail. One might say that Wang provides the practical details, the nuts and bolts, to fill in the outlines of a free-form architectural design, so elegantly traced by Lou.

Ripples of empire

Lou Chou's poetic depictions of the rice landscape, and Wang Zhen's diagrams of harrows and reeling-machines, were both immensely successful. Soon after they were first produced both works achieved something of the status of best-sellers among imperial officials and among the literate land-owning class. Their popularity continued unabated over the centuries. But there are some significant differences in how they were transmitted, which illuminate differences in what kinds of message they were thought to communicate.

Wang Zhen's detailed practical instructions and technical drawings were incorporated into later farming treatises, supplemented with critical commentaries or new passages, describing subsequent technical improvements or offering advice on how to adapt Wang's technologies to specific environments. A few new technical drawings of mechanical devices were added to the repertory (Figure 19, drawloom from *Tiangong kaiwu*). But most technical improvements involved new fertilisers, improved varieties, or more effective water management – and much of this kind of information could be accurately transmitted in words. It seems that within the domain of agriculture, Wang's Register represented the high point of technical drawing in the sense of "diagrams showing us how to construct material artefacts".

Lou's poetic depictions of the rice landscape were also reproduced numerous times over the centuries. Rather than being incorporated into the practical sections of farming treatises, however, they figured in the introductions, which were conventionally devoted to pious discussions of "farming as the foundation of empire". Lou's images were also included in household encyclopedias, along with instructions on ritual and etiquette; the selection of auspicious dates; the basic principles of *fengshui*; recipes and home remedies; and moral tales for the instruction of the young. We may infer that it was not so much the practical information contained in Lou's images that ensured their continued popularity, as their moral dimensions, and the social order they depicted.

Lou Chou's illustrations of rice-farming and sericulture, completed in about 1142, and the corresponding sections of Wang Zhen's farming treatise, composed a century and a half later, both depicted the advanced, intensive farming system which at that period was to be found *only* in the fertile plains of the Lower Yangzi. In many other

southern regions at the time, although rice was the main crop it was grown in very different ways. A twelfth-century official disapprovingly described the inhabitants of Guizhou province, upstream from Canton, as ignorant and lazy. They did not bother with transplanting or irrigation. They simply drove cattle over the ground to break up the clods, scattered some rice-seed and left the rest to nature. But the carefully tended landscape which Lou Chou depicted in such vivid detail, its patchwork of tiny fields with mulberry trees planted along the dykes (Figure 20), its cottages nestled under clumps of shade-trees, where women raised silkworms and wove their silk into cloth – this industrious and highly productive small-scale landscape gradually spread, like a ripple in a pond, right across southern China. From its birthplace in the Yangzi Delta, the ideal rice-landscape spread upstream into Hunan, and south to the plains of Canton and beyond. Eventually Lou's pictures accurately represented most of the farming regions in southern China. By the late 1600s the Guizhou farmers had built irrigated fields, which they tilled and weeded minutely like proper Chinese. They produced two crops of rice, much of which was shipped down to Canton, and a third crop of vegetables. A visiting official remarked approvingly that "they were never idle".

How was this transformation effected? Certainly the migration of farmers was one important factor in the transfer of practical skills, and also in the transmission of expectations of what a proper farming landscape should look like. But local land-owners were heavy consumers of technical books and household encyclopedias, and they managed their lands in dialogue between local conditions and metropolitan models of best practice. And the Chinese state played a huge role in disseminating this model landscape and its aesthetic. Chinese officials used the "how to" diagrams and descriptions in Wang's treatise as blueprints for technology transfer, a form of Latour's "immutable mobiles". Not only did they press the technical information upon the locals, setting up schools for weaving or training farmers in improved methods. They also funded and directed projects for land reclamation, terracing and irrigation networks, sculpting new contours onto the land. And – equally important in their view – they supported peasant small farmers with loans and relief in time of crisis, and tried to protect them against the encroachments of local landowners. Perhaps most important of all in the terms of Chinese political philosophy, the official class reminded villagers of their contribution to cosmic order, lecturing them on the social compact between emperor and farmer or rewarding chaste widows with monumental arches in their honour.

Historians of technology have usually taken Lou Chou's original *Gengzhi tu* and its later versions as more or less successful technical drawings in the conventional sense of "how to" depictions. But this, I believe, misunderstands the level at which they were intended to operate, and the basis of their continued popularity. In the *Gengzhi tu* it is as much the production of social harmony and political order that is at stake as material production. When the work was created, the imperial state had just lost its traditional economic base in the northern plains. For the first time it was obliged to recognise its dependence on the rice regions of the south. It had been common to underrate the skills and hard work of southern farmers: the south was referred to as “the land of rice and fish”, implying that it was such a naturally productive region that bounteous harvests sprang up unaided. The *Gengzhi tu* was the first work to celebrate the indispensable role of the irrigated southern landscape in supporting the

imperial order, and to show the skills, hard work and technical sophistication that made this contribution possible.

Together Lou Chou's pictures and poems insisted upon the daily toil that went into making the land yield such riches; they movingly portrayed the sweat, dedication and sacrifice that went into producing the rice and silk with which the peasants paid their taxes. They reminded the official class that they should be grateful for these sacrifices, that they should respect the small farmers who generated the wealth of empire and represented its moral bedrock. When three successive Qing emperors commissioned new versions of the *Gengzhi tu* in the 1700s, and added their own poems celebrating the bitter toil of peasant households, it was not to update technical details but to reaffirm – after yet another prolonged period of strife and moral uncertainty – the organic bonds that must exist between peasant farmers and imperial state for the realm to prosper materially and cosmically.

Lou's paintings and Wang's diagrams were both experiments in the visual rendering of technical knowledge. We can easily recognise Wang's diagrams as a form of technical drawing, however crude by modern standards. In terms of the register in which they were designed to operate, Lou's depictions are perhaps closer to the illustrations in a civics textbook, or even, perhaps, a "Dig for Victory" poster. Here (Figure 21) is a 1953 adaptation, a Communist poster exhorting women to join the collective workforce in what was, let us remember, initially a "peasant revolution". Yet despite their differences in conception and execution, the *Gengzhi tu* and the *Nongshu* shared a common goal. Both were both intended to serve the overarching pedagogical purpose of "promoting farming", a primary responsibility for anyone involved in imperial government. Together they encoded different dimensions – the material techniques and the social and cosmic values – of an enduring imperial aesthetic.

In the modern world we expect technical drawings to be abstract and objective. Governments and technocrats work relentlessly, and often quite successfully, to persuade us that technical knowledge has no politics, that technology obeys its own objective logic of progress. The ruling elite of imperial China were acutely attuned to the politics of skills and artefacts. They consciously acknowledged that the physical and economic attributes of the imperial landscape could not – and should not – be disentangled from the moral values and social relations in which they were embedded.

Figures

1. Combine-harvesters at work; photo of unknown provenance.
2. Irrigating the fields. Thirteenth-century copy by Cheng Qi of Lou Chou's *Gengzhi tu* (Ploughing and weaving illustrated) of ca. 1142; Freer Gallery.
3. Diagram of ground roll baler; http://extension.missouri.edu/explore/agguides/agengin/g01250.htm, consulted 28 May 2007.
4. Exploded view of selenium TW1 dome tweeter, Rafael Augusto de Oliveira, http://en.wikipedia.org/wiki/Tweeter, consulted 25 May 2007.
5. Jones model VX-880 sewing machine handbook.

6. Sankey diagram showing efficiency of steam-engine; http://en.wikipedia.org/wiki/Sankey_diagram , consulted 25 May 2007.
7. *Taiji tu* (Diagram of the Supreme Ultimate), Zhou Dunyi, eleventh century.
8. Emperor ploughing the sacred furrow. Wang Zhen, *Nongshu* (Agricultural treatise), 1313.
9. Yellow River Chart (*He tu*), Ming version.
10. Algorithm for solving an equation with four unknowns.
11. Astronomical clock, Su Shi, eleventh century.
12. Section of hydraulic engineering plan of Yellow River, Pan Jixun, sixteenth century.
13. Northern farming methods; mural from Jiayuguan, ca. fourth century AD.
14. Ploughing scene; Ming version of *Gengzhi tu*.
15. Drawloom; Qing version of *Gengzhi tu*.
16. Square harrow; Wang Zhen, *Nongshu* (Farming treatise).
17. Water mill driving a chain-pump; *ibid.*
18. Silk reeling machines; *ibid*.
19. Drawloom, *Tiangong kaiwu* (The exploitation of the works of nature), 1637.
20. Harvesting mulberry leaves; Qing version of *Gengzhi tu*.
21. `New view in the rural village', 1953. Propaganda poster from the collection of Stefan Landsberger, http://www.iisg.nl/~landsberger/iron.html , consulted 25 May 2007.

Table
State projects for "promoting agriculture".