Introduction

The Framework of Everyday Life: Technology, Women and Cultural History

> It must I think be perfectly clear that to understand lives, the ordinary activities of human beings in ages other than our own, it is indispensable to consider the technologies that served them, for they formed in many respects the very framework of those lives themselves.
>
> Jack Simmons, *History of Technology*

Among the most popular exhibits in local and national museums are the displays of everyday objects, the sets of craftsmen's tools and the reconstructions of kitchens or workshops that allow the visitor not just to view each step in the making of a cheese, a cart or a bolt of cloth, but to envision a world.[1] The glass cases, the roped-off spaces and "Do not touch" notices are far more frustrating here than the enforced separation between viewer and painting in an art gallery, for in the case of artifacts we feel strongly that the key to deciphering these tokens of the past is physical: if we can actually pick these ordinary objects up, weigh them in our hands, try them out (if only on the air), the physical experience will translate us back into the world in which they belonged, an everyday world of working, making and consuming that made up the lives of ordinary people. Enlightened museum curators recognize the urgency of this need for physical communion and provide some working machines where visitors can take turns with the trained and costumed personnel, fumbling for a few minutes at a loom or potter's wheel, then compensating for their incapacity by purchasing the "authentic" artifact in the museum shop.

For ordinary people the fascination of old technologies is that they seem to convey the core experiences of past lives. But conventional history of technology is rigid and reductive in its dealings with this rich world of

1. Throughout this book, I almost invariably use the masculine form of terms such as *craftsmen, kinsmen, man,* and so on, because in the Chinese context they refer to males.

meaning. It focuses on the production of commodities and the development of scientific knowledge, and relies on categories of analysis like "relations of production," "stock of knowledge" or input-output ratios. Nor is *technology* in the crude material sense a word to conjure with in social or cultural history, in fact it is quite out of fashion. We decode the sexual body and the gendered body as cultural artifacts, but despite routine allusions to Michel Foucault's "technologies of power" or to Pierre Bourdieu's concept of habitus, only a few historians pay serious heed to another fundamental level at which epistemes and relations of power are embodied: the everyday technologies that shape material worlds.

Every human society constructs for itself a world of food, shelter, clothing and other goods, a domain of material experience that is often richly and diversely documented in words, in numbers, in pictures and in artifacts. From these sources we can piece together a historical text that records the changing patterns and textures of a social fabric. We can tease out the strands that wove rulers and subjects, artisans and merchants, peasants and landlords, wives and husbands into interlocking patterns of hierarchy. We can try to retrieve the messages conveyed by technical practices and products, to see how social roles were naturalized through that most powerful form of indoctrination, the bodily habit. We can set these systems of material practice and experience against written formulations of metaphysics and ethics to explore the mutual penetration of ideology and popular belief. To read this immensely rich text creatively, to recover the meanings of the shifts, negotiations and ruptures that it records, we must go beyond the terms of conventional history of technology to analyze a society's technologies as part of a web of political and cultural practices.

This book explores the role of technology in shaping and transmitting ideological traditions, focusing on the contribution of technology to the construction of gender. The case I take as my illustration is late imperial China from the Song to the Qing, a society for whose material culture we possess an extraordinarily rich legacy of documentation.

Despite wars and invasions, natural disasters, dramatic population changes and economic growth, the social system in China between A.D. 1000 and 1800 displayed remarkable continuity.[2] From the Song to the

2. I have chosen to conclude my study before the nineteenth century, when China suffered the massive impact of Western economic and political demands and of exposure to Western ideas. Despite its weakness during the nineteenth century, however, the Qing dynasty survived until 1911, when the imperial era ended.

Qing the vision and indeed the practice of the basic political order remained essentially unchanged: the emperor ruled the common people through a bureaucracy staffed by scholars; as the economy became increasingly commercialized merchants grew in number and wealth, but they never gained political influence as a class, largely because their ambition was to join the ranks of the scholar gentry. This long period of continuity, which historians of the economy and of technology have tended to view as stagnation, is regarded by political, cultural and intellectual historians as something of a miracle. Given China's huge size, its social complexity and regional diversity, the effects of population growth and the violent shocks of war and invasion to which it was repeatedly subjected, not to mention the differences between the elite and the uneducated, how can we account for the fact that the culture of late imperial China became so well integrated and durable, and that people at every level of society had so much in common?

True, the political structure and modes of production in late imperial China were not dramatically transformed in the way that the social structures of early modern Europe were by the emergence of capitalism and the industrial revolution. But given the enormous shocks and challenges that the Chinese social order managed to absorb and contain over the centuries, the continuities that have often been labeled inertia or stagnation are better understood as resilience: they represent complex processes of cultural negotiation, incorporation and adaptation, the forging of symbols, identities and roles that eventually came to be accepted at all levels of society throughout a vast and heterogeneous empire. In recent years historians and anthropologists have worked hard to unravel and interpret these processes of cultural reproduction. I suggest that the study of technology can significantly enrich our understanding of such processes.

I am particularly interested in how technologies contribute to producing people and relations between people, which in turn requires me to look at technology as a form of communication. Taken overall, a society's technology gives out as many mixed messages as any other aspect of its culture: a study of a country's coal-mining industry will provide very different insights into the social formation from a study of cookery. Here I work on the premise that it is possible to identify within a particular society significant *sets* of technologies that constitute *systems*, providing overlapping messages about a particular kind of person. These messages are not necessarily identical even within one technological domain, and certainly not within the set. They operate at different levels, they present variations and contradictions; their power lies in the flexibility

this permits, the rich scope for "practice," for accommodating or expressing both synchronic differences and historical change.

This book looks at a set of technologies that one might call, in the spirit of Lewis Mumford, a *gynotechnics:* a technical system that produces ideas about women, and therefore about a gender system and about hierarchical relations in general. In this Chinese example of gynotechnics I include three technological domains that were particularly important in giving shape and meaning to the lives of women in late imperial China: the building of houses, the weaving of cloth, and the producing of children.[3] The relations between women and technology have usually been ignored in Chinese history, as elsewhere, and when I started to search for original sources I was surprised to find just how much there was. In concentrating on technologies that directly affected women's lives and identities, I have been able to explore not only what they can tell us about ideas and experiences of women and femininity, but also what we can infer about constructions of masculinity and of difference, and therefore about the changing organization of Chinese society as a whole.

Part 1 of the book looks at the material shell of family life. It analyzes the building of houses and the complex structuring of domestic space that embodied in microcosm the hierarchies of gender, generation and rank inherent to the Chinese social order, tying all its occupants into the macrocosm of the polity. Although women did not build the houses in which they lived in the sense of assembling bricks and mortar, they played an active role in the production of domestic space, which they experienced in ways very different from their menfolk. The evolution of domestic spatial practices during the later imperial period can be seen as the production of a text with multiple grammars, female as well as male, that could simultaneously accommodate popular visions of cosmos and society and the secular orthodoxy of the educated elite. Increasing numbers of women lived in strict physical seclusion, but orthodox ideology continued to insist on the importance of their contributions to the world outside and to the social order. The nature and readings of women's moral, human and material contributions altered in the course of the late imperial period, however, as

3. No doubt food preparation and cookery should also have been included, but I was not sure I would be able to find enough solid information, particularly about the roles of men and women in cooking. Françoise Sabban, a historian of Chinese dietetics and food preparation, informs me that she has found very few sources for any period that provide unequivocal information about the sexual division of labor in cooking.

the balance between what we would consider productive roles (part 2) and reproductive roles (part 3) shifted.

Part 2 penetrates inside the walls of the house to examine the meanings of the productive work that took place there. It focuses on historical changes in the production of cloth, traditionally a female domain construed in terms of complementarity to the male domain of farming.[4] Up to the Song the social contract between state and people was embodied in a fiscal regime based on the working couple, in which husband and wife contributed equally—he in grain and she in cloth—to the upkeep of the state. All women, even noblewomen, worked in the production of textiles. In the course of the late imperial period, however, the textile sector became increasingly commercialized and specialized; new forms of organization of production meant that commoner women's work in textiles was marginalized, while upper-class women abandoned spinning and weaving for embroidery. In classic Engelsian terms, one would expect the reduction in the recognized value of women's productive labor to bolster patriarchal control by allowing women to be represented primarily as reproducers dependent on men and living separate from the male, public world. In certain respects Engels's hypothesis holds for late imperial China; however, we must also take into account the fact that many elite men of the later Ming and Qing tried strenuously to reverse the trend by bringing women back into textile production. By now ordinary working families saw work, whether by men or by women, chiefly in economic terms, but for statesmen and philosophers "womanly work" in textiles was an indispensable moral contribution to the social order; its practical importance was that it protected families from destitution and allowed them to pay their taxes. We see an interesting divergence between popular forms of

4. Farm work in China was represented as a male activity (fig. 2). Women's real involvement in work in the fields was extremely limited compared with most of sub-Saharan Africa, where farming is women's work, and also with neighboring regions such as Southeast Asia or Japan, where tasks like transplanting rice or harvesting were often construed as mainly female. When a member of the male elite in imperial China noticed women working in the fields he saw it as unnatural, a symbol of profound social and moral disorder. So although women did in reality participate in all kinds of field work, from picking cotton (fig. 16) to plucking tea to harvesting grain, written and visual representations of farming generally masked this role. It is often asserted that Chinese women were physically unable to work outside the house because of their bound feet, but in fact foot binding restricted mobility much less than we imagine and did not prevent women from participating at least occasionally in almost every kind of field work except wet-rice cultivation.

patriarchy, in which women's childbearing role became increasingly prominent, and an elite orthodoxy that continued to represent an ideal world as one in which women (or at least wives) contributed actively to the maintenance of the polity.

Part 3 focuses on the women's quarters and the marital chamber. It looks at conceptions of the body and at the repertory of medical and social techniques that were available to women of different rank and class in pursuit of maternal status. I argue that fertility, far from determining the fate of every woman in "traditional China," must be understood in the context of a wider ideology of "nature" versus "culture" that defined male as well as female ideals and expressed differences in class even more clearly than it did those in sex. Once again we see a divergence between elite and popular ideals of femininity and forms of patriarchy. In poor households that could not afford the luxury of polygyny, all the burdens of the wifely role fell on a single woman, whose performance was likely to be judged by her natural fertility. For many elite women, however, social motherhood was more important than giving birth, since they were legally entitled to appropriate any children fathered by their husband on concubines or maids. I argue further that if we combine all the reproductive responsibilities of women in late imperial China, we see that the role of mother was subordinate to the overarching feminine role of wife. According to elite orthodoxy, both as a wife and as a mother a woman made active and indispensable contributions to the social order beyond the walls of the inner chambers. A wife's role was still represented as "the fitting *partner*"[5] of her husband. But although almost all women were attached to men, by no means all of them were legal wives. The ideals of reproduction thus reinforced class differences and exploitation not just of women by men, but of women by women, and of class by class.

Bringing together the spaces Chinese women of different class, rank and age inhabited, the work they did or did not do, and the ways in which they struggled to fulfill demanding reproductive roles while protecting their own health and life gives a new density and definition to the complex historical negotiations of gender and other social hierarchies that underpinned the political continuities of late imperial China. As a set they help us understand how historical redefinitions of domesticity, of gender roles, of the meanings of concepts like "wife" and "mother," of differences among classes, and of the relations between orthodoxy and popular custom took on the powerful shape of material practices.

5. *Book of Rites,* tr. Kuhn 1988: 20.

In two senses this book is an attempt to recover a history for a people without history. First, historians of technology treat non-Western societies as having not histories, but an absence of history. And second, women are invisible in most history of technology. In the case of China, historians who have studied Chinese technology agree that after an initial flowering up to about 1400, during which time it surpassed Europe in productive capacity and inventiveness, China fell into a period of stagnation and decline—a failure to generate the significant qualitative change that constitutes real history. Furthermore, today's conventional representations of "traditional" Chinese gender roles characterize women primarily as biological *reproducers* and as passive consumers or victims of patriarchal ideology. Their roles as *producers,* whether of commodities, of knowledge, or of ideology, have been marginalized and neglected. Since conventional history of technology focuses primarily on the production of commodities and the development of scientific knowledge, it follows that histories of technology in China pay almost no attention to women or to gender, whereas histories of Chinese women seldom even mention technology.

As conventionally defined and studied—that is, as a system of knowledge and equipment that allows more or less efficient production of material goods and control over the environment—technology is a central element in the discourse of Western superiority. More perhaps than any other branch of history, the history of technology retains a colonialist mentality. "For historians of technology, the 'master narrative' is the whig reading of Western technological evolution as inevitable and autonomous," writes John Staudenmaier, referring to Joan Wallach Scott's definition of master narrative, or historical received opinion, as an account of the past "based on the forcible exclusion of others' stories." In this epistemological framework, Western technology becomes a symbol in a structured hierarchy that opposes modern to traditional, active to passive, progress to stagnation, science to ignorance, West to rest, and male to female. Just as female is not-male, a looking glass that sets off the male image to advantage, so other societies and their technologies are not-West, a flattering mirror in which the West can contemplate its virtues.[6] By definition negatives of the original, the features of such mirror images can by and large be deduced: there is no need to accord them the same painstaking attention that the history of Western technology commands.

6. Staudenmaier 1990: 725; Scott 1989: 690; for an analysis of how technology is used as a symbol of Western preeminence and a justification for imperialism, see Adas 1989.

There have, of course, been serious historical studies of indigenous technology in non-Western societies. Joseph Needham's project on China, the first volume of which appeared in 1954, was the pioneering work that set the stage for a radical venture. Rather than cobbling material from different periods together to assemble patchwork images of a timeless, undifferentiated Chinese past, Needham used the wealth of sources he had collected to show how things changed with time. This was the first serious historical study by a scientist of non-Western science and technology,[7] and it has been absolutely fundamental in challenging ahistorical representations of non-Western societies. Still, it constitutes a first step rather than a critical revolution.

Needham's explicit purpose in devising the multivolume series *Science and Civilisation in China* was to demonstrate that real science and technology were not the unique products of European minds—that the history of modern science and technology was in fact a world history. His strategy was to divide Chinese knowledge into the disciplinary branches of modern Western science, pure and applied. Technologies were among the applied sciences. Thus astronomy was classified as applied mathematics, engineering as applied physics, alchemy as applied chemistry, and agriculture (the technical domain entrusted to me for the *Science and Civilisation* series) was classified as applied botany.[8] Himself a distinguished scientist, Needham was able to argue convincingly that China preceded Europe in a number of important discoveries and inventions—including documenting the three Chinese inventions that Francis Bacon associated with the birth of the modern world: printing, the magnetic compass, and gunpowder.[9]

7. Encyclopedic studies like those by Singer et al. (1954–78) or by Gille (1978b) either provide largely ahistorical glimpses of technology in non-Western societies or take it for granted that they were essentially static and argue why that should be.

8. For astronomy as applied mathematics see Needham and Wang Ling 1959; engineering as applied physics, Needham and Wang Ling 1966; alchemy as applied chemistry (a view strongly criticized by Nathan Sivin), Needham, Ho Ping-Yü and Lu Gwei-Djen 1976; and agriculture as applied botany, Bray 1984. I worked at Needham's East Asian History of Science Library in Cambridge (now called the Needham Research Institute) between 1973 and 1984 and have remained involved in the *Science and Civilisation in China* project ever since. I share with many of my colleagues there a strong commitment to carrying the project on to a further stage.

9. In fact Needham's claim that the magnetic compass was introduced from China to Europe is only circumstantial. Nor is it clear that Chinese woodblock printing was the direct inspiration for Gutenberg's movable type. But even if the precision of these claims has subsequently been called into question, there is no doubt that it was a brilliant move to invoke Bacon in this way.

Furthermore, Needham was able to construct convincing historical narratives of intellectual progress in all the scientific and technological categories covered in *Science and Civilisation in China,* although he felt that the extraordinary creativity and inventiveness of the Song dynasty (960–1279) died away in succeeding centuries, to be followed by a long period (from about 1400 or 1500 up to the nineteenth-century confrontations with the Western powers) during which China contributed little or nothing to the growth of world scientific knowledge.

Needham's project and its methods have been extremely influential both within and beyond the profession of history of science and technology. His work was warmly welcomed in China, and also in India, as a means of restoring national self-respect; both countries have now established institutions to study the history of indigenous science and technology. And in the West children now learn from their high school textbooks that the Chinese invented gunpowder and fireworks. Nevertheless, the teleology inherent in Needham's project raises two serious problems. First, accepting the evolutionary model of a family tree of knowledge whose branches correspond to the disciplines of modern science allows Needham to identify Chinese forebears or precursors of modern science and technology, but at the price of disembedding them from their cultural and historical context. One could caricature this as a Jack Horner approach to history, picking out the plums and ignoring the rest of the pie. It emphasizes "discoveries" and "innovations" in a way that is likely to distort understanding of the broader context of skills and knowledge of the period. It distracts attention from other elements that may now seem dead-end, irrational, less effective or less intellectually exciting but may have been more important, more widely disseminated or more influential at the time.[10]

Second, taking the scientific and industrial revolution as a natural outcome of human progress leads us to judge all historical systems of skills and knowledge by criteria derived from this specifically European experience. The rise of capitalism, the birth of modern science and the industrial revolution are so closely intertwined in our intellects that we find it difficult to separate the concept of technology from science,[11] or to think

10. See, for example, Pinch and Bijker 1987 on "closure" and on the interest of studying trails that came to a dead end.

11. Historians, sociologists and philosophers of science and technology nowadays recognize that it is best to consider the two domains as representing different kinds of knowledge, reasoning and skills; however, a more popular view of the relationship between the two is still that technology is applied science.

imaginatively about trajectories of technical development that emphasize other criteria than engineering sophistication, scale economies or increased output. Any deviation from this narrow path then has to be explained in terms of failure, of history grinding to a halt. Societies that produced undeniably sophisticated technical repertories but failed to follow the European path to the same conclusion—such as the medieval Islamic world, the Inca empire, or imperial China—are then subjected to the so-called Needham question and its correlates: Why did they not go on to generate indigenous forms of modernity? What went wrong? What was missing? What were the intellectual or character failings of that culture?[12]

After six multipart volumes (altogether about twenty separate books) detailing what the various branches of Chinese scientific and technical knowledge achieved, the three parts of the final and as yet unfinished seventh volume of *Science and Civilisation in China* are devoted to addressing the "Needham question," offering a constellation of linguistic, epistemological, social and political explanations for China's failure to build on its impressive medieval achievements and generate a modern society. Taking the Needham position a step further, Mark Elvin argued in *The Pattern of the Chinese Past* that exogenous forces were necessary (in the form of the impact of Western imperialism) to open China to a phase of true progress.

Needham's arguments, and Elvin's, have been widely if selectively drawn on by economic historians, comparative sociologists and historians of Western science and technology not as the essential first step to open up a critical world history of science and technology, but to confirm versions of the master narrative. Paradoxically, historians of science and technology can continue to ignore what happened in other societies precisely because of pioneering work by scholars like Needham—because the questions they set out to answer about China, or India, or Islam were framed in the terms set by the master narrative. In a sense, this absolutely foun-

12. Gille (1978b) lists China, the Muslim world and pre-Columbian America under his heading of "blocked systems." The Muslim world has perhaps suffered most explicitly from Orientalist gendered contrasts. It is commonly depicted as a *passive* repository of Greek learning rather than a realm with many outstanding centers of learning that actively advanced scholarship. The reconquest of Moorish Spain is represented in more than one study as the natural outcome of a confrontation between the passive, luxurious and effeminate worldview of the Muslims, congenitally unable to reap the full benefits of the rich heritage of Greece and Rome, and the virile, aggressive, questing culture of Christian Europe (e.g., Crow 1985; Mokyr 1990).

dational work has been sadly underexploited; in another sense, it has been sadly exploited. Within the discipline of history of technology, the differences between Europe and China or other non-Western societies are taken not as a challenge to recover other cultures of knowledge and power with different goals and values, but simply as confirmation that only the West is truly dynamic and therefore worthy of study.

As an indication of how serious the neglect of non-Western societies remains within the discipline, Staudenmaier pointed to the official journal of the Society for the History of Technology, *Technology and Culture.* Of the articles published between 1958 (when it was founded) and 1980, only 6 percent dealt with non-Western societies; after 1980 the figure dropped to 3 percent.[13] As another example, reading the program for a four-day international conference entitled "Technological Change" (held in Oxford in 1994), I noticed that of about a hundred papers, two or three dealt with some form of West-to-East technology transfer, and there was a theoretical session on evolutionary models of technological development; otherwise there were no papers dealing with non-Western technologies.

James Clifford has noted how ethnographic museums put together exhibits by selecting artifacts according to categories that fulfill Western expectations of a "primitive" or "traditional" society, thus creating the illusion of adequate representation.[14] Until one questions the underlying master narrative, the conventional history of technology—and the economic history and comparative sociology that draw on it for material grounding—succeed in creating this illusion of adequate representation. The technological histories of non-Western societies are depicted as faltering steps along a natural path of progress that only the West has trodden boldly to the end. Sometimes these alien technological systems are shown as coming up against insuperable cultural obstacles to further development, sometimes they are treated as inherently inert. The focus is always on what they failed to do, rather than on whether and how they met the goals, values and purposes of the society that generated them.

A critical history of technology should explore the local meanings of technological systems not in order to construct comparative hierarchies (and perpetuate ethnocentric judgments), but seriously to study alternative constructions of the world. The criteria in general use for evaluating technological success are seldom treated as culturally relative, but in fact, as Marx long ago made clear, they are an ideological product of our own

13. Staudenmaier 1990: 724.
14. Clifford 1988: 220.

history. If we assume that real technology is inseparable from experimental science, if we judge technical efficiency by mechanical sophistication, by the productivity of labor and of capital, by the scale of operation and the reduced number of human agents on the assembly line or in the field, if we think growth and change are more advanced than stability or continuity, it is because that is how our modern Western world was made.

But other worlds were made in other ways. How did past societies see their worlds and their place in them, what were their needs and desires, what rôle did technology play in creating and fulfilling those desires, in maintaining and reshaping the social fabric?[15] Such questions should provide the framework for exploring the technologies of non-Western societies. How else can we dispel the illusion of adequate representation and look at people in other worlds as something more (and more interesting) than benighted fools?

> There is a story, repeated by a number of Roman writers, that a man—characteristically unnamed—invented unbreakable glass and demonstrated it to Tiberius in anticipation of a great reward. The emperor asked the inventor whether anyone shared his secret and was promptly assured that there was no one else; whereupon his head was promptly removed, lest, said Tiberius, gold be reduced to the value of mud.

To a Roman mind, M. I. Finley says, this did not mean that Tiberius was an idiot blind to new ideas, still less did it mean that he or the Roman ruling class despised wealth. What did this tale signify then? "We must remind ourselves time and time again," writes Finley, "that the European experience since the late Middle Ages in technology, in the economy, *and in the value systems that accompanied them,* was unique in human history until the recent export trend began. Technical progress, economic growth, productivity, even efficiency have not been significant goals since the beginning of time . . . other values held the stage."[16] How then can we reconstruct those other values?

It is not surprising that some of the most fruitful approaches to the interpretation of technology have come from anthropologists, since anthropology is a discipline committed to investigating other systems of meaning. What is surprising, however, is how marginal this domain of experience remains in mainstream anthropology, especially in the English-speaking world. As Pierre Lemonnier remarks, "It has been some

15. In the contemporary world, the Greens offer one example of an attempt to construct a world around noncapitalist values and desires.

16. Finley 1973: 147, emphasis added.

decades since the interest in what was, in the 1930s, rightly called 'material *culture*' declined, and for years France has been alone in developing institutionalized research in the anthropology of techniques."[17] The French tradition grew out of a Durkheimian interest in *mentalités.* Marcel Mauss, a student of Durkheim, founded the tradition with a study of an aspect of technological experience that might surprise conventional historians of technology, namely "techniques of the body." Reflecting a deep concern among French social scientists to connect language, psychology and social norms, Mauss discussed bodily deportment and gestures as learned cultural practices and as a form of communication.[18] In the French ethnological tradition, technology has continued to be studied as a form of symbolic communication and cultural reproduction.[19] But even within French ethnology, technology remains a specialist domain rather than an integral part of cultural interpretation.[20]

The *Annales* school of history has also, in its many avatars, shown a consistent concern with exploring how material production and material culture relate to social, psychological and symbolic dimensions of meaning.[21] The preeminent example is Fernand Braudel's *Civilisation matérielle, économie et capitalisme,* which treats eating habits as well as the

17. Lemonnier 1993a: 7.

18. Mauss [1935] 1979. This approach to integrating nonverbal and verbal communication fed into the work of the ethnomethodologists and into current work in linguistic anthropology on contextuality.

19. Leroi-Gourhan entitled his two-volume study of communication *Gesture and Speech;* the first part being *Technology and Language,* the second *Memory and Rhythms* (1964–65). In the work of scholars like Haudricourt, Bernot, Barrau and Cresswell, and of the younger generation of ethnologists connected to the "techniques et culture" research team of the Centre National de la Recherche Scientifique, the study of techniques is always linked to linguistic and to symbolic practice (e.g., Haudricourt 1987; Koechlin et al. 1987; the journal *Techniques et culture;* Lemonnier 1992, 1993b). I myself was a member of the French research team for several years, although unfortunately I never acquired any competence in linguistic analysis.

20. Lemonnier believes a trend toward integrating technology and material culture into cultural analysis has begun beyond France. He draws attention to the work of ethno-archaeologists and postprocessual archaeologists, and also of a few anglophone ethnologists working independent of the French tradition (e.g., Ingold 1988; Reynolds and Scott 1987; Sillitoe 1988).

21. Perhaps because so many scholarly institutions are oriented primarily toward research rather than teaching, French scholars have less often been bounded by the disciplinary segregation typical of English-speaking universities, where the objects and methods of history, anthropology, sociology and other human sciences are often defined as distinct. But the role of Marc Bloch and Lucien Febvre in establishing the interdisciplinary journal *Annales* was extremely important in fostering this ambiance.

production of daily bread, furnishing styles as well as architectural techniques, as keys to explaining a civilization and its history. "Our investigation takes us . . . not simply into the realm of material 'things,' but into a world of 'things and words'—interpreting the last term in a wider sense than usual, to mean *languages* with everything that man contributes or insinuates into them, as in the course of his everyday life he makes himself their unconscious prisoner, in front of his bowl of rice or slice of bread."[22] But Braudel is no Norbert Elias; he places the economy firmly in the driving seat of history. In the section devoted to "technologies" it becomes clear that Braudel (not surprisingly, since his interest is in explaining the rise of capitalism in Europe) fully accepts both the boundaries and the master narrative of conventional history of technology:

> First the accelerator, then the brake: the history of technology seems to consist of both processes, sometimes in quick succession: it propels human life onward, gradually reaches new forms of equilibrium on higher levels than in the past, only to remain there for a long time, since technology often stagnates, or advances only imperceptibly between one "revolution" or innovation and another. It often seems as if the brakes are on all the time, and *it is the force of the brakes that I had hoped to describe more successfully than I perhaps have. . . .* [The role of technology] was a vital one. As long as daily life proceeded without too much difficulty in its appointed pathway, within the framework of its inherited structures, as long as society was content with its material surroundings and felt at ease, *there was no economic motive for change. . . .* It was only when things went wrong, when society came up against the ceiling of the possible that people turned of necessity to technology.[23]

As Braudel himself acknowledges, he does not succeed in conveying the nature of the "force of the brakes," not least because in his view the brakes are not so much active mechanisms as an absence of acceleration. Despite Braudel's privileging of economic production, he insists on incorporating the full experience of material life into his analysis of history. My study has been greatly influenced by Braudel's insistence on the need to link production and consumption, and to embed local technologies in the broader geographical and social context. But unlike Braudel's work, the heart of my study is precisely the interplay between accelerator and brakes, or rather, the various ways in which a social system can channel or absorb the potentially disruptive energies generated by disequilibria. Most materialist theories of human evolution or history, Marxist or not,

22. Braudel 1992: 1: 333.
23. Ibid.: 430, 435, emphases added.

are basically interested in the instability of modes of production; they highlight the role of technology as a vehicle for precipitating change. Historians have generally paid less attention to the fact that at another level, technologies, like kinship or gender, can also serve to reproduce the social system, channeling and absorbing the very energies that they generate.

This brings me back to gynotechnics. To understand the part technology plays in supporting a social formation, one must go beyond looking at a single technology or domain of technology (for example, the technologies of economic production), to consider the interplay of *sets* of technologies, or technological *systems*. In *Technology, Tradition and the State in Africa*, Jack Goody correlates African forms of political organization with kinship practices and agricultural technology on the one hand ("polity and the means of production") and with the technologies of warfare on the other ("polity and the means of destruction"). Analyzed as a system, the technologies reveal not just the material dimensions of a mode of production, but the social and ideological world it underpins.[24] The technologies I have brought together here also constitute a set or system: they were technologies for producing women. Each gave material form to different fundamental components of the overarching ideology of gender and hierarchy in late imperial China—gendered and hierarchical space, gendered and ranked work, and gendered reproduction tied to rank and status. Considered historically, each technology reveals changes that illuminate different dimensions of the overall historical process by which gender roles and social hierarchies were redefined, allowing the social order to adjust to the pressures of changing circumstance.

There are even more definitions of technology in circulation than there are of science—some sixteen hundred according to François Sigaut.[25] Many studies treat technology primarily as the rational application of knowledge to meet material challenges. While I recognize the importance of this aspect of human technical endeavors throughout history, here I am most interested in the social worlds that technology builds. Like Braudel, I am therefore interested in the language of technology and of things. For my purposes a *technique* can be defined as an action performed on some form of inanimate or animate matter (including oneself, as in the case of movement through domestic space, or of various practices of fertility

24. Goody's explorations of literacy as a technology of control also suggest helpful ways to explore the intellectual dimensions of technologies and the mindsets they make possible, as well as their role in producing certain forms of social stratification or political organization (J. Goody 1986, 1987).

25. Sigaut 1985.

control), designed to produce an object with human meaning. A *technology* is the technique exercised in its social context, and it is this social context that imparts meaning, both to the objects produced and to the persons producing them.[26] Technologies in this definition are specific to a society, embodiments of its visions of the world and of its struggles over social order. In this sense the most important work that technologies do is to produce people: the makers are shaped by the making, and the users shaped by the using.

Following Mauss and Goody, I have included in my Chinese gynotechnics some social and material practices that are not conventionally accepted as technology, for instance the tangle of medical theories, kinship rules, cosmological ideas and legal definitions that together shaped practices of fertility control. But at the core of each technology, even by my broad definition, there is a material core. This is important not least because of the key role that the Chinese accorded to material experience in shaping identity, morality and the understanding of the world.

My arguments about gender and technology in China depend on translating between material practices and forms of subjectivity. To what extent can we use material technologies as a guide to how people think about nature, about society, about meanings? Social studies of modern Western technology have been enormously creative in developing new, critical ways to analyze technology as ideology, as culture, as process. Feminist scholars have been especially innovative in analyzing the relations between technology, ideology and subjectivity, exploring the ways in which technological systems in the industrial world have given material form to social identities and inequalities and naturalized them in daily, embodied experience. They have been at the forefront of the critical approach to the technological history of the industrial West, questioning the selections and exclusions, redefining categories, pushing back the borders of what can legitimately be considered technology. I would like to mention just a few works that I have found especially stimulating in formulating

26. Marcel Mauss described a technique as "an action which is *effective* and *traditional* (and in this it is no different from a magical, religious, or symbolic action) felt by the [actor] to be mechanical, physical, or physico-chemical . . . and pursued with this aim in view" ([1935] 1979: 104). Lemonnier prefers to distinguish the technological from the magical or religious by confining techniques to processes that "lead to a real transformation of matter, in terms of current scientific laws of the physical world" (1992: 5)—but that drastically reduces both the scope of what constitutes technology and the criteria by which we judge its efficacity. For my purposes the emic understanding of what constitutes the material world and its transformations proposed by Mauss is more appropriate.

my own research on gender formation. Two outstanding works on the constitution of American domesticity are Ruth Schwartz Cowan's study of household technologies and the changing role of the "homemaker" and Dolores Hayden's analysis of postwar American house design, lifestyle and family values.[27] Aihwa Ong's study of the cruel pressures on Malay factory girls, inside and outside the workplace, is a feminist analysis of industrial alienation in a transnational framework; Ong extends her exploration of the meanings of women's work far beyond economic considerations, illustrating how a society whose values are under stress from rapid change may project its insecurities onto gender constructions. And Marilyn Strathern's recent work dissects the ethnocentric formulations of "nature and culture," gender relations and kinship goals that underlie public reaction to the New Reproductive Technologies, suggesting new ways to think about reproductive practices and beliefs in other cultures.[28]

For studies of technology and ideology in the contemporary world we can draw on a vast range of resources. Since the industrial revolution we have become acutely conscious of technology's place in our lives and anxious to record our feelings about it. We are as preoccupied with technology as Reformation scholars were with religion, or neo-Confucians with morality. Anyone wishing to study modern technology as ideology, from the perspective of reception as well as production, has ample resources to draw on. But is it possible to pursue cultural studies of technology in the past? Without factory studies, advertisements, statistics, personal interviews, novels and films, how feasible is it to unlock the past through its technologies, to make the jump from material form to social or mental world? An anthropologist assigns social or symbolic meanings to an artifact or process on the basis of detailed ethnographic, contextual observation. But for cultures of the past, systematic fieldwork is impossible and the retrieval of context may be at best partial or distorted. The interpretation of artifacts disembedded from or only partly situated in context is a challenge that defines the discipline of prehistoric archaeology, and it is naturally of interest to historians too. The richer the contextual remains, the greater

27. Cowan 1983; Hayden 1986. Staudenmaier remarks what a surprise it was that the Society for the History of Technology was willing to award the 1984 Dexter Prize to Cowan, for a book that dealt not with factory systems or military inventions but with the technologies of the "domestic sphere." But since then the impact of gender studies on the professional flag carrier, *Technology and Culture,* has remained limited: seven articles between 1984 and 1990 (Staudenmaier 1990: 723).

28. Ong 1987; Strathern 1992.

the claims one can make for interpretation—as in Georges Duby's *The Age of the Cathedrals,* or the series edited by Philippe Ariès and Duby entitled *The History of Private Life.* Where the context is more meager, how far can interpretation justifiably go? Let me give here one particularly interesting example of cultural analysis as applied to early Chinese technology.

David Keightley, a historian of early Chinese civilization, has sought to trace the intellectual roots of the earliest dynasties back to the prehistoric period by looking in the archaeological record for material expressions of certain concepts and values that are prominent in China's earliest written texts. During the neolithic period two distinct cultural complexes flourished in the Chinese heartlands. Both were well established during the sixth and fifth millennia B.C., one along the eastern coast and the other in the northwestern loess lands of the interior; in the central plains the two cultures coexisted. By the fourth and early third millennia eastern traits began to intrude in northwestern sites in the central plains, and by the late third millennium distinctively northwestern sites had vanished from the central regions and survived only on the far northwestern margins. Keightley asks whether ceramic styles offer any clues to explain the increasing dominance of the eastern cultural complex, and how they might relate to the worldview of the early Chinese state, which inherited many of the material characteristics of eastern culture.

Keightley analyzes the differences between potting techniques and ceramic styles in the two neolithic cultures. The northwestern ceramics have generous, softly rounded silhouettes and are painted with free-flowing naturalistic motifs. They are coiled pots, relatively unspecialized in form, each one made straight off at one go ("holistic construction"). The eastern styles are much more complex and angular in form and specialized in function. The potting wheel was in common use, and many of the eastern pot forms include elements that were separately molded and then assembled ("prescriptive construction"[29]), for instance pouring jugs with spouts and hollow legs, or tripod steamers (fig. 1).

Keightley hypothesizes the following social and cognitive differences between northwestern and eastern culture. First, the componential construction typical of the eastern style certainly required planning and careful measurement, thus presumably a greater level of abstract thought. It also most probably required a specialized division of labor and the capacity to communicate verbally about the construction process. Moreover, he

29. Keightley adopts these terms from Franklin 1990.

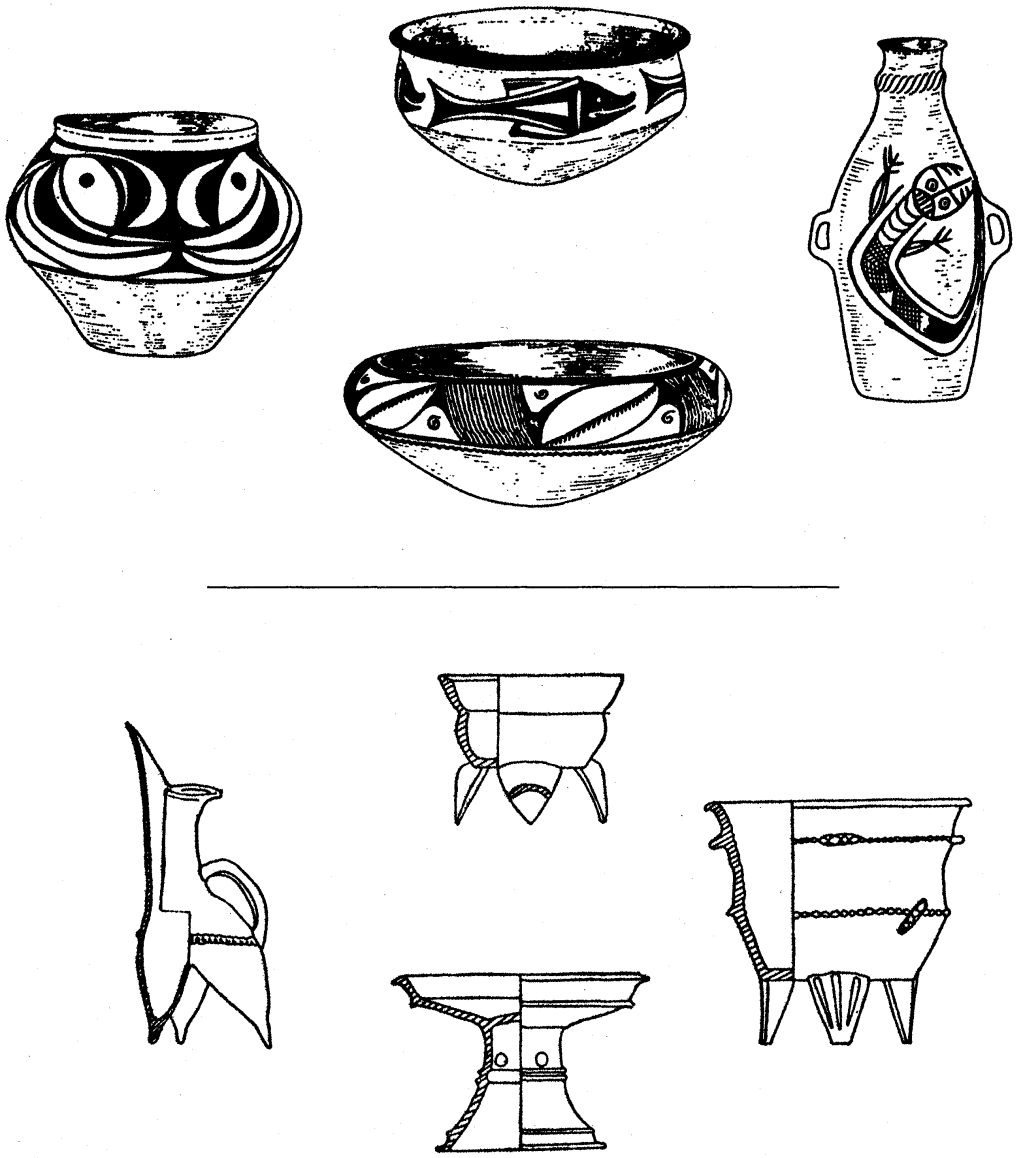

Figure 1. Ceramics from the northwestern (Banpo) culture (above) and from the eastern (Longshan) culture (below) (after Feng Xianming 1982: 10–11, and Weixian Museum 1984: 678–79). Note that the Longshan pots consist of several separately made components.

suggests that the eastern use of cores for forming components "is of significance socially and conceptually, since it implies a vision of creation as one of molding, of conformation to a model, of standardization—of 'engineering' in short."[30] Keightley concludes by connecting the use of molds in ceramics, and later in bronze casting, to the importance of moral exem-

30. Keightley 1987: 102; see also Keightley 1989.

plars as models for emulation in later moral and political thought. The crafts of potting, carpentry and jade carving provided the most frequent metaphors for statecraft in early Chinese philosophical texts; the potter forcing clay into a mold and the carpenter steaming timber to bend it into shape were central metaphors for the shaping of moral character.

There is no scientific method for making such jumps from the material to the conceptual, for linking artifacts to mentality or aesthetics to morals. Keightley is able to set his interpretation of the meanings inherent in neolithic potting styles in the context of later historical documents and philosophical texts concerning the world order of the early Chinese state. But there are no confirming statements by neolithic potters or their customers, telling us what different styles of potting represented in their eyes. Even if to a social or cultural historian such interpretations seem to fit nicely into broader cultural patterns, interpretations of this nature often arouse hostility and suspicion among archaeologists or historians of technology, many of whom believe that responsible scholarship should stick to functionalist explanations of the visible facts.

Yet if we accept that people in past societies probably had different intentions and values from our own, we are also obliged to be critical even of straightforward functional interpretations. Naturally in the search for meaning and power we must not neglect the problem-solving dimension of technology. The stylistic choices made by Chinese neolithic potters were not completely free. Clay pots were used as containers for storing, cooking or serving food and drink. The potter had to fashion and fire the clay in such a way that the contents would not leak or drop out—there were technical requirements and constraints that had to be met. But potting techniques were not predetermined by problem, resources and knowledge. Neither shape, nor size, nor pattern was inevitable, nor was the choice of clay or the method of forming the pot. In an important sense, the characteristics of a particular technology have to be accounted for in terms of choices: what are a society's tastes, its current needs and desires, and what technologies best fulfill them? We need to consider how to think about choices.[31]

To consider more realistically the meaning of technical choices, rather

31. See van der Leeuw 1993 on the choices exercised in neolithic ceramics. On technological choice as a heuristic concept, see Wagner 1995 and Lemonnier 1993b. The papers in Lemonnier 1993b study the interplay between material problem-solving and cultural meaning as manifested in a range of technological choices, from neolithic potting to plans for a revolutionary subway system—though in only a few cases do the choices consist of conscious group decisions (Latour 1993).

than reducing them to purely pragmatic considerations, we need to re-embed technologies in their social context to see what agendas they served. The northwestern neolithic cultures of China's central plains gradually merged with the eastern cultures, in the process adopting their potting techniques and styles along with other material features of the culture. Were the northwesterners of the plains impressed, seduced, or conquered? Probably a bit of each. When we consider the cultural conservatism of the last outposts of distinctive northwestern culture, driven far from the central plains to arid refuges on the edge of the desert, we may presume that these people were as familiar with the sophisticated techniques of the eastern culture as they were with the threat they posed to their cultural survival. Drawing a parallel with the experience of the non-Han minorities who were driven into the mountains as the Chinese empire expanded southward, or indeed with other cases of colonization, we might read the continued use of the traditional round red pots not as a pragmatic choice dictated by local clays, limited skills, or fuel shortages typical of the semidesert—but as a symbolic choice, an act of political resistance.

A good example of technical choice as political resistance is the case of the *swadeshi* movement in India, where nationalists advocated a boycott of imported British cottons and a return to the use of homespun cloth, *khadi,* produced in the household with simple handheld spinning wheels and traditional looms. This may have been a less economically efficient way of producing cloth than the British factory system, but it was certainly an efficient technique for producing Indian nationalism. For the Bengali nationalists of the early 1900s, the boycott of European cloth and the commitment to *swadeshi* techniques and the homespun cloth they produced symbolized a rejection of colonial dependence and the affirmation of Indian identity and tradition. But "Gandhi himself went beyond the use of homespun as a mere symbol to penetrate even deeper levels of meaning about the nature of weaving as a creative act, about the [low-caste] dhobi's cleansing as a token of redemption, and about the capacity of cloth to retain the luminosity of place and people." Gandhi played on the meanings of homespun to evoke the past, but in so doing portrayed a new future in which the Indian people would transcend the pernicious hierarchies of caste and gender: "The production of cloth in villages by spinning and weaving was to transform the moral fiber of the nation in a quite literal sense." "All Indians were to become spinners, weavers, and washermen," but in the process they would be redeemed from the impurity of craftsman status by the purity of the cloth they produced through

the act of weaving. "Khadi in [Gandhi's] hands regained its transformative and magical qualities, while the spinning wheel took its place on the Congress flag."[32]

Here there can be no doubt of the conscious political symbolism of homespun in preindependence India: the public debate was vigorous and explicit, Gandhi and Rabindranath Tagore corresponded on the issue. But did homespun as a product, or the act of weaving, hold the same meanings for Indians who were consumers rather than producers of these political statements—did the ideology have grass roots? And did the *swadeshi* movement have any lasting effects on technological choices in the Indian textile industry or on the ideology of technology in India?

If Gandhi was able to forge a compelling national ideology around clothmaking, it was precisely because Indians at every level of society, Muslim as well as Hindu, responded powerfully to the notion of cloth as a political, religious and historical symbol.[33] Gandhi's vision of an independent India that would be spared the exploitation and degradation inherent in the relations of capitalist production perished with him. Nehru and the Indian industrialists who had supported Gandhi's campaigns were happy to ban foreign industrial imports, but "consciously or not, they enlisted the moral and political capital generated by the Mahatma's campaign for village weaving in support of their own push for Indian freedom and industrialization." Nevertheless, the industrial economy they developed was profoundly marked by Gandhian visions and commitments: "Bombay's mills . . . produced careful, machine-made copies of different sorts of homespun fabrics for distribution in the interior . . . [and] the Republic of India has spent large sums on the propagation of homespun through institutions such as the chain of Khadi Bhawans (homespun retail stores), which often function at a loss despite the government's strong commitment to competitive industry."[34] The official protection of the homespun industry symbolized a commitment by the state to protecting its citizens and communities from the effects of rapid commoditization. And the huge internal market for real or simulated homespun suggests an enduring popular belief in the social and personal moral values perpetuated by wearing this type of cloth.

In the modern world styles or items of costume have featured prominently in the formulation of many nationalist and political identities. One

32. Bayly 1986: 309, 312, 314.
33. Ibid.; Bean 1989.
34. Bayly 1986: 314.

thinks of the Phrygian cap and baggy pants of the sansculottes, the black fez or *songkok* that is the badge of Muslim political leaders in Malaya and Indonesia, the Sun Yat-sen jacket (well-tailored and pressed in the Kuomintang version, baggy and rumpled for Communist leaders), or of the invention and adoption of Scottish tartans. But perhaps only in India could such powerful political messages be attached not to a style of clothing, but to a *technology* of cloth production, understood as a symbol of a social and moral world. In many ways it parallels the symbolism of native rice in Japan. When a modern Japanese family sits round the supper table eating their bowls of Japanese-grown rice, they are not simply indulging a gastronomic preference for short-grain and slightly sticky Japonica rice over long-grain Indica rice from Thailand. They are eating and absorbing a tradition—in the sense of an invented and reinvented past. While the television beside the dining table pours out a stream of images of the here-and-now, of an urbanized, capitalist, and thoroughly internationalized Japan, each mouthful of rice offers communion with eternal and untainted Japanese values, with a rural world of simplicity and purity, inhabited by peasants tending tiny green farms in harmony with nature and ruled over by the emperor, descendant of the Sun Goddess, who plants and harvests rice himself each year in a special sacred plot. Simple peasant rice farmers are as marginal in contemporary Japan as hand-spinners are in India, but the small rice farm, like the *swadeshi* industry, lives on as a powerful symbol.[35]

Japanese agricultural methods and policies are much criticized for their inefficiency (and for their unfairness to foreign rice producers in a world of free-market competition). There is no doubt that by standard economic criteria the production of Japanese rice is highly inefficient in terms of production costs, labor productivity, overuse of chemicals, overinvestment in machinery, and consumer prices.[36] To this list one could also add

35. Most of Japan's remaining four million farm households work their farms part-time and derive the major part of their income from industrial or white-collar jobs. Moreover, rice plays an ever-diminishing part in the Japanese national diet as Western-style foods such as bread become popular. Despite strong opposition at home, at the final round of the Uruguay GATT negotiations in late 1993 Japan was obliged to open its doors, if only a crack, to rice imports. In March 1994 the Japanese government allowed foreign producers (from Australia, India, Thailand and the United States) to exhibit rice for the first time at the annual food show in Tokyo.

36. Almost all farmers own a full range of expensive machinery, and the average chemical use for rice is over 1 tonne per hectare, about ten times the U.S. average. Such methods are made possible by heavy government subsidies. In 1977 a Japanese economist calculated that energy inputs in rice production amounted

pollution of the rural environment. In political terms, however, the smallholder technology of Japanese rice farming has been efficient. The land reform measures promulgated under American guidance after the war eradicated landlordism and distributed land to former tenants; furthermore, selling and renting of farmland became subject to strict control. Farm support policies not only permitted farmers to modernize their methods and increase their incomes, but also supported the expansion of an internal market for Japan's manufacturing and service industries. Independent smallholder farming was firmly established as the basis of the rural economy. The average size of a rice farm in Japan today is less than one hectare, and many families continue to live on farms even though most of the members work in nearby cities. The proportion of the Japanese electorate registered as rural voters is especially high for an industrial economy, and the Liberal Democratic Party (LDP), the ruling party in Japan since the end of the war, has been kept in almost unbroken power largely thanks to a loyal rural vote.

The rice farmers and their families, the LDP, and the manufacturing and service sectors all benefit directly from this system of rice production. The benefits to the public at large are less obvious to outside eyes, but are nevertheless sufficiently appreciated within Japan for the rice protection lobby to be able to mobilize considerable popular support.[37] The modern parody of peasant rice farming provides the urban Japanese with a "tradition," an emotional and aesthetic refuge from rapid modernization and internationalization. Japanese rice is consumed not only as a food redolent

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to three times the food energy of the rice itself. A 1987 comparison between the United States and Japan showed that yields per hectare were the same (just over 6 tonnes), but rice production costs in Japan were over eleven times those in the United States, farmgate rice prices were almost seven times as high, and as for labor productivity, while one American worker produced almost 2.5 tonnes of rice in an hour, in Japan the figure was a mere 106 kilograms (Bray 1986: 57, 1994; Tweeten et al. 1993).

37. "In questionnaires, more than seven out of 10 Japanese said they preferred domestic rice even at higher prices. But in blind tasting tests, six out of 10 could not tell the difference between Japanese and foreign Japonica" (*Guardian Weekly*, 13 March 1994). I visited Japan in October 1994 just after the rice harvest. In the foodhall basements of the big city department stores, which specialize in luxury foods (or at least the top end of the market), rice from up to a dozen well-known rice-producing localities was on sale at high prices. The only other products with comparable ranges of variety and provenance were tea, coffee and wine—the big notices announcing "the new rice is here!" reminded me of "le Beaujolais nouveau est arrivé!" campaigns. Meanwhile in less elegant streets the cheap takeout foodstalls were festooned with banners proclaiming that their dishes all used "100 percent Japanese rice."

of national essence, but also as a harmonious rural landscape, a weekend escape from the unnatural conditions of life in the modern city.[38] One could take the rosy-tinted public reading of this representation as what Michel de Certeau would call antidiscipline, a "reading in another key" whereby consumers of dominant representations subvert them and turn them to satisfying account. Yet at the same time it is the outcome of a highly successful political strategy of traditionalizing, of building modern national solidarity around an imagined past. The representation of Japan as a nation tied to its legendary roots by the labors of simple, thrifty and patriotic rice farmers has served Japanese nationalist causes well since before the turn of the century and still has immense popular appeal.[39]

The symbolic dimensions of farming are equally important in accounting for state policies toward agriculture in the premodern state of China. China was an agrarian society and the state continually intervened in the domain of agricultural production. All through the two millennia of the Chinese empire the state would undertake to open up new lands for cultivation; to loan tools, seed and animals to settlers on the lands; to develop irrigation projects; and to disseminate improved methods or equipment and encourage the cultivation of new crops. One of the responsibilities of local magistrates was to encourage agricultural improvement in the region under their jurisdiction, and many farming manuals were written with this form of transmission of knowledge in mind. But although the ubiquitous exhortation to "encourage agriculture" was taken seriously by almost everyone with official responsibilities, except possibly for a brief period during the Song dynasty, it would be a mistake to imagine that the Chinese state was trying to promote agricultural *development* in the sense that we use the word today.[40]

As conventionally used by economists, the term *development* implies continuous improvement in the productivity of a technical and economic system, resulting eventually in some kind of "qualitative" change, such

38. In a presentation of the arguments for preserving small-scale rice farming in Japan today, the economist Kenji Ozawa propounds the environmental importance of paddy fields in preventing floods and in maintaining a "traditional" Japanese landscape (1993). Yamaji and Ito also make much of the "cultural, emotional, and environmental factors" affecting whether or not Japan should open its rice markets (1993: 363). Ohnuki-Tierney discusses the role of rice in the construction of Japanese identity (1993).

39. See Bray 1986: 214–16 for a brief account of the literature on "agrarian fundamentalism" in Japan. On the importance of rural imagery in the construction of tradition in Japan, see Goto and Imamura 1993 and J. Robertson 1991.

40. Will 1994. On the Song dynasty, see note 49 of this introduction.

as a mechanical innovation that allows a quantum leap in labor productivity and thus produces a transformation of the relations of production. Economic historians of China, correctly noting the absence of this kind of change, speak of China in terms of stagnation, involution, or "growth without development."[41] It is true that the late imperial Chinese state was not favorably inclined to that kind of development. Growth of a kind that might transform the means and mode of production did occur at various points in the imperial period, in agriculture as in other sectors, but the state perceived the rapid generation of goods and wealth as a threat to social stability and inherently undesirable. It therefore countered this type of growth, directly or indirectly, to the best of its ability.

In England the technological advances of the agricultural revolution—and the consequent development of the labor-substituting machinery and methods that set the model for subsequent agricultural modernization worldwide—depended on the consolidation of land into large capitalist farms. The formation of large farms in England was facilitated by a state that represented the interests of the rural elite and so was willing to pass laws legalizing enclosures at the expense of the peasant class. But in China the state's commitment to the survival of peasant farmers was never questioned.[42] In one dynastic history after another we find legislation to limit landlordism, to redistribute land to the poor, to fix the ratio between the price of grain and other commodities, and to adjust levels of taxation where possible in favor of small farmers. The "stagnation" school quite rightly points to this political philosophy as an institutional obstacle to true conventional development.

Yet framing the issue in terms of the failure to develop seems to be asking the wrong questions of Chinese history. The evolution of farming systems in imperial China was profoundly shaped by the fiscal and agrarian policies of the state. The Chinese state controlled agriculture as part

41. E.g., Elvin 1973 on involution, P. Huang 1990 on growth without development.

42. The English parliamentary system allowed the members of the political (property-owning) elite to further the interests of their own class by representing them as beneficial to the country as a whole. In China, even though most of the literati who made up the civil service came from gentry families (that is to say, families whose primary source of income was rents from the land they owned), when they became officials they were expected to represent the interests not of their own group but of the state and its people. This frequently led to friction between magistrates and the local gentry, and was one reason why magistrates were not supposed to serve in their home region, or to stay too long in one place. The archetypal moral dilemma for a member of the Chinese elite was whether his first loyalty should be to his family or to the state.

of its strategy of maintaining a world order that acknowledged its authority to rule, and by this criterion it was clearly successful. My point is not that the long-term survival of the Chinese social order denotes a system that was in any moral way "better" than that of other, more dynamic (or less stable) societies. My interest is in the mechanisms by which this long-term continuity was achieved, and in particular the ways in which technical systems (such as farming) were contained or enlisted to maintain the social order.

When I speak of China as displaying long-term ideological or cultural continuity or stability, this certainly does not mean the absence of change. Between 1000 and 1800 China was three times conquered by foreign invaders; it also experienced numerous internal rebellions and civil wars.[43] There were territorial shifts,[44] population growth,[45] technical

43. The carnage and dislocation attendant on such upheavals were enormous. During the twelfth and thirteenth centuries the Mongols depopulated vast areas of the farming regions of North China, which they attempted—unsuccessfully—to convert to pastures. One of China's richest and most populous provinces, Sichuan, was reduced to a wasteland in the series of wars that brought the fall of the Ming in 1644 and the consolidation of the alien Qing (Manchu) dynasty. The consequences of such tribulations were not only material. The soul-searching and doubt among educated Chinese that followed the fall of the Ming and the Manchu conquest were especially profound and contributed to the formulation of a new critical scholarship that questioned the meaning of history and redefined the social uses of learning (Elman 1984).

44. Until about A.D. 800 the great northern plains were the heartland of the Chinese polity, economy and culture; for northerners the south was alien, a place of exile. By the mid-Tang the rich potential of the Yangzi rice lands had started to occupy a central place in state economic calculations (Li Bozhong 1990; Lamouroux 1995).

45. The population of China in the Tang-Song period may have been about 110 million (Hartwell 1982). During the Mongol invasions it dropped sharply, but it recovered again during the Ming and by 1700 had reached something like 150 million. Between 1700 and 1850 it grew to 430 million. This tripling represented a rather modest rate of growth at 0.7 percent (Ho 1959). But although long-term rates of population growth were low, the ratio of land to population fluctuated more rapidly, with invasions, wars, rebellions and natural disasters often drastically reducing the farming area, while the occupation or development of new territories or ecological niches counterbalanced population growth (e.g., Rawski 1972; Bray 1984; Perdue 1987). By the beginning of the eighteenth century, however, it seems that the problems of population pressure on land were no longer perceived as local or as soluble by internal migration or by innovations in the exploitation of local land. In the minds of the emperor and his civil servants population pressure had become an irreversible threat to food supply. The response of the state was not to suggest any limitation of family size, or to press for sustained innovation in agriculture. Instead it renewed the emphasis on "correct" farming methods, on frugality, and on stemming the flow of labor away from cereal farming into "parasitic" occupations (Will 1994).

advances[46] and a shift from subsistence to commercialization that marked a radical transformation of the national economy.[47] Whereas in medieval China most cities had been primarily administrative centers, from the Song era towns grew and flourished as centers of production and consumption. Subsistence farming was eventually limited to a few distant backwaters, as more and more of rural China was tied into a web of interregional commerce that encouraged local specialization. Sometimes entire rural districts were enmeshed in the urban economy and transformed from villages into suburbs. The prosperous urban middle classes that emerged included landowning gentry families as well as merchants and manufacturers; the boundaries between the old social categories of scholar, farmer, merchant and artisan became permeable. The marked medieval distinction between gentleman and commoner, between cultivated person and rustic, blurred with the spread of prosperity and literacy across classes.

Despite these significant changes and the new possibilities for government that they might have opened up, the late imperial state continued to

46. For example, considerable demands were made on southern agriculture following the loss of northern China to Jürchen invaders in 1126; in fact the withdrawal of the Song state and of numerous northern refugees to southern China led to extraordinary advances in southern agricultural yields and in silk production that seem to have increased per capita production as well as overall output (on the "Green Revolution" of the Southern Song, see Elvin 1973; Bray 1984: 597). Will (1994) states that in the present state of knowledge it is not possible to say definitively whether the economic growth that took place between the sixteenth and nineteenth centuries was only quantitative or had significant qualitative characteristics too. In the case of agriculture, Perkins (1969) argued that until about 1800 Chinese farm output kept pace with population growth, although the per capita output of farm workers did not expand, whereas Elvin (1973) saw the balance in more pessimistic terms, believing that as more labor was absorbed per capita output decreased. However, other scholars have pointed to instances where, even within the admittedly highly labor-intensive framework of Chinese farming systems, improvements were adopted that reduced labor demands or increased its productivity. For example, I have argued that late imperial improvements in water management, fertilizer use and plant breeding freed up time for rice farmers while tying them to the land, thus providing a natural basis for the development of rural petty commodity production (Bray 1986).

47. Until the Song dynasty the Chinese economy was predominantly noncommercial and characterized by local exchange, apart from the movement of tax goods. Given the highly regional and unintegrated nature of China's local economies right through the Qing, local cycles or variations cannot safely be taken as typical of the economy as a whole (Skinner 1985). But despite local and generalized hiccups and reverses, a secular trend toward commercialization characterizes the late imperial period. Interregional markets for commercial crops and products developed rapidly from Song times, as did international markets; see the treatment of the development of the cotton trade in chapter 5 for a good example of how interregional economic dependence developed.

define rural problems, even those of poverty and low levels of production, in terms that are better understood not as those of modern economics, but of political or even moral economy. The agricultural policies of the Chinese state all through the imperial period represented a continual and rather successful struggle to maintain a physiocratic political order in which the emperor and his administrators exercised direct rule over "the people" (*min*), that is, the peasantry. This political philosophy translated into a fiscal order that remained unchanged in its broad principles throughout the imperial period: the state was supported in large part by direct appropriations from peasant households.[48] The underlying assumption was that men worked in the fields to produce grain, and their wives produced the textiles that were used to clothe the servants of the state. Agriculture was defined as the fundamental occupation, crafts and trade were considered at best secondary, at worst pernicious; the rapid generation of wealth through commerce was seen by most statesmen and rulers throughout the imperial period as a source of dangerous social instability.[49] By the mid-Ming the real transformation of production was so profound that it had to be recognized in fiscal terms: in the late sixteenth century taxes in cash definitively replaced taxes in kind. But still peasant

48. I am grateful to Frank Perlin for directing my attention to the importance of modes of extraction in understanding social formations; my analysis of women and weaving in part 2 owes much to this perspective.

49. According to Paul J. Smith (1991), the early Song state was a unique exception. Because of the extreme military threats the government faced, statesmen of the period sought unprecedented methods to raise revenues. The Song state practiced economic activism at a level unknown before or later, at least until the late nineteenth century. It participated in a burgeoning commercial economy directly (through state enterprises and monopolies) and indirectly (through taxation of commercial activity). Song financial specialists were an elite within the bureaucracy. They elaborated a complex and powerful network of specialized fiscal institutions which regulated increasing proportions of the nation's activities. Commercial taxes provided an ever-growing proportion of state revenues and drain on the economy. The New Economic Policies, which operated from 1068 until 1085, "extend[ed] state control to new regions and industries and directly challenge[d] private commercial industries for the profits of foreign and domestic trade, in order to finance an aggressive new policy of territorial expansion and national defense" (Smith 1991: 9). As an example, the Sichuan tea industry was converted to a state monopoly in 1074 to finance the purchase of Tibetan warhorses. But these policies contained the seeds of their own destruction, leading to severe exploitation of the peasantry, an increasing state dependence on merchant middlemen or agents and, inevitably, corruption. The strategy of increasing state revenues through developing a commercial tax base was repealed in the mid-Song, after which it fell into permanent disrepute, particularly among orthodox neo-Confucians.

farmers were perceived as the state's authentic tax base—though at this point one might have expected a policy shift that would develop commerce and manufactures as the basis of taxation. Almost all late imperial legislation concerning agriculture was intended to keep a broad rural tax base by protecting peasant farmers: the ideology of a direct interdependence of state and peasantry remained unchanged. Qing policies were even more prosubsistence and anticommerce than those of the Ming; indeed one could say that the Manchu emperors fetishized peasant subsistence production. Numerous Qing imperial edicts demonstrated how central the valorization of what Pierre-Etienne Will calls "correct agriculture" was to their very traditional concept of social order.[50]

At this point a technological historian might wish to root the conservatism of Chinese rulers in the material realities of what Mark Elvin describes as a "high-level equilibrium trap": Chinese agricultural and manufacturing output was brought to high levels not by the development of labor-saving devices but by continually increasing labor inputs (a trajectory often labeled "involution"). Such a mode of production both supported and required population growth. Industrial capitalism did not develop indigenously in China because there was no incentive to invest capital in centralized and more labor-efficient production.[51] From there one might argue that since there was no radical transformation of productive relations, one would not expect a radical transformation in the ideology of state and subject. Conversely one could argue, as Needham has been inclined to do, that ideological conservatism was not the effect but the inhibiting factor, translating into policy that hampered any radical breaks.[52]

50. Will 1994. When serving officials tried to change agriculture in the locality under their jurisdiction, they were usually obliged to temper principle with pragmatism. Plans to implement ideal models of the rural economy, such as cultivation systems attributed to the Zhou dynasty that were supposed to give immensely high yields, fell by the wayside when a magistrate found that the climate was too harsh, the land too hilly and barren, the local landowners uncooperative, and the local peasants could demonstrate convincingly that their own system worked better. Perdue 1987 gives an excellent account of this.

51. Elvin 1973.

52. Needham blames China's lack of industrial or scientific revolution on what he calls "bureaucratic feudalism." In China itself until recently, marxist orthodoxy required scholars to cast the complexities and contradictions of late imperial economic history in terms of indigenous "capitalist sprouts" that withered away in the sterile soil of feudal China (see Brook, forthcoming); with the recent loosening of that dogmatic straitjacket exciting work has started to be published—Brook (forthcoming) and Wong (forthcoming) cite some examples. An interesting variant of the marxist approach, because it makes gender central to its analysis, has been

In the light of the growing body of recent work that documents the complexities and inconsistencies of Chinese economic history and the gaps between official discourse and real conditions,[53] perhaps it makes better sense to look at the ideological continuity embodied in economic and agrarian policy—and its undoubtedly significant influence on the persistence of social values and aspirations—not as directly related to material conditions, but as a fetish or a mantra. That is to say, the tradition of frugality, order and appropriate social roles and relations that was reiterated in successive economic and agrarian policies neither inhibited real change nor reflected its absence, but rather allowed the challenges it presented to be tamed, contained and addressed in manageable terms.

The Qing emperors were particularly assiduous in their pursuit of "correct agriculture." They issued a series of edicts condemning the lust for profit that drove farmers to abandon the cultivation of food staples for commercial crops or to leave the land to work as artisans or traders in the towns, edicts that attempted to persuade farmers all over China to concentrate on the production of staple cereals and to develop the necessary resources for local self-sufficiency. Imperial edicts and local magistrates' campaigns stressed that frugality and hard work were necessary so that peasants could support their families, survive lean periods—and pay their taxes. Imperial ceremonies were revived in which the emperor ploughed a ritual furrow in his sacred field each spring, while the empress and her ladies retreated into special apartments to raise silkworms. At one

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advanced by Hill Gates (1989), who argues for a continuing dialectic in late imperial China between what she calls the tributary and the petty capitalist modes of production. Although the Chinese economy was indeed transformed in the course of these centuries, Gates argues, to the extent that small-scale, commercial household-based economic activities deserve to be thought of as a mode of production, the commercial sector was unable to dominate the economy because the state repeatedly acted to contain it. However, commercial imperatives intertwined in interesting ways to reinforce certain aspects of the state ideology of social organization, in particular kinship patterns and gender relations.

53. I have already referred to the Western-language publications of Skinner, Smith, Perdue and Will, but there are many others. Will (1994) offers a particularly fine critique of the relation between Qing imperial discourse on agriculture and its translation into real effects. He makes two important points in this regard. First, imperial edicts urging the improvement of agriculture did not translate into a coherent, centrally organized campaign; implementation depended on the individual efforts of local officials, and for that reason tended to be limited in both scope and duration. Second, in agriculture as in many other domains, Chinese rulers had traditionally ruled out compulsion or coercion, and tried to achieve their goals through education and persuasion; not surprisingly, persuasion often failed.

level the Qing ruling class's preoccupation with re-creating a hard-working and frugal peasantry stemmed from its fears that the population had begun to outstrip natural resources. At another level the edicts and campaigns were an attempt to forge anew the sacred Confucian social contract, the reciprocal bond of obligation between the rulers and the people (equated with the peasantry) that underpinned the ordered state.[54]

There were two reasons why the early Qing emperors, who in the eyes of many Chinese were barbarian upstarts, were so well served by such a strategy. The first was that the fall of the Ming was frequently blamed on a decline into luxurious living and consequent social promiscuity and moral decadence, and this ideological campaign was a means for the Qing rulers to distance themselves from Ming excess and commit themselves publicly to purity, moderation and order (yet without the inconvenience of having themselves to live in austerity). The second reason was that this strategy enabled the foreign Manchu emperors to declare their allegiance to the classic fundamentals of Confucianism by integrating themselves into the moral ruler-people dyad. They thus demonstrated their inherent worthiness to rule China here and now, while tying themselves into a native Chinese historical tradition. At the same time, for the Qing rulers "correct agriculture" was a fetish: if the people could be persuaded to practice it, then social order would be restored from below as well as from above.

The efforts of late imperial Chinese rulers to preserve a reasonably convincing and workable ideal of a "peasantry" might well have been in

54. This social contract was most directly expressed in the bimonthly lectures on the *Sacred Edict* that Qing local magistrates were expected to organize in all the villages under their control. The *Sacred Edict* was issued by the Kangxi emperor in 1670, when he was only sixteen years old and in the ninth year of his reign. It consisted of sixteen maxims, each seven characters in length, and "was recognized as the most concise and authoritative statement of Confucian ideology" from its promulgation to the end of the dynasty (Mair 1985: 325). Maxims 4, 5 and 14 related to "correct agriculture" and its social goals: "Recognize the importance of husbandry and the culture of the mulberry tree, in order to ensure a sufficiency of clothing and food"; "Show that you prize moderation and economy, in order to prevent the lavish waste of your means"; "Fully remit your taxes, in order to prevent being pressed for payment" (ibid.: 325–26). The *Edict* was elaborated for pedagogical purposes by numerous elite scholars and civil servants; pictures were added, poems and exegeses were composed either in classical language or in the vernacular, and thrilling tales of vice and virtue were appended to get the message across. Mair believes that although large numbers of the common people were familiarized with the messages conveyed in such lectures or readings, they listened when they had to but seldom read them on their own initiative, "whether out of duty, for pleasure, or for edification" (ibid.: 358).

vain were it not for the technical characteristics of wet-rice farming and the constraints they exercised on the development of the means and relations of production. The structures of power and the nature of the social contract might have been transformed if the economic center of China had not shifted in medieval times from the millet-growing plains of the north to the southern rice regions.

The history of farming technology in medieval North China offers an interesting case study of state efforts to control potentially disruptive development in the relations of production, made possible by technological development. During the first thousand years of imperial rule (from about 200 B.C. to about A.D. 850), the northern plains were the central economic region of China. This was a low rainfall area, and the main grain crops were millets, wheat and barley. Farming techniques in the north developed moisture conservation to a fine art. Crop rotation, the use of animal and green manures, drilling the seed in rows, repeated shallow plowings, harrowing, raking and weeding were all known by the first century B.C. and had been brought to a high degree of perfection by the sixth century.[55] They were only viable, however, if the farmer had a fairly large farm, animals for draught and manure, and sufficient capital for animals and animal-powered equipment; that is to say, the technical system presented significant economies of scale. During these centuries landed aristocrats (and Buddhist temples) were able to increase their wealth by practicing estate farming, adding to their centrally managed domains the land of small peasants unable to survive alone. The proportion of land concentrated in these feudal estates varied over the period, but when uncontrolled it always increased rapidly.[56]

Such concentration of land management represented a serious threat to the power of the central state: small farms each paid an individual land tax, but even when aristocratic (or religious or warlord) holdings were not exempt from the land tax, such powerful figures were able to evade many of their obligations. As a result, there was a continual oscillation: when a new dynasty came to power it would institute radical land reforms, some variant of an "equal field system" by which big estates were broken up and individual peasant households were allotted an amount of land depending on the fertility of the soil and perhaps the number of household

55. These methods are mentioned in fragments of agricultural treatises surviving from the second century B.C. and described in great detail in the *Qimin yaoshu* (Essential techniques for the peasantry), written by Jia Sixie in A.D. 535.

56. Bray 1984: 587–97.

members. But small peasant farms were seldom able to survive profitably under this regime for long, since they lacked the capital resources to practice the best farming methods. Meanwhile the aristocracy, given lands in perpetuity by the ruler as a reward for support, or allotted estates in return for service in the bureaucracy, hastened to buy up land from bankrupt peasants, for the elites were well able to practice the best methods and could therefore add to their incomes by increasing their estates. As the dynasty wore on, the rivals of the state became richer as its own income from taxes declined. Had northern China remained the economic and political center of the Chinese polity, it seems quite likely that at some point the state would have definitively lost control to its rivals.

The cycle of power shifts was broken, however, when the rice-growing regions of the Yangzi region started to rival the northern plains in gross output, some time around the ninth century A.D.[57] Wet-rice cultivation allows almost infinite intensification of land use, as Clifford Geertz famously noted in his study *Agricultural Involution.* In modern Japan this has been achieved by an enormous increase in capital inputs in the form of specially designed farm machinery, fertilizers, herbicides and other chemicals. In late imperial China it was achieved largely through improvements that required little in the way of capital. They included refinements in irrigation methods and in cultivation techniques, selective plant breeding, multicropping and the use of small quantities of commercial fertilizers such as treated nightsoil or beancake.[58] Rice requires intensive inputs of labor at transplanting and harvesting (fig. 2), but in other periods household labor can be spared for other activities, and in many areas of South China peasant households grew rice almost as a sideline, investing most of their labor in commercial cropping or other forms of household commodity production.[59]

57. Li Bozhong 1990; Lamouroux 1995.

58. Elvin 1973; Bray 1984: 477–510. Beancake was the name for the large fibrous disks that were the byproduct of crushing soybeans for sauce or beancurd; the extraction of various vegetable oils also produced cakes that were sold as fertilizer. Lime was another form of fertilizer that was commonly purchased. One beancake was apparently sufficient to fertilize the rice seedlings for a whole family farm (Bray 1984: 289–98).

59. Bray 1986: 113. In parts of the Yangzi Delta a kind of self-sustaining ecosystem of rice, silk and fish was developed. Mulberry trees were grown on the banks between the rice fields and their leaves were used to feed silkworms, whose droppings were used as powerful fertilizers for the rice. Fish fry were put into the fields soon after the rice was transplanted; they were fed the silkworm moltings and they also protected the rice by eating the larvae of insect pests. The men tended the mulberry trees, grew the rice and caught the fish. The women tended

Figure 2. Men's work: men transplanting rice seedlings (*Bianmin tuzuan* 1/4a). The small field is typical of the intensive irrigated agriculture of southern China. Transplanting rice was women's work in Japan and throughout Southeast Asia, but in China women played little part in farming.

In medieval North China, the most productive and profitable farms were large ones that could afford expensive capital equipment; small farms that could not were economically vulnerable, though the state tried to protect them. In the wet-rice regions of China economies of scale did not operate, and little capital was needed to farm well. Although the ownership of land tended to concentrate in the hands of the gentry, the most efficient units of management were small and the countryside remained thickly populated by peasants working as independent or tenant farmers. The technological system of wet-rice farming was sufficiently productive to allow for a double level of extraction, so that in this case landlordism was not perceived by the state as a threat even though it often imposed severe levels of exploitation on peasant households. In conventional economic or technological terms, the estate agriculture of early North China had the potential for true development. But in the eyes of the state it was a threat both to the political ideal of relations between ruler and subject and to the fiscal regime.[60]

In fact what was at stake for the emperors of both medieval and late imperial China was not an economic but a symbolic order. The Chinese ruler was expected to strive for the welfare of his people, that is, the peasants. It was the duty of the state to provide help in times of hardship, and to take measures to prevent hardship arising in the first place. Such measures often resembled the technical packages of modern agricultural development policies. As well as distributing food and giving tax relief in famine regions, the Chinese state regularly opened up new farmland, invested in large-scale works for flood prevention or irrigation and encouraged improvements in peasant farming technology. The goal, however, was security and moderate prosperity rather than the uncontrolled (and unequal) generation of wealth.[61] The policies were intended not to develop the

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the silkworms and produced silk thread for market. In other Yangzi regions summer crops of rice alternated in the fields with winter wheat. In the seventeenth century the semitropical regions of the far south grew two crops of rice a year, with a third crop of rape for oil, indigo for dyeing, barley or sweet potatoes. Their surplus rice was exported to Canton (Bray 1984: 509).

60. After the Song the north became something of an economic backwater, and peasant farming became the norm (Buck 1937) until the advent of capitalist industry to regional cities in the early twentieth century (P. Huang 1985). The introduction of the examination system in the late Tang marked the beginning of the downfall of the Chinese aristocracy. Moreover, the shift of the economic center to the Yangzi regions meant that control of land in the northern plains was no longer so profitable.

61. Official discourse on peasant prosperity frequently advocated the production of wealth *(shengcai)*. But Will opines that it is a mistake to interpret such an

economy, but to preserve (or in hard times to restore) well-being in a social order where the organization of agriculture symbolized proper relations between ruler and subject and defined the distinction between productive and parasitic occupations, toilers and thinkers, and also the proper tasks of men and women as male and female subjects of the state.

The examples I have given—of the symbolic roles of *swadeshi* in Indian politics, and of agricultural policy in contemporary Japan and imperial China—illustrate ways in which technological systems represent and diffuse dominant values. Basic productive technologies define the everyday work and material lives of large numbers of people; they are one important way in which ordinary members of society "live through" ideology and through which hegemonic values are transmitted. Technical knowledge and the hierarchies of working relations were passed down from generation to generation in the powerful form of bodily practices, naturalizing the values and beliefs they incorporated and inscribing them in social memory.[62]

Physical habits—deportment, etiquette, working practices—are powerful in two senses. First, they embody power relations. A Chinese son prostrating himself before his father embodied the respect and humility inherent in filial piety. A peasant woman working deep into the night at her loom, her eyes smarting and her fingers sore, struggling to finish the last bolt before the tax collector was due, embodied her family's subordinate position as peasants obliged to labor for the state. Second, physical habits

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expression in the sense of quantitative, cumulative growth or growth in individual consumption. "What is meant is the production of the wealth indispensable for maintaining a general equilibrium, not the Faustian ambition of making each individual (or each family unit) ever richer" (1994: 881). Needless to say, the peasants did not usually see eye to eye with the state in such matters, nor did they draw such fine distinctions between the amount of surplus necessary to survive a lean period and the surplus that permitted a change in living style. Nor did they always draw the same line between "basic" and commercial production. Often specialization in commercial crops or household manufactures offered the best chance of economic survival or even enrichment. Commercial crops could be successfully cultivated as a sideline in most regions, but if it was cheaper to buy rice than to grow it, farmers often turned their land over exclusively to specialist crops (Bray 1986: 131). The state usually tried to discourage or at least control such trends in favor of self-sufficiency, fearing that regions which abandoned the cultivation of basic grains in favor of sugar, tea, oranges or cotton were paving the way to disaster. The Maoist policy of turning all available land, however unsuitable, over to grain would have been familiar to many earlier officials.

62. Connerton 1989: 72–104.

are powerful in the sense of being enormously forceful instruments of cultural reproduction. They are ingrained, unconscious, and therefore unquestioned.

While historians of technology still concentrate on the transformative aspects of material life, cultural historians or anthropologists are usually equally interested in its reproductive aspects as an embodiment of ideology. Today it is de rigueur, in any study attempting to integrate material experience and physical habit into the analysis of culture and power, to cite either Bourdieu or Foucault, or both. Bourdieu's concept of habitus includes deportment as well as the technologies of work and the use of space. Foucault's analysis of modernity decodes the "diffused power" inherent in the material experiences of everyday life, as shaped by techniques of observation, classification and containment ("technologies of power"). I find both Bourdieu and Foucault helpful when it comes to decoding the meanings and effects of technology within a limited timespan, but less so for historical analysis. Foucault's concept of immanent and thus anonymous power is unconcerned with personal agency or with the resolution of social tensions.[63] Bourdieu's socially rather self-contained concept of habitus does address the effects of time, especially cycles of diurnal and seasonal change; he also stresses the flexibility within habitus that allows for adaptation to circumstance. But I have been unable to fathom how Bourdieu's practice theory might be developed into a theory that could account for history.

Bourdieu (following Mauss) borrows the term *habitus* from medieval monastic discipline, a milieu we associate with tradition rather than transformation. Before its use by Bourdieu, however, the concept of habitus was developed for the purposes of social analysis by Norbert Elias, working with Karl Mannheim at the University of Frankfurt in the 1920s and 1930s. Elias was interested in the concept as a tool for dynamic, historical analysis—analysis that would account for processes of change (what he called socio- and psychogenesis) as well as reproduction. He defined habitus as the "psychic economy" characteristic of a specific social group or "figuration" and remodeled through shifts in the balance of tensions between figurations. Elias felt Marx was mistaken in believing that such dialectics were essentially dualistic, played out in the conflict between dominant and dominated class; he also held that the economic dimension is only one of several that fundamentally shape the relations between

63. Since Foucault in his early work explicitly stated that he did not deal in historical explanations, it would be tricky to reproach him on this count.

classes and the identities of persons belonging to them, so that "ideology" is not superstructural but far more central.[64]

Not all of Marx's work was published when Elias made these criticisms, and his main objections have since been met by the many marxist theorists who have developed more nuanced approaches to class conflict and to the role of ideology. But paradoxically, modern marxist scholars' interest in the material world is almost always abstract and narrow, devoid of significant detail. This I find disappointing and frustrating. The materialists are not interested in the material, Foucault and Bourdieu are not interested in history. Maybe that is why Elias's brilliant study of court society in France is so appealing, for it illuminates the importance both of material worlds and of the fine details of their meaning.

Elias believed that one of the most powerful forms of the expression and experience of ideology—as well as the most easily retrievable—was its concrete, material manifestations. For that reason he begins his study of ancien régime France, *Court Society,* with a chapter entitled "Structures and Significance of the Habitat," which describes and analyzes a new form of building characteristic of this period, the *hôtel* that was the Paris residence of the grand aristocratic family. He explores the values displayed and the social relations expressed by the spatial design of the *hôtel* and the meaning of the modifications that the bourgeoisie made to this style of dwelling, stressing that in a society where the political players fell into three groups—the absolute monarch himself, his courtiers, and the aspiring bourgeoisie—the aristocratic *hôtel* made sense only in relation to Versailles on the one hand, and to the bourgeois dwelling on the other.[65] In his treatment of habitat Elias decodes the *hôtel,* the stage that the French

64. This critique of marxian economic reductionism, in tandem with a critique of Freudian psychological reductionism, appears in Elias's *The Civilizing Process* ([1939] 1982).

65. For example, the lifestyle accommodated within the aristocratic *hôtel* depended on swarms of servants. These servants were invisible; they lived behind the façades of noble life, but even when they were in the same space as their masters they did not intrude. Aristocrats were concerned only with their own kind as audience; others were either too vulgar to count (the bourgeois), or not really human (the servants)—hence the absence of any concern with what we think of as privacy. Thus a noblewoman could undress without embarrassment in the presence of a male servant. However, this attitude reflected a code of ethics that was to the bourgeois mind immoral. Whereas the aristocrats justified an action in terms of its effects within their own group, the bourgeois extended their own morality and feelings to their social inferiors. This can be seen in the much more permeable boundaries—spatial as well as behavioral—that the bourgeois drew between themselves and their servants.

courtiers built for themselves to their own design. This was where they could give an uninhibited performance of what they saw as the role of their class, with its finely tuned aesthetics, relationships and forms of rationality.

Although my own work also begins with the structures and significance of a habitat, it is by coincidence (or perhaps force of logic), for I did not read Elias until my study was nearly complete. Interestingly, in the case of the Chinese habitat I am able to take my social analysis further than Elias in one important respect. Roger Chartier remarks in his preface to the French edition of *Court Society* that the work does not consider the diffusion of models of behavior beyond the court to other social strata. Elias does address this issue in the final section of *The Civilizing Process,* where he argues that cultural models do not simply diffuse or percolate downward: their transmission must be understood in terms of often conscious competition that obliges elites to develop new levels of civility. Interdependence is a crucial factor in this model.[66] In the case of *Court Society,* however, it is true that Elias omits the majority of the population—not least because at the time peasants and artisans were excluded from the domain of civility both by the prevailing political mentality and by their material condition. In late imperial China the contrary was true: the elite saw their task as drawing the lower orders firmly into the domain of civility, while maintaining the distinctions that justified their authority. The case of house design in China nicely illustrates reciprocal cultural influence of the kind that Elias hypothesized.

A concern with the power of material practice is not, of course, a modern invention, as the history of the term *habitus* shows. It is found in every religion and in much premodern political and social theory. Chinese Confucian philosophers argued over the relationship between ritual performance and moral orthodoxy for over two thousand years; they were also concerned with the symbolism and moral effects of different types of work and with the moral import of the most mundane details of their material world.[67]

Cultural historians and anthropologists have produced several key works in response to the question What held Chinese society together? Dis-

66. Chartier's critique appears in Elias [1933] 1985: xxiv. Elias looks at the question of diffusion in 1982: 2:229–336.

67. On the relation between orthodoxy and orthopraxy, see Ebrey 1991b and Watson and Rawski 1988; on the meanings of work see Cartier 1984.

cussing the various institutions and social processes that contributed to this cohesion, James L. Watson identifies one of the most obvious factors in the creation and maintenance of orthodoxy at popular levels as "control over the written word as expressed in literature and religious texts; equally important was the subtle manipulation of oral performing arts"; he then goes on to add death rituals, ceremonies of paramount importance in Chinese society since they converted dead relatives into ancestors. Others have added marriage rituals, kinship, and family organization and rules to the list of practices of cultural reproduction.[68] To this I add everyday technologies, seen at once as processes of cultural reproduction and as potential catalysts of social change.

At this point it becomes necessary to state the nature of my sources and to consider what kinds of reading they permit. Would the Chinese even recognize my organizing concepts of "technology" or "techniques"? I discuss my sources in greater detail in each section, but here I would like to give a general sketch of what sources are available, why, and what they can tell us.

Reflecting on why technology has never been incorporated into Indian studies, Marie-Claude Mahias notes that Indian thought shared with Western thought a predisposition to separate the spiritual and the material. Indian thought attributes high value to spiritual and low value to material activities, and the literate Brahmin elite tended to pass over technology in silence. Knowledge and skills of a practical kind were not considered to belong to the domain of true knowledge, and there is almost nothing written on technology in the historical record. If an outsider today (say a visiting ethnographer) wishes to enquire about a craft in an Indian village, even in the presence of the artisan it is the Brahmin who will reply to the questions, by virtue of his status as a person of knowledge—which in this case, of course, amounts to ignorance.[69]

Chinese intellectuals, on the contrary, paid meticulous attention to this practical domain, being acutely sensitive to the ways in which bodily action shaped identity, and to how the material world in which one lived produced a social and moral being. The Song dynasty saw the consolida-

68. Among the numerous works on neo-Confucianism and its penetration, see K. C. Liu 1990 on orthodoxy; Elman and Woodside 1994 on the examination system and its effects; Ebrey (1991b, 1991d) and Watson and Rawski 1988 on various kinds of ritual; Watson and Ebrey 1991 and Birge 1992 on marriage and female status; Johnson, Nathan and Rawski 1985 on the accommodation of orthodoxy with popular culture.

69. Mahias 1989: 5.

tion of a new political and cultural elite and of a new social philosophy in which bodily practices played a prominent role not just in the expression of identity but also in social incorporation. The aristocratic elite of pre-Song China had protected their status and maintained the social order through practices of exclusion: their status was transmitted through descent, and their marriage practices, family rituals, and other markers of status were forbidden to commoners. From the Song, however, the new political elite were meritocrats who worked through a strategy of inclusion. They strove to build an organic social order, ranked but open to all, that would bind the whole population into a shared culture of orthodox beliefs, values and practices. This strategy of inclusion was highly successful. It allowed the Chinese polity to absorb the populations of remote provinces and foreign invaders into its own culture, and gradually to incorporate the members of every level of Chinese society into a workable orthodoxy.

The social philosophy underlying classical learning in late imperial China is often referred to as neo-Confucianism. It was developed by a group of thinkers in the Song dynasty, the most famous of whom was Zhu Xi, as a response to the increasing popularity of Buddhist otherworldliness, on the one hand, and to the active interventionism of the early Song state, on the other. Neo-Confucianism elaborated the classical Confucian model of social order,[70] which depicted the family as the microcosm of civic virtues and skills: one learned to govern the state by managing one's own family. Perhaps in reaction to the relative power and independence of elite women of the Tang and early Song, neo-Confucianists during the Song strongly emphasized the segregation of the sexes, the seclusion of women and their subordination to men (to their fathers before marriage and to their husbands thereafter). But throughout the late imperial period we also find repeated expression, by men as well as women, of the classical view that wives were active partners rather than acquiescent subordinates. An important theme in this book is the interplay between these two views of gender and between different forms of patriarchy within Chinese society.

One way in which orthodox values were diffused in late imperial China was through the structures of education, which not only regulated access to political power but also were used to incorporate the population. The

70. Formulated by the fifth-century B.C. philosopher Confucius, elaborated by his adherents such as the fourth- and third-century thinkers Mencius and Xunzi, and accepted as state orthodoxy in the early Han dynasty, c. 100 B.C.

emperor ruled through a hierarchy of civil servants recruited through examinations that tested their classical learning. Many more people studied for the examinations than actually passed them and gained office. The examination system effectively transmitted dominant values to large sections of society through the system of classical education, and over time these values were disseminated to ever broader numbers of the general population, through such media as public lectures by local magistrates, sections on social morality and etiquette in popular encyclopedias and almanacs, and the increasing incorporation of neo-Confucian morality into the legal code.

Ideas and texts were fundamental elements in the Chinese concept of education, as they are in our own, but the material dimensions of education were far more prominent. Teaching appropriate bodily practices and the correct use of material objects was a way of reinforcing intellectual messages as well as an integral part of inculcating dimensions of morality and right thinking that could not always be completely encompassed in words. This aspect of education was the more powerful because it could be absorbed even by those untrained in literacy.

As I suggested earlier in my discussion of agrarian policies, late imperial intellectuals were concerned with the social and moral effects of different kinds of work, and "womanly work" became a prominent theme in statecraft and moral writings from the late Ming. The statement by the fourth-century B.C. Confucian philosopher Mencius—to the effect that those who work with their minds govern, while those who work with their bodies are governed—should not be taken to mean that laborers are naturally subordinate to thinkers, but rather as an expression of "the complementarity of human activities and the necessary solidarity of social groups." " 'Work' was highly valued as a productive activity synonymous with civilization," and the art of ruling over this civilization was explored through technical metaphors drawn from carpentry, building, spinning, weaving, potting and jade carving.[71]

At the same time work was ranked. The "basic" productive activity was agriculture, which like government was considered an essential form of labor. Other forms of labor than farming were considered of subsidiary dignity, even though houses, cloth, iron tools and other craft products were indispensable everyday items. Even the production of cloth, the work of farmers' wives and the source of half the state's revenues, did not have

71. Cartier 1984: 278, 304 on the ideology of work, and Keightley 1989 on political metaphors.

such high status as agriculture. The skills required for crafts like carpentry and metal working were popularly associated with magic. In medieval China craftsmen were classified as "mean" people; their status was hereditary, they were not supposed to intermarry with commoners, nor were they allowed to sit for the entry examinations to the civil service. Farming was not demeaning but an activity in which an educated man could engage with pride and pleasure when not serving the state. Giving people access to land was the best way to foster civic virtue, and we should not wonder that the reins of government were entrusted to landowners.[72] In China we would not find a philosopher who earned his living by grinding lenses.

Treatises on subjects that we would consider technological were a respected genre, dating back at least to the early Han dynasty (second century B.C.). The best-known works were transmitted over centuries, through new transcriptions and then through printed editions, often updated with commentaries or new sets of illustrations.[73] Most numerous were the agricultural treatises, written or compiled by members of the educated class. Most of them had personal experience as farmers, some had also served as administrators, and some authors tell us they interviewed "experienced peasants" to supplement their own knowledge.[74] The classic gender division of labor was expressed in the phrase "men till, women weave," and from Song times onward most farming treatises included sections on textile production (also treated in numerous separate works). Wang Zhen, who published his systematic *Agricultural Treatise* in 1313, decided to include diagrams and detailed descriptions of all the tools and machinery he described, so that people who wanted to try out new methods could do so.

The number of technical works on crafts (including building, carpentry, papermaking, ship building, metal casting and so on) is rather fewer. Most of them were originally put together not by literati but by artisans or other trained experts. Since the dexterity or skill (*qiao*) required for each craft was at least in part esoteric, the information supplied is often cryptic or incomplete—the written texts served the purpose not of descriptive

72. Cartier 1984: 304.

73. For example, the *Kao gong ji* (Artificer's record), a set of laconic, not to say cryptic, descriptions of crafts probably predating the Han, that was included in the canonical text *Zhou li* (Rituals of Zhou) around 140 B.C. Among its many recensions one might cite the explicated version produced by the Southern Song scholar Lin Xiyi in about 1235, and the critical illustrated edition produced by the famous classical scholar, mathematician and astronomer Dai Zhen in 1746.

74. Bray 1984: 47.

how-to books but rather of scriptures or even incantations. A complementary genre (this time the work of scholars, not craftsmen) is the information provided for consumers of crafts, in books of connoisseurship and popular encyclopedias. Again, such texts do not tell us "how to" make a lacquer box. The basic techniques are taken for granted; what is important is the different consistencies, textures and colors of lacquer, the methods of layering, carving or inlaying, that define a regional style or quality. We are dealing with techniques of taste rather than of production.[75] Technical books were often illustrated with woodcuts. The professional artists might sacrifice accuracy to artistic effect, but although this means that such pictures are not always entirely reliable as technical representations, they usually show the work taking place in reasonably characteristic surroundings, so that they are useful as social documents.[76]

Other sources of technical information include the economic sections of dynastic histories and local gazetteers, genre paintings, poetry and novels, archaeological excavations, and artifacts. To give some idea of just how rich the material is, Needham's series *Science and Civilisation in China* includes volume-length sections on architecture and civil engineering, ship building, paper and printing, textile production and dyeing, agriculture, food processing of various kinds, mining, ferrous and nonferrous metallurgy, weaponry and medicine.

When we consider how such material can be used in a study of technology and gender, we must bear in mind that of all the sources I have just listed, the written materials form by far the most important element. Apart from a few technical or magical works put together by artisans they were all written by educated men, even where they recorded knowledge passed on to them by working men or women. They therefore convey a male perspective and a privileged perspective. Some writers were sympathetic to the sufferings of the working classes or to the feelings of women, and even went so far as to question aspects of the social order that did such violence to certain kinds of people (the Tang poet Du Fu, who wrote movingly of the plight of farmers, weavers and other workers, is a notable

75. Ruitenbeek (1986, 1993) describes the mixture of esoteric and practical information conveyed in the carpenters' sacred text *Lu Ban jing* (one of my basic sources in part 1). Clunas (1991, forthcoming) discusses the late Ming literature of connoisseurship.

76. Of course there is a tendency to prettify. Work in these woodcuts always seems to be done by smiling people, neatly dressed and chatting pleasantly, their sweating brows cooled by the breeze wafting through a convenient bamboo-shaded lattice.

example of the former,[77] the seventeenth-century playwright and novelist Li Yu of the latter). But however deep their concern, they remained educated men, and their representations of class or gender roles and relations, as of different varieties of female experience, must be evaluated accordingly.

To some extent the sources written by elite males can be read "against the grain," examined for absences and contradictions. This is largely how I have used the sources on textiles, in order to reconstruct the emergence of new, unconventional gender divisions of labor and their impact on female status. Since all the female roles and experiences I am interested in were defined in relation to a corresponding male counterpart, what is said about men is often a good basis for speculation as to what might have been said about women, had it been thought necessary or interesting in this context, and vice versa. I should note that my sources provide considerable scope for investigating how forms of male power over women were exerted and experienced; they also allow me to suggest how women fashioned peculiarly female versions of orthodoxy and to throw some light on how inequalities among women were materially experienced. My sources reveal much less, however, on the fashionable matter of resistance.

Some of the most original feminist scholarship on late imperial China has now shifted away from viewing women predominantly as victims, to consider elite women at least as active—if relatively restricted—partners in the construction of the Chinese social order. While such women might have perceived some of the gendered restrictions on their actions as constraints to be resisted or subverted, their allegiance to the basic values of their world was seldom in doubt. Indeed, as Dorothy Ko demonstrates in *Teachers of the Inner Chambers,* elite women embraced their special and indispensable role as moral educators with enthusiasm. My materialist study does not contradict this view; rather, it tends to confirm it as far as the high-status women in elite families were concerned. But one can only have high status if somebody else has low status; power is exerted on people, it is not an intangible aura. My materialist sources also provide glimpses into how the dignity of high-status women was often achieved at the expense of women lower in the social hierarchy, whether under the same roof or in families of a lower class.

To return to whether we might take technology as a Chinese category: the notion of craft, cunning or skill, *qiao,* which I mentioned earlier in

77. Du Fu's proletarian sympathies made him the favorite classical poet of the early Communist regime.

relation to artisans, was an attribute that distinguished among men of different social status. *Qiao,* implying "cleverness in the practical skills of manipulating the environment,"[78] was not an attainment to which educated men or farmers aspired—it was characteristic of only one order of men, and they were of low status. *Qiao* enabled them to make objects that were classed as being of only secondary importance compared to the work of educated men or farmers (although paradoxically the instruments, vessels and dwellings that craftsmen produced were treated as central to the performance of Chinese culture). As a female attribute, however, *qiao* transcended class. It was associated with "womanly work," primarily textiles: all girls were expected to learn the skills of spinning, weaving and needlework. Textiles were classed as fundamental goods, indispensable to the maintenance of the world order. The other practical skills that women exercised to maintain the domestic order were equally integrated into the organic Chinese polity, in which a well-run household was the basis of a well-ruled state. *Qiao* was not at the top of the scale of human attainments—and its connection with cunning and magic made it a somewhat ambiguous category, like the word *craft* in English—but in its female manifestation it denoted a relation to the material through which women crafted a path to virtue and a cornerstone of the moral order. What I would call techniques or technology, therefore, strike me as an object that is particularly appropriate for investigating the female experience in China, not least because it provides unique possibilities, both for transcending class boundaries to identify commonalities in gender practices across classes and for exploring how inequalities among women as well as between men and women might be materially expressed.

78. Blake 1994: 680.

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