MAX PLANCK INSTITUTE FOR THE HISTORY OF SCIENCE
Max-Planck-Institut für Wissenschaftsgeschichte

Press Release "New Department at the MPIWG"
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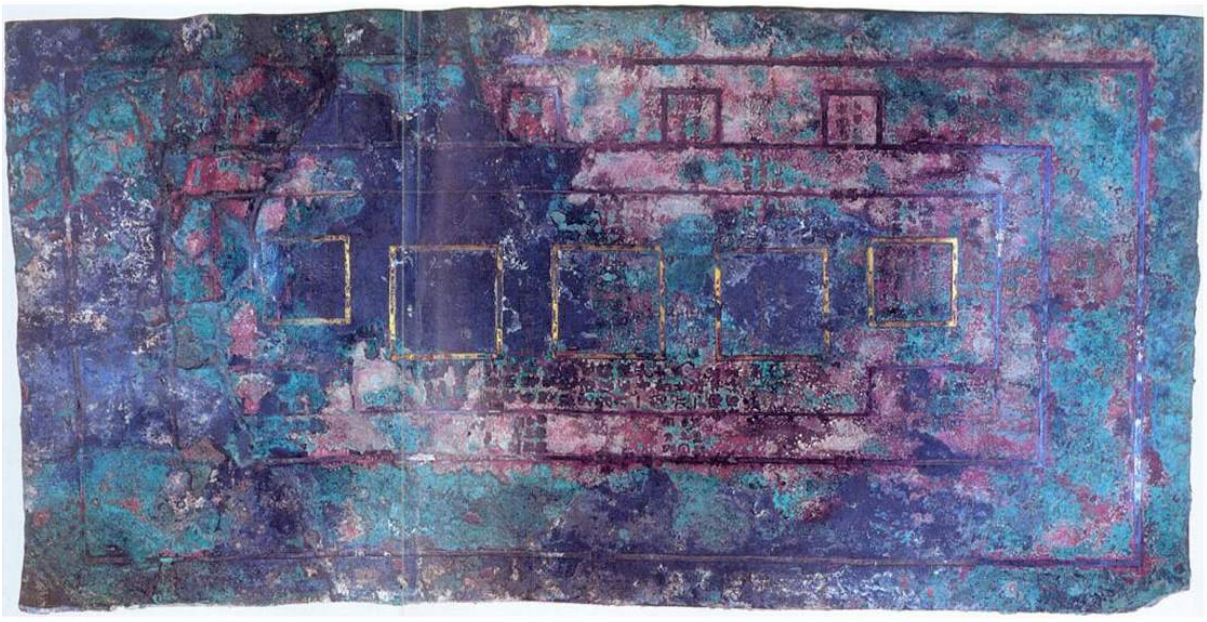

Der *Zhao Yu Tu* ("Die Karte der Umgebung des Mausoleums"), ausgegraben in den späten 197Oer-Jahren in Pingshan, der südlich-zentralen Provinz Hebei. Hebei Provincial Museum at Shijiazhuang, Hebei Province, China. © World Map Co. Ltd., Supervised by National Administration of Surveying, Mapping and Geoinformation.

Is Bigger Better?

Large-scale technology projects—and their dramatic effects—highlight the role size and scale play in our understanding of the world that surrounds us.Chinese history can help us to understand the many small decisions and simple acts that take place behind the scenes and shows how planning plays a crucial role in knowledge worlds.

What do an accelerator complex at Cern, a factory in Philadelphia in the nineteenth century and lotus cultivation during the Qing dynasty all have in common? All such activities generate knowledge and know-how. And all of them require planning. Goals need to be set, skills and materials promoted or identified. Guidelines, models, recipes and blueprints are generated to coordinate and organize. Historians from the Max Planck Institute for the History of Science in Berlin (MPIWG) have begun to question the role of management and organization, arguing that this viewpoint not only transforms our understanding of the historical developments of technology and science, but also offers new insight into recent debates on large-scale research and technology projects.

"How central modes of planning impact knowledge production can be seen particularly well in Chinese history," says Dagmar Schäfer who is heading a new department at the MPIWG, "we find here an outstandingly continuous documentation on the many ways people 'planned'." Architectural drafts,

astoundingly modern in their technical designs, were used in this region of the world in ancient times. A bronze plate, excavated in the 1970s in Hefei, has gold and silver inlays depicting the contours of the fourth century tomb of King Cuo where it was found. Engraved measurements suggest that the plate was used in construction. Inscribed along the left hand side, an official decree identifies the plate as part of a complex imperial administrative apparatus. Bureaucracy translated the messy realities of life and death into the grand visions of the contemporary elite.

“Grand projects increase the need for logistics and organisation,” explains Schäfer, “Thinking big forces people to reflect on expertise and skills. Significant to the Chinese case is that the elite’s concerns about ordering state, society, and self, spread throughout areas of intellectual and practical engagement. Views of nature express a special concern in systems, structures and processes.” The question how one should plan and which knowledge, or information needed to be documented, conveyed or systematized, became central to political and intellectual debates. Was thinking in bigger schemes better than tending to details? How could flexibility be achieved and creativeness promoted and control still be maintained?

In eleventh-century Song (960–1279) China, the renowned Chinese philosopher Zhu Xi (1130–1200), for instance, assumed that the key to the success of big schemes was to bring order to the small things: that is everyday needs. For him, the proper placing of the ancestral shrine in each individual’s home was a first step towards organizing society and state. The principle of big planning was to understand the major effects that could result from small details. Some contemporaries of Zhu Xi believed in grand set-ups and the detailing of things. As the Song state gradually lost political control over the Northern plains,—where the traditional source of cattle and horses used to provide locomotive energy for civil transportation and warfare were reared—these men opted for the institutionalization of offices and publication of pharmaceutical literature to promote state-run large-scale livestock holdings. This peculiar Chinese case also shows that each approach to planning brought forth distinct formats and fields of knowledge and know-how. To facilitate large-livestock holdings Chinese scholars of the Song created a field called ‘methods to counterbalance diseases or malfunctions,’ which, besides veterinary care and medicine, included hydraulic engineering, crop selection, and moral training, as well as philology and philosophy.

In the past as much as in the present world, planning meant juggling complex situations but also deciding whether long-term vision require long-view hindsight, or taking a risk. Accordingly people gathered empirical data, performed divination or calculated measurements. “Often we can see how the shadows of yesterday's plans turn into iconic templates for the future.” The diagrams, illustrations and textual descriptions that candidates for service in state veterinary care of the tenth century produced in training became the guidelines in the fifteenth century. Similarly documents on—imagined or real—hydraulic projects of the past became the blueprints for future aims.

Modern China takes pride in a long tradition of water management, enhancing ancient traditions with modern engineering practice and ideals: faster, higher, bigger. While scientists and engineers ponder whether superlative interference necessarily produces the best results, the enactment of such projects—making things work—brings forth new insights and ideas. Such projects, however, also show that within the most rigid of

planning, there is still room for creativity and spontaneity. The world's highest dam at the border of Sichuan and Tibet—first envisioned in the 1960s—is nearing completion in 2014 after a construction period of a mere seven years. An underground laboratory for particle physicists has been added only recently, almost as an afterthought, an opportunity grasped when it turned out that research conditions were ideal at this mountainous site. Clearly here scientific research is informed by a very different approach to planning than Cern where a diverse community of European researchers, physicists and engineers has been probing the fundamental structure of the universe since 1954.

By analysing such divergent approaches to scientific planning, the historians at the MPIWG do not believe in the historical persistence of black and white paradigms such as the Haldane principle which states that "politicians should not interfere in scientific decision-making." Instead, they look at the actors themselves: "When we attempt to find out how engineers, priests, artisans, housewives, scientists, and others tried to make things work, we do so to unravel the complex impact of social, political, economic, and material conditions. We want to learn how complexity is dealt with and how individual choices and collaborative decision-making were translated into procedural logics or systems of thought or belief," Schäfer says, whether it is eleventh-century Chinese households requiring ancestral shrines, particle studies in modern times or nineteenth-century American children requiring vocational training six days each week, but Sabbath-keeping on the seventh.

Nina Lerman, a historian of industrialization, is researching the training of children in Philadelphia in the nineteenth century, exploring what children were expected to learn in order to function as industrial workers or housewives, engineers, or textile designers. Educational planning was the backbone of both industrialization and democratic beliefs, and researching its history can reveal how the large-scale changes of industrial capitalism were formed by a mosaic of many small-scale decisions about which children would need what knowledge—how to bake bread, how to build a locomotive, how to behave on Sundays—to become "useful citizens" as adults.

Researchers thus take into account that often it is the seeming marginalia that counts. Historian of science and technology, Martina Siebert, is researching how the cultivation of the lotus plant in China evolved into a complex and interlocked system between the seventeenth and nineteenth century. A map of Beijing from around 1900 shows the water bodies in the so-called "Inner city" which, according to Qing dynasty archival documents, were all used for the cultivation of lotus and thus demanded new expertise and organizational structures. One reason for this, Siebert says, was the Qing court's zeal for efficiency and profit that viewed empty water spaces as wasteful and when looking at lotus, saw not only the beautiful flowers, but also the economic value of the roots buried in the mud.

Yet, particular to the Chinese case is a seeming continuity in big schemes that dynasty after dynasty re-deployed. Changes on this level are often subtle, even if they had dramatic effects. At closer sight, like in many western projects a certain localism prevails. In the East and West projects such as the setting up of an industrial plant, planning a school education, or building a dam followed local traditions and conventions. "Looking at the histories of planning in China and comparing them with historical and recent examples in Europe, South America or the US helps us to better understand how much large-scale projects depended and still depend on

many small-scale decisions and the interests of the people who pursued these projects," Schäfer sums up.

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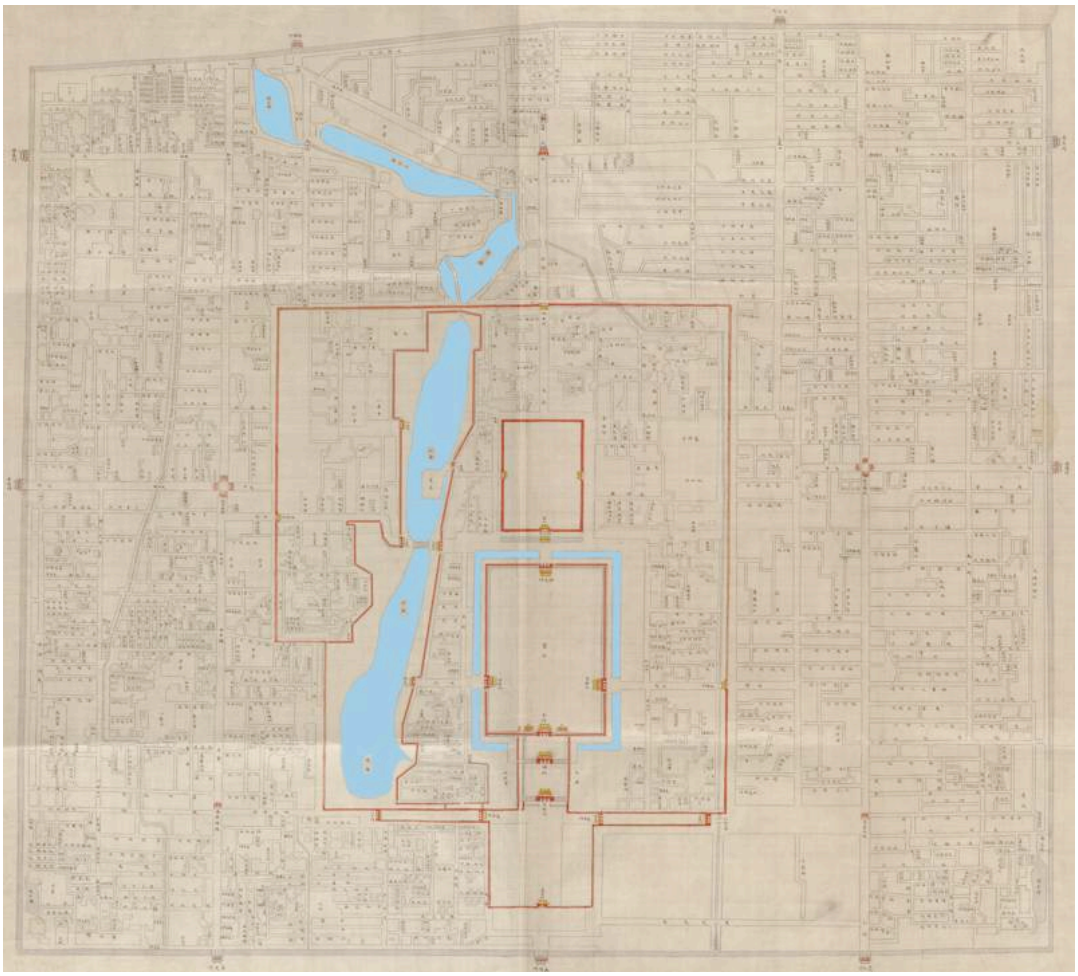
How the Lotus Got its Own Administration

By Martina Siebert

View to the north over the "Middle Lake" of the Westpark towards the "Rainbow Bridge" and the "White Stupa." The lake in the foreground is completely covered in lotus plants (from: Ogawa, Kazuma: Shinkoku Pekin kōjō shashinchō. Tōkyō 1906).

Actually the lotus is a very ordinary plant. Nevertheless, during the Qing dynasty (1644–1911) a complex bureaucratic structure was built up around this plant. The lotus was part of the Imperial Household, the palace machine that produced money, things and identity for the Manchurian Court.

On 47 hectares of water bodies adjacent to the Forbidden City in Beijing lotus was cultivated on a grand scale. The harvested roots went first to the imperial kitchens and deserving officials, any remainder was sold for silver. The whole was the responsibility of the Garden Office and was just as meticulously planned as the representative functions of the Westpark. But what did it mean to "plan" the lotus? What was important and recorded? And what was tacitly implied and left out of the "histories of planning"?



Map of the Tartar city with the embedded Imperial City, the Westpark and the Forbidden City surround by moats. The blue areas denote water bodies planted with lotus, the red areas denote the walls of the Imperial and Forbidden Cities (Library of Congress, Map Division).

After taking over the rule of China the Manchurian Qing established a detailed formulated bureaucracy on all levels. The record keeping was particularly painstaking in the case of the imperial household, which, with its silk and porcelain manufacture and its monopoly on furs, jade and ginseng was a prosperous and profitable business over a long period of time. With its every more complex web of "Regulations" and the Qing officials also reacted to the errors of their predecessors. In the previous Ming dynasty, eunuchs had ruthlessly dominated these profitable areas. Yet, the Qing would also experience some spectacular abuses of authority.

The Regulations set out even the smallest details. They specified the color and quality of the yellow cloth to wrap the lotus roots when delivered to the palace kitchen. They laid out how the worn-out punt poles were to be re-purposed as sickle handles to cut the withered lotus leafs and trim the over-grown roofs. They further stipulated that the blades for the sickles were not to be sharpened by the garden office, this responsibility was to be handed over to the expertise of the imperial armoury.

For their other duties and the organization thereof the garden office had independent responsibility. They were merely required to inform the central office of the imperial household about any expenses in monthly or annual reports. This independence was partly based on the income from the leasing of a total of 212 hectares of water bodies in the Inner City and

northwest and south of Beijing for the cultivation of lotus plants as well as the sale of surplus roots from the Westpark.

In 1814 these business practices generated about 57 kilos of silver for the garden office. This appears as “lotus-money” in the administrative files and regulations and was treated almost as a separate currency. For example, it was spent on repairing the sluice gates that regulated the water level in the Westpark lakes. The regulations made it a priority to repair and re-use all working components as far as possible. If anything else was needed it was to be bought outside the palace with “lotus money.” If it was too expensive then money needed to be saved and increased through interest from money-lending.

From: Xu Guangqi’s Agricultural handbook (1639).

But lotus was not only worth money. The plant was an ingredient in food and medicine, a decorative flower and an agricultural product. In bloom the plants contributed to the scenic landscape of the Westpark and inspired more than one poet. In autumn the withered leaves were cropped and the masses of organic matter carted away. Lotus roots grow in long chains horizontally in the mud. Harvest workers had to churn up and loosen the lake bottom by stamping through the mud and then pull out the chains of roots. All of this had to be coordinated with the reception of foreign delegations, ritual ceremonies and imperial festivities.

Many “histories of planning” can be portrayed with this example. The focus of the research is not so much about economic success or lack thereof, rather to see which different systems and processes lotus cultivation was embedded in, and which did it cause or construct. Where did it seem better to plan bigger and estimate roughly, where was it better to outsource responsibility or predetermine every tiny detail.

A look at planning processes shows historians where and when knowledge was systemized, what was written down, what was recognized as expertise and which areas and processes were accepted unthinkingly or deliberately ignored.

Talking Silk

What Labels can Tell us About Society

By Dagmar Schäfer

Inscriptions named the responsible managing official, in this case Wang Yutai and identified the silk as of "top quality decorated with real gold thread."

Throughout Chinese history, dynastic states used labels on textiles to spread information on the maker, the commissioner, the owner or the date and site of production. Silks produced in state-owned manufacture of the Qing carried the so-called reign-marks which globalized trade today uses as a means to confer "Chinese-ness" of its arts and crafts.

But labels on textiles can tell us much more. First, the place where the labels are knitted in is changing. Trademarks on eighteenth century Manchester's cotton textiles were placed on the end selvages, verifying standards of length and width. Functional inscriptions on Chinese silk textiles were at the head selvage of the bolt, indicating to a quota system, in which the weaver, working with commissioned raw materials (that is, given to the weavers in advance), committed to state purposes with the first shuttle-run. Throughout the 300 years of Ming rule for example, the techniques of inscription changed, reflecting a growing concern to attach such information saver to the artifact. While first silk was stamped or the name written in ink, by the late Qing weavers wove information on production, finance or funds directly in the chef-de-piece. Shifts in techniques reveal changing modes of trust and responsibilities and indicate new forms of labor and production techniques.

Such changes often resulted from institutional reorganization and the varying roles of silks in everyday life and as ritual item, tributary ware, and commodity. Across trades merchants and craftsmen of the late Ming referenced imperial symbolism to invoke trust in the quality of their wares and, at the same time began to creatively adapt such symbolism to advertise their skills and wares. Markings on artifacts challenge the role of written rules as the standard or only historical format available to states to

control material culture in the market or as an expression of individual rights.

Textiles can therefore tell us a great deal also about the changes in society. These pieces reveal how new trades were built up. While the ancestors of the Huang Sheng clan may have produced most of their silk garments in their own private workshops or purchased it from private workshops run by other locale elite households, by the time Madame Huang Shen was buried in 1235, the situation had dramatically changed, because the state began to take over silk manufacture in the region. The Song state was well aware of the silk trade in Quanzhou and already regularly dispatched officials to skim the regional market for exceptional pieces. Soon the Song rulers decided to economize and set up a local office to collect silks as annual tax ware. In a next step, officials handed out raw or reeled silk contracting weavers to produce on demand. Finally by the twelfth century the Song established the first pillars of a state-owned manufacturing system of local workshop that specialized in one or the other (already established local) production lines. In this way the state benefited from a regional clustering of expertise and resources and eventually also contributed to it.

Training Children, Imagining Industrial Adulthoods

By Nina Lerman

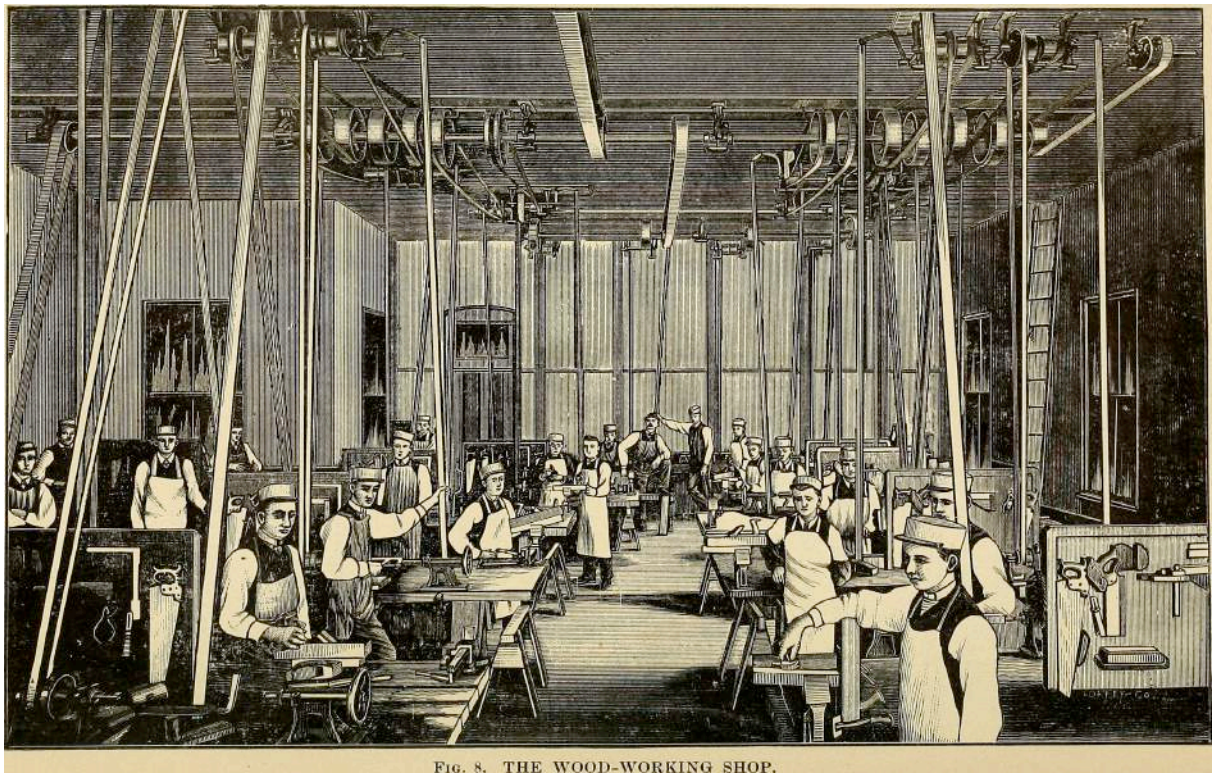
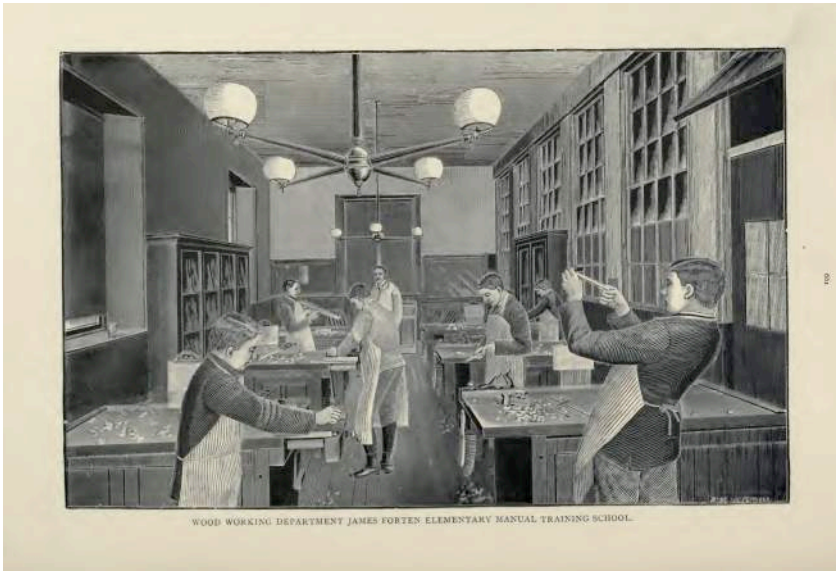


Figure 1*: School workshops at the turn of the 20th Century: machine woodworking for prospective engineers at the Manual Training High School* (Woodward, Calvin Milton. The Manual Training School, Comprising a Full Statement of Its Aims, Methods, and Results with Figured Drawings of Shop Exercises in Woods and Metals. Boston: D. C. Heath & co., 1906. p. 39).

What had happened to "Yankee ingenuity"? Professors in the newly professionalizing engineering schools of the late nineteenth century US lamented the disappearance of a figure they called "the Yankee whittling boy" amidst the vast urban industrial growth of several decades. The mind was being trained in the urban setting, they thought, but the eye and the hand were left behind. They devised a new high school curriculum, publicized as "Manual Training" and intended for future engineers and draftsmen: algebra and physics, French and shop training—in wood and metal, by hand and by machine, boys would master both the theory and the practice of technology in preparation for adult expertise.

But the term "manual training" was versatile, and the engineers' pedagogical work meshed with a growing trend in educational theory overall: children should learn by experience, building on connections with things they knew, deriving theory from example. Manual training could also apply to younger children, to girls, to students never expected to enter the halls of university. By the 1890s, manual training might require a classroom full of steam-powered woodworking machinery, even machine tools (fig 1)—or it might only require a set of cards with holes punched in them, so very small children could work on threading yarn through the cardboard (fig 2).

Or, in between, it might include instruction in the use of hand tools, where each child made an exact copy of the model prescribed by the teacher (fig 3), work which would instill "habits of accuracy, neatness, dispatch, and obedience" as well as training the mind, the eye, and the hand together.



Figures 2 and 3: Manual training approaches at the turn of the 20th Century: card sewing and "Sloyd" woodworking at the Elementary Manual Training School (Custis, John Trevor. The Public Schools of Philadelphia : Historical, Biographical, Statistical. Philadelphia : Burk & McFetridge Co., 1897. p. 195 + p. 199 http://archive.org/details/publicschoolsofp00custrich).

Disentangling these multiple meanings of "manual training" requires attention to the technological knowledge content expected in each setting, rather than repeating the overlapping terminologies of school reports and teachers' manuals. High school boys designed machines, created working drawings, tested theories, and built a working model. Boys in elementary manual training copied the teacher and followed rules; they were not, for the most part, educated in preparation for high school (manual training or otherwise). They were, instead, predicted to be the children—most of them from immigrant and working class households—who would leave school for work at age 14, so high school preparation was beyond the "experience" and needs of the child.

While in many ways we may find such sorting of children unsurprising in retrospect, the apparently natural mappings of children onto ways of knowing about the material world was actually the product of a century of debates, negotiations, experiments, and improvisations. Some of these results, indeed, might have surprised the adults of a generation or two earlier, whether the philanthropists of the 1820s, who could not have imagined girls using manual training woodworking tools, or the reformers of the same era seeking more democratic access to knowledge for citizens of the young republic, or the new middle-class parents of mid-century, who made sure their sons worked in white shirt collars and not greasy artisanal aprons. Over the course of the century, in apprenticeships and schoolrooms, technical institutes and workshops and courtrooms, we can see many small forms of planning and judgement: who valued what knowledge, under what circumstances? Which kinds of knowledge seemed valuable, for whom and to whom? How did people understand their often-changing relationships with material things? Making technical education work meant envisioning the city of children's futures: its technologies, its political order; its economic functions. And planning this future city meant, in turn, looking at children, envisioning them as adults.

Thinking about "industrialization" as long-term historical change often brings to our minds processes of rationalization and efficiency, but this large transformation, bundled so neatly into a single word, was made of many smaller decisions—by people with more and less power, weighing a range of values, making plans for today, next year, their lives, their children's lives. The "histories of planning" constituting the fabric of industrial capitalism in a nineteenth-century manufacturing centre are the histories of many small plans, many small decisions, many small processes of knowing how: a city full of people engaged in "making things work."