

周丰 许焕敏 著

承载乡愁的设计

中华传统水利机械之美

The Design with Nostalgia
The Aesthetics of Traditional Chinese Water Machinery

科学出版社

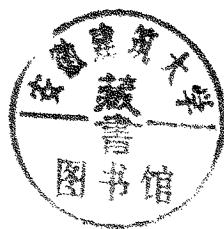


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北 京

内 容 简 介

本书以追寻“乡愁”的视点,就中华大地上曾出现过的20多种传统水利机械,对其运动原理、历史渊源、形制、生态美学特点进行系统梳理。并设计制作了中华传统水利机械交互装置;进行了3D复原、虚拟仿真及APP制作;提出建设水车之乡的地方创生生态设计构想,对建设“美丽乡村”具有一定的启示。

本书是以中华传统水利机械为研究对象,通过知识科学的方法,融合了生态美学、设计学、科技史等知识展开的专题研究。可供设计、美学、机械、科技史、社会、生态等多学科专业的读者及广大水利院校师生阅读参考。

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序

当收到《承载乡愁的设计——中华传统水利机械之美》（以下简称《中华传统水利机械之美》）书稿时，和以往不同，我的内心是一阵阵激动，（完全忘记了通常写序的苦恼）陶醉在一行行文字和一幅幅图片中。由于我出生于 20 世纪 60 年代，从小在皖南最大的河流——率水旁，摆弄和看着传统木制水利机械长大的，儿时就见过率水大河中千帆竞渡的宏伟场面，一种迫切的心情，想把全部传统水利机械再重温个够。既是对美好童年乡村景象的回忆，同时，也想帮助作者检验一下，该著作所叙述的各种传统水利机械里，有没有漏掉我见过的、用过的传统水利机械。

对于中华传统水利机械，我有一定的发言权，因为我外公家是开水碓的。值得自豪的是，对于水碓，我有着同龄人无法相比的熟悉^①。我从记事起到初中毕业，都在月潭水碓旁管理水碓的房子里（外公家）居住。水碓是我童年、少年玩耍的主要场所，对水碓，我真是太熟悉了。

故乡徽州的月潭水碓是我见过的最大的水碓，气势雄伟。划坝长度超过 500 米，拥有 1 个石磨和 12 个白窠。水里的木头部件均由松木制作——“水底千年松”，松木在水里是不容易腐烂的，车轴也是松木的。碓搭、车轴滚子、碓挺（杵杆）都是柞木的，因为柞木更硬，更耐磨。

① 所谓水碓，就是水动能的碾米、磨粉作坊，是水利机械比较宏大的一个种类。水碓的组成：划坝门、划坝、水碓港、拦栅、单元水闸、车穀港、车穀、车穀板、斗芯板、水成板、十字档、车轴、车轴硬（滚）子（木制轴承，包括散热的水槽）、车枕、机笼宕、碓搭、碓挺、碓耳朵、碓平、白嘴（石杵）、白、碓头篦、石磨（老水碓还有黄泥砬）、米隔、风车、筛子（大小孔）、挖斗、竹木簸箕……水碓是一个集水坝、水能机械、后加工为一体的大型综合水动力机械，也是中华传统水利机械的重要代表。

1972年，正好遇上月潭水碓大修，由于那时候的孩子不需要过多课堂学习，也没有家庭作业，我就随我外公一起张罗起水碓大修的事情。

月潭水碓应该是率水上最大的水碓之一，车毂的直径达三丈（约10米），有12个花岗岩石臼。那次大修除了白窠、白嘴（石杵）、车毂港、机笼宕没有动以外，所有的木制部件都是新的。先是我外公带着丈尺到颜公山余脉中岩溪山上，选五丈长且匀称的挺拔松树，以做车轴用，要求最细处出料后达到二尺半（约83厘米）见方的规格。记得做那根车轴单是砍树就花了整整两天，在山上初加工、运下山用了5天，运到月潭水碓又用了5天。整个运输过程，是50个青壮年劳动力轮流扎小杆抬的。松木车轴抬起前行时，就像是蜈蚣在爬行。

那次月潭水碓的大修，不如说是重造。休宁县第一碓匠师傅，吾田村的碓匠愚，带着包括女婿长松在内的4个徒弟，足足干了半年才完成这项宏大的工程，这还不包括划坝和水碓港的清理、车毂港的局部加固等。

而大修期间我就基本没有好好上学，完全像个小童工，跟着工匠们后面转。说是帮忙，其实就是围观和玩耍。

大修完毕，月潭水碓焕然一新，硕大的车毂、木制轴承在运转时发出吱吱声，貌似在告诉别人：新，且结实！

花这么多笔墨回忆月潭水碓的大修再造，是因为我想表述：中国传统水利机械从形式到内容的美。

对于中华传统水利机械，我有发言权的另一个原因，是我研究艺术哲学多年，每年都要招收艺术哲学的博士生。期间也涉及了艺术创作的本身，探索美的来源。

因为对中华传统水利机械，特别是水碓十分熟悉，再加上对艺术哲学领域有着较系统的研究，所以，我很高兴能为周丰所著的《中华传统水利机械之美》写上一篇序言。

说起传统机械，其显著特点就是每一个环节、每一个部件都无法遮（掩）盖，完全暴露在眼前。无论是坐落在世界各地工业展览馆的各类庞大的蒸汽机，还是庞大又精致的布拉格水动力天文钟（也属于水利机械），所有的部件及动力传导细节尽收眼底，原理直观得一目了然。爱好机械的人因为这些机械部件的裸露、细节尽显，而看得入迷——既能看到笨拙，也能看到灵气，更多的是巧夺天工所留下的智慧。

与国外那些 100 年前就停止使用的各类水利机械不同，中华传统的水利机械，40 年前还运行在我们的劳动与生活里。

细读《中华传统水利机械之美》，我们就能看到这些在 40 年前陆续“退役”的水利机械的样式，还能看到运行的原理。

记得有位哲学家说过：劳动是美丽的。我始终认同这个审美观点。《中华传统水利机械之美》告诉我们，劳动的美丽不仅是一个傣族姑娘打糍粑的美，也不仅是一个黑人农妇在夕阳下采摘菠萝剪影的美，还有一类充满设计的智慧、灵巧飘逸之美。中华水利机械的美就是这种美的类型。

今天，每当我们回忆、想象这些曾经坐落、安置在那些乡村里的传统水利机械，是一种暖心的回忆——中华传统水利机械从制作到运行，是那时乡村里不可或缺的组成部分，更是一道风景，是心中无法抹去的一段回忆，也是中华民族历史上劳动创造美丽的华彩乐章。

我们阅读《中华传统水利机械之美》时，书中的每一幅图画、每一段描述、每一节剖析，就像一幕幕歌剧的宣叙调和咏叹调，用美丽的形式展现在你的眼前，你的心底也会被共鸣出一曲中国乡村往日动听的歌谣。

中华传统水利机械的设计、制作与运行，承载着我们的祖辈对自然的感应共鸣以及理解的透彻深邃，讲述了人与自然相处的合为一体、声息相通。

《中华传统水利机械之美》是中国手艺人的智慧与自然的对话，是美丽的乡村歌吟，是难以再现的精湛与灵动……更是始于看得见摸得着，却又仿佛无影无踪的如梦般的乡愁。

毫不夸张地说，《承载乡愁的设计——中华传统水利机械之美》一书，作为从形式到内容美的一种典型，真正达到了“形式是内容的张扬，内容是形式的主题”的完美境界。

聂圣哲

同济大学教授、博士生导师，“工匠精神”的首提者

2018 年 2 月 28 日于姑苏城外改华堂

前言

21 世纪的今天，当工业文明取得长足进步的同时，自然环境正遭受前所未有的破坏，人类社会需要实现可持续发展。然而，由于大规模的过度开发所带来的物种灭绝、PM_{2.5} 及温室气体排放、污染横行、水资源枯竭等问题频频出现，世世代代赖以生存的田园牧歌般的乡村风景正从我们的视野里迅速消失，取而代之的是高大的钢筋混凝土建筑矗立于今天的地平，人类社会面临着自然、环境、生态美的危机。越来越多的人厌倦了都市的浮华与喧嚣，向往牧歌田园、篱笆葱葱、炊烟袅袅、聆听翻转的水车和水碓房的和谐宁静，寻求着乡愁的“原风景”。

中华民族有着上下四千年（易中天认为从二里头文化算起 3700 年）的悠久历史和文化，古人很早就懂得运用水利机械解决灌溉、饮水、生产、搬运、计时等问题。在长期的生产生活中，中华民族的先民凭借着对地域的水文、水资源的了解，积累了丰富的本土水利知识和水利经验，形成了独特的地域知识技能。在传统农耕文明发展进程中，由先民所发明的传统水利机械，曾养育过众多人口，是体现中华先民创造力的最精彩内容与最突出亮点。

中华传统水利机械所蕴含的经验知识与智慧，是先民几千年来屡遭灾难而生存下来的依据。然而，伴随着现代工业化的发展，人们千百年中在固定地域、社会、生态环境下形成的传统知识和技能正迅速丧失，许多技能及详细的运用方法，则要到博物馆或古文献中才能见到和查阅。倘若任这些优秀遗产消失，将是人类和历史的遗憾。

今天，世界的发展越发依赖于现代科技文明所带来的便利，例如，以电力、石油为能源的现代农田水利机械对于“化石能源”有绝对的依赖；横行于食品领域的转基因，暴露了今天人们为摆脱困境所采取的单一的、解决问题的途径和方法。然而，任何单一的解决问题的途径和方法，都会在未来的某个时间点有着不可预知的风险，多元化的解决策略才是人类应对未来所应有的态度和素养。因此，包括对中华水利机械在内的传统知识与技能的挖掘、保护、保存和再创造，对于人类的未来有更为深远的含义。

过去，科技史对中华传统水利机械的研究多局限于各式静止的农具，其目的是对古机械的使用原理作记录与保存，并没有从传统水利机械与生态环境互动的视角展开考察。本书借此机会不仅从机械原理的角度完善对中华传统水利机械的理解，同时更希望侧重于挖掘传统水利机械的“形制/设计及生态美”。长期以来，中国设计史崇尚华丽的设计，所讨论的对象是以古代王侯将相墓葬的考古挖掘的陪葬品或精美的宫廷器具为主的，忽视了素朴的民具——中华传统水利机械与农村田园风景融合的儒释道的生态设计美学。本书以中华传统水利机械为专题切入，思考未来的创新、环境、生态、匠心等一系列问题。

今天，反思我们祖先曾经掌握的技术，中华民族却是一个“早熟的民族”（马克思语），中华民族在实用理性上的早熟体现了其思维方式具有鲜明的实用理性的特点。曾在农耕文明时代一路领先的中华民族，虽然有四大发明率先创造出来，但“四大发明”全都是实用技术，中华先民的发明创造都是经验科学的范畴，没有发展成为现代科技的系统科学。传统水利机械所运用的杠杆定律、浮力定律、合力原理等，至今没有一笔与我们的祖先相关，这一点，后人需要做哲学意义上的反思。

因此，本书希望通过严肃、客观的探讨，从中华传统水利机械的经验知识中汲取一些经得起现代科学实证的、有用的东西，并从过去中华民族的造物轨迹探索对于我国今后走科技创新的道路有借鉴意义的价值。

从 21 世纪工学设计 (engineering design) 的发展来看, “可持续设计” “服务设计” 已经成为工学设计重要的发展方向。为此, 本书以中华传统水利机械为抓手, 倡导可持续发展的环境教育 (education for sustainable development, ESD), 以传统水车制作为题材对学生展开环境教育的实践活动。同时, 以皖南山区的源芳乡、涧泉村为基地, 提出水车之乡——地方创生的生态设计构想, 这些探索是工学设计与现实的生态、乡村等问题的融合, 有一定的实践意义。

本书基于技术史、机械学、设计美学、知识科学、社会学和技术考古等知识, 对中国几千年来出现过的主要类型的传统水利机械进行系统、全方位研究和梳理, 并结合现代信息技术对某些传统水利机械进行保存和 3D 展示, 进而展现中华传统水利机械蕴涵的朴素智慧和工匠精神。历史发展到今天, 对传统水利机械进行研究, 启迪我们要充分利用大自然等环保能源, 进而改进、创新设计, 同时这也是一门今天亟须开拓并不断完善的学问。本书只是这方面研究的一个启动与开始。

本书绪章介绍了 “乡愁” “原风景” “民具” “民艺” “知识科学” 等概念与传统水利机械的关系。本书的目的是挖掘和利用先人智慧与经验知识, 并尝试做改良或创新的探索。这种探索并非是简单的怀旧或复古情怀, 也并非认为古老的东西皆有价值, 本书的观点是, 在传统文化、知识或技能中, 只有那些具有能够向未来所延展的某种特质的传统, 才配得上真正 “传统” 的名号。

第 1 章介绍 “水利” 及传统机械的分类、历史。

第 2~9 章, 就中华史上曾经出现的水利机械, 如桔槔、水车、翻车等 20 多种传统水利机械, 并按杠杆原理、曲柄连杆和链传动等机械进行分类, 做了逐一介绍, 同时分析各个机构的机械运动原理、历史渊源、形制及生态美。

第 10 章, 留住乡愁——中华传统水利机械的复原与展示, 介绍了传统水利机械 (龙骨水车、水碓、筒车等) 的交互装置设计与制作; 水运仪象台的 3D 复原与宋式设计美学的展示; 以乡村风景为原型的虚拟仿真及 APP 制作; 水车之乡——地方创生的生态设计构想。

最后，本书从民艺、民具、生态的视角对“中华传统水利机械之美”作了归纳与总结；通过对中华传统水利机械的研究认识到回归经验知识重要的同时，需要仰望星空、知行合一的精神；今天的地方创生可以通过改良中华传统水利机械，为地域的饮食文化继续发挥作用，唤起人们内心潜藏的乡愁的情感。

本书从“乡愁”的视角对中华传统水利机械之美进行探索，为进一步把握中华传统文化的根本，促进水资源合理利用、和谐的开发、建设美丽的中国乡村，具有一定的启示。今天，对于传统知识与技能的挖掘与保护，同样需要像梁思成、林徽因等一批建筑学家构建起东方建筑学大厦的那种执着、求真务实的精神。传统水利机械反映出中华先民能充分利用木材的特性，进行非常巧妙设计的智慧，是令人感叹的，这些学问不能等到他国学者展开研究之后我们再扼腕叹息。

本书作为江苏省教育厅高校哲学社会科学研究项目“生态文明建设背景下的中华传统水利机械之美的研究”（项目编号：2016SJD760001）的成果，得到中央高校基本科研业务费专项资金项目“构建和发展以知识科学为基础的感性工程学设计理论体系的研究”（项目编号：2012B05614）等的资助。

Preface

The twenty-first century is witnessing the unprecedented destruction of the nature whereas the industry has been making great progress. We human beings need sustainable development. Many problems have kept emerging and threatening, such as extinction of species, PM_{2.5}, greenhouse effect, pollution, water depletion, etc. Pastoral idyllic landscape is disappearing in our horizon at a great speed, instead, the skyscrapers of concrete construction are standing before our eyes. We human beings are facing a crisis of losing ecological scenery. Today's human beings are tired of the bustle life of urban flash and noise and are hunger for the harmonious and quiet life of pastoral idyll, green fences, curling smoke, for the flip waterwheel sound and the leisure around the water pestle hut, seeking the original atmosphere of nostalgia.

The Chinese nation has a long cultural history of more than 4000 years (according to Yi Zhongtian). The ancient Chinese could make use of water machinery to solve the problems of irrigation, drinking water, production, transportation, handling, timing and other issues. In the long productive activities, the Chinese nation accumulated abundant knowledge and experiences related to the use of water and formed rich knowledge of geographical information and skills based on their knowing local meteorology and water resources. In the developing process of traditional agricultural civilization, the traditional water machinery invented by the

ancestors raised thousands upon thousands of people, reflecting the most exciting contents and most prominent features of Chinese ancestors.

The experiences, knowledge and wisdom contained in traditional Chinese water machinery in our ancestors water conservancy is the evidence of our nation's survival after thousands of years' sufferings and disasters. However, with the modern industrial development, people's traditional knowledge and skills forged in certain areas, societies, ecology are disappearing rapidly, and many of them, for example, the detailed applicable methods, have to be found in the museums and ancient literature works. If we let it go as that, we will be guilty to human and history.

In today's world, the development is depending more and more on the convenience brought about by modern science and technology, such as modern farmland water conservancy machinery using electricity, petroleum depending wholly on fossil energy; omnipresent genetically modified food. This reveals that people have to adopt the only solution and method to solve the problems in order to get rid of the dilemma. Any single solution and method to solve the problems will surely lead to the unpredictable risk in the future. Diversified solutions are the options people have to make for the problems and the attitude people have to adopt. Therefore, to explore, to protect, to preserve and to recreate the traditional knowledge and skills including Chinese water machinery will give human beings diversified solutions and methods with far-reaching effects.

In the past, the research of technological history of traditional water machinery focused on all kinds of stationary agricultural tools, aiming at the recording and conservation of ancient mechanical system, without exploring the interaction between traditional water machinery and environment. The book hopes to perfect the understanding of traditional water machinery from the mechanical system's

perspective, and gives a preference to probe the development, design as well as ecology contents of traditional water machinery. For a long time, the Chinese design history advocated gorgeous design, paid attention to the funeral goods discovered from archeological excavation of ancient nobles and the subjects and beautiful court equipment. It ignored the simple civilian tools—traditional Chinese water machinery, and ecological design aesthetics of Confucianism, Buddhism and Taoism fusing with rural countryside landscape. This book starts with traditional water machinery and provokes a series of thinking in innovation, environment, ingenuity, etc.

Today, we are reflecting on the technical skills our ancestors had mastered and found that the Chinese nation is a “premature nation” according to Marx’s saying. The Chinese nation’s premature in practical reasoning and thinking embodied that its way of thinking showed typical characteristics in practical reasoning and thinking. The Chinese nation, used to take the lead in agricultural civilization and had the four great inventions, but they belong to practical techniques, and the inventions of the Chinese ancestors were limited to the area of empirical science, without developing to the systematic science of modern science and technology. Leverage law, buoyancy law, synergistic principle, etc., have nothing to do with our ancestors. We descendants have to rethink of the phenomenon from the philosophical perspective.

Therefore, the book hopes to get something referential for our future scientific and technological development from our past knowledge and experiences through serious and objective exploration, especially from human technical history, such as the knowledge and experiences of Chinese traditional water machinery, and they will be useful and withstand modern scientific evidence.

The “sustainable design” and “service design” have been the important direction of development for engineering design in the 21st century’s engineering design. So the book, starting with traditional water machinery, advocates education for sustainable development and launches referential educational topics practices for students by traditional waterwheel making. At the same time, an ecological design concept of combining waterwheel hometown with placemaking is put forward, Yuanfang Township and Jianquan Village in Southern mountainous Anhui as the experimental bases. The experiments are of advanced and original benefits, and have certain practical meaning in the future engineering design.

Based on technical history, mechanics, design aesthetics, knowledge science, sociology as well as technical archeology, the book conducts systematic and comprehensive research and combing of typical traditional water machinery in the thousands of years appeared in China, and shows the simple wisdom and craftsman spirit contained by traditional Chinese water machinery. History has developed to today, the research in traditional water machinery might inspire us to make full use of green energy, such as water conservancy offered by the great nature and thus improve and create designs. This is a subject needed to open up urgently and improve continuously. This book is only a start and probe in this respect.

The Introduction of the book gives an introduction to the concept of “nostalgia” “the original landscape” “civilian tools” “folk art” “knowledge science”, and their relationship with traditional water machinery. The book aims at probing and utilizing our ancestors’ wisdom and knowledge experiences and tries to make some explorations of reform and creativity. The main idea of the book is: the very tradition in traditional culture, knowledge and technique, which could be spread and extended to the future, can be worthy of the title of “tradition”.

The first chapter introduces water power and the classification and history of traditional water machinery.

From Chapter 2 to Chapter 9, on the water machinery appeared in the history of China, for example, well-sweep, water wheel, dump truck and other 20-odd traditional water machinery, the book makes a classification of them according to principle of leverage, principle of crank connection rod, as well as principle of chain transmission and other principles, and makes a one-by-one introduction. The book explains the principle of mechanical movement, historical origins, forms as well as ecological beauty of the mechanism.

Chapter 10, dwells on retaining nostalgia—restoration and display of traditional Chinese water machinery. This chapter presents the design and making of the interaction device of traditional water machinery(keel waterwheel, otter, cart, etc); the display of 3D restoration of waterborne horoscope and the design aesthetics of Song-dynasty style; virtual reality and APP making with the prototype of rural landscape; homeland of waterwheel—ecological design concept with local creation.

Finally, this book summarizes the aesthetics of traditional Chinese water machinery from the perspective of folk arts, folk implements and ecology. Through the study of traditional Chinese water machinery, the importance of returning experience and knowledge is emphasized, and we need the spirit of the looking up at the starry sky and the unity of knowing and doing. Today's local creation can continue to play a role in the regional diet culture by improving the traditional Chinese water machinery and arousing the feelings of homesickness that are hidden in the hearts of people.

This book explores the aesthetics of traditional Chinese water machinery from the perspective of “nostalgia”, which has some inspiration to further grasp the

root of Chinese traditional culture, promote the rational use of water resources, develop harmonious and build a beautiful country in China. Today, for the excavation and protection of traditional knowledge and skills, it is also necessary for the spirit of persistent and pragmatic like Liang Sicheng and Lin Huiyin and the other scholars to construct the oriental architecture. It is amazing that the traditional water machinery reflects the wisdom of the very ingenious design of the Chinese ancestors to make full use of the characteristics of wood, so we can not wait and regret after the research of scholars from other contries.

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