Professors' Collections— Future of the National Cheng Kung University Museum 教授的收藏 – 成功大學博物館永續發展的關鍵

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# Abstract

The National Cheng Kung University (NCKU) Museum was inaugurated in 2007, and it comprises the Main Museum, the Campus Environment Museum, and various Departmental Museums. In general, a (main) museum with the cultural property of the university usually turns out to be a unique museum to educate the local communities, such as present NCKU Main Museum. Academic departments and associate professors normally collect and preserve items for teaching and research purposes. However, such collections would most likely be destined to be neglected and eventually sold off in time once the professors retire. These collections can be sustainable and even reach a reputation of national level if a departmental museum, historical gallery or display room is established by the administration and with the active support of passionate professors. Furthermore, the key to a successful university museum is the enthusiasm of the professors, who often than not collects items as a long term hobby and social responsibility rather than just for the purposes of teaching and research. Under their guidance, the museums in the university would often house reputable international attractions. The collections of antique mechanism models in mechanical engineering department and ancient Chinese padlocks acquired by the author are presented as examples for author's viewpoint on the roles of professors' collections to the sustainable development of the NCKU Museum.

## 摘要

國立成功大學博物館成立於2007年,由博物館總館、校園環境博物館、及系 所專業博物館群構成,本文旨在說明教授對於物件的收藏研究及熱忱奉獻,是成功 大學博物館成功營運與永續發展的關鍵。一座擁有校史文化資產的大學博物館(總 館),通常會成爲具特色、服務社區的在地性博物館,如目前的成大博物館總館(包 括校園環境博物館)。專業系所及其教授因教學研究之需所蒐集的物件,有助於相關 課程與主題的教學與研究;然而,這些物件往往在教授退休及行政人員異動後,逐 漸被淡忘、甚至報廢。唯有具熱忱教授的主動投入及行政單位的配合之下,成立系 所博物館、系史室或展示室,該主題的展示與推廣才能永續、並且在該領域出類拔 萃,例如本校機械系系史室的古董機構模型。大學教授若能跳脫教學與研究的桎梏, 將物件的收藏與研究視爲個人的嗜好與社會責任,如作者所收藏的古中國掛鎖,則 可使該系所博物館、甚至該校博物館(總館)發展成爲具世界知名度的大學博物館。

# Introduction

The first modern museum, the Ashmolean, was created in 1683 at the University of Oxford, and included a school of natural history with lecture and demonstration rooms, a chemistry laboratory, a library and an exhibition room. Since then, thousands of universities all over the world have created museums as an essential tool for teaching, and research, and as an educational service to the community.

Founded in 1931 as the Tainan Technical College, the National Cheng Kung University (NCKU) is a research university that seeks to advance knowledge for the benefit of society and to provide students with an active and comprehensive education to face and deal with real world problems. NCKU is one of the oldest universities in Taiwan, and is currently one of the nation's leading research and education institutions. The National Cheng Kung University Museum, inaugurated on the 11th of November 2007, is the first national university-affiliated museum incorporated into a university's organization in Taiwan. It is an educational, scientific, cultural and research element of NCKU and is under the auspices of the president of the university.

In general, there are three types of professors' collections in universities. The most common one is the collection of items related to teaching and research in the associated departments. The second one is the collection of historical artifacts related to the history of the university and departments. The third type is the hobby collections of academics staff of the university, mainly, professors. This work introduces the NCKU Museum first. It then focuses on the role of professors as the key to the success of departmental and university museums. The collection of antique mechanism teaching models in the mechanical engineering department and ancient Chinese padlocks looked after by the author are described to illustrate author's viewpoint regarding professors' collections and research to the sustainable development of the NCKU Museum.

### About NCKU Museum [01]

The NCKU Museum is a multi-faceted institution that includes the Main Museum, the Campus Environment Museum, and various Departmental Museums situated within colleges and departments on campus, rendering the entire university a large museum, Figure 1. The Main Museum is responsible for housing, researching, exhibiting and promoting the university's cultural property including the Campus Environment Museum. In addition, the Main Museum also assists museums and/or display rooms within the various colleges and departments whose roles are mainly to preserve and display items relating to the teaching and research of their subjects of interest.



(c) Departmental museums Figure 1 The NCKU Museum

The missions of the NCKU Museum include: collecting and preserving significant historical artifacts, researching and publishing the university's history and cultural property, displaying and extending achievements of faculty and students' academic pursuits, and fostering a multidisciplinary social education within the university and the local community. Overall, the museum wishes to promote the university's abiding tradition, to raise the university's cultural capacity, and to assist in the university's long term development.

The collections of the museums on campus are primarily relating to the history of the university and individual departments with secondary collections relating to teaching and research programs. Some of these were acquired from donations outside the university. The collected items at the Main Museum are opened to scholars, students, and interested members of the public for educational and research purposes.

Research programs supported by the NCKU Museum focus on the history of the university and are based on collected related cultural artifacts from which publications, exhibitions and educational promotions are built on. On going projects include: Achievements of 1931~1945 Alumni to Taiwan's Industry and Economy, The Beauty of the Provincial College of Engineering (1946~1957), and the Legend of Professor Wong Tsoo (Boeing's first chief engineer and a retired professor of NCKU). There are two books published by the NCKU Museums: More Than Meets the Eyes – the Beauty and Sadness of NCKU (by C.W. Wang, 2007) and Antique Mechanism Models in Taiwan (by H.S. Yan, H.H. Huang, and C.H. Kuo, 2008).

Standing and special exhibitions at the Main Museum include: University Historical Artifacts, The Beauty of the Taiwanese Folk Life – Master artifact pieces donated by BoYi Villa, A Glance of Professor Su Xuelin's Study, Moving Generations: Antique

mechanism models, the 20th Anniversary of the NCKU Hospital, the Purdue-Formosa (NCKU) Project in the U.S. Aid Period (1951~1965), and Eco-NCKU – A city green island.

The Campus Environment Museum houses natural grounds relating to campus ecology, historical sites and buildings, and commemorative artifacts. Campus ecology includes Banyan Garden, Cheng Kung Lake, Sciences and Engineering Boulevard, Yoyo Pond, Mongmong Pond, Cheng Kung Yellow Cleome, etc. Historical sites and buildings include the Small East Gate Remains and the Small West Gate (1777), Lishien Building, Dachen Hall and Department of History (1911), Weishu Hospital (1916, the highest ranking military hospital during the Japanese governance period), Department of Physics (1930), Double Courtyard of the Faculty of Engineering (1932, old departments of mechanical engineering, electrical engineering and applied chemistry), the NCKU Main Museum (1933), Gerchih Hall (1934), Old University Library (1957), etc. Commemorative artifacts on campus include the BK24 Locomotive Steam Engine (1905), the Old School Bell (1952), the Archway (1956), Former Residence of Su Xuelin, etc.

There are various departmental museums and special exhibitions on campus, such as: Briefing Room of the University History, the NCKU Gallery, College of Liberal Arts' Museum of History, Historic Chamber of the College of Management, Historic Chamber of the College of Medicine, the Geology Museum of the Department of Earth Sciences, Historical Gallery of the Department of Mechanical Engineering, Department of Electrical Engineering Museum of History, Chimei Liquid Crystal Science Museum, Special Exhibition of Ancient Chinese Locks, etc.

In the following sections, the collections of antique mechanism teaching models and ancient Chinese padlocks, and related research programs, publications and exhibitions at NCKU are described.

## Antique Mechanism Models – A departmental collection [02-05]

A mechanism, the fundamental unit of a machine, is an assembly of mechanical members connected by joints with the function of transmitting constrained motions, typically to fulfill a required task. A mechanism model is a physical model and a kind of educational apparatus for the convenience and manipulability of studying the theory of machines and mechanisms. Figure 2 shows the sectional model of the transmission system of an antique automobile.



Figure 2 The model of an automotive transmission system

Since the study of kinematics of mechanisms began in the middle of the 19th century, physical models of mechanisms had been developed by scholars for the purposes of teaching and research. Franz Reuleaux (1829~1905) has been regarded as the founder of the modern kinematics of mechanisms and one of the forerunners of modern design theory of machines. He embarked on a method to codify, analyze, and synthesize the kinematics of mechanisms so that engineers could approach machine design in a rational way. In the process, he designed 800 mechanism models. In 1876, Reuleaux authorized a workshop, Gustav Voigt Mechanische Werkstatt, in Berlin to manufacture more than three hundreds of these models and successfully sold the models to technical schools all over the world. By 1907, Voigt published a catalog to list their Reuleaux's models, some of which are shown in Figure 3(a). Unfortunately, most of these models were destroyed during World War II. The few that survived, along with reproductions, can now be found in various places, namely, Deutsche Museum in Munich, University of Hannover, Swiss Federal Institute of Technology, University of Porto, Bauman Moscow State Technical University, Cornell University, Purdue University, etc.



Figure 3 Reuleaux's and Shimadzu's mechanism models

Shortly after Reuleaux's effort on mechanism models, the development of mechanism models in East Asia was also initiated. Founded by Genzo Shimadzu (1839~1894) in 1875 in Kyoto, Japan, the Shimadzu Factory started its business in manufacturing educational instruments for the study of physics and chemistry and was reorganized into Shimadzu Seisakusho Limited in 1917. In 1882, Shimadzu published its first business

catalogue with 112 products. However, only two of them were relevant to mechanisms. By 1906, Shimadzu's mechanism models gradually evolved into a more complete set. At this time, Shimadzu started to import mechanism models from Germany, France, England, Austria, Switzerland, America, etc. and listed at least 20 mechanism models in its catalogue. The Shimadzu Factory began to build mechanism models in 1913. In Shimadzu's catalogue published in 1925, a total of 45 mechanism models were included. This increased to 49 in their catalogue published in 1929. Shimadzu's first special issue catalogue for mechanism models was subsequently published in 1937, as shown in Figure 3(b), with 124 mechanism models listed. Furthermore, based on historical and geographical evidences, it can be inferred that some of Shimadzu's mechanism models were replicas of Reuleaux's models.

The history of mechanism models in Taiwan can be traced back to the origin of mechanical engineering education in Taiwan. This came in the form of Taiwan's first engineering school, Subsidiary School of Industrial Instruction under Education Department of the Ministry of Civil Affairs (now the National Taipei University of Technology, NTUT), established by Taiwan Governor Office under Japan in 1912. It provided courses in civil engineering, metalwork and electrical engineering. In 1931, the Tainan Technical College (now the National Cheng Kung University, NCKU) was established with three main departments, mechanical engineering, electrical engineering and applied chemistry. In 1943, the Department of Mechanical Engineering at Taipei Imperial University (now the National Taiwan University, NTU), which was founded in 1928, was set up. Hence, the three universities, NTUT, NCKU and NTU are the three oldest engineering schools in Taiwan and their departments of mechanical engineering are the pioneers of mechanical engineering education in Taiwan.

There are at least 119 surviving antique mechanism models in Taiwan. Classified by the birthplace of manufacture, 111 models were from Shimadzu Factory/Seisakusho Ltd. (Kyoto, Japan) and 8 models from W. M. Welch Scientific Company (Chicago, USA). Of these, 55, 52 and 12 items were preserved, respectively, at the National Cheng Kung University (NCKU), the National Taiwan University (NTU) and the National Taipei University of Technology (NTUT). Sorted by mechanism types, they can be classified into 12 types, namely, joints of mechanisms, linkage mechanisms, cam mechanisms, gear mechanisms, belt and chain drives, ratchet mechanisms, screw mechanisms, couplings, friction drives, compound mechanisms, mechanical elements, and machine system models. In November 2007, the NCKU Museum started to exhibit those 55 mechanism models preserved at NCKU, as shown in Figure 4. In addition, a book entitled "Antique Mechanism Models in Taiwan" was published by the NCKU Museum in June 2008.



Figure 4 Exhibition of the antique mechanism models at NCKU

To ascertain the production period of the original Shimadzu mechanism models in Taiwan, the product catalogues of Shimadzu and the trademarks on its models were scrutinized. It was clear that the patterns on the models held similarities to the model pictures provided in the Shimadzu's product catalogues published in 1906, 1925 and 1929. This dated the Taiwanese models as being produced by Shimadzu during the period of 1906 to 1929. However, the fact that Shimadzu did not begin manufacturing its mechanism models until 1913, it is possible that some of the models were imported from America and Europe. Furthermore, it was possible that of those which may not be imported, they may be replicas of Reuleaux's collection from examining their patterns, dimensions and materials. This not only suggested the close relationships between Taiwan and the wider world in the field of mechanism models, but also demonstrated the globalization of mechanism theories during the early 20th century.

In 1882, Dr. A. D. White, the first president of the Cornell University, acquired a collection of 266 Reuleaux's models from Europe. Up to now, 220 of these models collectively know as the Reuleaux Collection of Mechanisms and Machines, are still owned by Cornell's Sibley School of Mechanical and Aerospace Engineering, and was designated as "National Mechanical Engineering Historic Collection" by the American Society of Mechanical Engineers in November 2002. In the same year, Cornell University completed its Kinematic Models for Design Digital Library (KMODDL). This website (http://kmoddl.library.cornell.edu/) introduces Cornell's Reuleaux mechanism models to the world with text descriptions, photos, movies, animations and CAD simulations.

In January 2006, supported by the National Science Council (Taiwan, ROC), the author and Dr. H. H. Huang, together with research assistant C. H. Kuo began to investigate surviving antique mechanism models in Taiwan. In July 2007, a digital museum was developed for showcasing all available Taiwan's antique mechanism models including those from the National Cheng Kung University, the National Taiwan University and the National Taipei University of Technology. The website (http://www.acmcf.org.te/model/) provides model descriptions, model movies and CAD files for educational purpose and for interested visitors to explore the function and beauty of these artifacts, Figure 5.



Figure 5 Digital museum of Taiwan's antique mechanism teaching models

Numerous mechanical engineering departments around the world owned various physical mechanism models before CAD/CAE gained popularity in academia in the 1980s. However, due to destruction brought about by World War II, relocation of departments, natural aging of the models, the ignorance and bureaucracy of the university and department, most models were lost or destroyed, and even discarded as common aged objects. Cornell University's collection is believed to be the most complete extant collection of the Reuleaux mechanisms in the world, whilst National Cheng Kung University houses the largest collection of the Shimadz mechanisms in Taiwan and probably in the world. The drive behind the successes of these collections was enthusiastic professors in these two institutions who had taken the tasks up as a long term social responsibility rather than just for the simple purpose of teaching and for the personal interest of research. If a professor collects and preserves items solely for teaching and research purposes, such collections would most likely be destined to be neglected and eventually sold off in time once the professor retires. To ensure continuity and longevity of the collections, it should be managed and promoted by passionate and enthusiastic professors who continually collect, preserve, study, publish (book and web-site) and exhibit the collected items for the purpose of raising the standard of the departmental museum to a national level. Since one of the goals of the NCKU Museum is to encourage academic departments to establish their own historical gallery/museum, professors, supported by their staff and the university, are playing an important role for the future of the departmental museums, and collectively for the NCKU Museum.

### Ancient Chinese Padlocks – A professor's hobby collection [06-11]

In today's perspective, locks are security devices operated by keys, rotating plates, push buttons, circuits or other means to prevent objects from being opened or taken away.

Albeit with a long history, related documents and preservation of ancient Chinese locks are still quite scarce. Over the past centuries, the manufacturing technology of this art-craft was strictly confined to locksmiths with low social status. It was unsurprising that despite the existence of delicate and exquisite locks, little is known of the inventors. Ancient Chinese locks are viewed as treasures of the Chinese civil culture. They are, however, often overlooked due to their plain outlook, which also accounts for the lack of interests from antique collectors and the failure to attract research interests. Furthermore, most ancient locks were destroyed by perpetrators forcing open treasure boxes, closets or buildings, who had no sense of value or appreciation of the intricate designs of the locks. Due to such neglect, ancient Chinese locks are fast disappearing with only a few still cared for in good environment. Figure 6 shows a bronze shrimp-tail padlock on a chest from the Ming Dynasty (1368~1644).



Figure 6 A bronze shrimp-tail padlock

Ancient Chinese padlocks were mostly key-operated bronze locks with splitting springs and partially keyless letter-combination locks, used for locking doors, closets, chests, etc. A splitting spring padlock used a key for opening, and were of the broad and pattern types. Broad locks were a type of horizontal positioned locks, as shown in Figure 7(a). Pattern locks came in many different shapes such as human figures, animals, musical instruments, letters, utensils, etc., as shown in Figure 7(b). A letter-combination padlock did not require a key and was unlocked when the letters of all wheels were rotated into the right positions, as shown in Figure 7(c).



Figure 7 Types of ancient Chinese padlocks

Major features of ancient Chinese padlocks were the type, shape, engraving, material and structure of the lock. The characteristics of the splitting spring locks were the configuration of the splitting springs, the shape of the key-heads, the number of keys, the location and shape of keyholes, and the opening methods. Typical ancient Chinese padlocks were splitting spring locks opened by keys, and Figure 8 shows such a design. The lock body and the sliding bolt were mostly made of bronze or iron and several splitting springs were attached to the sliding bolt. Once the key was inserted, the splitting springs were squeezed such that the sliding bolt could be released from the lock body.



Figure 8 Mechanism of a slitting spring lock

The history of locks is closely associated with the specific time of the materials, tools and cultural background. The development and applications of locks in the past reflected the technological, cultural and economical situations of each time period in history. Wooden locks should be the most substantial type of early Chinese locks. Its history can be traced back to the society of slavery in the Stone Age. It is said that the earliest Chinese wooden locks were found at the ruins of the Yang-Shao Culture around 3000~4000 BC. However, none existed today, nor were they ever mentioned in official documents. Figure 9 shows a wooden lock made in the Ming Dynasty (1368~1644).



Figure 9 A wooden lock from the Ming Dynasty

Simple and plain bronze locks appeared in the Bronze Age. A thin, flat piece of spring can be found in the lock. The geometric relativity and the bouncing effect between the key and the spring formed the mechanism for locking and unlocking. The design of locks became progressively complicated in the Spring and Autumn Period (770~481 BC); some locks were designed with hidden mechanisms. Lu Ban (507~444 BC) in the Zou Dynasty, a master carpenter and inventor, was widely credited for promoting Chinese locks to the general public. The application of large quantity of metal locks started in the late Eastern Han Dynasty around 200 AD, with bronze as the main material. And, some locks were designed with the patterns of animals and insects, such as tigers, panthers, kirins, turtles and butterflies. The technological skill of locksmiths were considerably advanced in the Tang Dynasty (618~907) when the usage of metal splitting spring locks, mostly made of bronze and partially of brass, iron, silver or gold, was increasingly popular. The types, shapes and engravings of locks were also diversifying. During this period, some locks and keys were not only breathtakingly beautiful and colorful, but also came in various shapes. In addition, locks were also symbols of wealth and power, with pretty pictures engraved on the locks of the nobles and riches; some of them even bore totems. After the late Eastern Han Dynasty around 200 AD, metal splitting spring padlocks became the most widely used locks by the Chinese people. Although the shapes of ancient Chinese locks continued to diversify, the inner structures had not changed much for the past two thousand years. Since the introduction of the western pin-tumbler cylinder locks in the 1940s, Chinese locks had gradually faded.

The earliest western lock was the Egyptian wooden lock invented around 6000 BC. An example is shown in Figure 10(a). And, Figure 10(b) shows the concept of the mechanism of modern pin-tumbler cylinder locks. It is worth noting that the basic mechanical theory of the ancient Egyptian wooden locks, the above mentioned ancient Chinese wooden lock in the Ming Dynasty, and the modern pin-tumbler cylinder locks are the same.



(a) Ancient Egyptian lock



(b) Modern pin-tumbler cylinder lock Figure 10 Ancient and modern western locks

The author has been collecting and studying ancient Chinese padlocks since 1986 and to date has collected more than 800 pieces of locks. In 1997, he developed the first web-site museum of Chinese padlocks (http://www.acmcf.org.tw/lock/) in the world. He

wrote the first ever book on Chinese padlocks titled 'The Beauty of Ancient Chinese Locks' published in 1999 in Chinese and 2003 in both Chinese and English. In 2004, he published the first ever academic paper on Chinese locks titled 'Design considerations of ancient Chinese padlocks with spring mechanisms' in the international journal of Mechanism and Machine Theory. Since 2003, part of the author's collections has been exhibited in the main library of the National Cheng Kung University, as shown in Figure 11. This exhibition, built upon solid academic research background and extensive publications, has attracted increasing number of domestic and international visitors year on year.



Figure 11 Exhibition of ancient Chinese padlocks at NCKU

With such a solid example of collections and research by an individual professor, the NCKU Museum has embarked on a project to encourage professors on campus to present and/or display their personal collections in a campus-wide exhibition. The NCKU Museum will further encourage and support these professors to collect and study their collections as a long term hobby and social responsibility, with the view of surpassing the present collection of ancient Chinese padlocks in the long run. And, this would be the key to the success and sustainable development of the NCKU Museum in the future.

### Conclusions

After nine years of preparation, the National Cheng Kung University Museum was finally inaugurated in 2007. Since then, the NCKU Museum has been encouraging faculties to collect, study, preserve and exhibit cultural heritage items and at then same time, nurturing students to become expert volunteers in running the museums. The NCKU Museum is an educational resource for faculties and students on campus as well as the general public. It also engages collaboration with other museums from within Taiwan and abroad for exhibitions, research programs and promotional campaigns.

University museums have to meet certain professional standards for them to be classed as a museum. These requirements include what they should collect, what they should know about the collected items, and the way they curate and display their objects. The true value of the collections lay in the appreciation, study and discoveries of the objects. Without solid research, exhibits would become meaningless and collections mere repositories of rare objects.

The NCKU Museum is research oriented. With the ongoing collection and research projects on the historical artifacts of the university, the NCKU Main Museum, including the Campus Environmental Museum, will undoubtedly become a reputable and unique museum in the near future. At present, it attracts alumni, visiting scholars of the university, and general public from local communities.

Departmental museums are traditionally established through individual collections of artifacts and specimens by faculty members for use in the classroom and/or research. These collections were later expanded to include history of the subjects' area. With solid collection based research programs together with teaching and research by passionate professors, departmental museums would flourish as they did with the NCKU Main Museum. The collections of antique mechanism teaching models housed in the Mechanical Historical Gallery and ancient Chinese padlocks by the author are two successful examples. And, this underlines the importance of the roles of professors' collections and research to the sustainable development of the NCKU Museum.

The birth of the National Cheng Kung University Museum is the landmark of national university museums in Taiwan. It is the author's hope that this would attract increasing interest from universities in Taiwan toward the collection, preservation, exhibition, research and publication of historical relics, and even toward the establishment of various university and departmental museums.

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Professor Hong-Sen Yan (顏鴻森) received his PhD from Purdue University (W. Lafayette, Indiana) in 1980. He previously served as an associate professor at National Cheng Kung University (Tainan), a Sr. Research Engineer at General Motor Research Laboratories (Michigan), an Associate Professor at State University of New York at Stony Book (New York), the Director-general of National Science and Technology Museum (Kaohsiung), and the President of DaYeh University (Changhua). Currently, he is an NCKU Chair Professor in the Department of Mechanical Engineering and the Director of the NCKU Museum. Dr. Yan's areas of interests are creative mechanism and machine design and reconstruction designs of lost ancient machinery. He had published more than 300 academic papers and authored 8 books. Dr. Yan received the National Chair Award by the Ministry of Education (Taiwan, ROC) in 2007 and he collects ancient Chinese padlocks as a hobby.