PARTICIPATION, NOT CONSERVATION

A computing approach to traditional craft

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Abstract. This paper introduces a research context characterised by a rich traditional heritage and by rapid urbanisation, and it argues for a discursive and participative, rather than a conservation-oriented approach to heritage conservation in this context. Harnessing the digital mastery found at architecture and design schools, the presented approach aims at the production of self-referential stories that hopefully engage students as well as others in appreciation of these traditions’ intangible qualities. A case study based on this approach undertaken in the context of silk weaving is discussed, and some results are shown.

Keywords. Heritage; digital craft; storytelling; design; Jacquard loom.

1. Introduction

The work presented in this paper is situated in the Chinese city of Suzhou, an urban context that is characterised by rich traditional heritage as well as high-speed urbanisation. While these characteristics coincide elsewhere too, they coincide in this context to such extreme degrees that in 2014 the city was recognised with the bi-annual international Lee Kuan Yew World City Prize. The citation accompanying the award commends Suzhou for its “[…] success in meeting the multiple challenges of achieving economic growth in order to create jobs and a better standard of living for its people; balancing rapid urban growth with the need to protect its cultural and built heritage and coping with a large influx of migrant workers while maintaining social stability.” (Urban Redevelopment Authority, 2014). The establishment of multiple significant development zones as well as of multiple UNESCO World
Heritage Sites in Suzhou in recent decades testify to the balancing act recognised with the award.

Notwithstanding these achievements, challenges remain. As it happens elsewhere, much of Suzhou’s urban development occurs at the expense of history and tradition. Significant portions of the city’s built heritage, including numerous traditional neighbourhoods and villages, were demolished. Farmland was lost to make space for new districts and industries, while the sustainability of the city’s development has been called into question for depending overly on exogenous growth (Carter, 2011). The heritage protection approach favoured by the city, somewhat analogously, does not maintain traditional ways of life, but establishes tourist attractions by way of conserving physical heritage sites.

As villagers and farmers adopt urban ways of life working in modern production and service industries, and as the local population mixes with a fast-growing non-local population, local traditional heritage faces marginalisation. As elsewhere, the continuance of local arts and crafts is subject to commercialisation of their products, typically in high-end middle class or low-end tourist markets. Genuine interest is waning, and young people fail to join and continue traditions of many generations.

Cultural treasures are found in this context in two domains: The more obvious one is the domain of tangible sites and artefacts that are readily commercialised and valued via entrance tickets and price tags: Musical instruments, gardens, paper cuts, pearl jewellery, jade discs and so on. The less obvious domain is that of intangibles that are appraised and understood through participation, and which are thus far less prone to commercialisation: Values, aesthetics, attitudes, practices, stories, and, in essence, people. Initiatives to strengthen traditional arts and crafts will inevitably raise the question of which of the two domains is primary to the other. It is argued here that valuing in these two domains is ultimately interdependent: It typically requires the tangibles of the first domain to draw devotees into the second domain, and only from the position of the second domain of intangibles can judicious price tags be put onto the tangibles of the first domain. Despite sometimes generous supplies of traditional sites and artefacts, however, lines of interest and progeny are broken today, placing the onus of attraction in the second domain.

Based on the above observations, this study adopts the view presented by Affleck and Kvan (2005, p. 170) that “[a]ny interpretation attempts to understand the significance of cultural heritage in relation to a contemporary perspective.” Based on Uzzell’s (1994) distinction between heritage re-creation and heritage reconstruction, Affleck and Kvan (ibid., p. 171) distinguish between a descriptive and a discursive approach to heritage. In the discursive
approach, explanations of historic recollections are debated in relation to and in the context of the present, rather than resurrected for presentation by costumed guides. It seeks authenticity primarily in the domain of intangibles, and only secondarily in the domain of tangibles. It is argued here that the hacker mentality and digital mastery found at architecture and design schools can lend themselves to the participatory reconstruction of intangibles as much as they have been shown to do to the virtual recreation of tangibles. In this way, design, design research and design computing capabilities present at design at architecture schools can serve ends beyond the immediate built environment.

The heritage preservation-through-participation approach presented here recognises that arts and crafts are based on generations and centuries of stories and traditions. At the same time it recognises that arts and crafts embodies particular means of pattern making and expression through which those stories can be told. This approach engages architecture and design students to pursue these storytelling opportunities, using the allure of contemporary digital craft as an entry-point into investigations of historical backgrounds and into careful ways of making. It aims at the production of self-referential stories that hopefully engage the students as well as others in appreciation of these traditions’ intangible qualities. In the first instance, arts and crafts traditions can thus tell their own stories in their own media. This approach is taken in the following case study. In the second instance, different arts and crafts traditions can tell each other’s stories, or even the stories that connect multiple traditions.

2. A case study: Silk weaving

The starting point of the case study presented here is the “discovery” of operational Jacquard looms in “Suzhou No.1 Silk Factory Co Ltd.” Previously a state-owned garment factory, the factory is now a privatised tourist attraction showcasing local silk production and selling silk products. The company operates vintage textile machinery on a factory floor that is open to the public. The machinery includes operational Jacquard looms: Punchcard-driven textile weaving machines manufactured in the Cultural Revolution era, and based on a technology that dates back to the Industrial Revolution. Still in production, these looms are an international rarity. The museum’s efforts in operating its vintage machinery being obviously commendable, there is also room for improvement. With museum staff not being fully aware of it, the historical significance of the machines is largely inaccessible to museum visitors, and while the museum shop sells silk products, it does not offer any materials through which visitors can connect with the cultural history of silk
production. Some looms have broken down, and are harvested for spare parts for the looms remaining in operation, while, for reasons explained above, engineers willing and able to operate and maintain the looms are an endangered species.

3. Research objective, research question and methods

This case study project aims to preserve some of the few remaining Jacquard looms in Suzhou by communicating the importance of Chinese silk industry and of the Jacquard loom in the development of the modern computer. Punchcard-driven silk weaving is used as a visual storytelling medium, and proposed as an educational product development strategy for the museum shop of No. 1 Silk Factory.

We are investigating the following research questions: Can the operation of the Jacquard loom and its significance in the development of the digital computer be illustrated and modelled digitally so as to generate a set of punchcards, which, if run on a Jacquard loom, produce a textile pattern that explains the functioning of the loom? Could such a textile pattern be productised so as to engage museum visitors with the historical significance of Suzhou’s silk weaving, and could the sale of products of this nature be set up to benefit the maintenance of the looms? In other words: Can the Jacquard loom be programmed to tell the story of its past in order to secure its future?

To investigate these questions we have established a small team of faculty and students from the departments of architecture, urban planning and design, and computer science to engage in a range of research methods including an on-line and print literature review; hands-on loom building and hand weaving; visits to museums, factories and research institutions, informal interviews with researchers, technicians, and other experts; sketch development and visual story telling; liaison with local industrial partners; and prototyping of a series of notebook computer sleeves. Interim findings and outcomes are presented below.

4. The interwoven histories of silk and silicone

In the second half of the 17th century, mathematician Gottfried Wilhelm von Leibniz, an admirer of Chinese culture, proposed using binary on/off states to represent data and logic as it is done in every digital computer today. Centuries ahead of its time, the binary idea was initially ignored by Leibniz’ academic peers, which caused him to abandon it temporarily. He picked it up again a decade later when his belief in the binary number system was reinforced by the Chinese Book of Changes (I-Ching), whose hexagrams com-
bine broken and unbroken lines in the way the binary number system combines zeros and ones (Aiton, 1985). In 1679 Leibniz imagined a digital computer that represented binary numbers using spherical pellets and was governed by a rudimentary form of punchcard control. This machine, too, was far ahead of its time and punchcard-driven binary computing could not be realised for several centuries. The untold story of Suzhou’s role in the invention of computing, however, starts much earlier.

According to legend, silk was discovered over 4,700 years ago by 14-year-old empress Leizu (嫘祖), when she began to unroll the silk fibre of a cocoon that fell into her tea cup. Leizu is also said to have invented the silk loom and sericulture, i.e. the rearing of silkworms for the purpose of silk production (Kuhn, 1984). During much of China’s history, silk was reserved for royalty and when trade opened across the Silk Road, it was considered a very valuable luxury good in the West. Suzhou has established itself as one of the silk production centres since the Tang and Song Dynasties. Knowledge of the origin of the silk material remained in China, which hence enjoyed a monopoly over silk production until around the year 550. At that time, two Persian monks who had lived as missionaries in China revealed the secrets of the origins of silk to the Byzantine emperor Justinian I, who ordered them to return to China and smuggle silkworms to Constantinople. They trekked back to China and returned with thousands of silkworm eggs concealed in their hollow bamboo canes. The silkworms that hatched from these eggs became the origin of the European silk industry (Essinger, 2004, p. 8).

By the time of the Industrial Revolution, European demand for patterned silk weaving far exceeded production capacities offered by conventional looms. To address this demand Joseph Marie Jacquard invented a punchcard-controlled loom in the French city of Lyons. The Jacquard loom can be “programmed” to weave any image or pattern at dramatically increased production speeds. Using a pattern of punched holes and non-punched locations, the cards instruct the loom to lift threads at different times during weaving, thereby controlling which colours come to the front of the fabric. Jacquard’s punchcards thus realised the concept of the binary “bit” for the first time.

A few decades later, 19th century English mathematician Charles Babbage designed a general-purpose mechanical computer called the Analytical Engine. It used three different kinds of punchcards to encode arithmetical operations, numerical parameters, and memory operations. Babbage aimed to build this computer. However, as the Analytical Engine was to be made of tens of thousands of pieces, and with Babbage’s high demands for machining precision, the project far exceeded his own extensive wealth. Babbage
toured continental Europe to garner support for his project, hoping that such support would convince the British government to fund it. He inspired Italian mathematician Luigi Federico Menabrea to publish a detailed article in 1843 about the Analytical Engine. The article was translated into English by Babbage’s friend Countess Ada Lovelace, daughter of poet Lord Byron. Lovelace extended the translation with her own notes, which are longer than the translated article itself. In these notes, Ada details how punchcards can be used to program the Analytical Engine to compute Bernoulli Numbers, earning her posthumous recognition as the world’s first computer programmer.

Figure 1. Suppliers of material and of digital data: Silk worms and punchcards.

The breakthrough of the punchcard in data processing, however, had to wait until “big data” had to be processed quickly. Mandated by the U.S. Constitution, the U.S. government conducts a census every ten years. With its rapidly expanding population, and increasing interest in more detailed insights, the U.S. census reached a tipping point in the 1880s. At this point census administrators found that the next census would be due before the data analysis of the preceding one was concluded. This problem was solved by Herman Hollerith in the late 1880s with his invention of a mechanical tabulating machine that could process data encoded on punched “Hollerith cards”, helping to
generate statistical reports from millions of pieces of information at high speed. Hollerith’s company, the Tabulating Machine Company, marketed his system to various governments, which, for better and for worse, used it to survey and to govern their populations. From this success the company built a global empire of information-processing machinery, and in 1924 changed its name to International Business Machines (IBM).

Connecting Chinese silk with emperor Justinian I in Constantinople, with Joseph Marie Jacquard in Lyons, with Charles Babbage and Ada Lovelace in London, and with Herman Hollerith and IBM in the United States, Suzhou’s untold story of digital inspiration has come full circle. Today, Suzhou’s silk weavers are abandoning their punchcard-controlled Jacquard looms in favour of their semiconductor-controlled successors while the city’s urban modernisation and service industries embrace digital technologies inspired by the Jacquard loom. The Chinese company Lenovo has taken over IBM’s “Thinkpad” business, and Suzhou students perform their university examinations on MCQ cards, a derivative of the Hollerith card. Suzhou, however, is not yet alert to the interwoven histories of silk and silicone. It is estimated that there are fewer than fifty Jacquard looms still being used for production worldwide today. A large proportion of these are running in Suzhou, where they cater to small niche markets or perform their clunky ballet for visitors of Suzhou No.1 Silk Factory Co Ltd. The factory’s Jacquard looms are rented from a Hangzhou-based company that recently abandoned its silk production to do other business. The supply of spare parts and the continued maintenance, and hence the future of these significant pieces of digital history and local heritage, are uncertain. Visitors to the museum shop are offered everyday silk products such as bed linen, shirts and decorative accessories made of silk. Nothing is on offer at the museum shop at this time to those who are interested in engaging intellectually with the history and culture of silk weaving and its global technological repercussions.

5. Design development

Based on an extensive sketch development, we have developed a visual story of the interwoven history of silk and silicone, shown on the left in figure 2. This visual story was translated into 1278 punch cards, woven on a loom (see right of figure 2), and integrated into a series of notebook computer sleeves (see figure 3), which we intend to propose as inspiration for products to be offered in the museum shop of No. 1 Silk Factory and in other places in Suzhou.

We hope to be able to refine the outcomes achieved in this project in the near future, and to use our findings to demonstrate to local authorities and to
the management of No. 1 Silk Factory that the intertwined histories of Suzhou’s silk weaving industry and digital technology offer a worthwhile subject matter to share with locals and with tourists alike.

Figure 2. Visual story of the interwoven history of silk and silicone (left), weaving of the visual story of the Jacquard loom, on a Jacquard loom (right).

Figure 3. A series of notebook computer sleeves.
To this end, we hope to have shown with this project that it is possible to get a Jacquard loom to tell the story of its past to educate the interested public about its technology and its historical significance, and to possibly productise the outcomes to secure the looms’ continued operation in the future.

The items we have produced in this project serve as a proof of concept, and further work is ongoing to develop repetitive weaving patterns for wider use in a product line of original items (see figure 4). Other opportunities for future work include the development of educational items and interactive installations for No. 1 Silk Factory to allow museum visitors to engage more fully with silk production technologies and their role in the development of the digital computer. Possible connections between architectural design and sericulture, similar to those recently demonstrated by Oxman et al. (2013), can also be explored.

Figure 4. Design for a repetitive textile-weaving pattern.
6. Conclusion and outlook

This paper argues for a participatory rather than conservation-oriented approach to heritage preservation. This approach engages the pattern making and storytelling opportunities offered by traditional arts and crafts to tell stories of these arts' and crafts’ long histories with a view to stimulate engagement with, and appreciation of the intangible treasures of local (and, in the case of silk weaving, global) heritage. It does not conserve arts and crafts in the state they are found in, but engages in their practices in ways that are sometimes time-tested and sometimes new, offering entry points for the appreciation of intangible traditional values, stimulating new interest, introducing young people to traditional practices, and leading to the development of new forms of expression and new ways of making.

Acknowledgements

I gratefully acknowledge the collaboration of Jessica Sewell, Sun Chenxing and Dai Xiaowei, as well as the support of Fu Jiaqi and Gu Qinting. This project was funded under XJTLU SURF project code 201403.

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