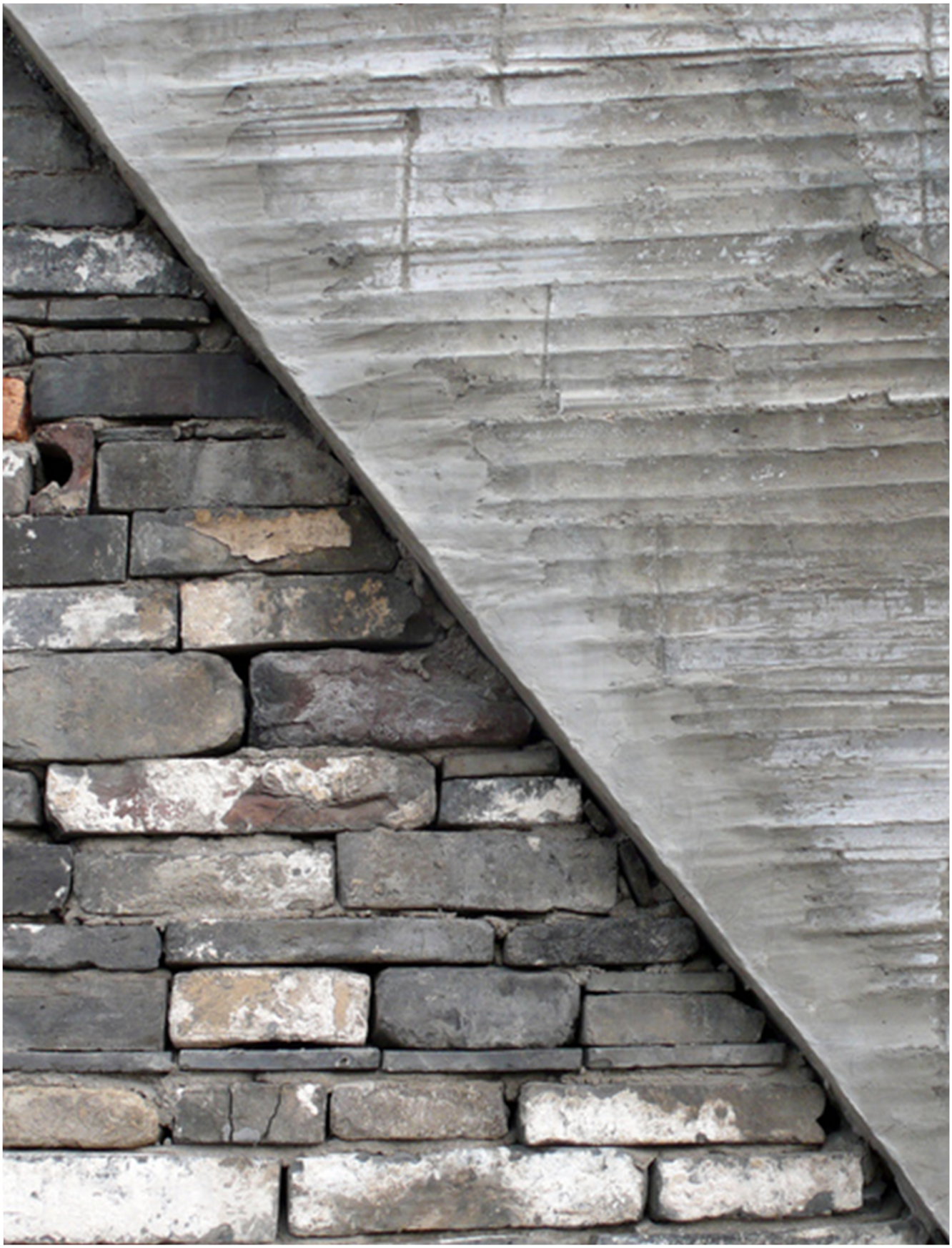
CRAFT:
A LOSS OR A METAMORPHOSIS?

MARA FRATICELLI

POLITECNICO
MILANO 1863



Essay

History and Theory of Architecture

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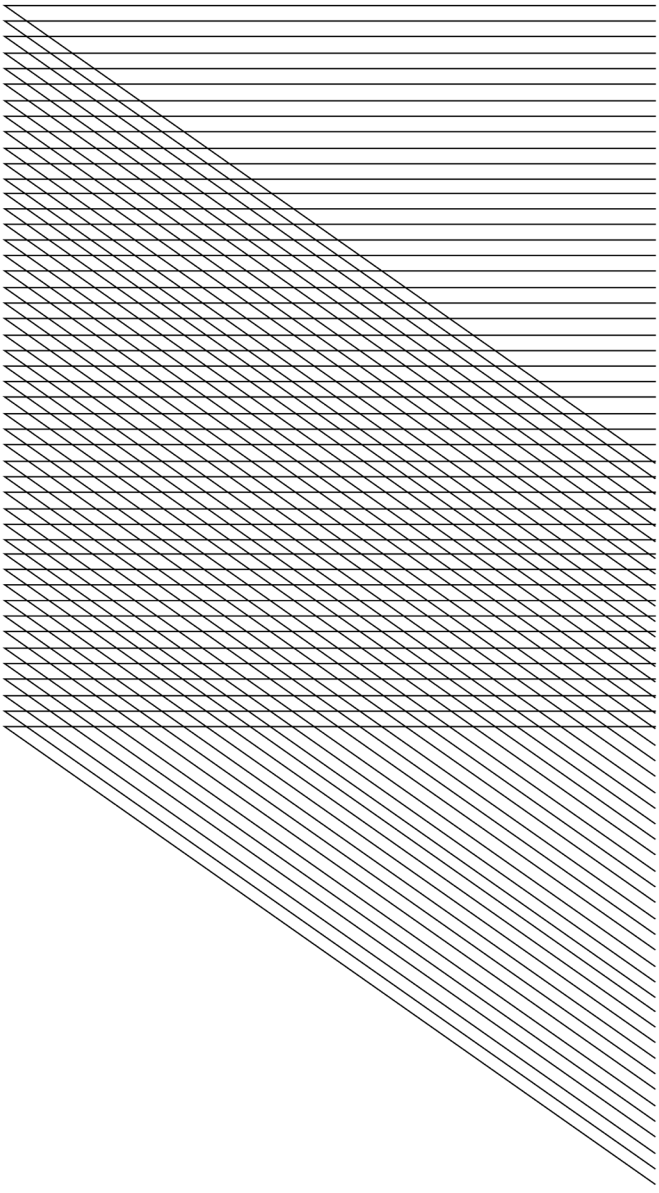
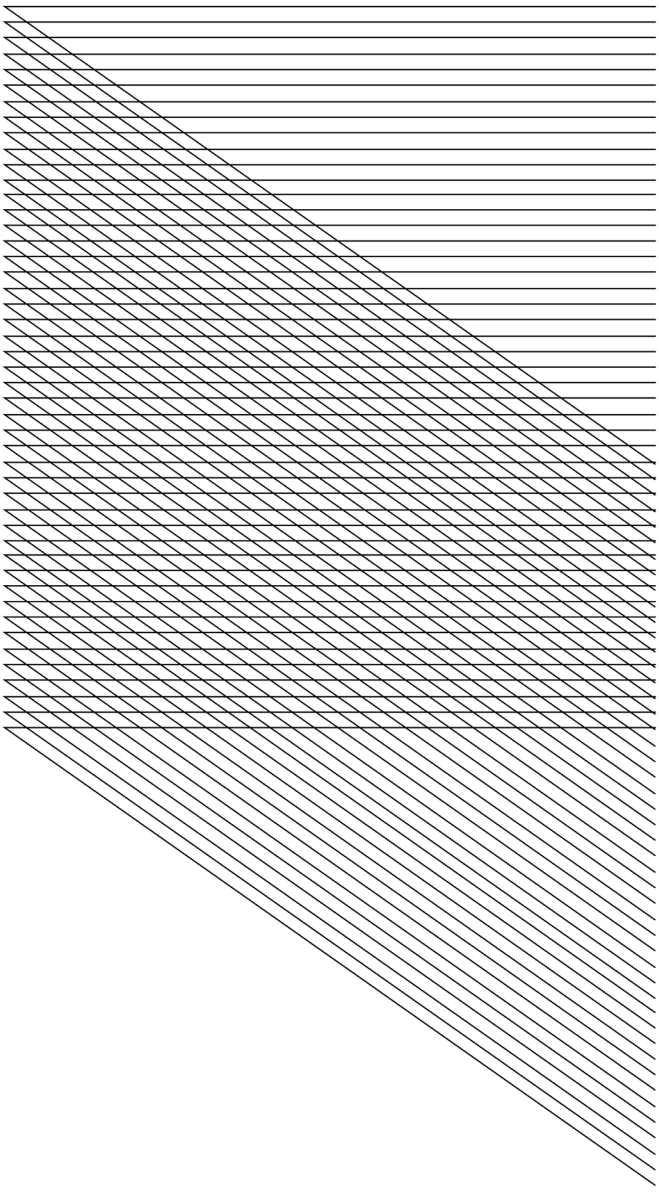


Introduction



"If I must ascribe a meaning to the word craftsmanship, it means simply any kind of technique or apparatus, in which the quality of the result is not predetermined, but depends on judgment, dexterity and care which the maker exercises as he works. The essential idea is that the quality of the result is continually at risk during the process of making; and so I shall call this kind of workmanship "The workmanship of risk": an uncouth phrase, but at least descriptive." (David Pye) [1]

The word 'craft' can not be defined using a single sentence nor a synonymous, but the most accurate explanation of its meaning is the one given by David Pye in his book *The Nature and Art of Workmanship*. The idea of craftsmanship has looped through history since before the Middle Ages and moved on into Modernism and beyond. Its meaning and pertinence, particularly with reference to architecture, has changed with the times. An investigation of the concept of craftsmanship and how its definition moves through the different architectural theories and movements will inform a contemporary interpretation. What attributes, techniques and relationships might be said to be craft-like?

In order to understand the complex nature of craft it is necessary to first ask: what is craft, literally? Origins of the word can be traced back to Old English *craeft* 'strength, skill', of Germanic origin; related to Dutch *kracht*, German *kraft* and Swedish *kraft* 'strength'. Craft is required as an art, trade, or occupation requiring special skill, in particular manual skill. The word, thus, has always been associated with the art of skill and making. Across cultures and time, the archetype of the craftsman has represented man's ability to create and has been the mark of mature manhood. He is *homo faber* — man the creator. A craftsman was seen as a knowledgeable person, a master creator with great artistry and prowess in his field. He was admired by the society and became a prominent figure in the community across various cultures and periods in history. A broad definition of the word includes composers, poets, writers, sculptors, potters, glass-makers, lace-makers, carpenters, plasterers, weavers, stone masons and other trades that require a definite 'skill'. The ancient Greeks included jobs now considered "knowledge professions" like doctors, legislators, and administrators under the craftsman label. Even the work of a father was considered a craft of sorts that required the same care and attention to detail as that of the carpenter.

Lately, however, contemporary labels like 'mass production', 'manufacturing', 'fabrication', 'digital' and '3D printing' overpowered the word craft, specially related to architecture. It can't be denied that over the past two decades a technological shift has occurred in order to produce more impressive structures and details, allowing for new methods of construction, design and perhaps practice as well. The idea of craft underwent a slow process of transformation and evolution in order to keep up with the times and it has been side-lined as something pre-industrial that was passed down from a master craftsman to an apprentice. As we accelerate towards artificial intelligence and robotics, the future of many profession (including those considered skilled), hangs in the balance. Could architectural craft possibly one of them?

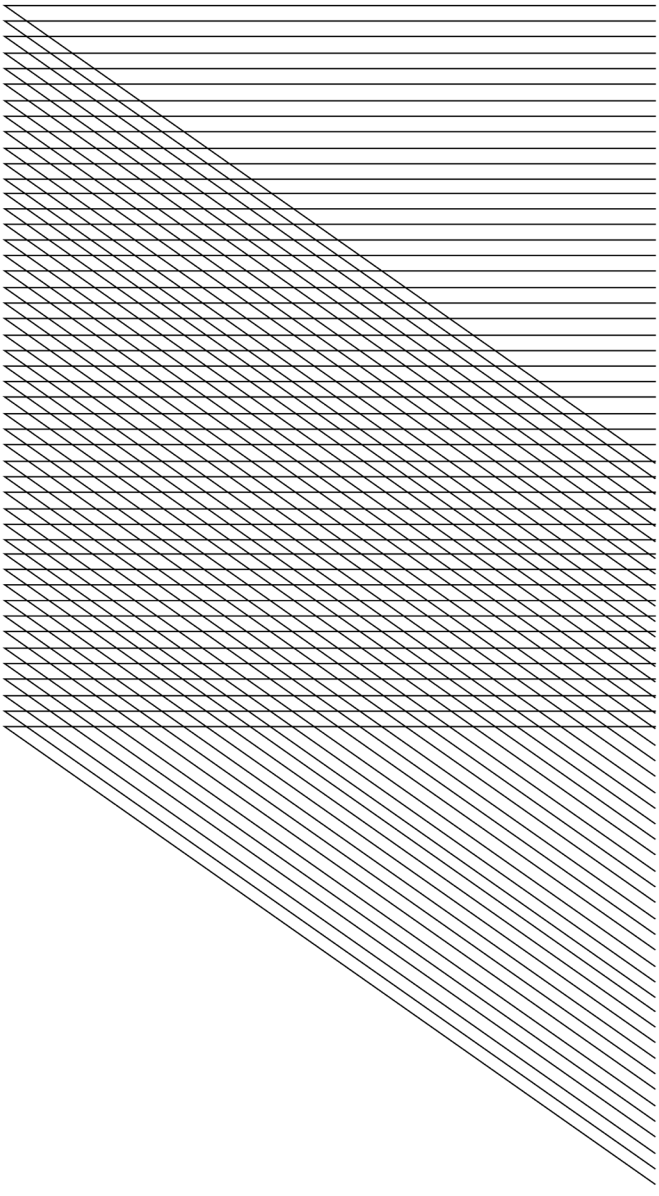
Briefly analysing the consequences of technology on professions, there have been several instances in history where technology has been responsible for unemployment as well as the creation of new jobs. For example, horse drawn carriages were replaced by automobiles. Mechanized factories annihilated cottage industries, ruining local businesses but also creating opportunities of employment in the factories. Computer-aided drafting replaced manual draftsmen. In all these cases, it's evident that there was a shift in the occupation of people – often translated to an increase in productivity. According to the economists Joel Mokyr, Chris Vickers and Nicolas L. Ziebarth, the situation we are facing now is far from being similar to what was happening during the Industrial Revolution.[2] These concerns are not new to the modern era and understanding the history provides perspectives on whether this time is truly different.

So, is the reign of new technology sounding the end of craft and craftsmanship? Are we losing craft? What role does craft play nowadays and, in particular, in contemporary architecture? To answer these questions it is necessary to delve into the history of craft to understand the current influence craft has in 21st century architecture.

1 Pye, D. (1968). *The workmanship of risk and the workmanship of certainty* in The Nature and Art of Workmanship. Cambridge: Cambridge University Press, 20.

2 Mokyr, J. and Vickers, C. and Ziebarth, N. (2015). The History of Technological Anxiety and the Future of Economic Growth: is this time different?. *Journal of Economic Perspectives,* 29 (3), 31-50.

Evolution over Time



The period when traditional craft truly flourished was prior to the Industrial Revolution. An example of this, is the work that was carried out on cathedrals in Medieval Europe with the efforts of carpenters, masons, blacksmiths, glass makers and other skilled men with or without an architect to oversee the work. Towards last few years of the medieval period, architecture wasn't just fuelled by religious fervour, but also began to develop a spirit of invention, ambition and innovation. It was considered a highly specialized endeavor that received respect and admiration from the society. Master masons reached a higher social status. Some of them, though most likely of a peasant background, found themselves in the company of men of great power and influence (such as kings or bishops).

For every skilled craftsman there was at least one apprentice or assistant as well as great number of labourers required for each piece of work. Once the work was completed, they would move from one town to another that required a cathedral (or a church) to be built (Fig.1). Their skills, ideas and experience travelled with them, resulting in the spread of their craft and knowledge to faraway lands through extensive travel. Consequently exposure to different techniques and styles in the various places that they travelled sparked an urge to produce even more striking structures with the advancement of technology of each craft. One craft fed off the developments of another. For example, when the smiths learned to forge stronger steel than the tools of the masons and sculptor became more refined, the clamps to lift the stones became stronger and the skills of these craftsmen expanded accordingly.

It is evident, therefore, that craftsmanship included practice and apprenticeship, but its true value was believed to be not in the outcome but in the process involved. The craftsmen developed a kind of masterly intuition though years of practical experience. This intuition allowed him to think and resolve as the building evolved, i. e., during the making process.
The Architect Mark Hewitt, while explaining the conception of a work of architecture in his essay *Representational Forms and Modes of Conception,* suggests why – perhaps – the construction of some cathedrals took many decades to be completed:

> *"Medieval master masons, who also relied on full-scale templates and models during construction, designed extraordinarily complex cathedrals and churches primarily through the use of a myriad of different kinds of plan drawings. These were laid out not arithmetically but geometrically, using simple tools such as compasses and squares. The intricate geometric formulae, which formed the canon of Gothic architectural design were passed down through the guilds or masonic lodges, falling under the rubric of the "Art of Geometry". Accurately measured and proportioned elevation drawings (using orthogonal projection) are rare among collections of 14th and 15th century Gothic drawings. Evidence suggests that they played a much less significant role in design and construction than they do today."*[3]

The use of drawings in construction transformed the process of 'making'. It enabled architects to design and understand a buildings more precisely even before the start of the construction process. It became easier to foresee problems and find a solution in advance (Fig. 2). Leon Battista Alberti, who epitomised the Renaissance Man believed that this would allow architecture to be elevated to its true status as an art even if it was at the cost of quality of workmanship. This change in status meant not only a change in the tools and skills of the architect who had previously been so closely associated with the craftsmen, but also a greater social separation between the two. What is more, there was now a distance in time between the thinking (or designing) by the architect and the making (or building) by the craftsman. Architectural craft and craftsmanship became two separate entities.

As a consequence of the Industrial Revolution, mass production and machines overshadowed the high perception of craft as valuable. Mechanization and capitalism drove out the need for the human hand in the manufacturing industry but technically skilled persons were still necessary to run the machines. The Industrial Revolution was based in part on the concept of division of labour, that was introduced as an innovative and efficient solution to manage multiple tasks simultaneously and as a way to increase productivity. Rather than depending on a small number of highly skilled craftsmen to oversee the work from conception to completion, individual skills could be taught to a variety of people who would perform that chore and pass the item to another person to perform the next task.

3 Hewitt, M. (1985). Representational Forms and Modes of Conception: An Approach to the History of Architectural Drawing. *Journal of Architecture Education,* 39 (2), 2-9.

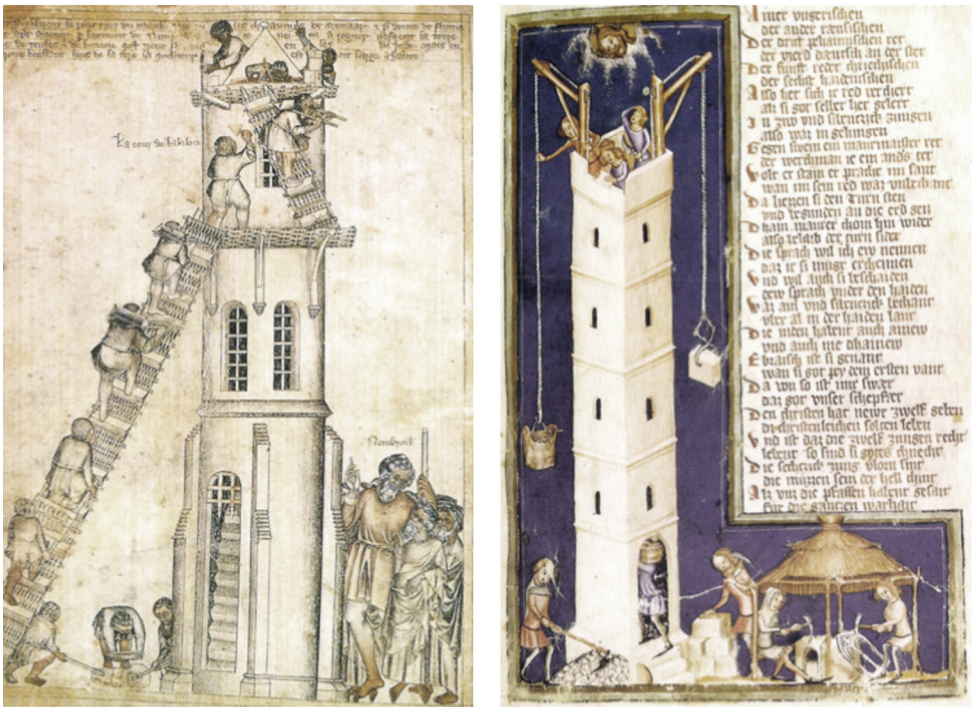


Fig. 1 Examples of medieval construction site. Published in Nicola Coldstreas book *Masons and Sculptors (Medieval Craftsmen),* British Museum Press, 1992.

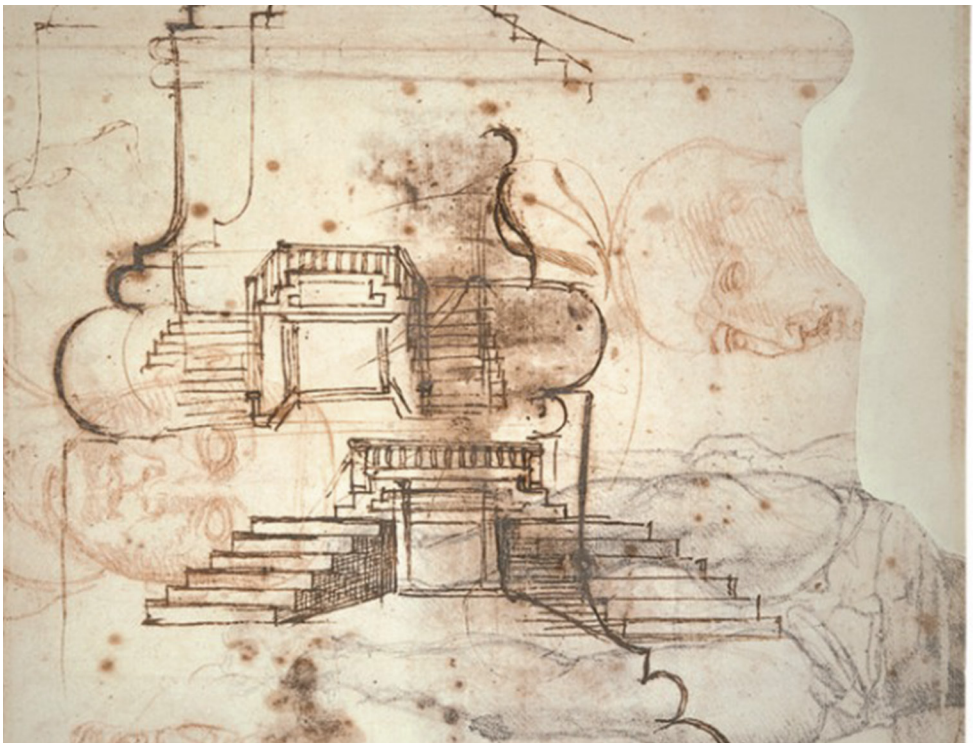


Fig. 2 Design sketches for the staircase of Biblioteca Laurenziana in Florence. Michelangelo Buonarroti, Firenze, Casa Buonarroti, 1524-1525.

This division of labour might have been a good move for the industry but it also meant that it robbed the labourers of the pleasure of seeing their work through to completion as the traditional values of quality and beauty were being replaced by the new motto of economy and profit. As mass production became ubiquitous, advances in technology accelerated at a pace unparalleled in the past. Even before one version of a product was completely sold out, a newer version would emerge rendering the previous one obsolete. This brought on the era of disposable goods which worried even the most forward-thinking men of that time.

A focus on the merits of craft and craftsmanship re-emerged thanks to intellectuals and artists in England such as John Ruskin and William Morris. Augustus Welby Pugin, English architect, designer, artist and critic chiefly remembered for his pioneering role in the Gothic Revival style was not against technology and advancement. He was, however, worried by the rate of decline of nature and human touch to make way for progress. He believed that people were increasingly turning their backs on the gratification that accompanied traditional craftsmanship and artistry. This philosophy of Pugin considerably influenced and inspired scores of artists, craftsmen and philosophers later especially John Ruskin. Ruskin, in the late 1840s started a crusade to restore England's lifestyle back to a simpler way of life compatible with nature. His perspective rejected the need for factory-made decoration and promoted a purely English-influenced design. This was in contrast to the Victorian lifestyle prevalent at the time which borrowed heavily from the French. His campaign eventually led to the revival of English Gothic and Medieval styles. Ruskin promoted the idea of 'workshop' as the healthier and safer environment for the thousands of workers in factories labouring in poor conditions for many hours at a time. He believed that work was meant to be a delightful experience. This notion was deeply rooted in the ideals of craftsmanship from the past and laid the foundation for the Arts and Crafts movement.

In the same period, William Morris attended Oxford University where John Ruskin was working as an art history professor. It is said that William Morris was so moved by Ruskin's philosophy that in 1853 he dropped plans to become a minister in order to make his life's work the reformation of society through art. In 1859, Ruskin co-designed the Red House with architect Philip Webb which was constructed using Morris' ethos on craftsmanship and artisan skills. It was here that the ideas of Pugin and Ruskin were made physical and thus began the architectural and design style known as British Arts and Crafts. There was a re-emerging focus on the merits of craft and craftsmanship. The dawn of the Arts and Crafts movement in the mid nineteenth century gave craft a fighting chance once again in a largely mechanized world. It was an opportunity for skilled craftsmen to exhibit mastery of both tools and materials. *"Have nothing beautiful in your house that you do know to be useful or believe to be beautiful"*, Morris declared. Like Pugin and Ruskin, Morris also was concerned about the effects of industrialization on society. In an article in the Fortnightly Review Morris wrote:

> *"[…] production by machinery necessarily results in utilitarian ugliness in everything which the labour of man deals with, and that this is a serious evil and a degradation of human life."*[4]

According to Morris, the manufacturing process was currently the dictating factor in determining the style of a piece whereas it should have been the design that dictates the manufacturing process. He believed that beauty was being lost in pursuit of ease of mass production. (Fig. 3-4) Morris' work was often organic and fluid with intricate details exhibiting the skill and merit of hand-made craft. He felt that the only solution to restore society to its former self was for the re-establishment of the guild system. Quality craftsmanship emphasizing the importance of the arts could contribute to economic reform and, according to him, lead to a better society: one that was fundamentally happier and more productive.

Many people view his utopian dream as unrealistic and idealistic and it might be so. However, he did identify the problem with mass manufacture which, as time has gone on, has only proved to be correct. It was his belief that only the integration of ornament and functionality would save craft. The success of the Arts and Crafts movement was however short lived. The rise of the modernist movement in the twentieth century rejected traditional building craft once again in an effort to promote the usage of machines in more advanced industrial processes resulted in the loss of highly skilled traditional crafts that were only recently starting to re-emerge. Consequently, over time, the ideals of craftsmanship were cordoned off to just technical and studio arts.

4 Morris, W. (1888). The Revival of Handicfrat. *Fortnightly Review*.

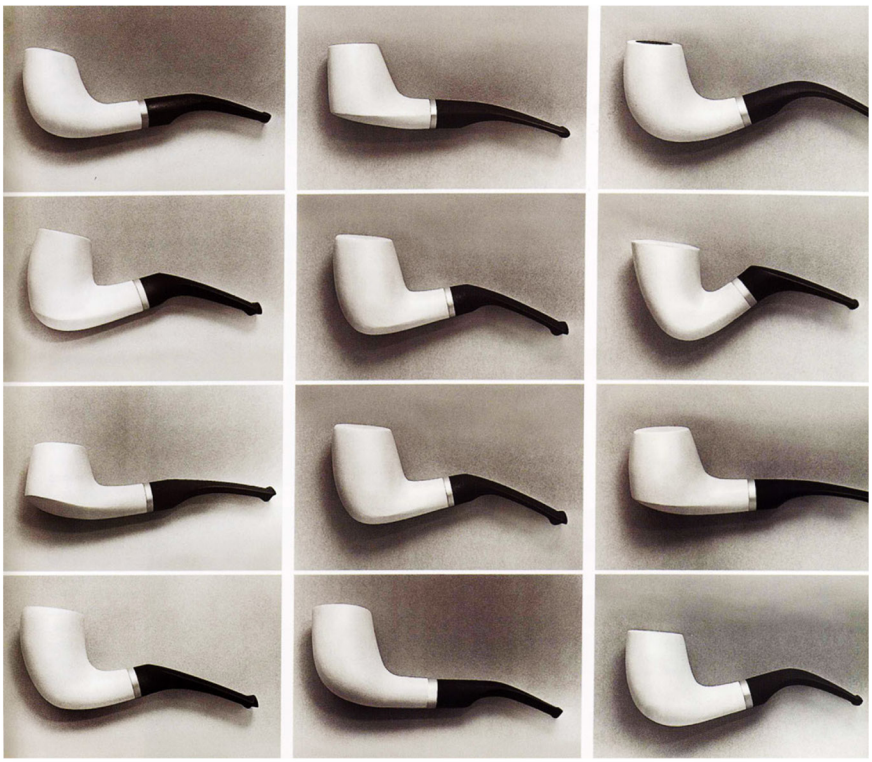


Fig. 3 Pipe models illustrating craftsmanship. Tapio Wirkkala, ‘meerschaum’ (sea foam) and nylon, 1974-76.

“A true craftsman is not bound to a single idea, as the formal idea often gives rise to a family of variations.” (Pallasmaa, 2009)

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depends on the effort made and the attention paid to these alarming symptoms.

Architecture or Revolution.

Revolution can be avoided.

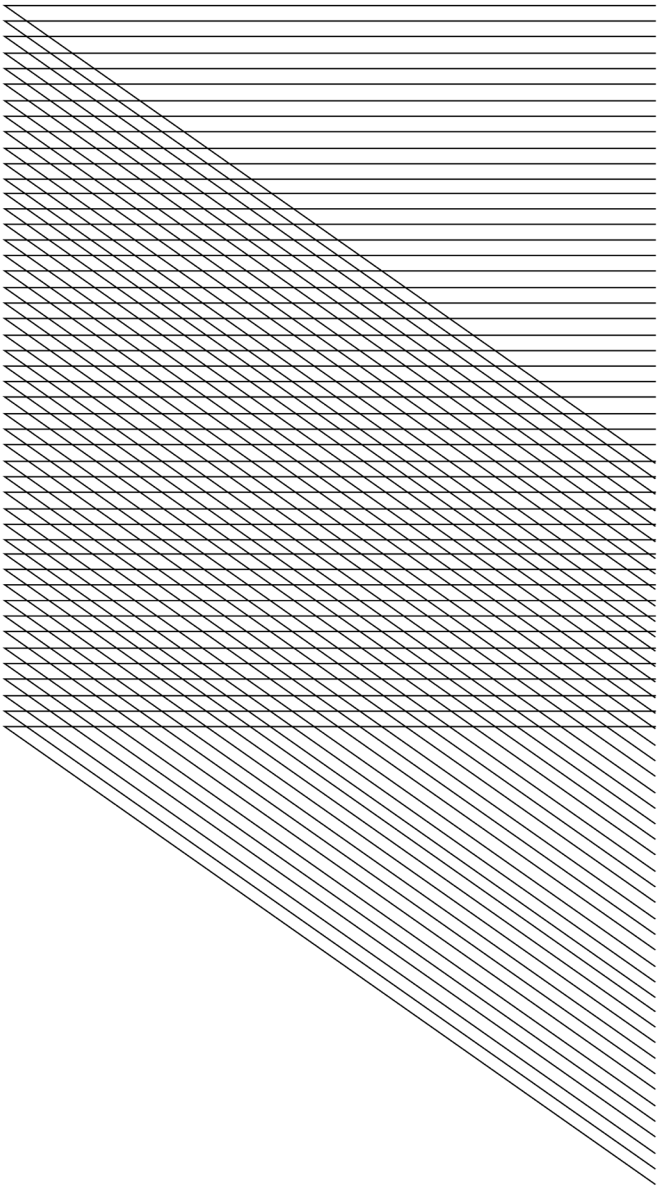
A BRIAR PIPE

Fig. 4 Briar pipe from *Vers Une Architecture*, a symbol of industrialization. Charles-Edouard Jeanneret-Gris (Le Corbusier), 1923.

While the dictionary definitions of “craft” and “craftsmanship” are broad, some conclusions from this short historical investigation can be drawn from the point of view of architecture and the building process. Firstly the theme of material and the mastering of its applications remain consistent. What is meant by ‘material’? Thanks to its apparent historical status, a craft material is often thought of as a “traditional building material” (wood, stone, lime). It is not so difficult to see how the same term might include new age construction materials like steel or glass or even combinations like curtain walling. Secondly, there is another common theme: making and learning to make. It is clear that craftsmanship includes learning by doing, practical experimentation and apprenticeship.

So what is regarded as craft and craftsmanship today? The answer to this question is subjective and depends highly on the point of reference. Now, what is the point of reference in a contemporary scenario? The following investigation of some contemporary architects and their works explores what some of these points of reference could be.

Idea of Contemporary Craft



Caruso St John, Victoria and Albert Museum of Childhood, London 2007

"We are interested in the emotional effect that buildings can have. We are interested in how buildings have been built in the past and how new constructions can achieve an equivalent formal and material presence" (Caruso, 2008)

Analysing the works of Caruso St John somehow reminds one of the ideology of the British architect Alan Colquhoun, whose ambition was to create *"An architecture that is constantly aware of its own history"* (1983). The work carried out by Caruso St John in the renovation of Victoria and Albert Museum of Childhood, a nineteenth century building, is an excellent example of this. The project successfully integrates contemporary architecture with Victorian sensibilities. This is evident in their composition of the new colonnaded contemporary entrance pavilion referencing the existing brick piers with its patterned elevation of red quartzite and brown porphyries, giving the museum the formal front and outward aspect that it previously lacked. The meticulously executed pattern creates an apparent visual depth in the elevation attracting public towards the building. A closer look reveals the craft, precision and level of detail with which the stone panels have been treated. The varying texture and colour of the grains and the rawness of the natural stones makes one appreciate the craft that exemplifies the truth of materials in a contemporary context.

Fig. 5 The new entrance pavilion is clearly modern in its smooth-skinned way with flush glass windows.

Fig. 6 Detail of the wall pattern: a riot of coloured stonework – quartzite, porphyries and Ancaster limestone.

Wang Shu, Ningbo History Museum, China 2008

"Tradition should be lived. Once you put it into a museum it means the tradition has died. So that's why I worked with local craftsmen. Here, tradition and modernity are very directly combined together: on the huge concrete walls you will find a very rich bamboo texture, while the use of traditional recycled materials has a relation to tradition, but it's used in a new way." (Wang Shu, 2015)

Craft in architecture can also be related to the nature of the connections a building (or space) creates - both internally, between its constituent parts, and externally, through its relationship to its place. The design of the Ningbo Museum in China by the architect Wang Shu demonstrates this perfectly. Most of the museum's exterior is composed of debris – some date back 1200 years to the Tang Dynasty – collected from the surrounding area where traditional Chinese towns and villages were demolished to make way for new developments, while other walls are decorated with cement-covered bamboos. The Architect referred that originally the area was the place of thirty beautiful villages (now demolished), that's why he decided to *"built the museum for the people who where originally living there so they can keep some memories"*. The debris were assembled using a local technique known as 'wapan' used by farmers in the region to cope with the devastation caused by cyclones. In 2015 the Architect refers:

> *"Only the craftsmen in this area know how to do this, but if we don't use it in modern architecture I think the craftsmen will forget how to do it"*.

The museum whose constructional techniques, physical context, and spiritual associations function harmoniously well together to instil the structure with a quality that elevates it to the status of true craft.

Fig. 7 The south elevation of the museum shows the relationship between the concrete part of the facade and the one made by debris.

Fig. 8 Detail of the wall pattern. Materials assembled using the 'wapan' technique.

David Chipperfield, Neues Museum, Berlin 2010

"You don't restore 'the last supper' by filling in the missing bits - you preserve. You accept the material that has somehow survived" (Chipperfield, 2009)

In *The Principle of Cladding* Adolf Loos suggests that the experience of a space is produced by both material and the form of the space. The Neues Museum is a great example of this concept, where material and space are meticulously considered to create a contemporary architectural experience that reflects the destructive history of the building. Both preservation and intervention pay homage to, and are driven by, the fragmented nature of the remaining historical building. It is a testament to the importance of craft in making spaces through ruin and restoration. In Chipperfield's work - where the architecture is as much the exhibit as the artefacts contained within and the history has the significance of that in Berlin - the intentional acts of preserving, restoring, and making again are particularly poignant.

The surviving historic parts of the building express the original architecture, defining a material palette for preservation; furthermore, the stair defines Chipperfield's architectural approach of contemporary rebuilding and the relationship between old and new. The craft is rooted in the act of contemporary intervention, creating a cohesion in the experience of space throughout the building. The contrast of the smooth concrete and the rough brick of the walls sets a tone that is continued throughout the building with new meeting old in unapologetically clean lines.

Similar to Ruskin's ideology, Chipperfield's work look to create a fusion between the old and the new: it is the refinement of the contemporary architecture that allows the fragments to form a visual, and emotional, link to that which survived the bombing.

Fig. 9 The new staircase stands as a vertical 'hole' that interrupts the horizontal layout of the exhibition rooms.

Fig. 10 Contrast between the new staircase and the original bombed wall.

Richard Rogers + Renzo Piano, Centre Georges Pompidou, Paris 1977

"Architecture is an artistic craft, but at the same time it is also a scientific profession, it is precisely its distinctiveness" (Renzo Piano, 2013)

High-tech architects are passionately driven by a love of building craft and artistry, so long as it produces work that is aesthetically exquisite. Their care, fetish approach towards the details and the high level of craft involved in the process makes the details true works of art. Some of them (Calatrava i.e.) are in danger of becoming too mannerist with their more personally expressive and stylistic interpretations of technology.

Often the construction detail of high-tech buildings is carefully designed and machined. Working on the centre Pompidou in Paris, for example, took a great deal of time, as great attention was given to details design - much of it a process of creating one-off elements, requiring the making of prototypes before the actual buildings components can be made. For this reason, construction drawings are very important. Probably, some believe that drawing is the ultimate instrument for the architect. But they're wrong. In fact, as Pallasmaa says in *The thinking Hand*, drawing is the first tool of the architect, is part of the maker's hand. The pencil in the hand of the architect closes the gap between imagination and the resulting image. Renzo Piano, for instance, deeply recognises the importance of hand drawing because it gives a sense of liberty:

"This is very typical of the craftsman's approach. You think and you do at the same time. You draw and you make. Drawing […] is revisited. You do it, you redo it, and you redo it again".

Repetition is the key to his working methodology. Freehand is guided by impulse. And it is always imperfect. It is this frailty of drawing that triggers change and aids in the continuous development of a conceptual idea.

Fig. 11 Feticism of the architects in designing the details. The pipes and ducts are all color-coded.

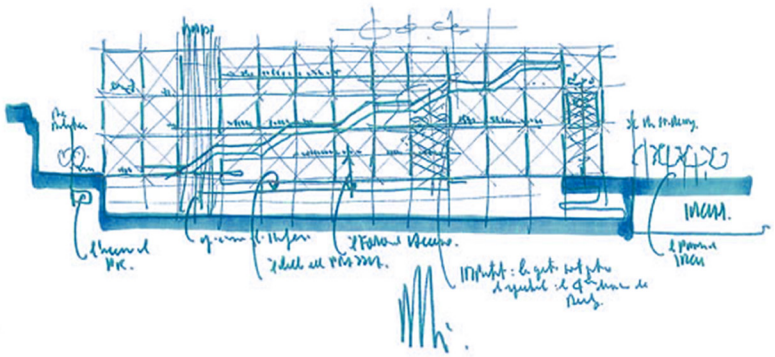


Fig. 12 Renzo Piano's sketch of the building.

Gramazio & Kohler, Gantenbein Vineyard Facade, Fläsch 2006

A contrasting approach to the above examples is visible in the research works of Gramazio and Kohler. They radically dismiss the current design methods by combining the two distinctly diverse worlds of digitality and materiality in their robotic fabrication laboratory. They believe *"the possibility of directly fabricating building components described on the computer expands not only the spectrum of possibilities for construction, but, by the direct implementation of material and production logic into the design process, it establishes a unique architectural expression and a new aesthetic"*.

Gramazio and Kohler's project , in fact, proposes a form of masonry that minimizes the contact a builder would have with the project (essentially minimizing the risk of any human errors or inconsistences in assembly) and reduces the cost of hiring bricklayers. The project uses an innovative robotic manufacturing called ROBmade which focuses upon repeatability and accuracy of the construction process. One of their initial projects was the Gantenbein Vineyard Facade, Fläsch, Switzerland in 2006.

> *"The masonry of the vineyard's façade looks like an enormous basket filled with grapes. At closer view – in contrast to its pictorial effect at a distance – the sensual, textile softness of the walls dissolves into the materiality of the stonework. The observer is surprised that the soft, round forms are actually composed of individual, hard bricks. The façade appears as a solidified dynamic form, in whose three-dimensional depth the viewer's eye is invited to wander. In the interior, the daylight that penetrates creates a mild, yet luminous atmosphere. Looking towards the light, the design becomes manifest in its modulation through the open gaps. It is superimposed on the image of the landscape that glimmers through at different levels of definition according to the perceived contrast"*.

The sheer power of a structure to arouse the viewer's senses demonstrates a sense of craftsmanship.

Fig. 13 Interior of the vineyard. The masonry pattern at the same time filters and allows the light coming in.

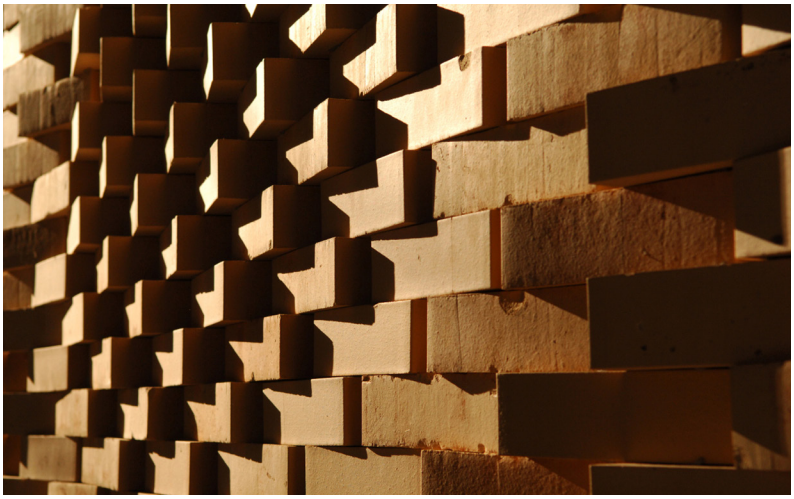
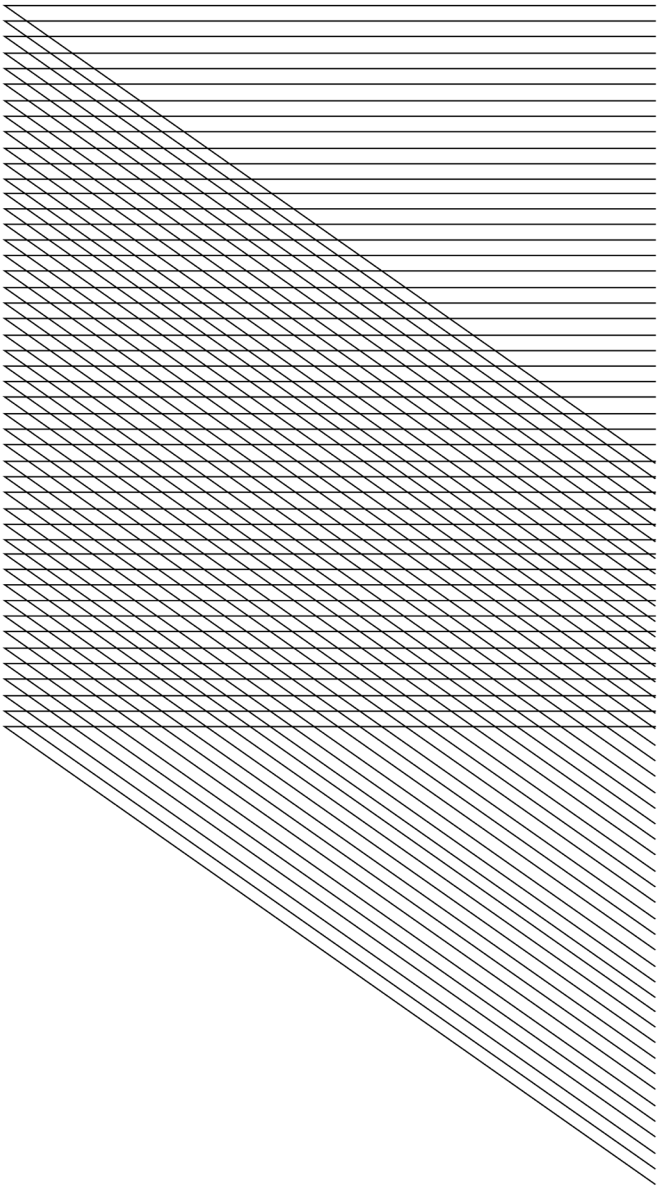


Fig. 14 Zoom on the facade that shows the precision in assemling the bricks.

Conclusions



The above case studies show how craftsmanship in architecture can be interpreted following different ways: craftsmanship through context, craftsmanship in the detail, craftsmanship in drawing and craftsmanship in the making process as illustrated, each having its own point of reference.

While excellent design has always been the essence of craft, the story behind the making of the object is now gaining prominence; the choice of materials and technique, the origin and context, all combine to add value, appeal and uniqueness. This union of design, materials and craftsmanship is very much relevant and active in today's digital world and the intrinsic value given to the object has not been lost in the form of digital craft. It is supported by fresh thinking, contemporary design ideas and new approaches to making.

The fundamental ideas of craftsmanship - making, techné, mastering material – have spiralled through architectural theory for ages. Its meaning and applicability, particularly with reference to architecture, however, is what keeps changing and evolving with the times. This is the answer to the original question of this essay: no, craft has not been lost, but it has metamorphosed over time to accommodate new advancements and new techniques.
It is true that traditional craft has certainly witnessed a decline and it would be reasonable to suggest that the future for craft in architecture is naturally going to move from the traditional skills held by the craftsman to a digital process. But craft can still be defined as the connection between the maker and the product. Craftspeople still have a moral and ethical viewpoint which aims to combine beauty with utility and make the new product still embody the old symbol. They are still artisans; who believe that the final product is not essential but the process of creating and experimenting is.

Keeping the notion of craft going is crucial for the generations to come because craft is, after all, the "mother of fabrication". Understanding traditional craft lays the foundation for understanding contemporary fabrication methods. An architectural project is ultimately the architect's interpretation of the ideal solution to a proposed question. It is the physical manifestation of his perception and thought that we perceive as architecture. His intentions, obsessions and wishes are central to the resulting outcome. At the heart of every composition is its author. The future of craft lies in our choices. What we do with the knowledge we possess of traditional craft has the power to mould the practice of craft for years to come.

"Craft is a starting place, a set of possibilities. It avoids absolutes, certainties, over-robust definitions, solace. It offers places, interstices, where objects and people meet. It is unstable, contingent. It is about experience. It is about desire. It can be beautiful." (Edmund de Waal)

Image list & sources

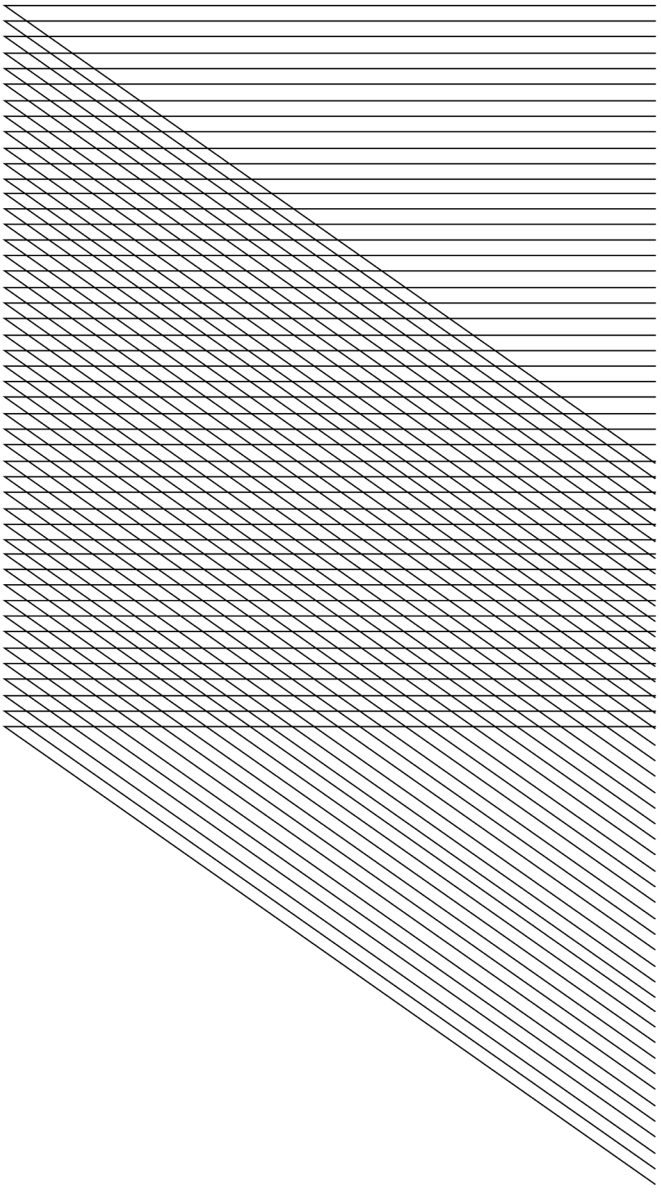


Fig. 1 Examples of medieval construction site. Published in Nicola Coldstreas book *Masons and Sculptors (Medieval Craftsmen),* British Museum Press, 1992.
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Fig. 2 Design sketches for the staircase of Biblioteca Laurenziana in Florence. Michelangelo Buonarroti, Firenze, Casa Buonarroti, 1524-1525.
Retrieved from <http://www.michelangelodigitalmuseum.com/?p=1318>

Fig. 3 Pipe models illustrating craftsmanship. Tapio Wirkkala, 'meerschaum' (sea foam) and nylon, 1974-76.
Retrieved from <https://www.kaufmann-mercantile.com/field-notes/tapio-wirkkala/>

Fig. 4 Briar pipe from *Vers Une Architecture*, a symbol of industrialization.
Charles-Edouard Jeanneret-Gris (Le Corbusier), 1923.
Retrieved from <http://www.tate.org.uk/research/publications/tate-papers/07/towards-anarchitecture-gordon-matta-clark-and-le-corbusier>

Fig. 5 The new entrance pavilion is clearly modern in its smooth-skinned way with flush glass windows.
Retrieved from < http://www.vam.ac.uk/moc/visit/>

Fig. 6 Detail of the wall pattern: a riot of coloured stonework – quartzite, porphyries and Ancaster limestone.
Retrieved from <https://it.pinterest.com/bradkrom/caruso-st-john>

Fig. 7 The south elevation of the museum shows the relationship between the concrete part of the facade and the one made by debris.
Retrieved from <http://www.metalocus.es/en/news/2nd-detailers-meeting-madrid>

Fig. 8 Detail of the wall pattern. Materials assembled using the 'wapan' technique.
Retrieved from <https://cfileonline.org/architecture-wang-shus-ningbo-museum>

Fig. 9 The new staircase stands as a vertical 'hole' that interrupts the horizontal layout of the exhibition rooms.
Retrieved from <http://www.designboom.es/entrevistas/262401/>

Fig. 10 Contrast between the new staircase and the original bombed wall.
Retrieved from <http://exspace.pl/articles/show/1186>

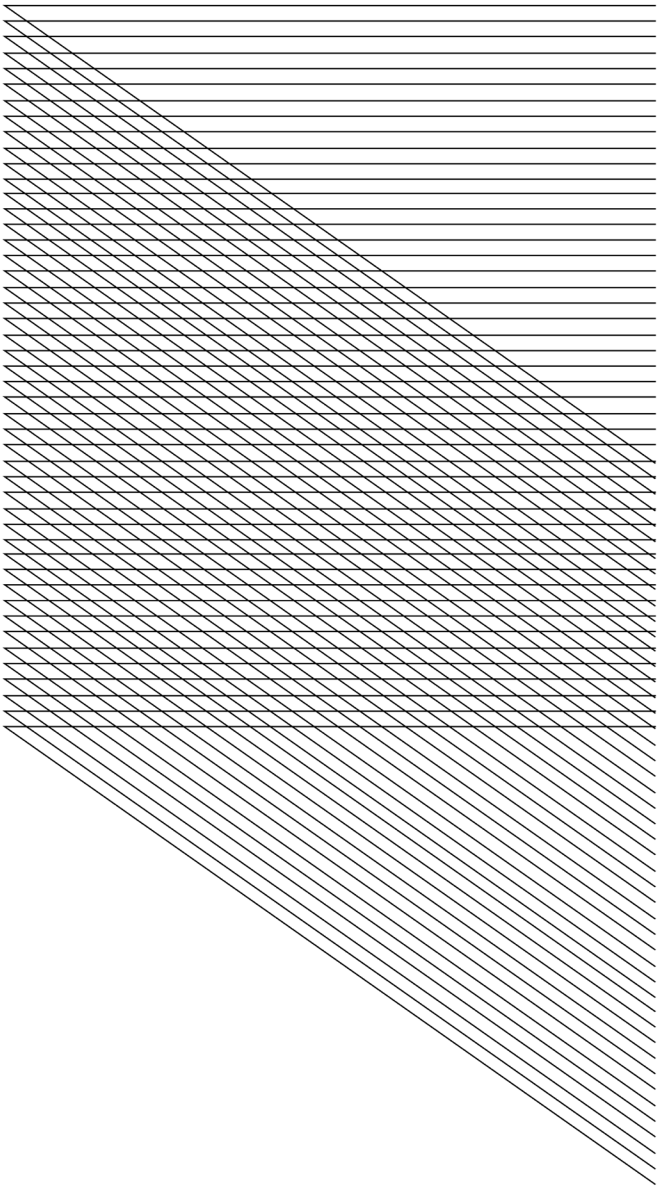
Fig. 11 Feticism of the architects in designing the details. The pipes and ducts are all color-coded.
Retrieved from <http://subeozone.blogspot.it/2011/02/centre-pompidou.html>

Fig. 12 Renzo Piano's sketch of the building.
Retrieved from <http://www.fondazionerenzopiano.org/project/83/centre-georges-pompidou/drawings/enlarged/192/?l=it>

Fig. 13 Interior of the vineyard. The masonry pattern at the same time filters and allows the light coming in.
Retrieved from <http://www.aic-iac.org/en/editorial/architectes/gramazio-kohler/>

Fig. 14 Zoom on the facade that shows the precision in assemling the bricks.
Retrieved from <http://www.aic-iac.org/editorial/>

Bibliography



Butcher, L. (2001). *The Architecture of the Profession*, University of Manchester.

Chipperfield, D. (2011). *Searching for Substance*, Royal Gold Medal Presentation & Speech.

Gimpel, J. (1983). *The cathedral builders*. Grove Press.

Kelbaugh, D. (2002). *Repairing the American metropolis: Common place revisited*. University of Washington Press.

Pallasmaa, J. (2009). *The thinking hand*, AD Primer.

Pye, D. (1968). *The nature and art of workmanship*. Cambridge UP.

Sennett, R. (2008). *The craftsman*. Yale University Press.

Zumthor, P. (2006). "Atmospheres." *Architectural environments, surrounding objects*, Birkhäuser.

Zumthor, P. (2006). *Thinking architecture*. Birkhäuser (113).

All website references were accessible 5th January 2017-01-05

Fisher, E. *What role does craft play in contemporary architecture?* *<https://issuu.com/edfisher6/docs/dru_bookx>*.

McKay, K. *Measure Twice, Cut Once: Applying the Ethos of the Craftsman to out Everyday Lives* <http://www.artofmanliness.com/2013/07/03/measure-twice-cut-once-applying-the-ethos-of-the-craftsman-to-our-everyday-lives/>

Arts and Crafts History: Origins 1830-1860 <http://www.craftsmanperspective.com/history/>

Winnie, C. *Craft: lost or found?* <http://www.arch2o.com/craft-in-architecture/>

<https://www.dezeen.com/2016/08/18/video-interview-wang-shu-amateur-architecture-studio-ningbo-history-museum-movie/>

<http://www.carusostjohn.com/projects/victoria-and-albert-museum-childhood/>

<http://gramaziokohler.arch.ethz.ch/>