UNDER THE ROOF OF HOKUSAÏ

A research on his architectural representations , and their impact on craftsmanship preservation.

Under the direction of Pr. Anja Fröhlich
with the support of Mr. Tiago André Pratas Borges.

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Introduction

Architectural handbook

Through ages and cultures, architectural handbooks have influenced the way our modern world is built as well as individuals perceive it. They have infiltrated our history, our society, our landscape, and a lot more. This medium has been the foundation of our architecture heritage conservation[1]. *Its function and response to incident or external actions (natural or anthropogenic) and how building were conceived and constructed in order to understand how they will be affected by the intervention process to which they will be subject and adopt the adequate measures so these processes will not harm the building*[2]. So it is interesting to read architectural treaties that refer to constructive process or construction techniques but we often forget other heritage's visions such as ancestral

1 Da Casa, Fernando, Ernesto Echeverria, and Flavio Celis. 2011. 'The Historical Foundations. Historical Architectural Treaty How Information Source of the Architectonic Heritage'. Geoinformatics FCE CTU 6 (December): 74-80. https://doi.org/10.14311/gi.6.10.

2 Id.

know-how, social life around buildings, manufacturers and workers among others design processes. The intangible architecture heritage carried by these books are related to on the one hand their writings and on the other by their graphic representation techniques.

In Europe famous references shaped our vision, and this has been mostly done by architects e.g. *De Architectura - Marcus Vitruvius Pollios*[3], *Histoire de l'architecture - Auguste Choisy*[4], *Le dictionnaire raisonné de l'architecture française du XI au XVIème siècle - Eugène Viollet-le-Duc*[5]. As their production was made up of written and illustrated parts, their readings were mostly technical and pragmatic, it's specifically shown by choices taken for illustrations: without any context, rarely people, no craft's practice or the lack of colour. But it has not been the same case on other continents. In East-Asia, more particularly in Japan, there's been an appropriation of architectural representation by artists during the 19th century - one of the most famous is Katsushika Hokusaï. Currently well known in western countries for his engraving's series named *Thirty-six views on mount Fuji* - his very prolific work was much broader than that. Only in its Manga[6] production *Transmitting the Spirit, Revealing the Form of Things: Hokusaï Sketchbooks 1 to 15*, he drew no less than four thousands patterns for trainee painters. Even

3 '"Architecture ou art de bien bastir de Marc Vitruve Pollion ; mis de latin en françoys, par Jan Martin, pour le roy très-chrestien Henry II'. n.d., 375.

4 Choisy, Auguste. 1954. Histoire de l'architecture. Vincent, Fréal&-Cie. Vol. Premier tome. Ancienne maison Aug. Vincent. Paris.

5 Viollet-le-Duc, Eugène. 2021. 'Dictionnaire raisonné de l'architecture française du XIe au XVIe siècle'. Wikisource, la bibliothèque libre. 24 February 2021.

6 A Manga is a Japanese illustrated book. This term arrived from Japan in the West during the 19th century mainly because of the arrival of the Hokusaï's Manga and its popularization.

though it wasn't initially intended for architects, his work was one of the first illustrated books that engaged construction as the continuity of forms - not the other way around. Because the various construction techniques where isolated and protected from each other's to keep craftsmanship knowledge within the clans, his innovative perspective of observing a building as whole was in a sense the birth of the concept of architecture in Japan as we knew it[7].

Hokusaï's handbook

In his huge amount of production, the *volume 5 of Transmitting the Spirit, Revealing the Form of Things: Hokusaï Sketchbooks*[8] is the first of its series to develop a strict organization of its illustration. All the previous ones were made up of various topics with no structure while this one was specifically composed of architectural elements based on the architectural movement between the Asuka period[9] (538-672) and the Nara period[10] (710-794).
This volume is also the first of its kind to bring back to the forefront architecture. From his perspective, the multiple construction techniques were to be perceived as a globality which is why he decided

7 Cluzel, Jean-Sébastien. 2014. Hokusai, le vieux fou d'architecture: 30. Seuil-BnF. Paris.

8 Hokusai, Katsushika. 1816. Transmitting the Spirit, Revealing the Form of Things: Hokusai Sketchbooks, volume 5. Vol. 5. 15 vols. Japan.

9 'Japon : histoire'. n.d. Dictionnaire numérique. Larousse. Accessed 10 January 2023. https://www.larousse.fr/encyclopedie/divers/Japon_histoire/185382.

10 'Nara'. n.d. Dictionnaire numérique. Larousse. Accessed 10 January 2023. https://www.larousse.fr/encyclopedie/ville/Nara/134757.

to end the segregation of knowledge by trade[11] through its graphic design choices. Indeed, until recently in this culture (around two centuries ago) craftsmanship was secretly kept in clan or family. The knowledge transmission was within only - no book or public illustration - which made the preservation through decades difficult. As there was no democratization and so on no public awareness, the frame around tangible and intangible architectural culture was blurred.

Because of its innovative representation, Hokusaï was able to mix manufacturing processes and aestheticism in order to de-compartmentalize culture, people, and knowledge which lead to the beginning of tangible and intangible architecture's democratization in his society. Because of this specific openness, a specific awareness appeared in the society not only for built objects but also for non-materiel knowledge called intangible culture.

Under his roofs - a symbol

The roof is often represented in art as well as in architecture as a major element because of its capacity to show built environments, landscapes, building's typologies, building complexes or even interior's space definition[12]. Through the prism of construction, it gathers multiple crafts. But in particular wood crafts because of the way they were constructed : carpentry. The fifth façade as it is sometimes called, reunites technical knowledge,

11 Cluzel, Jean-Sébastien. 2014. Hokusai, le vieux fou d'architecture: 7. Seuil-BnF. Paris.

12 Barthassat, Marcelin. n.d. Considérations sur la tectonique des toitures, 10.

complex representation and under itself, the intangible world of life scenes, culture, history, etc. It has also been subject to major evolutions and adaptation.

In Japan, traditional roofs had the characteristic to be heavy, very weatherproof and robust. On those islands, the specific climate is known to put a strain on this element. Typhoons, extreme wind, pouring rains and snows forced wood craftsmen as well as clay craftsmen to develop efficient and elegant solutions which made roofing and its main connections maybe the most complex element that could represent great Japanese constructive craftsmanship.

In the fifth volume of Hokusaï, the roof is illustrated as a major object by its detachment to its load-bearing structure. The choice of layout leaves the possibility to assemble together the whole building and the focus is made on divers elements with a combination of technical, cultural, and societal characteristics. Because it is always drawn in axonometric projection, proportions are kept and scientific reading can be done. The axonometric graphic process allows as well the understanding of this structure as a whole.
Even if various graphic representations of roofs can be found and from various periods, it is specifically in the fifth volume that the roof is mainly studied and illustrated as an important element of the construction. It showed different aspects of craftsmanship, construction techniques and local material and culture that are surroundings. It is only in this one that comparisons between different structures of the same typologies are made.

Under roofs - a traditional craftsmanship

Because this material has been almost the only one to be used until the 19th, all Hokusaï's drawings show timber structure. As the country is largely covered by forest, it has been for a long century the basis of their load-bearing structure as well as the basis for the development of craftsmanship. Under this specific material, tangible and intangible cultures are reunited. Under the roof lies multiple skills and knowledge of specialized artisans. The harmony of lines and forms that appears in its conception is concealed in the complexity of the structural system in wood and its craft. Every element plays a role in the final results. Joints or assemblage can be linked in many ways as with ropes, carved, nails, screws or glue. So master joiners in Japan were focused on this craftsmanship[13] and especially without paste. Their aim was to find a perfect balance between resistance in bending, torsion and shear and its *absence of noise*.
This *absence of noise* is the reflection of their philosophy of making based on their culture. It is notable through their attitude towards showing or hiding the joints and through their inclination to promote *maintenance over robustness* that it is seen[14].

Roofing in Japanese culture is also one of the most plastic exercises. Because of the load-bearing wood structure always based on similar grids independently of typologies, the roof was an element that helped to distinguish building's functions.

13 Toraschichi, Sumiyoshi, and Matsui Gengo. 1990. Wood Joints in Classical Japanese Architecture. Kajima Instute Publishing Co. Japan.
14 Katsu, Fukushima. n.d. Japanese Wood Craftsmanship: 29-40, 63.

Main question

The issues with the following engravings of Katsushika Hokusaï are connected to architectural perception and craftsmanship. As he allowed a new perception of architecture, his highly detailed drawings showed final productions of carpentry and wood craft. Because of integrations of those details in those public illustrations, it concedes to constructive techniques a sort of front page for the reader. Therefore, two reports remain. Firstly, there exists a craft reality beyond poetic aspects of his representations. And secondly, these new ways of representation might have influenced the awareness for preservation of tangible and intangible architectural heritage in Japan.

So, as it is, what constructive knowledge his illustrations release and how those enlightenments might be connected to the preservation's heritage of craftsmanship?

"A research on Hokusaï's production in the fifth volume of Transmitting the Spirit, Revealing the Form of Things. How could his graphic representation techniques be read as constructive details and might have influenced the Japanese heritage wood's craftsmanship?"

Methodology

In order to answer, the methodology is as follows.

The painter's situation, and his graphical techniques of drawings for architecture is described. And the consideration of the context of heritage in Japan with the development of the *Law for the Protection of Cultural Properties*.

To begin, the initial analysis is on the original drawings. Through the reconstitution of the illustration's part by hand drawings, the subjects are read as whole buildings. And as redrawing is a way of working on references as well, a first understanding of composition of constructive details is done.

Then with the help of the overview of each structure, common details are highlighted and described. The written investigation will be conducted via various criteria: the function of the building, its symbolic and spiritual purpose, the initial layout and the architectural details connected to the roof comprehension. Because the graphics design is a tool for the expression of constructive elements, the number of divisions and the meanings of alternative elements (colours, people, animals, landscape, objects, pattern) are considered.

This will lead to the central analysis which is from the basement to the top of the structure. Even if the observation of the roof is central, the load-bearing structure has to be read to understand impacts on the roof's components. So roofing is seen through its typology, carpentry's details, specific details such as corner's pitch, corbels

and struts. Then woodwork on structural elements, and the traditional tiles is read as well.
In addition, an illustrated compilation of details aims to show each element of building and their specificities. Every zoom of the *Detail's booklet* is referenced in the text. Both documentation are complementary.

In order to justify the reality of those imaginative representations, they will be overlapped with an existing and similar construction in Japan: *Hase-Dera* temple.

Finally, for the interest of craftsmanship under those representations, a chapter has been added about the preservation of wood crafts with the necessity of the intangible context surrounding those techniques. And the particular status that it take in Japan's culture.

Context

Law for the protection of cultural properties

As Nabuoto Ito writes in his essay on Intangible cultural heritage involved in tangible culture heritage :

"*Intangible culture is the mother of all culture*".

During several years, he worked on its recognition and protection. In Japan cultural heritage has been preserved under a law's creation for *Protection of Cultural Properties*[15]. Even though Japan society has a long history with heritage protection from more over a thousand years, the first proclamation of the *Law for the Protection of Cultural Properties* (*LPCP*) was in 1871[16]. If its development takes roots in the 19th century, it is still currently evolving. From 1871 to 1950, the law was extended respectively to *Preservation of Ancient Shrines and Temples*, *Preservation of Historic Sites*, *Places of Scenic Beauty and Natural Monuments*, the *National Treasures concept*, and *Preservation of Important Objects of Art*[17].
After the Second World War, the country suffered from the loss of national identity and interest in tradition, and the financial damage postwar led to a lack of enactment of the *LPCP*. But in 1950, after a major fire in a temple with one the oldest

15 Ito, Nobuo. n.d. 'Intangible Cultural Heritage Involved in Tangible Cultural Heritage', 4.

16 National Graduate Institute for Policy Studies, Tokio, and Emiko Kakiuchi. 2017. Cultural Heritage Protection System in Japan: Current Issues and Prospects for the Future: 9. Gdanskie Studia Azji Wschodniej 10 (January). https://doi.org/10.4467/23538724GS.16.013.6170.

17 Id.

wood structures, the preservation was reactivated. Therefore measures were requested by the national and local government.
At this time, the concept of culture properties was already a compound of three definitions : the first took into consideration *Tangible Cultural Properties*, the second introduced *Intangible Cultural Properties*, and the third *Monuments*.
Nowadays, Japan has maybe one of the most preserving visions and one of the broader in terms of encompassing. To the three precedent topics, they have added *Cultural Landscape* and *Groups of traditional Buildings* as well as they have stated on *Conservation Techniques for Cultural Properties* and *Buried Cultural Properties*.

But the enumeration of this time-lapse aims to show how Japanese society has integrated in its very constitution heritage concepts and preservation. Not only as a rigid act of definition but as the creation of a mutable safeguarding context integrating the intangible culture directly linked to architecture[18]. This fluidity involves a huge shift in the vision of preservation compared to the European one in which we are living.

Hokusaï - the innovator

If Hokusaï's work may not be the only to popularize architecture and its conceptions in Japanese society, his work is certainly an interesting reference to study. His way of illustrating is innovative: how his vision of architecture helped democratization and how the de-compartmentalization

18 Id.

of knowledge may have led to popularized craftsmanship? When we look at these aspects, he was one of the first to create architectural representation for a non-specialized public.

Hokusaï's biography

Katsushika Hokusaï (1760-1849) is an impressive prolific painter and illustrator of his time. Born in Japan at Edo - the current capital: Tokyo - he has been adopted by a craftsman specialized in mirror making for the shogun's court and he developed very young high skills in drawings by his side[19]. Some years later, he worked at a bookseller where he had the opportunity to study books and illustrations before becoming the apprentice of a wood engraver. He practiced there from 1773-1778[20]. As his life was evolving, the artist changed his name and signature more than one hundred times - maybe a reflection of his ability to improve and change his style indefinitely[21]. In 1830, his most famous serigraphy began through his appropriation of the holy and sacred Mount Fuji: *Thirty-six Views of Mount Fuji*.
If the apparition of architecture is quite clear in those engravings, it is notable that it is not the main subject. On the other hand, his Manga series (1814-1849) - a compilation of around forty thousands prints - illustrated many of life, human, cultural, animal, nature and mystical themes. This iconographic compilation named *Transmitting*

19 Bouquillard, Jocelyn. n.d. 'Hokusaï'. BnF, Les essentiels. Accessed 26 December 2022. https://essentiels.bnf.fr/fr/focus/e6ee7188-2044-418c-91a4-1140f88dd8d6-hokusai.

20 Id.

21 Id.

the Spirit, Revealing the Form of Things: Hokusaï Sketchbooks in fifteen volumes might have been a graphical innovation in more than just the architectural fields.

Hokusaï roof's illustrations

Among his prolific art work, several illustrations of architecture and roof appear as well in his most famous series of landscape prints - *Thirty-six Views of the Mount Fuji*[22] (which counts forty-six engravings) - in which architecture is often used as a composition element. More than half have built components that set up the framing to highlight the well-known Japanese mountain: Mount Fuji. On the totality, it counts at least about twenty where roofs are drawn, sometimes detailed in the forefront, sometimes with abstraction in the back front.
(See 5 examples: Fig. pages 23-26)

If those examples show certainly his use and understanding of architecture in his compositions, they do not support the dissemination of constructive or architectural knowledge even if it is the first approach to a form of democratization.
On the other hand, the artist developed in his fifteen sketchbooks some axonometric drawings based on geometric composition, respect for proportions, and inspired by studies of realistic constructive details. The main one is the fifth compounded of wood structure, carpentry and roofing. But it was in the third and fourth book that roofs were firstly studied.

22 Id.

It is interesting to observe the mix between the studies he made in the third and fourth. Respectively, the third book introduces the concept of perspective that is directly coming from western countries (see Fig. page 28) and in the fourth the analysis of roof's typologies (see Fig. page 29) pictured with the traditional Chinese graphic design[23] (see Fig. page 27). Then in the following releases, roofs appeared in the eleventh (see Fig. pages 30,31), thirteenth (see Fig. page 32) and fifteenth (see Fig. page 33) but much more as a composition element than as the main subject.

Therefore he is one of the first to represent architecture for itself. Putting it to the foreground, he combined two graphic techniques that were normally separated: a great pictorial effect with colours, surroundings, people or animals and a detailed geometric design based on traditional Chinese technical drawing. This innovation conceded to his work a character close to constructive book in addition to aesthetics aspects and incremented his work in a strong realism.

"[My traduction] All his works, each more singular than the last, refer to his two architecture manuals; it is within these few pages - through the subjects, the representation's mode, the layout, the crossing of editorial styles - that the painter synthesizes his vision of the art of construction."

Cluzel, Jean-Sébastien. 2014. Hokusai, le vieux fou d'architecture. Seuil-BnF. Paris.

If the architectural illustrations in the fifth volume follow strict geometric guidelines in order to stay close to a constructive vision, he adds some new intangible elements rarely represented in

23 Cluzel, Jean-Sébastien. 2014. Hokusai, le vieux fou d'architecture: 6. Seuil-BnF. Paris.

older pictorial techniques. They allow a better understanding of the Japanese civilization and culture that encompasses development of constructive techniques. And by the way, most of his most famous paintings use the architectural grammar that he synthesized in his handbook[24].
Until 2014, his sketchbook has never been translated in any other language than the original version in Japanese, and illustrations were never analysed under an architectural prism[25] until now.

The roof in the fifth sketchbook

The fifth book brings out in his first part four clear roofs and their load bearing structure. As the number one is the roofing of a bell tower (*Shoro*[26]), the followings are subsequently the one for the revolving bookshelves (*Rinzo*[27]), for the sutra's pavilion (*Kyozo*[28]), and finally for the first gate (*Somon*[29]). Further in the pages opens the second part dedicated to figures of poets which

24 Id.

25 Id.

26 Def: *Shoro*: Shoro, in which a Bonsho (a Buddhist bell) is hung. It is placed on the premises of a temple and is used for informing people in the neighborhood of the time by ringing the bell.
Yu, A. C. "Japanese Wiki Corpus." - Japanese Wiki Corpus. National Institute of Information and Communications Technology (NICT). Accessed December 21, 2022. https://www.japanese-wiki-corpus.org/Buddhism/Rinzo.html.

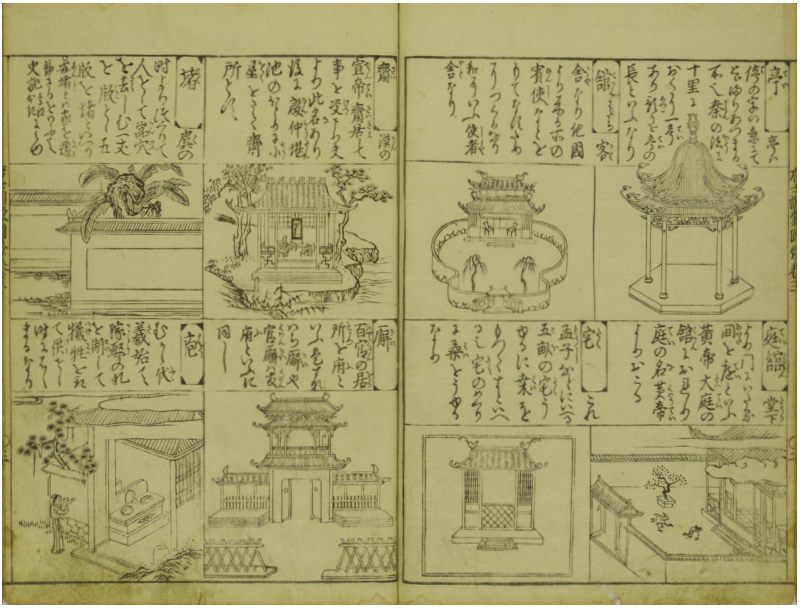
27 Def: *Rinzo* means a type of sutra warehouse that is built within the sutra's pavilion. In the centre of the warehouse, there is a bookshelf with the shape of a regular octahedron, which can be rotated, and sutra is kept inside (the bookshelves are movable). Generally, people believe that once someone rotates the Rinzo, it has the same value as reading all the Buddhist scriptures.
Id.

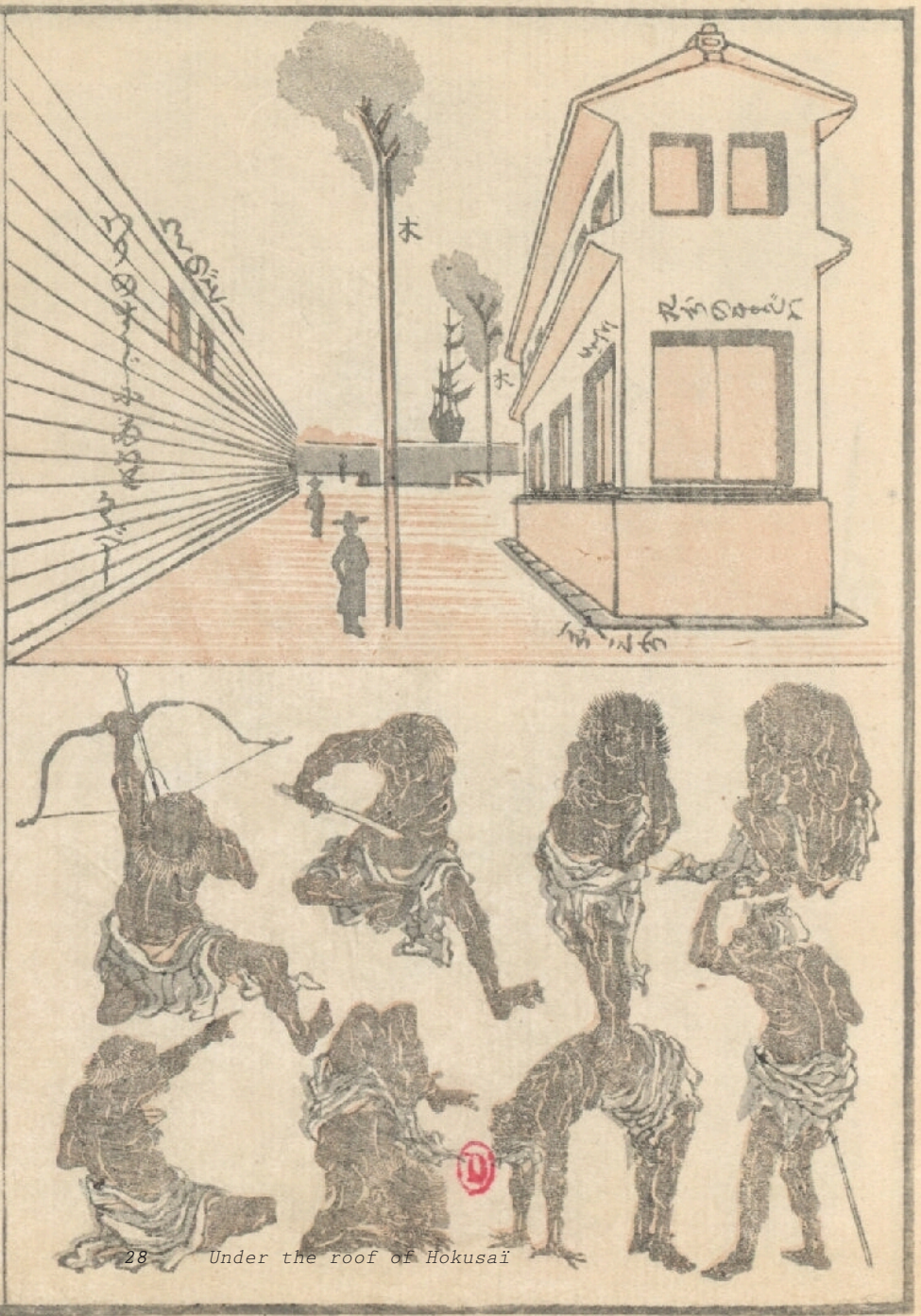
28 Def: *Kyozo*: It is the building which contain the Rinzo. One of the main typology of a Buddhist temple in Japan.

29 def: *Somon*: The term *Somon* refers to the first gate with three doors always located as the first entrance in a holy space.
Id.

will not be analysed here.

Through their review, they will be viewed from different perspectives: their graphism under their layout and drawing's techniques, their constructive techniques under materials, carpentry, tiles and ornaments, the intangible aspects such as human characters, spiritual figures, cultural elements or landscape if there is any.
Then the sutra's pavilion will be subject to further investigation and correlate to existing structure in order to understand how Hokusaï's drawings are able to illustrate and transmit tangible and intangible knowledge around architecture.

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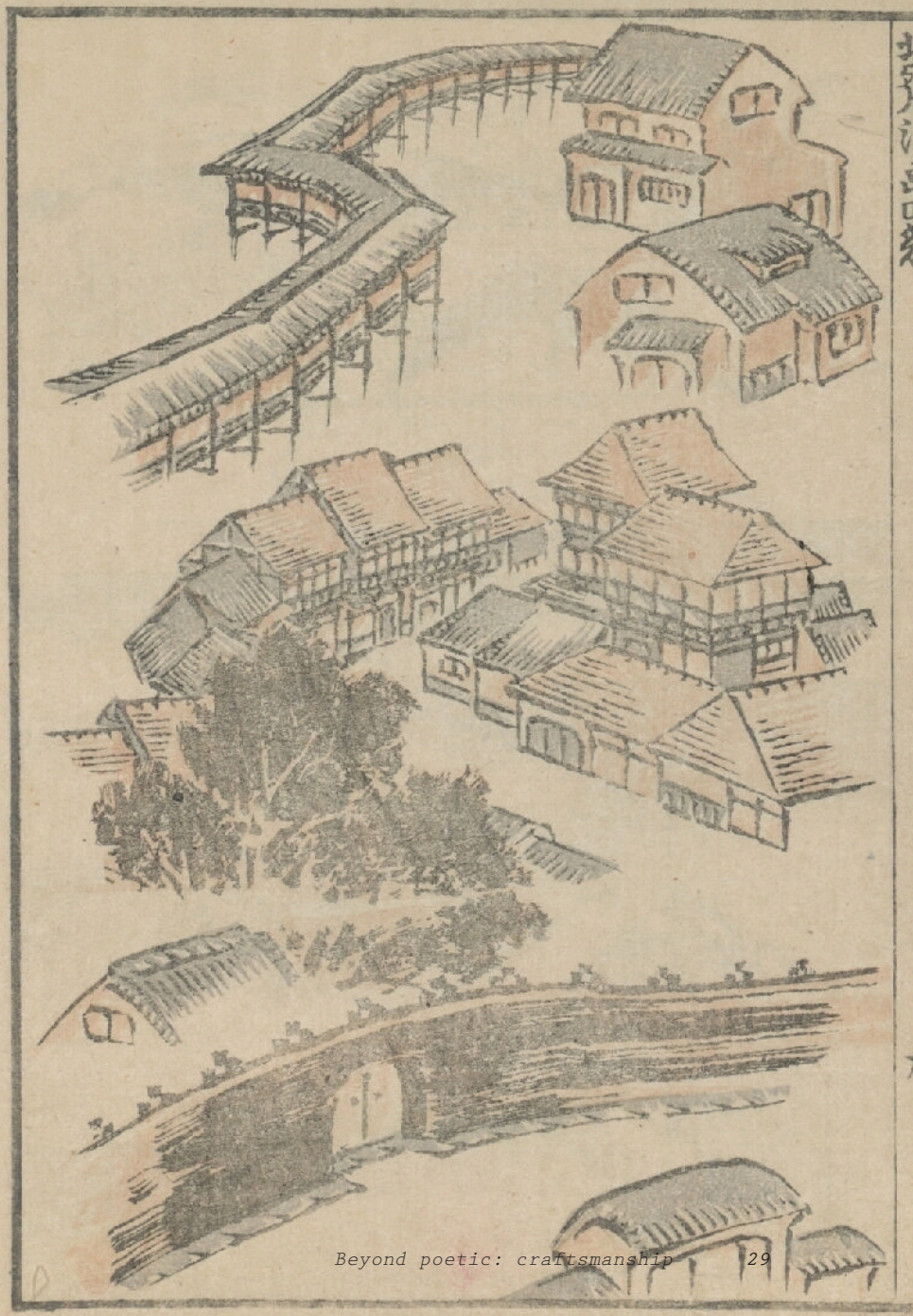

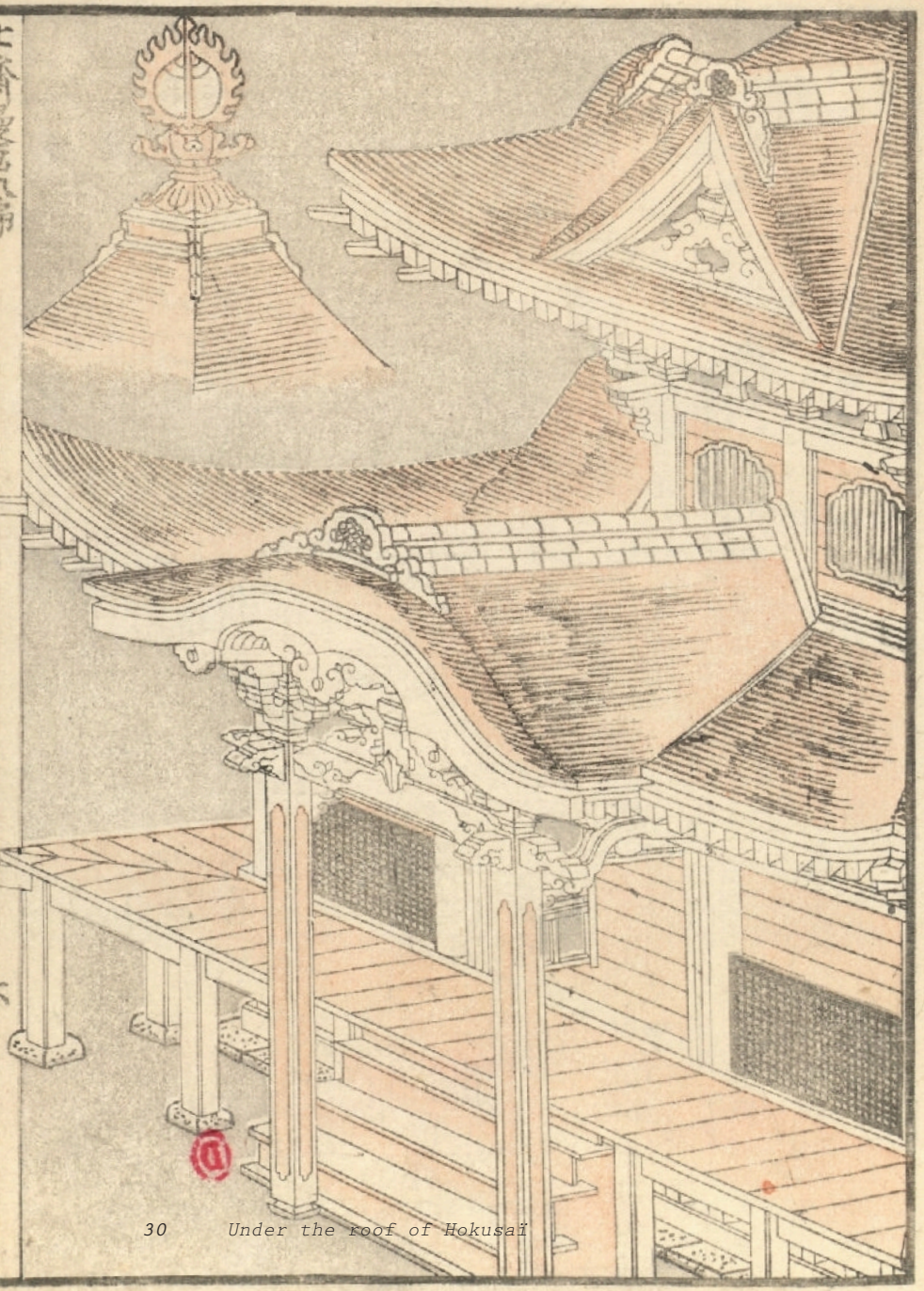

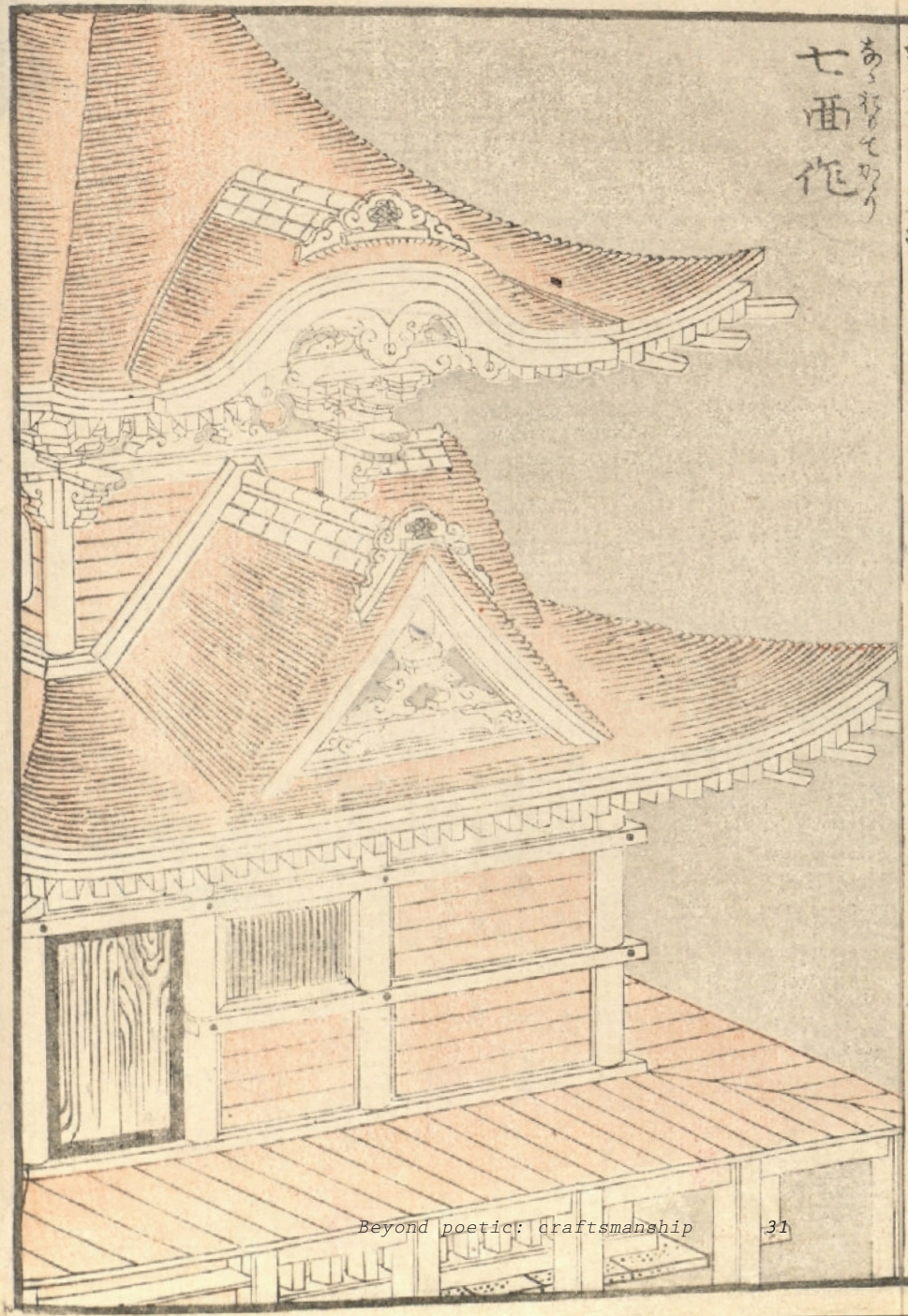
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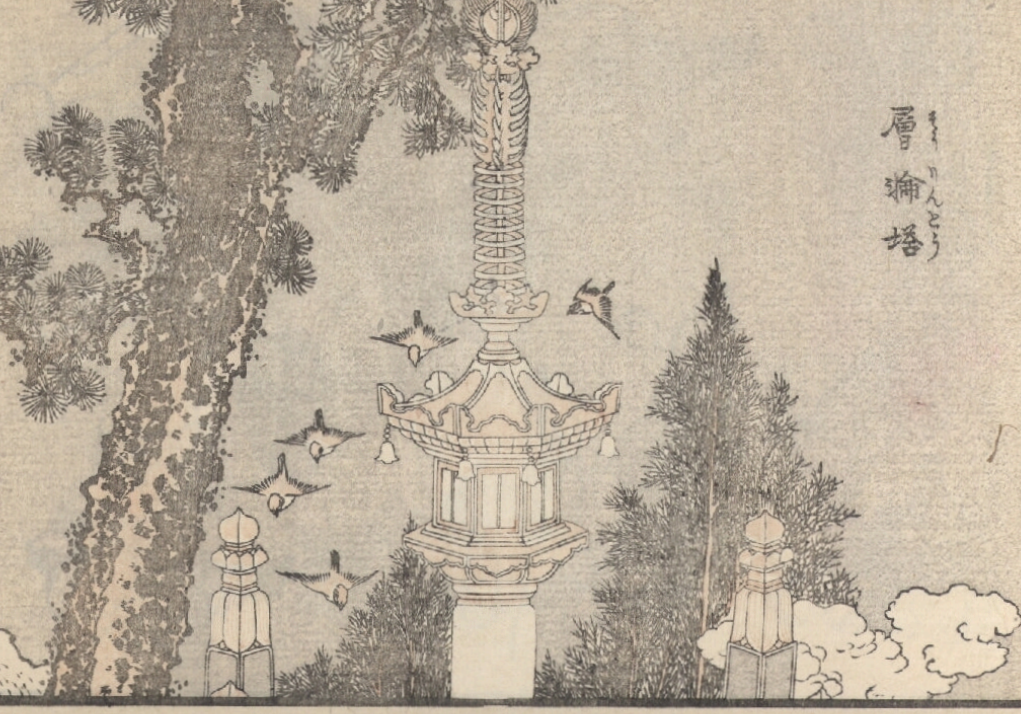
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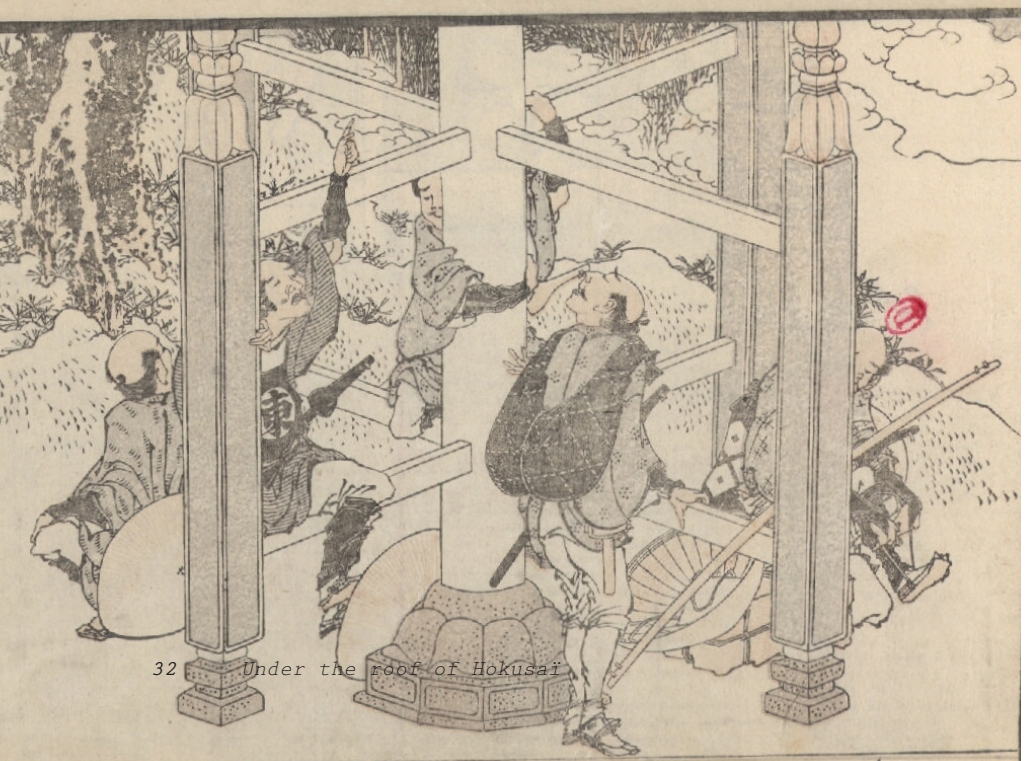


Hokusaï's temple - His illustrations in the fifth volume

For hand-drawings, please refer to Detail's booklet
For Hokusaï's illustrations refer to figure at the end of this chapter (see Fig. pages 47-63)

Somon - First Gate

For hand-drawings see Detail's booklet (see pages 3 to 15)
For Hokusaï's illustrations of this manuscript (see Fig. pages 48-49)

The drawings show a gate that describes the *Somon*[30], which is the first gate to express the separation between a secular and a holy place. This gate sometimes is followed by a second one more impressive called *Sanmon*[31] - the gate with three distinct doors. In order to develop boundaries between the sacred temple and its surrounding, the entrance is flanked by fences.
In this graphic design many operations are remarkable: the three relevant pages are a continuity (Fig. page 48-49) The roof is not exploded from the load bearing structure, fences are drawn connected to the gate and not as annexes, the important scale allows more details. And at last, a human figure as well as a bit of a tree are visible. Those final elements might be analysed as the expression of

30 Japanese-English Bilingual Corpus of Wikipedia's Kyoto Articles. n.d. 'Japanese Wiki Corpus'. Translated by National Institute of Information and Communications Technology (NICT). Japanese Wiki Corpus. http
s://www.japanese-wiki-corpus.org/Buddhism/Sanmon%20(large%20triple%20gate%20to%20temple).html Consulted 24 déc. 22.

31 Id.

the separation between the mortal world - symbolized by the tree - and the character - a monk with the traditional outfit and the classic Buddhist tonsure. The monk's gesture is also a hint about the way of living and the humble behaviour that are required in a temple.

The constructive observation will be bottom-up in order to respect the way it was constructed and also to finish with the common element of comparison: the roof.
From a technical point of view, the gate is basically a compound of a set of double wood doors and two lateral pillars that bear the roof. The high detail's level of the roofing can be explained by the representative function of this entrance for believers.
The roof's orientation leads to two pitcheds which rely on wood carpentry which are covered by traditional clay. Basically made in clay, those tiles are divided into three types (see page 5). The *Hongawara*[32] style is used to cover the whole upper roof. Those tiles have the same dimension as the span between the rafters, and the second one is a half cylinder and has the function to cover the empty space between the vertical tile's rows. Ridge tiles are particular due to their large size. In many western constructive techniques, ridges tiles are small format. But in this illustration, the *Hongawara*[33] tiles techniques use a unique large format size in order to cover edges at once. A specific attention is given to their ends by adding symbolic ornamentations such as religious,

32 Neighbour Parent, Mary. 2001. 'JAANUS, Honagawara'. Japanese Architecture and Art Net User System. 2001. https://www.aisf.or.jp/~jaanus/deta/o/honagawara.htm.

33 Japanese-English Bilingual Corpus of Wikipedia's Kyoto Articles. n.d. 'Japanese Wiki Corpus'. Translated by National Institute of Information and Communications Technology (NICT). Japanese Wiki Corpus. https://www.japanese-wiki-corpus.org/Buddhism/Sanmon%20(large%20triple%20gate%20to%20temple).html Consulted 24 déc. 22.

spiritual or clan's icons. Called *Onigawara*[34], the ridge's tile takes the form of a spirit's face and is designed to stop leaking roofs. It can be decorated with flowers or animals as well (see page 9).
The visible gable is represented with the same cloud patterns specific to the spiritual world (see page 9). The outstanding wood crafts are always related to structural pieces and have the capacity to transform the technical perception of the tri-dimensional connections in a work of art.
The head of the right pillar is an example of the spatial development of wood joints (see page 11). In this case, the corbel arch, set up to support the roof, is equally a solution to integrate the massive lintel-grid above doors. As the gable is seen, it is notable that the carpentry is the association of two wall plates parallel to the gate that generate the cantilever for the usual shed roof. The roof's extension is commonly used to protect the exposed structure from weathering. At both extremities the ceiling joists are decorated while rafters are only carved at corners (see page 15).
If most of the tiles are usual, four clay sculptures that represent the same mythical figures lie at every corner. They are either the figuration of a tiger or a dragon but in both ways, their holy aspect is shown by the use of clouds and their position on the entrance possibly as a protection's sign (see page 5).

A quick comparison between the graphic representation of Hokusaï highlight common elements such as the typology of tiles - always traditionally crafts and issued from the *Hongawara* style -, the plastic

34 Neighbour Parent, Mary. 2001. 'JAANUS, Onigawara'. Japanese Architecture and Art Net User System. 2001. https://www.aisf.or.jp/~jaanus/deta/o/onigawara.htm.

patterns - clouds - and mystic figures, the corbel techniques that are deployed in many versions and carpentry's details always following the same guidelines. All those suggestions express the high quality of the architecture's understanding of the artist. A first bigger picture is read between the lines. As all buildings appear to speak for themselves, their analysis and correlations show gently the study of main elements of a Buddhist temple in Japan.

Shoro - The bell tower

For hand-drawings see Detail's booklet
(see pages 17-27)
For Hokusaï's illustrations of this manuscript
(see Fig. pages 50-53)

Often placed on the same axis east-west than the sutra's pavilion, the bell tower also named *Shoro*, is a typological element that can be found in Buddhist or Shintoist temples. Beyond the spiritual calling aspects that the bell tower carries as in many other cultures, the wood structure has the function to bear the impressive weight of the bell itself as well as the bear of the roof. The construction of the bell in bronze, *Bonsho*, used to follow the lost-model casting process with wax. The object was then decorated with religious or spiritual symbols as well as ornaments and monks rang it to call for prayer.
Hokusaï's illustration has a very detailed level of representation. The structure clearly shows the necessity to bear weight and that's why the section of the wood pillar has those dimensions. Then the subtle intrication of beams specifically in the

four corners under the roofing allows corbels to express hidden constructive techniques by very specific crafts (see page 19, 23).
As those structural details are made by carpenters; they express the delicacy with which the wood is used, the great knowledge of the structural exertion intrinsic to this material and the use of ornaments to make visible cultural elements.

The bell tower's illustration is distributed on two double pages. Inside the black frames, the load-bearing structure is represented in axonometric and divided on both sides thus they can be easily assembled and read as a whole. The roof follows the same design but is the subject to more articulation because of its scale. Once all pieces are reunited, the *Shoro* appears in its overview: its constructive settings as well as its cultural function and symbols.

From the analysis of the intangible heritage perspective, several specialties are noted. The use of colours can help to differentiate materials and volumetry. Swathes of colours are idiosyncratic to the techniques of wood's engraving. And even if there are few nuances, they leave a subtle atmosphere in the drawings that stimulate neophyte readers compared to the precedent Chinese illustration techniques that were mainly in black and white.
Three monk characters dressed in traditional outfits stand in the tower in different positions. The choice to draw those figures as well as some of their objects is not only to create some references to traditions and rituals but affects the scale's understanding of the construction. As monks are the main users of this typology, their presence integrates the premise of scene life in those architectural drawings which is innovative for this time.

From the additional point of view - the tangible heritage - many elements can be dismantled and linked to architectural crafts techniques.
The mineral basement as solid foundation has the specificity to be load-bearing and to protect the wood pillar's bases from capillarization and thus moisture. Here, its height is surely to highlight the bell's function and symbol (see page 17).
The four round wood columns are equally deployed on a square plan. If in this case the size of the bell tower is regular, the number of pillars can be augmented when the structure is bigger, but it always respects the form of the initial proportion's plan. At the top of columns three layers of beams are used to reinforce the carcassing - the bigger beam's sections are the one directly connected with the roof. Their size is explained by their function. As they bear the roof and the bell they have to divide the vertical load distribution. The others might be for the wind bracing (see page 21). As they are very decorated, a particular observation shows that ornaments are only on structural wood pieces as struts, corbels, beams and connecting joints issued from the double plug techniques[35].
There are two kinds of ornaments: the most current is the cloud pattern - *Kumo* - which represent the admiration that this culture brings to nature, and as well as the classical meaning for god's proximity. It is seen in every representation of this book.
Then in each corner, corbels are carved and take the spiritual forms of supernatural entities issued from their folklore - *Yokaï* (see page 23).
The hip and gable roof presents two identical pairs. The most detailed are the two faces compound

35 Toraschichi, Sumiyoshi, and Matsui Gengo. 1990. Wood Joints in Classical Japanese Architecture: 58-61. Kajima Institute Publishing Co. Japan.

of specific gables that are composed of wood carved patterns which are the same as the gable's *Somon* (see page 25). If a look is given to the four angles, miniature bells are hung to recall the function of the building (see page 27).
Despite the non-existence of this roof, the painter was able to reunite many constructive details, crafts, and cultural elements that allows one to read and understand the bigger picture of a *Shoro* and its issues.

Rinzo - The revolving bookshelves

For hand-drawings see Detail's booklet
(see pages 29-37)
For Hokusaï's illustrations of this manuscript
(see Fig. pages 54-57)

The next object to be over-viewed has a different function from the precedent because it is always erected within the sutra's pavilion building. It is not an edifice but an interior warehouse and therefore issues against weathering are not necessary. In the Buddhist temple, it is mainly a symbolic structure that contains the sutras[36].
The *Rinzo* - the revolving bookshelves- is deployed on an hexagonal plan. The whole wood structure is able to rotate at three hundred degrees and is thus concentrated on one axis: the wood central pillar (see page 29). The belief is that once the user has rotated the *Rinzo*, it is as he has read all the

36 Hokusai, Katsushika. 1816. Transmitting the Spirit, Revealing the Form of Things: Hokusai Sketchbooks, volume 5: 11. Vol. 5. 15 vols.

Buddhist scriptures[37].
Following the same previous layout, the structure is on a double page while the roof is on three. A particularity is that left part of the roof is on a third page which is also the first page of the sutra's pavilion structure. It might be an indication of the internal position in the pavilion. No specific elements as figures or objects are drawn for this one but the specific red background makes clear a difference in contextualisation.
The structural analysis leads to a very technical wood craft that is highly visible in this graphic representation: corbels (see page 31, 33). At the bottom as well as the top use the corbel arch system to fix everything to the central axis and allows a very complex vertical load distribution (see page 33, 35).
Corbel's technique is often found at tops of pillars and is declined in many ways. It functions in a superposition of layers that has at least three wedges[38]. Their multiplication of dimensions and numbers help the load centralization to the pillar (see page 35).
Another observation of the wall plate shows how they are detailed to be able to receive the rafters of the roof and allow the required span for the shed roof.
The roofing has the same geometry. Its covering is in wood board instead of tiles and hip rafters are not protected. Those logical constructive choices are permitted by the interior function of the *Rinzo*, in the sutra's pavilion. At the top, the central pillar sticks out of the roof in order to be finally fixed in the rook of the *Kyozo* - the

37 Japanese-English Bilingual Corpus of Wikipedia's Kyoto Articles. n.d. 'Japanese Wiki Corpus'. Translated by National Institute of Information and Communications Technology (NICT). Japanese Wiki Corpus. https://www.japanese-wiki-corpus.org/. Consulted the 25 dec. 22

38 Tamoya, Masuda. 1969. Japon: 128-129. Office du Livre. Architecture universelle. Fribourg.

sutra's pavilion (see page 37).

Kyozo - Sutra's pavilion

For hand-drawings see Detail's booklet
(see pages 39-77)
For Hokusaï's illustrations of this manuscript
(see Fig. pages 58-63)

The pavilion of sutras is the main building in the temple. It is the repository for the sutras kept in the *Rinzo* - the revolving bookshelves (see page 39). This protective building appeared later than the *Rinzo* itself and for a protective reason. Often on the same axis as the belfry, in the centre of the court, the square shaped construction is based on the Japanese unity of a span in the old Japanese language: a ken. Generated in China, this measure became the length of one tatami or the width of two[39]. Its dimensions are of 3 ken by 3 ken and if it has to be from a larger size then it keeps this proportion.
Because of its content, the *Kyozo* can be very ornamented with complex roofing. This might be the reason why this illustration is the most important in this sketchbook. Obviously, one specificity on this layout is its size. In order to understand the scale of this structure, and being as detailed as possible, the whole structure required three double pages - the most extended engraving in the book. The first double page is dedicated to the right façade and expresses it when the pavilion's doors are closed. Vice versa the next one is the exact same façade but with doors open. As the

39 Jacquet, Benoît, Teruaki Matsuzaki, and Manuel Tardits. 2021. The Carpenter & the Architecte: 108. EPFL Press English Imprint. Suisse: EPFL Press.

first is close, the other one is also a solution to draw a part of the interior. Some hints in the illustration, among others, suggest that the plan is completely symmetrical and accessible from all sides.
If we look at added items, it is the only one to represent animals. On the left of the pavilion, three birds fly while human characters look at the *Kyozo*. As the space's consideration in Japan is always related to nature, this animal's representation reminds us of their spiritual beliefs.

The author wrote in a note the graphic choice to create ellipses considering the paper's size. For this reason, he decided to use the intrinsic separation of his layout - spaces between the vertical black frames on the double page - to express the non-drawn areas and chose carefully to illustrate both façades in a complementary manner. Those graphic choices are consequences of his great architectural consideration.

When we look at the construction, the same statement can be easily done. The façades are basically four wooden post-and-beam systems symmetrically distributed. Slightly curved, they are made of four vertical pieces that are laterally reinforced by an horizontal skeleton. They lie on a continue baseboard that seems to be mineral, maybe stone, in order to protect wood from capillarization and humidity (see page 41).
To allow an important span in the middle for the double doors, a lintel overhangs the central void. Doors are folded out on one of the entries thus it shows the great opening sensation that can be generated. On both sides of the doors are two perforated openings called *Katomado* (see page 43). Initially from China, this window's typology has been a remarkable element of Japanese Buddhist

architecture. In the form of an ogive, it is also the symbol of a bell or a flower. The wooden grid lets the light and the air enter inside and provides good ventilation.
Under those windows, some sort of cross which could be in wood or metal are connected to the wall. Even if they could be seen as a simple ornamentation, they probably have a bracing function (see page 45).
At the top of the four façades, four crossed wired beams reinforce the upper part to create a flat plan on which corbels and struts act as load vertical distribution for the carpentry's weight (see page 47).
Three systems are used : the first is the classical Japanese strut, the second is the classical corbels and then for corners, complex offset corbels - together they support wall plates. (In order, see page 49 to 53)
The strut has the specificity to be highly ornamented. As its upper part is one surface, the lower part is divided in two. This means that the vertical load division helps for the weight distribution (see page 71). The classical corbel, which is also used as a strut, has a different composition. This one function conversely to the previous. As the upper part is composed of four surfaces, the lower part is in one. This means that the load is concentrated in one point through the micro-structure. The joint between the two wood element of a halved joint. The offset corbel is based on the same system than the classical corbel except that the multiplication of layer allows the re-direction of the weight as well as the concentration (see page 73). It is mainly used in under corner's roof.
If we look at edges, wood details help to understand the substructure and its assemblies (see page 55). Firstly a cross-shaped girder joint connects

two orthogonal wall plates with the hip rafter, conceding the possibility to integrate rafters (see page 65 to 69). Unlike to western techniques, the rafter's pace is dense enough to precisely fix the *Hongawara* tiles. At the rafter's extremity, which correspond to the periphery of the roof, *chanlattes* are fixed in order to stiffen the shed roof and nail the last tiles.

The roof illustration of the pavilion presents the same complexity due to its scale than the below wooden load-bearing structure: it was not possible to draw it completely. The author took advantage of the symmetry to not print everything without losing any information.

The complexity of this carpentry is mainly due to its second level. This second elevation creates a discontinuity in the load vertical distribution and additional weight as well. Japanese craftsmen found a simple solution to support the second one and divert structural efforts in the intermediate wall plates. With the second roofing, exact same constructive details have been chosen. In order to transmit the upper roof load to the lower part, the same constructive solutions are used such as the offset corbel, and the strut. The offset corbel continues the vertical load bearing from the roof's corner to the lower carpentry (see page 57). They are supported by the intermediate wall plates. Then the two types of struts have the same function, and are used to maintain the spacing between the beams as well (see pages 59 to 61).

Finally, at the top of this roof and only in this one, a particular ornamentation is built. Probably in zinc, this object serves to hide the central wood pillar's end (see page 63). As it is particularity of this roof's typology, the four pitched roof is

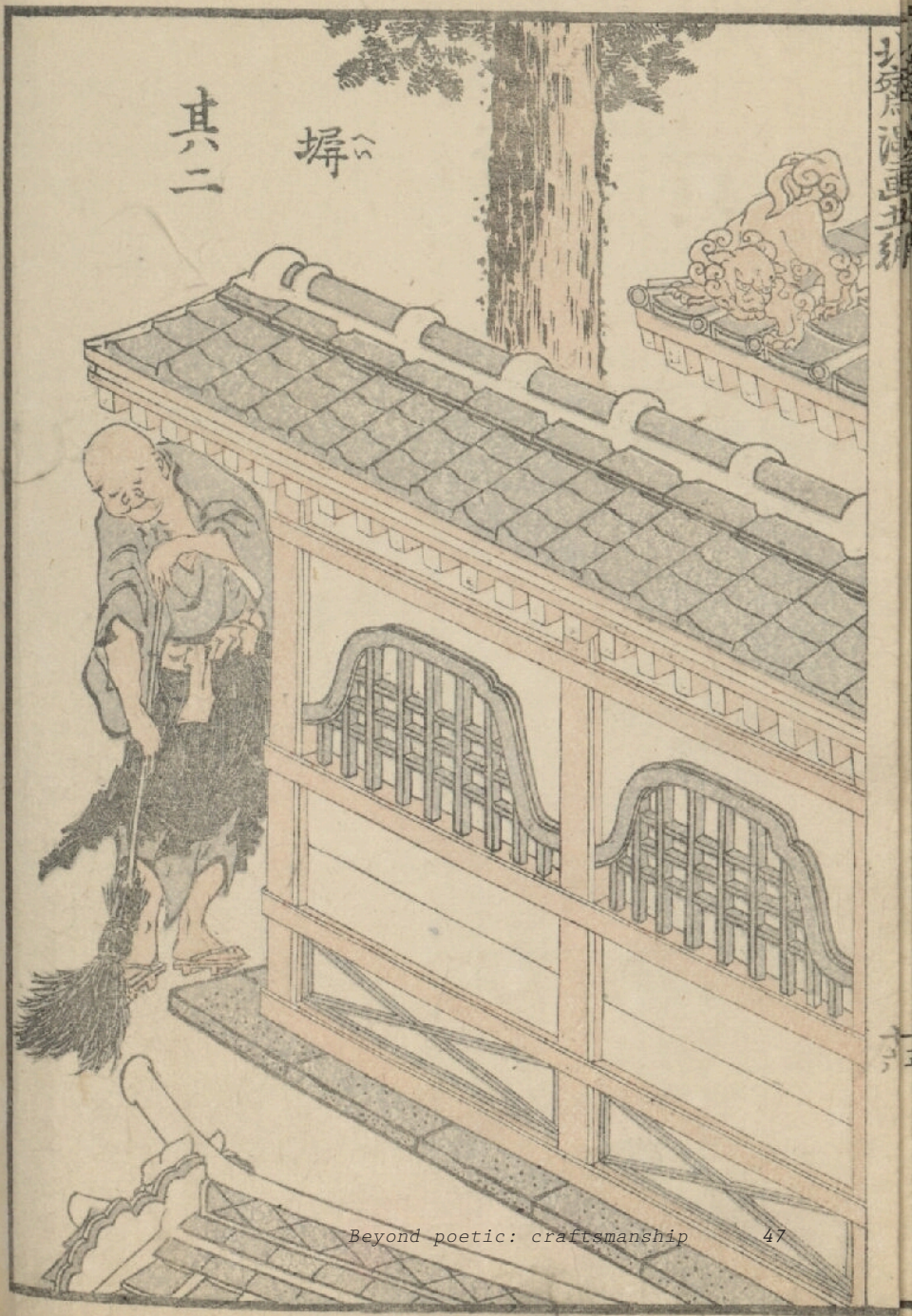
only used in this building. This highly sophisticated roof is not only the expression of the main building but also an answer to the necessity to protect the sacred *Rinzo* which has a certain size itself.

Tera - A Japan Buddhist temple

(See poster)

Finally and after the analysis of those buildings main elements that composed a Japan Buddhist temple are revealed. Even if Hokusaï does not represent it at once and as a whole, his innovative layout has permitted complicated architectural representation with a huge amount of details. The continuity between each engravings is kept even though the vertical layout was not obvious for technical prints. And the black framing helps to understand limits and discontinuities if there is any.

The assembly highlights a temple from the beginning of the Nara period. Even if Hokusaï lived in the later Edo period, the construction of those Buddhist temples were from several earlier centuries. Those drawings let emerged the capacity for those constructions to last over time. But the most important perception of this imaginative holy place that he prints is the very realistic grouping of details and crafts under one accessible illustration. This could have been a great help for the popularization of architectural illustration in his society which led to a special awareness of the people. As the architectural perspective of Hokusaï changed, his teaching evolved as well and it is noticeable in his engravings.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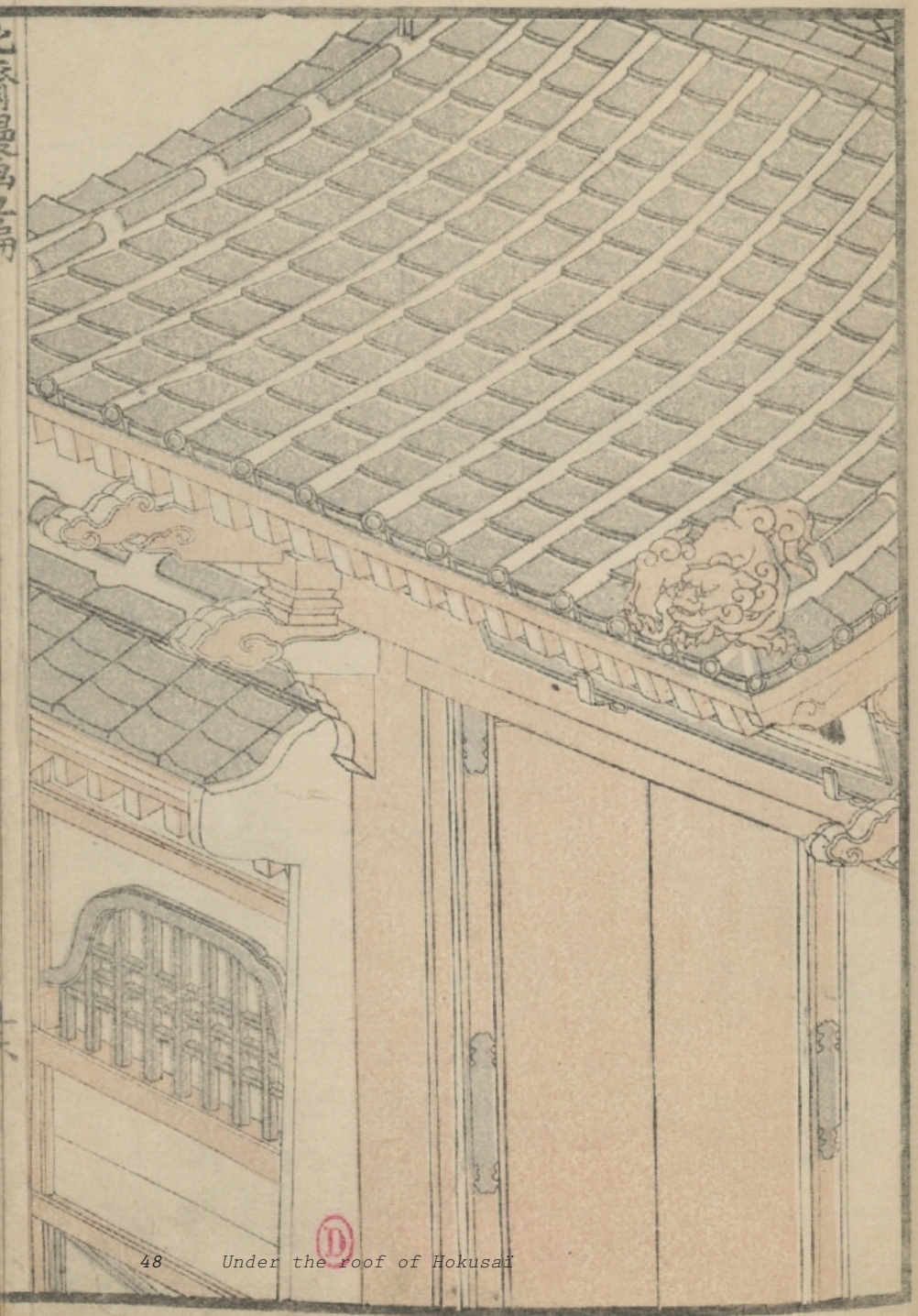

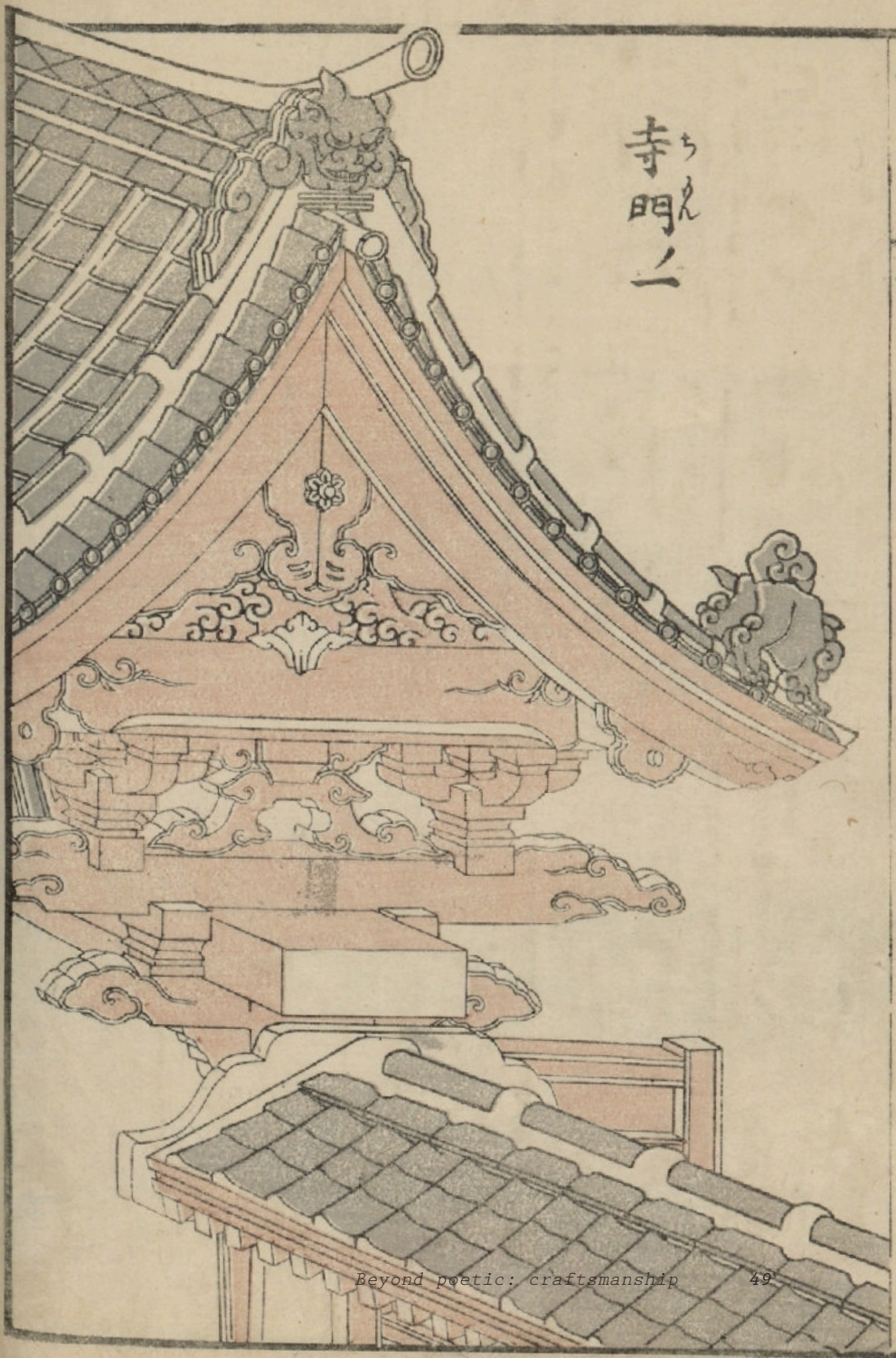
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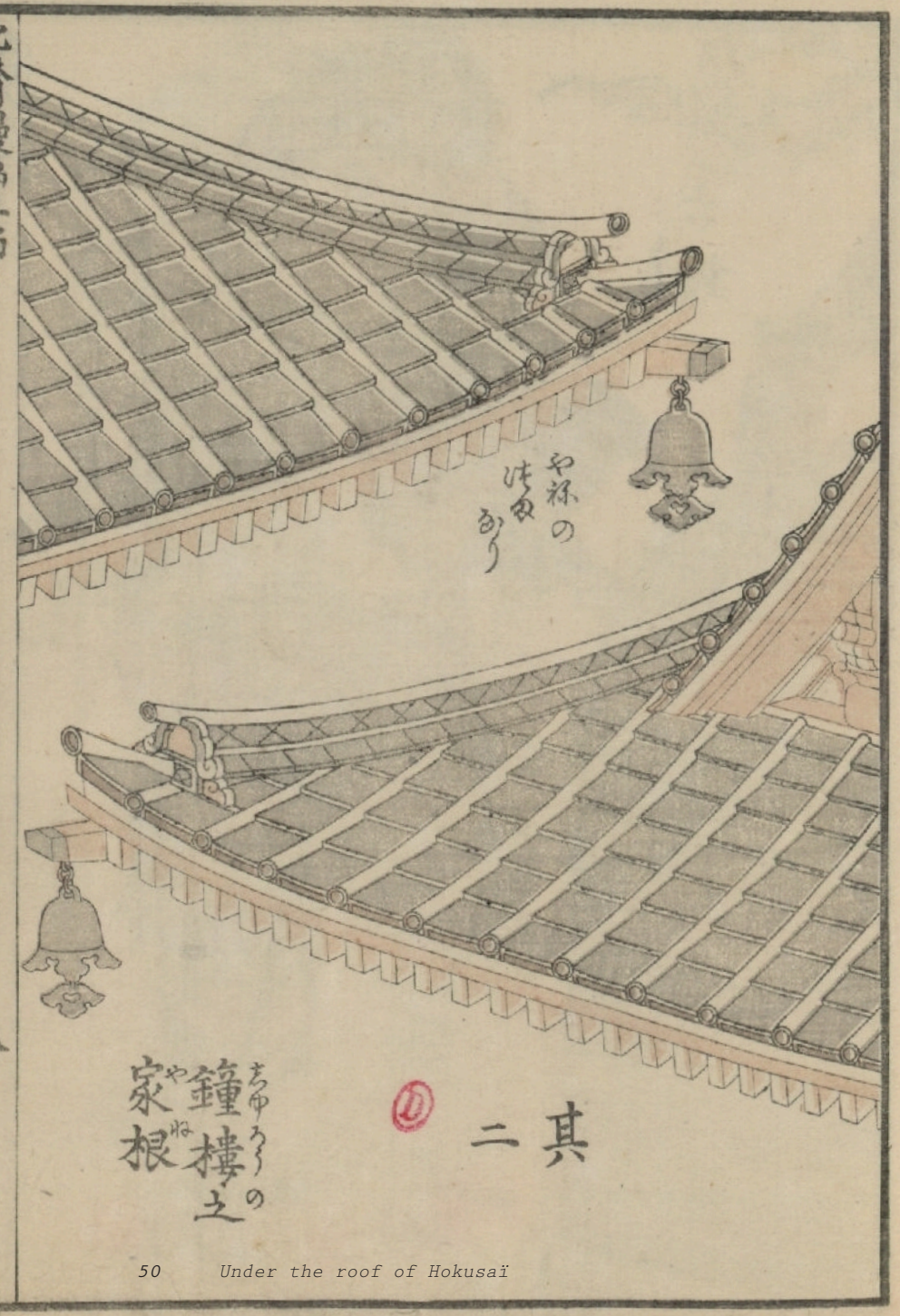

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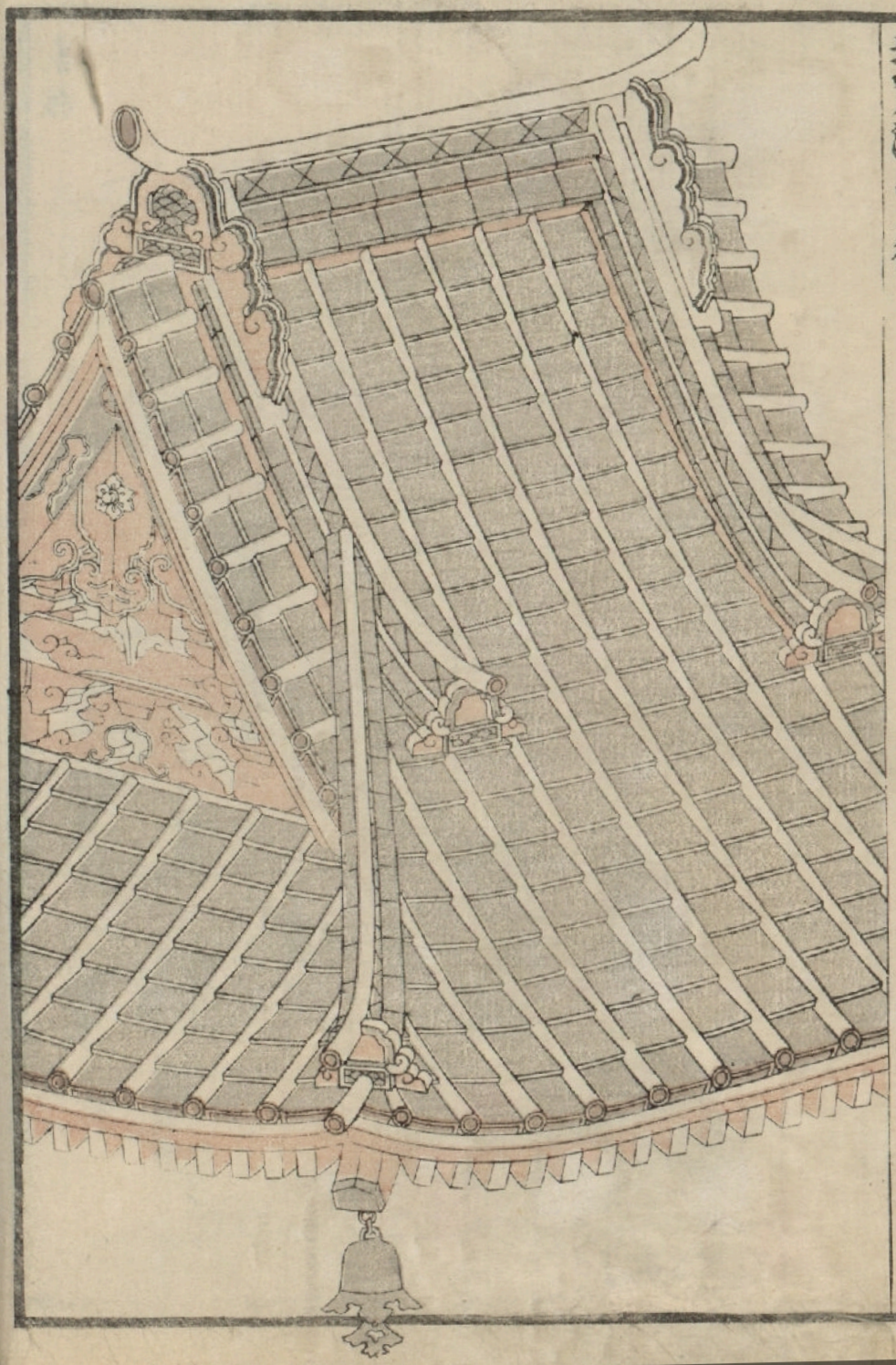
鐘楼之家根




家根
製作致す者へ次の編ふ与す

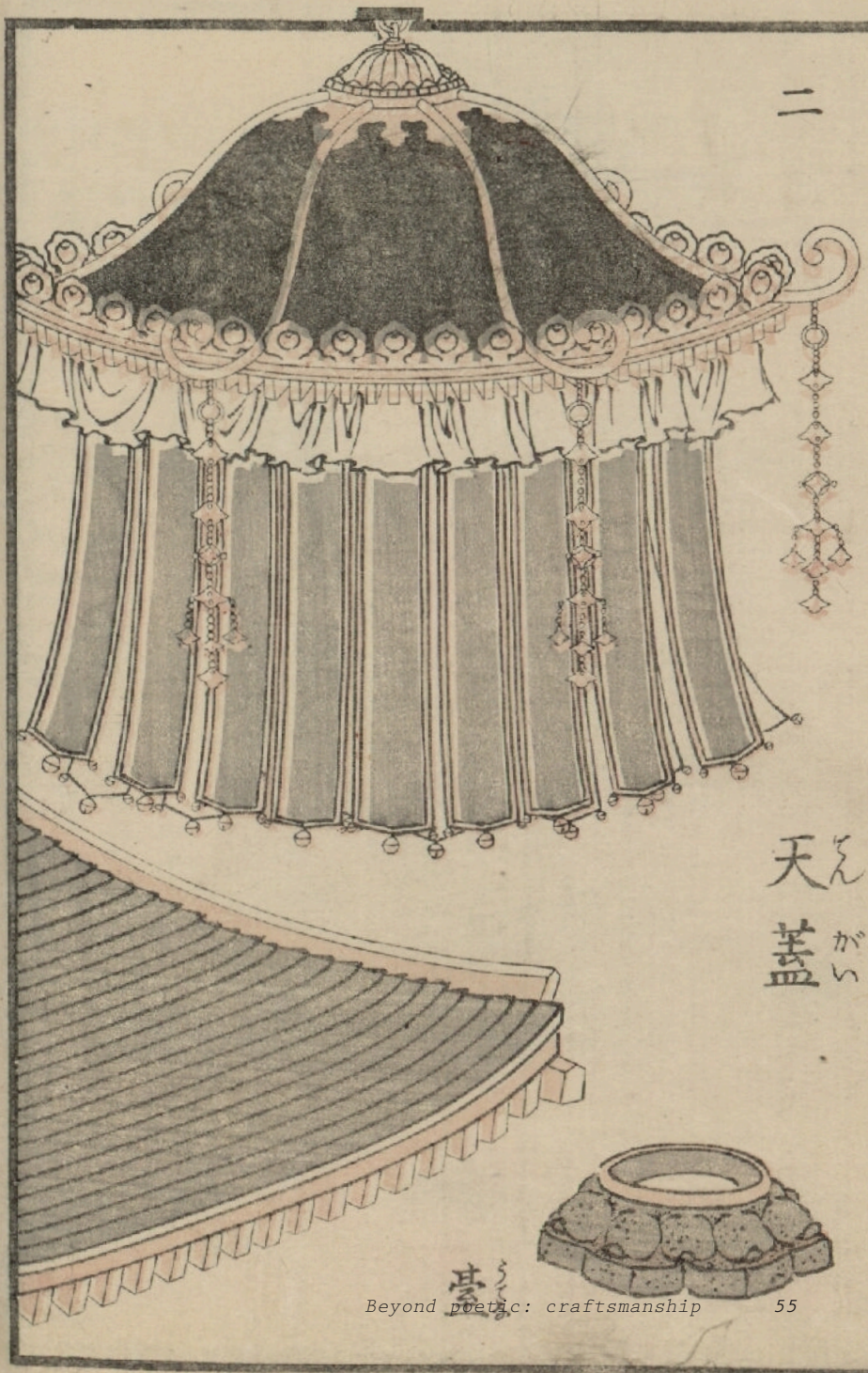

鐘樓一

裏文曰

迷悟三界城
悟故十方空
本來無東西
何処有南北

竿

經堂ヶ
森之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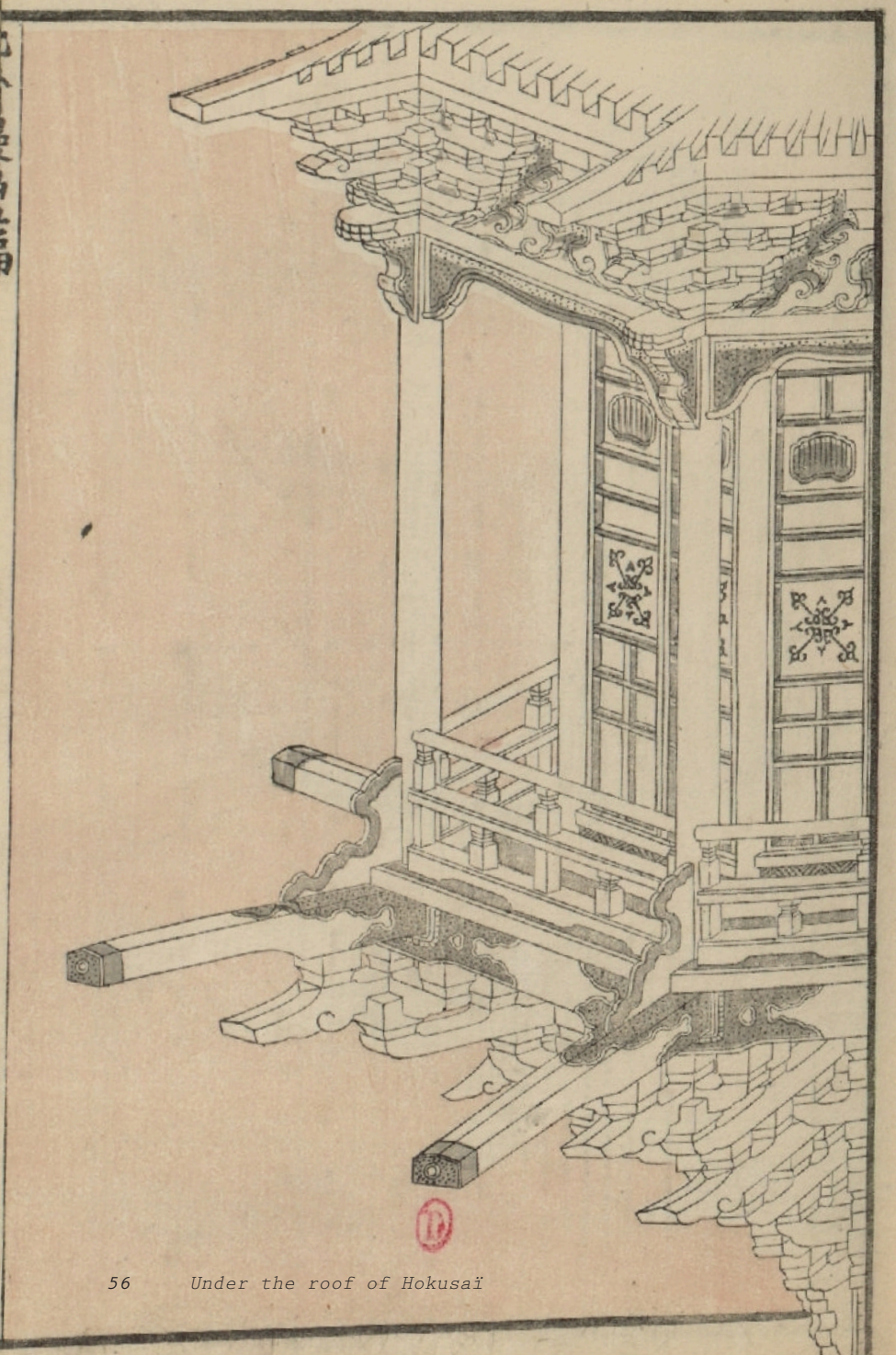
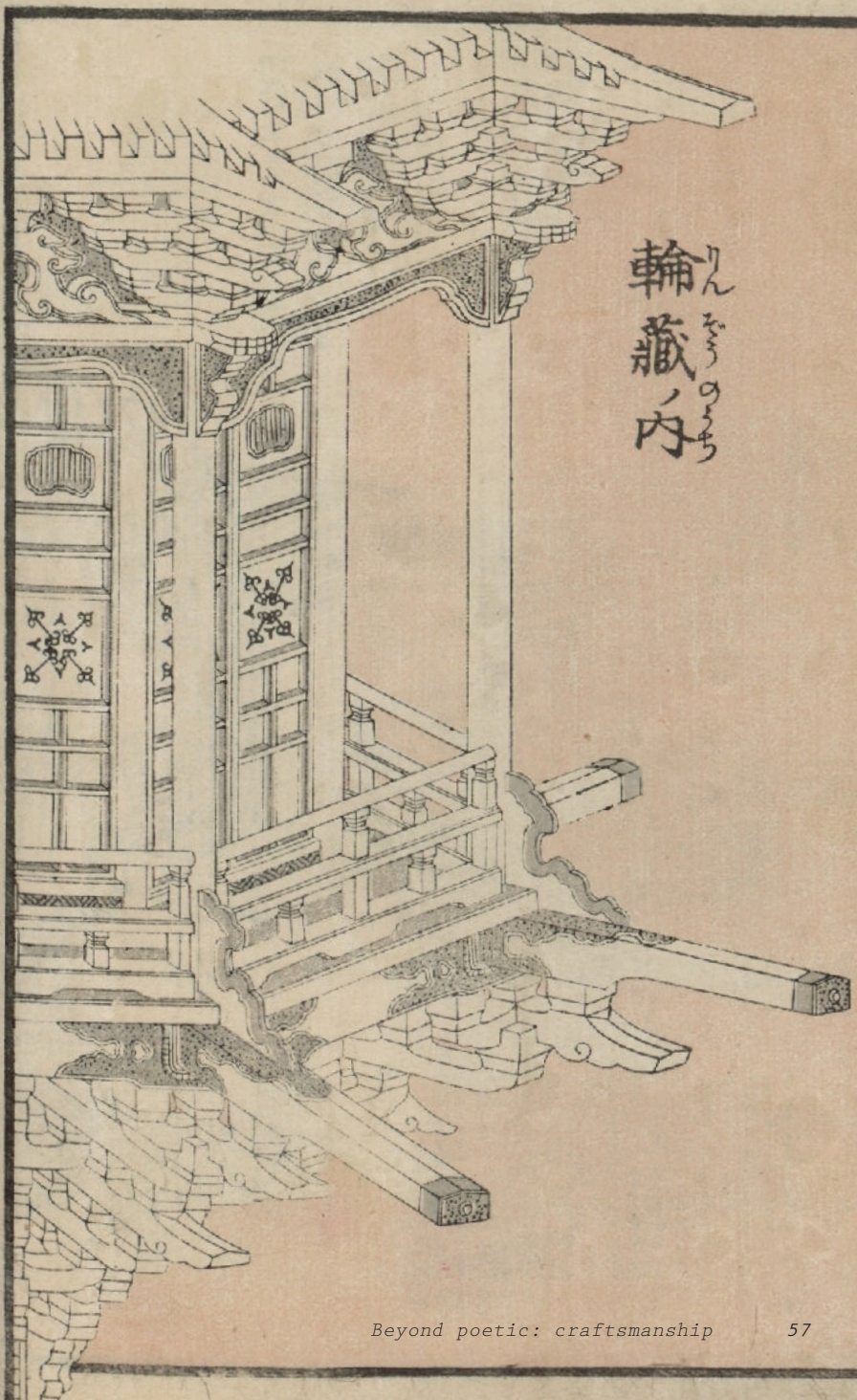
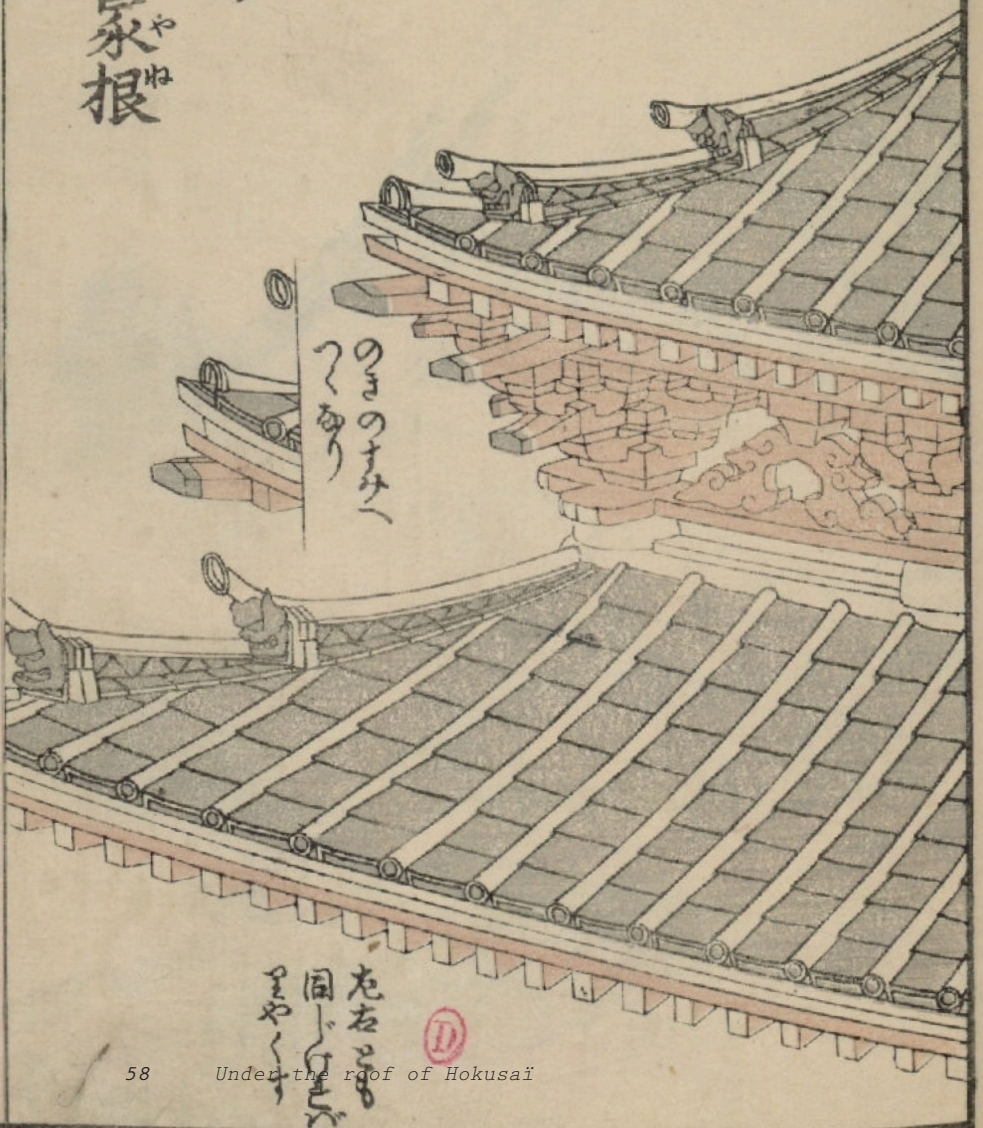
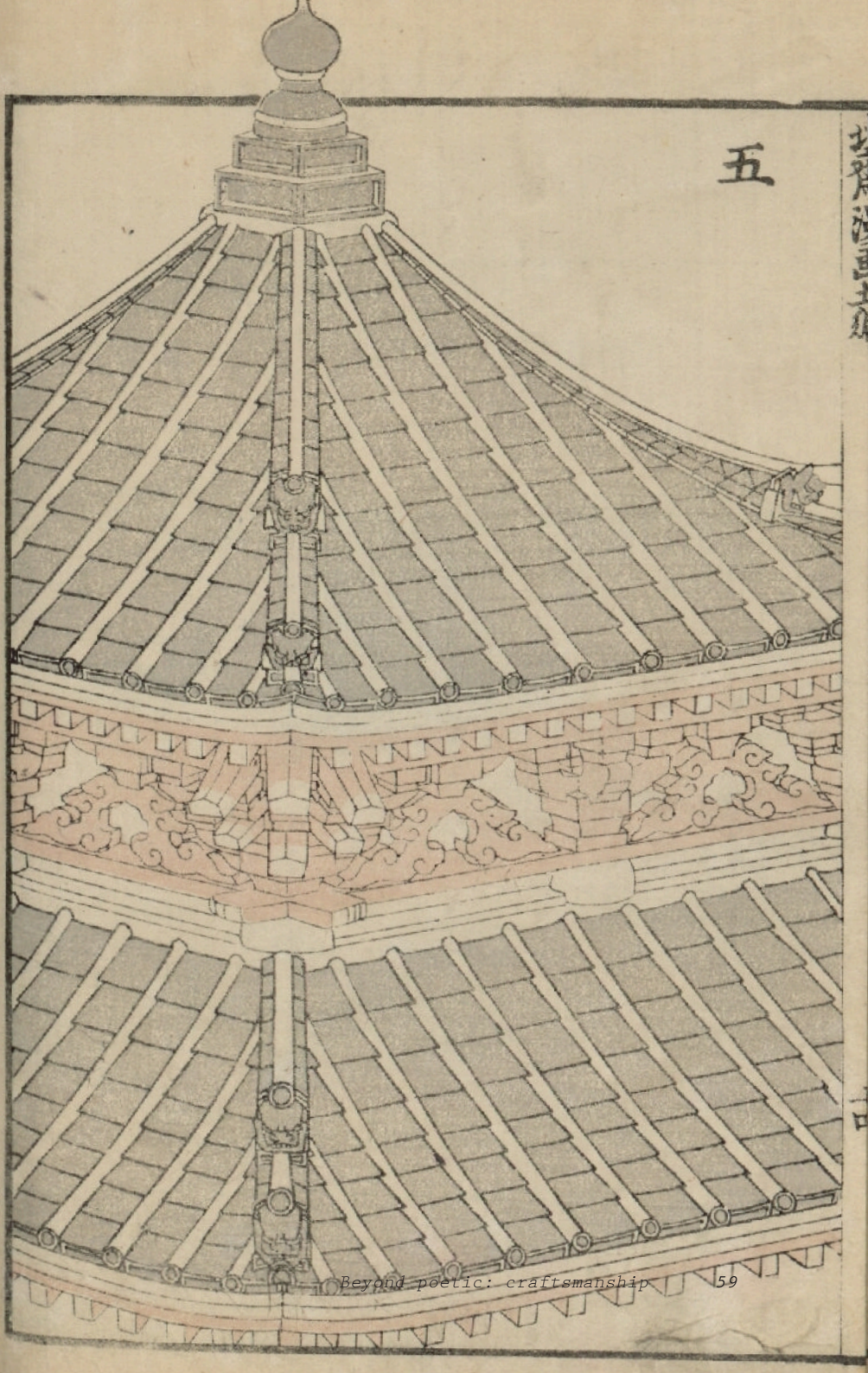
天蓋




輪藏ノ内

輪藏ノ家根

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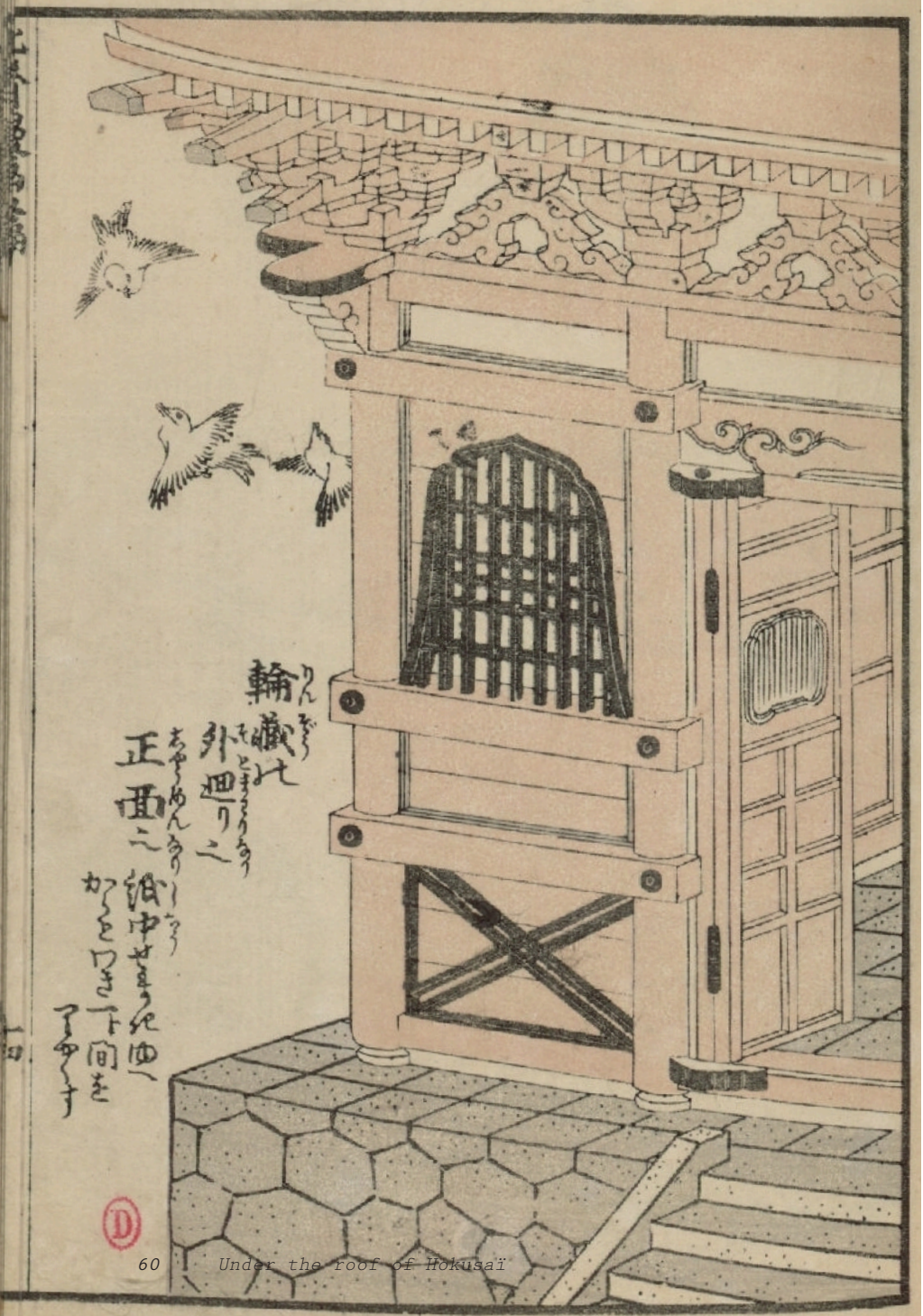
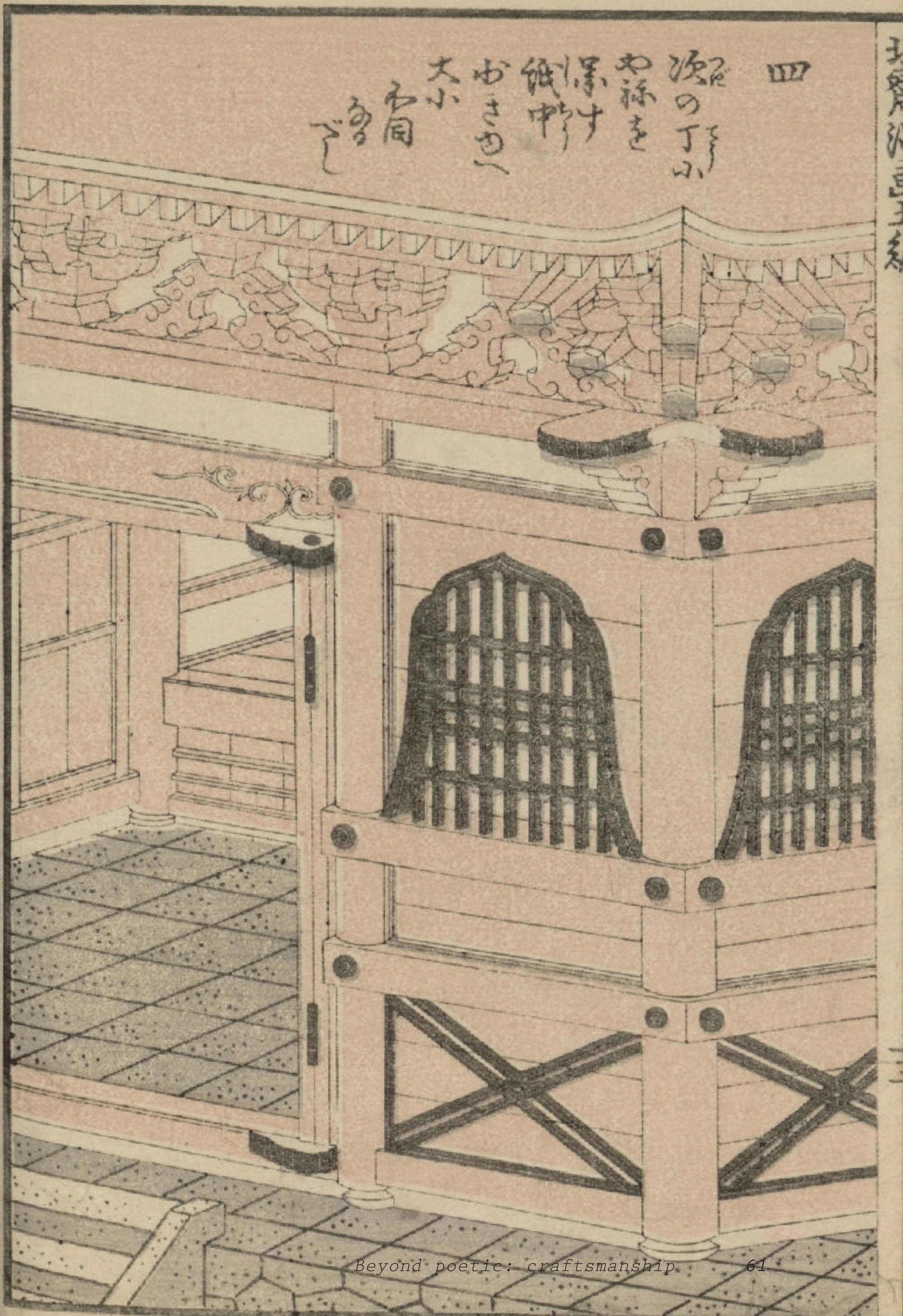

輪藏
外回り
正面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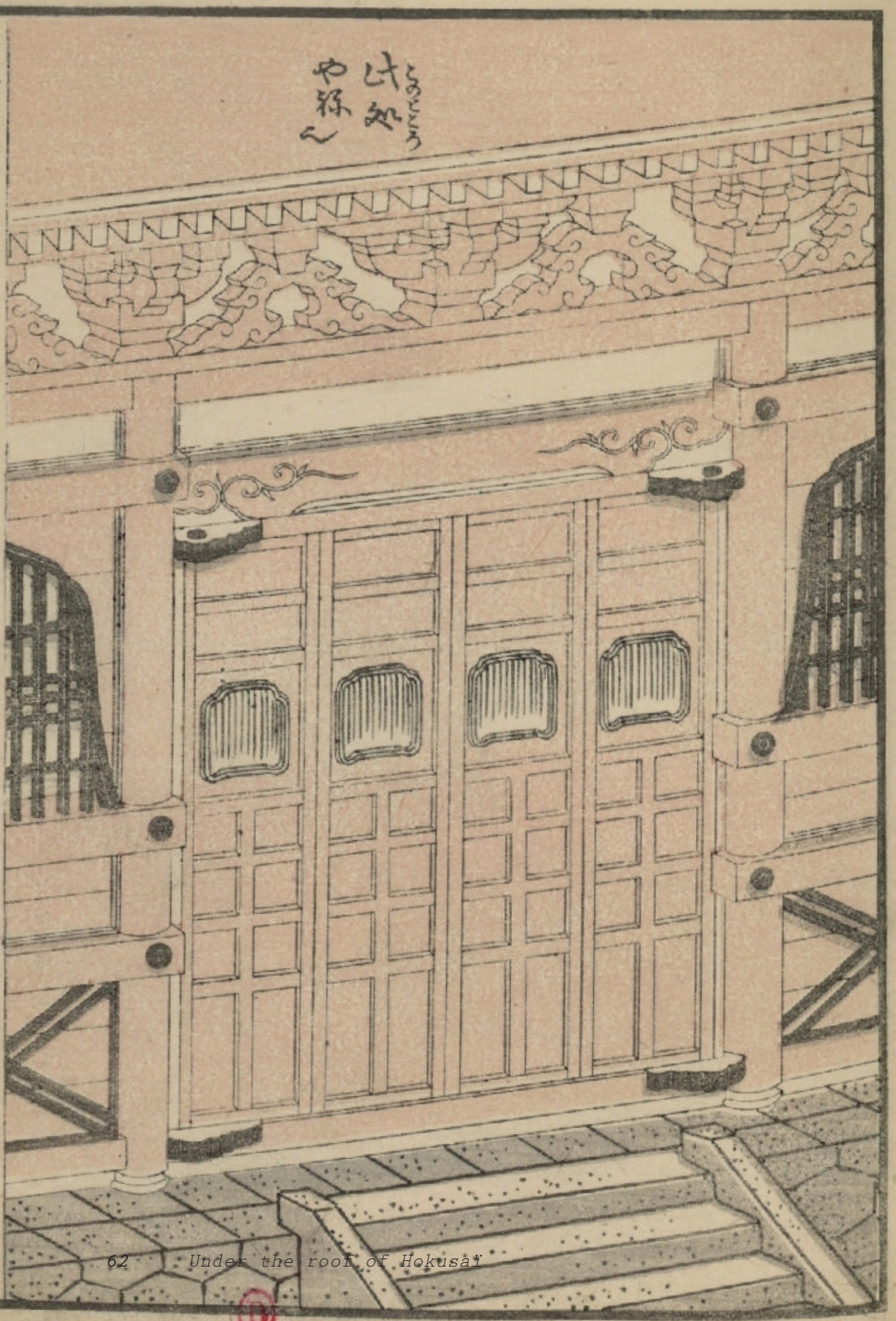


三
輪蔵は脇正面に同じ

Hase-Dera - under the roof an existing shrine

For Hase-Dera's pictures (see Fig. pages 70-76)

The highly detailed illustrations that the volume 5 contains is a first step to the truthfulness of Hokusaï's understanding of architecture and wood craftsmanship. The existence of details does not mean the reality of the whole. Even though it strikes how realistic the Buddhist temple looks, it's necessary to understand at which level it does and how.
Japan has a huge number of Buddhist and Shintoist shrines, and sometimes they are more than thousand years old, and they underwent an evolution during centuries. If the oldest wood structure is from the 7th century - The *Horyu-ji*[40] temple in Nara's prefecture - some others are more recent - such as the *Ginkaku-ji*[41] temple in Kyoto - dated from the 15th century. Within the gap, various architectural styles and techniques have been developed and some of structures may have needed restoration or reconstruction therefore it is challenging to find a unique shrine that could overlap with the old construction's representation of the painter Hokusaï.
The architectural style that is represented in the sketchbook is close to the *Hase-dera* temple from the Nara period in the early 8th century. Initially a monastery, it was built in 747 with

40 Tamoya, Masuda. 1969. Japon: 186-188. Office du Livre. Architecture universelle. Fribourg.

41 Id.

the strength of two hundred monks[42]. The simplicity of the structures and the type of ornamentation are both hints of this early period. In opposition, more recent temples exhibit a wider variation of ornaments, colours, and complexity in their structural lecture.

Somon - The first gate

For Somon's pictures (see Fig. pages 70-71)

The *Somon*, the first gate, has the same characteristics as the precedent drawings analysis. The wood structure is visible and the almost identical double pitched roof is used to cover the entry. On both sides is the beginning of the fences to determine the limit between the holy and secular area.
Comparisons show variation in details between both gates but always with the same constructive or typological guidelines. The wood structure has four pillars instead of two but has only the function to bear a quite massive roof for a double wood door. When we look at the pattern, the same *Kumo* is used on the grid and their tails. Apart from the green shade that the tiles have in *Hase-Dera* which is due to a waterproof paint, the geometry and roofing are identical. Corbel's system is also used to transfer the load to the bearing structure.

42 Iwao Seiichi, Sakamato Tarō, Keigo Hōgetsu, Itsuji Yoshikawa, Terukazu Akiyama, Teizō Iyanaga, Shōkichi Iyanaga, Hideichi Matsubara, and Shizue Kanazawa. 1981. '108. Hase-Dera'. In Dictionnaire Historique Du Japon, Lettre (H), 7:71-73. https://www.persee.fr/issue/dhjap_0000-0000_1981_dic_7_1.

Shoro - The Bell Tower

For Shoro's pictures (see Fig. pages 72-73)

Another reason for choosing this temple is the similarities between *Shoro*. Both based on a based-rock, their wood structures are planned on the same geometric plan and proportions as it was required for the bell tower. Later this construction was improved with the addition of a second level for the door, and a closed space ground floor with wood wall. This cleanliness speaks for the earliest construction.
In the illustration, a slight detail shows that the central strut is composed in two parts which allow two axed grids to cross in order to hang the massive bell. In the existing construction, the same detail appears.
Roofings show two different typologies, as the drawn one is more complex by the use of a hip and gable roof, the second is just a double pitched. Those indications show that Hokusaï was able to develop several constructive perspectives from the simplest to more difficult.

Rinzo - The revolving bookshelves

For Rinzo's pictures (see Fig. pages 74-75)

Not present in each temple, the *Rinzo* in this temple is one of the last listed in Japan. Often sacred, they can be protected by preservation's laws. The foundation of the shelves is also based on a corbel system but axed one on each other. The stacking of the structure frees the space under

sutras and lets the central pillar for the rotation be seen. Many corbels above the six wood posts are used to support the weight's roof and transfer it to the beams carried by them.
The issues in this construction are the following: the number of sutra's being high the weight caused by them is important; the central rotation forces the concentration of efforts in one central pillar and leads to a structural imbalance; in addition the symbolic roof with its six pitcheds also in wood, weighs. This is why the central axis has to be anchored in the ground and in the roof.

Kyozo - The sutra's pavilion

For Rinzo's pictures (see Fig. pages 75-76)

The last element to be correlated with *Hase-Dera* temple is the *Kyozo*. They have the exact same proportions and structure, only some wood ornamental crafts are different. What could be named the *entablature* is formed on four corbels that bear the wall plate which bear the whole carpentry. On the front, structural posts are visible and reinforced with horizontal beams. The eight opening *Katomado* are very similar to the prints as well as the folding doors that are on each side of the building.
This roof is on one level only but the corner's details are the same as well as the matching of roof tiles. The top is also covered by an ornamentation. As no explicit detail has been found about it, and that it is only present on the sutra's pavilion with a *Rinzo*, the hypothesis could be that it is the hidden extremity of the central axis of the bookshelf's rotation.

Besides, the correlation allows us to bring Hokusaï's work beyond his artistic world. The precision and realism with which he engraved every building is directly in correlation with the constructive world of his tradition and society. The finesse of crafts is reflected and shown to the population. Because of his great interest in architectural representation, he exceeded the ancient boundaries of his time. The grouping of different know-how knowledge, their representations viewed as one whole construction, the integration of cultural or symbolical elements that express the tradition and life, and finally the facts that this sketchbook was aimed to be printed in many exemplary showed a way of democratization of architecture and crafts-manship for neophytes.


長谷寺


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轉輪藏

Preservation of wooden architecture

Japanese are known for their highly-developed constructive techniques and craftsmanship. Their isolationist past kind of protected their culture and knowledge from outsider influences unlike ours which was expansionist. For 700 years and until they opened during the 19th, the craftsmanship was developed in this unique context far away of foreign impact, modernisation and industrialization. When the seclusion was done, their constructive knowledge could have disappeared but the status they have taken in the society lead them to the beginning of the Preservation Law. Even if this particular integration of architecture in their intangible heritage came from various factors, illustrations and representation as the one of Hokusaï may have helped.

Because of the great areas of forest in Japan, wood has been mainly used for centuries for load-bearing structure, carpentry, woodwork, joinery, etc. It is significant to understand that the term carpenter implies much more responsibilities than in Europe and could be more related to the western term architect[43]. Also there is a particular relationship between carpenter, construction and wood as it is steeped in an ethical philosophy which makes them consider it as a living organism[44] even after the cut.

As an highlight of the great respect that they show to this intangible heritage, it is worth noting the

43 Cohen, David, Sherry Mckay, Linda Brock, Raymond Cole, Helmut Prion, and Dave Barrett. 1996. 'Wood Construction in Japan, Past and Present': 19. Forest Products Journal, Materials Science & Engineering Collection, 46 (11/12): 18-24.

44 Id.

3'844 wood constructions designated as Important Cultural Properties in 2003, as well as the sixty-two historical towns and villages including more than 10'000 houses and other structures[45]. Preservation's principles are deeply rooted in their perception of their culture and heritage and it might have allowed the survival of wood crafts through the evolution of construction.

Post-and-beams structure

The use of wood in architecture implies automatically post-and-beam structures that forces one to develop expertise in joinery such as mortise-and-tenon, wedges and pegs. Those specificities allows wood structure to be reversible and help the maintenance by the possibility of its dismantlement[46]. This potentiality is directly connected to the same Japanese constructive philosophy previously exposed: *maintenance vs. robustness*.
Another basis is the exposed structure which became one of the main essences of Japanese traditional design and let the expression of forms and patterns as ornamentations.
Among various joint's details, three categories exist: splicing joints, connecting joints, and miscellaneous[47]. Splicing joints[48] are used to connect girders, beams or ground-sills but always when it is in the same axis. It allows the construction of pieces bigger than the basic dimensions of

45 Satoshi, YAMATO. n.d. 'The Tradition of Wooden Architecture in Japan: 2', 18.

46 Id.

47 Toraschichi, Sumiyoshi, and Matsui Gengo. 1990. Wood Joints in Classical Japanese Architecture: 1, 29, 63. Kajima Institute Publishing Co. Japan.

48 Id.

massive wood. Depending on the intern structural efforts pieces are differently curved. In addition to this first group, the connecting joints[49] have the capacity to develop their structure in multiple directions. Some of them are used to create a change of direction when others can create until three. They may be the most difficult to realize. The last one reunites multiple joints but only the one for gable boards[50] is linked to carpentry.

Evolution - Transmission

The whole knowledge around wood craftsmanship from joinery techniques, tools, and gestures has continued to evolve in a uniquely Japanese manner[51]. The great perfection of their craftsmanship is the consequences of the wood post-and-beams composition, the wide weather exposition and furthermore to the continuous transmission between generations. While those techniques were currently practiced, they were not exposed to disappearance. But since the modernisation of the construction during the 19th, because of the end of the isolationist politics, those techniques were threatened. This is why Japan set up the preservation perspective during this period.
Since the establishment of the law, many aspects have improved and nowadays, this is the first country to have shaped the concept of Living National Treasures. As it is named, this notion has the capacity to elect living people that possess a

49 Toraschichi, Sumiyoshi, and Matsui Gengo. 1990. Wood Joints in Classical Japanese Architecture: 1, 29, 63. Kajima Institute Publishing Co. Japan.

50 Id.

51 Satoshi, YAMATO. n.d. 'The Tradition of Wooden Architecture in Japan: 5', 18.

high degree of knowledge in their work. It helps to preserve intangible knowledge around construction and perpetuate skills beyond tangible productions. The Japan state financially supports those people to let them practice their crafts, and assure the transmission to new craftsmen.

Synthesis and freedom

With the aim to answer initial questions about the constructive knowledge that Hokusaï's illustrations release and their influence on the preservation of craftsmanship's heritage, several perspectives have been investigated from pictorial elements to constructive techniques.
The history that remains behind Hokusaï's life shows the path that led him to understand and represent architecture in his time and society. The innovative techniques had the advantage to mix artistic design and geometric skill which helped to perceive his buildings as a whole composed of various crafts. Because of the illustration's process every detail was highly documented and therefore linkable to existing architectural objects. The truthfulness behind his work is thus obvious.
Once the reality of his architectural understanding is confirmed, a precise analysis of each component could be done. The analysis revealed great knowledge of craftsmanship that shaped traditional architecture, and ancient society of Japan.
Because we currently know that the Japanese developed a particular perspective of heritage's preservation of crafts, it is possible to figure out how the change of perspective made by the painter could have helped to raise awareness on architecture. Not only on tangible production as it was already done by his time but also on intangible elements such as know-how or philosophy.
Among other influences, Katsushika Hokusaï was an innovator. The highly skilled architectural representations demonstrated his great consideration of his built environment. And the fact that he absorbed the segregation of the craftsmanship's

knowledge by submitting it to non-experimented people such as young painters make him one of the first to democratize crafts details.

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Illustrations

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