

niponica

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Discovering
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Special Feature

Blending Technology with Tradition:
Amazing Paper in Japan



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Cover photo: The kimono-clad woman's parasol has a canopy made of *washi* paper.
(Photo: amanaimages Inc.)
Above: Underside of a *wa-gasa* parasol made with *washi* paper of many colors. It lets the sun through gently. (Photo: Takekasa)

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Special Feature

Blending Technology with Tradition: Amazing Paper in Japan



Beautiful cut paper decorations shaped like sea bream (a fish associated with good luck), and folding fans. Shrines in the Tohoku region of northern Honshu have long passed on the custom of displaying them in the household shrine at New Year. (Photo: Oya Takao)

Paper can be a lot more than just a medium for communicating and recording information. The Japanese have long been adept at using paper for a wide variety of purposes. That flair is very much alive today, demonstrating new possibilities for paper.

Paper in Japanese Culture

Washi: Tradition and Evolution

Paper has played a prominent role in everyday life in Japan, as culture and paper converged in unique ways. These pages offer a perspective on the rich Japanese culture of paper.

From a conversation with Sugihara Yoshinao

Photos: Kuribayashi Shigeki

Collaboration: Sugihara Shoten

Early beginnings

Papermaking techniques came to Japan from China, reportedly in the early part of the 7th century. Back then, it was made from hemp. Hemp fibers are very long and tough, and getting them into a workable state requires strenuous, time-consuming cutting and beating. So a switch was soon made to the fibers of native shrubs like *kozo* (paper mulberry), *gampi* and *mitsumata* (paper bush), which are broken down more easily.

Kozo is used for making a pliable yet heavy-duty paper, *gampi* for a densely woven, glossy product, and *mitsumata* for a smooth, glossy finish. Hold *washi* up to the light and you will see how the fibers are intricately woven together. The longer the fibers, the more they are knit together, creating the potential for a sturdy paper. The length of *kozo* fibers is about 10 mm, while *gampi* and *mitsumata* both come in at about 5 mm.

Washi is light in weight, and soft in texture. The fibers tend to ride up on each other, creating opportunity for the formation of tiny layers of air. Although the paper may appear dainty, it is hard to rip, giving it many purposes. *The Tale of Genji*, thought to have reached its existing form by the early 11th century, included this comment: "Foreign paper is easily torn." So even back then, people were aware of the strength of *washi*.

Below Left: A scene from *Genji Monogatari Emaki* ("Tale of Genji Scroll"): *Yugiri*, from a novel depicting the lives of the aristocracy. The scroll was drawn in the 12th century. (Property of the Gotoh Museum)

Right: One of the *Hyakumanto* ("1 million pagodas") made centuries ago (height approx. 20 cm). Each pagoda held one *Hyakumanto Dharani*, a strip of *washi* paper inscribed with a Buddhist prayer (below right). (Private collection)



The toughness comes also from the manufacturing method. The *nagashi-zuki* method interweaves long plant fibers into a uniformly sturdy sheet. The fibers are rocked back and forth in a mixture of water and *neri*, sticky matter made from *tororoaoi* (sunset hibiscus) or some other plant having glutinous properties. As the long fibers weave themselves together, liquid is cast out in a repetitive motion until a tough, evenly formed sheet of paper is made.

Papermaking spread through Europe around the middle of the 12th century, and as time passed, artisans switched from hemp to cotton fibers. They used the *tame-zuki* method, letting water drain out through the mold, rather than casting it out, as in the *nagashi-zuki* method. This is suitable for short fibers that disperse themselves well in water, but the draining occurs only once, and this tends to result in a paper that is easily torn and uneven in quality.

An inspiration for Japanese culture

Artisans apparently established the *nagashi-zuki* method in the Nara period (710-784), when copying and distributing sutra prayers became part of a national campaign to spread Buddhism. This goal required plenty of paper, prompting the cultivation of *kozo* for the raw material, and the teaching of papermaking techniques in different parts of the country. The *Hyakumanto Dharani* was a series of one million miniature wooden pagodas, each containing a rolled-up strip of paper with excerpts from a Buddhist sutra printed on it. Those still in existence were printed in 770, making



Making *washi* paper the traditional way. Left: Pulp water is lifted and filtered through a reed screen, using dexterous hand motions. Right: The paper sheets are placed in the sun to dry. (Photos: Mino City Government, Nakata Akira)



Sugihara Yoshinao
Representative Director of Sugihara Washipaper Inc. Tenth-generation owner of Sugihara Shoten, a wholesaler of *Echizen-washi*. He plans, manufactures and markets traditional handmade paper that has deep local roots. While maintaining tradition, he is a proponent of new types of *washi* for the modern age, including *washi* paper for inkjet printers.

them the world's oldest printed work. We can assume that production was as huge as it was because artisans had already mastered *nagashi-zuki* papermaking techniques.

During the Heian period (794-1192) the culture of the aristocracy flowered. Native *kana* letters were invented, and this encouraged the reading and writing of novels and *waka* poetry. These were sometimes written on gorgeous paper to highlight the content, using dyes with hues like *murasaki* (violet), *ai* (indigo), and *beni* (crimson). Some paper was ornamented with sprinklings of gold and silver.

The Edo period (1603-1867) was a time when woodblock printing techniques were mastered, not only by illustrators working for the Shogunate, but also by other artisans who made *kawara-ban* newspapers and *ukiyo* woodblock print posters, both of which were produced in large quantities. During the Edo period, then, ordinary people were using paper on a daily basis.

A regular part of life

Washi came to serve many purposes because it is sturdy, beautiful and highly versatile.

Traditional architecture in Japan would hardly be Japanese without *shoji* and *fusuma* sliding screens and partitions. Their use of *washi* is striking. The *shoji* latticework is covered with *washi*, and light passing through it caresses the interior with a touch of nature. *Fusuma* are covered with decorative paper to define and beautify space.

Washi can be made waterproof and stronger with a coating of persimmon tannin lacquer or oil, for the manufacture of containers, umbrellas and other often-used products, even items for the wardrobe. *Washi*, either cut into fancy shapes, folded or glued together, demonstrates its adaptability:

- in annual festivities as *tako* kites flown at New Year's, *koi-nobori* banners¹ fluttering in the wind in May, and *tanabata* strips of paper² in summer;
- in games such as *karuta*³ and *sugoroku*;⁴ and
- as decorations for Shinto and Buddhist rites and festivals.

Washi came to play many roles in daily life in Japan, and some live on to the present day.



Folded white paper streamer (*shide*) tied to a *torii* gate at Shimogamo Shrine, Kyoto. *Shide* are decorations, but at the same time they are emblems indicating a sacred place. They are similar in this way to the cut paper art on pages 2 and 3. (Photo: Nakata Akira)

The future

Handmade *washi* entered into a decline in the Meiji period (1868-1912), due to the importation of paper from large-scale mechanized factories overseas. The paper we use today is made from fibers about 1 mm long, solidified from a wood pulp mush with the help of chemicals. This makes it suitable for mass production, but also makes it easy to tear and limits the ways it can be used. *Washi* can still satisfy many needs because of its manufacturing techniques and characteristics. For instance, although Japan's paper currency is known for the advanced technologies used to print it, less known is the fact that the bills incorporate certain advantages of *washi*—they contain *mitsumata* materials for a smooth finish and extra strength, and have watermarks developed by *washi* makers to prevent counterfeiting.

I often display items made of *washi* at overseas exhibitions in Paris, London, Milan and elsewhere, seeking to spread appreciation of its charms. Visitors are surprised that a natural material can be used in so many ways. My recent projects include mixing traditional materials with wood pulp or rayon, using machinery to replicate manual techniques, and developing new types of *washi* for interior decoration and ink jet printers.

The potential continues to grow. And one thing is sure—new varieties of paper for as yet unknown purposes will be developed. They will hold true to the tradition of *washi* while fitting in with modern lifestyles.

¹ *Koi-nobori*: Windsock-like banners resembling huge fish (carps), flown to celebrate a boy's growth on May 5 each year.

² *Tanabata*: Decorative paper strips inscribed with wishes and attached to thin bamboo poles. Displayed on July 7 every year.

³ *Karuta*: Small rectangular playing cards made of thick paper, printed with illustrations, writing, etc.

⁴ *Sugoroku*: A board game. Lines divide the paper board into squares that make up a highly illustrated tableau. Players advance their pieces by the number shown on thrown dice.



Light passing through *washi* paper softens the contours of space.
Top: Ceiling illumination for the Fuji-no-ma Hall at the Kyoto State Guest House. (Photo: PIXTA)
Above: *Washi* gate. The work is called *Koukou* ("Rainbow Light"). Threads of seven colors were incorporated within the paper during the manufacturing process. (Horiki Eiko Exhibition, 2012. Photo: Asakawa Satoshi)

With *Washi*, Light and Space Shimmer in Harmony

Next page: Lights inside *washi* paper "curtains," for a store display at Guerlain in Paris, 2014. (Design and production: Jörg Gessner. Photo: Sugihara Shoten)

Below: *Byobu* screens covered with a tough *washi* paper that incorporates fabulous flower motifs. The paper was handmade using *Edo-Karakami* techniques. (Photo: Tokyo Matsuya Inc.)





Tapestry art expressing the moon in different phases. The *washi* was given pale tints during the manufacturing process. A creation of Horiki Eriko, Japan's most prominent designer using handmade *washi* to give artistic expression to space. She is active in the design of architectural space in Japan and abroad. (At Hanamurasaki Restaurant in Ishikawa Prefecture; Photo: Photography department of Shinkenchiku-sha Co., Ltd.)



For Rituals and Celebrations, for Art and for Fun... Paper Brightens Up Life in Japan



Top: A crane figurine made with *mizuhiki* (twisted cord made from thin strands of *washi* paper). You are just about sure to see one at tables on formal festive occasions. (Photo: amanaimages Inc.)
Two items mid-page left: *Esugoroku* paper board games. They became popular in the Edo period (1603-1867). (Property of the Paper Museum)
Bottom: *Karuta* cards. The object of the game is to match the *e-fuda* (picture card) with a text. (Photo: Kuribayashi Shigeki)



Washi is light, making it perfect for kites dancing in the sky. The three here are (clockwise from top): *Nambu-dako*, *Oni Yazu*, and *Oni Yocha*. (Property of the Kite Museum, Japan Kite Association)



Top right: The *Tanabata* festival is a time to write hopes and desires on colorful paper strips, then hang them on thin bamboo poles on July 7. Scene at Kitano Tenmangu Shrine, Kyoto. (Photo: Sudo Koichi/Aflo)
Bottom right: An *uchiwa* fan will cool you down on a hot summer day. *Washi* paper glued to a bamboo framework. (Photos: Komaru-ya Sumii (above) and Aiba (left))



Yes, You Can Wear Paper

Washi paper and *shifu* paper cloth are two traditional materials bringing excitement to today's fashion world. Young manufacturers recognize the uniquely pleasant texture that only paper can give, and with the application of technology and design they are opening up new frontiers for clothing.



1. Parasol. The canopy is paper cloth made from traditional *Mino-washi* (Gifu Prefecture). The texture gently softens the light underneath. (Photo: Hayashi Kogei)
2. Earring with a modern design, but inspired by traditional *mizuhiki* (a twisted paper cord used since ancient times for tying a gift package in a decorative fashion). (Photo: TRART)
3. Pattern clothing taking advantage of full size sheets of *Shiroishi-washi*. From the Issey Miyake Men Spring/Summer 2013 collection. Theme: "Living with a Bicycle." (Photo: Issey Miyake Inc.)
4. Blouse made from woven *washi* paper, cotton, and linen. Special techniques make it possible to transform *washi* into thin threads. The result is a supple texture.
5. Shawl made from 100% *washi* material, colored with natural dyes. Light, warm, and beautiful too. Absorbs and then releases moisture well. (Photos 4 and 5: Natural Dye Studio Tezomeya)
6. Bags made from a fabric developed by one of Japan's well-known product designers, Fukasawa Naoto, and the *washi* paper manufacturer Onao Co., Ltd. Highly durable. (Photo: SIWA)
7. Baby's first shoes. Made entirely from *kozo* grown in the locality famous for *Sekishu-Banshi*, which is now on UNESCO's Intangible Cultural Heritage list. The paper cloth threads are all made from natural materials worked by hand. (Photo: Kawahira, a manufacturer and seller of *Sekishu-Banshi* and *Sekishu-washi*)



High-Tech Paper: Bringing Convenience to People's Lives

Paper is used in every aspect of daily life, and in Japan the race is on to develop technologies for new types of paper that offer even greater freedom and convenience.

Photos: Fukunaga-Print Co., Ltd., Musashi Co., Ltd., Nippon Paper Papyrus Co., Ltd., Nippon Paper Creca Co., Ltd., Shibatake Kakoshi Co., Ltd., Mitsubishi Pencil Co., Ltd., and the Laboratory of Professor Isogai at The University of Tokyo, PIXTA

Left and below: The "air vase" is the result of highly advanced die-cutting techniques and superlative design. It was born during the Kami no Kousakujo Project launched by the company Fukunaga-Print Co., Ltd. and collaborating creators. (Photos: Tomita Satomi, Tatsumi Yosuke (healthy))



A world of possibilities: Paper processing and special types of paper

Here are some highly unusual products you might not believe are made of paper, until you look closely. They come from a small printing company in the Tokyo suburbs specializing in paper processing techniques like punch cutting and intricate folding methods. The company is getting plenty of attention for its stunning "air vases," manufactured in collaboration with outsourced creators. They seem to float in air and show an ever-changing shape. Each one is made from a single sheet of paper, cut in an extraordinarily delicate manner which looks like a beehive. Before succeeding with a finished product, the company's dedicated artisans used their intuition to make more than a hundred prototypes during a project that began with manufacturing metal dies and ended with punch-cut paper strands with thicknesses in the 0.01 mm range.

Another project pursued by the company, this one in collaboration with an architect, came up with 1/100 scale model kits containing miniature paper parts. The kits have taken the model-making hobby industry to a new level, and are now commercially viable thanks to painstaking and attention-to-detail punch cutting techniques.

Japan's ancient papermaking traditions are alive today in techniques used to make a special product called synthetic paper. One type has a surprising role on voting day. When the ballot is folded and dropped in the ballot box, something strange happens inside the box—the ballot opens up



A miniature world of paper created through a combination of the design ingenuity of architect Terada Naoki and the innovative die-cutting techniques of Fukunaga-Print Co., Ltd. Precision-cut pieces of paper come together to form a 1/100 scale model of a scene during the cherry blossom season. The scene measures 103 x 148 mm. (Terada Mokei and Fukunaga-Print Co., Ltd. Photo: Masunaga Kenji)



by itself. This makes ballot counting a lot easier and leads to faster election result announcements. The ballots are printed on YUPO Synthetic Papers®, which are a type of film material made primarily from polypropylene. It looks like paper and feels like it, too. In the early development stage it was too smooth, but this problem was soon eliminated, making it easy to write on, even with a pencil. The same manufacturer has developed a machine to automatically read which candidate the voter has chosen, and this too has helped create a highly advanced election system.

Paper diapers and other high-quality sanitary products include an advance you would naturally expect to come from Japan, in the form of improved tissue paper. The paper includes glycerol and other substances for a moisturizing effect and has a soft, gentle touch, a blessing when blowing your nose a lot during a cold or pollen allergy reaction. The paper hit the market about 20 years ago, and now offers many types of moisturizing ingredients, including menthol, hyaluronic acid and collagen. Many women use it as part of their makeup set.



Above left: When voters fold their ballots and push them into the ballot box, the ballots open up by themselves inside the box. Ballot paper sold by Musashi Co., Ltd.

Above right: The paper breaks down as soon as it is soaked in water. Water-soluble paper made by Nippon Paper Papyrus Co., Ltd.

Bottom: "Kleenex® Lotion Tissue X" paper made by Nippon Paper Creca Co., Ltd. is coated with plant-based glycerol for a moisturizing effect.



Left: In Japan, most orchards wrap each fruit in a paper bag to obtain optimum quality. (Photo: amanaimages Inc.)
Above: Apples protected by bags developed by the company Shibatake Kakoshi Co., Ltd. Keeping out direct sunlight gives the fruit a more colorful and vibrant appearance.

Right: Discs covered with an adhesive paper friction material (below) developed by Dynax Corporation. The paper improves clutch action.
Far right: Inside a motor vehicle's automatic transmission, steel discs engage and disengage to change speed.



And then there is a paper that rapidly breaks down when moistened with water. It was developed by shortening the bonds between paper fibers to a minimum. The disintegration speed is far greater than what one could expect from ordinary toilet paper—the new paper simply vanishes in water, making it is an excellent choice for sowing seeds in bags in the ground, for paper lanterns set afloat on a river, and for other purposes requiring the paper to disappear. It also demonstrates the future possibilities of paper.

A helping hand for industry

Paper is doing its part in one of Japan's key industries, car manufacturing. The clutch in automatic transmissions uses thin steel discs to transmit the force of the motor, taking advantage of friction for automatic gear shifting. It was paper that inspired the idea, and the discs are actually covered with a friction material made out of paper. The material is first treated so that it readily absorbs oil and releases heat, giving it the ability to withstand wear-and-tear practically forever and perfecting a friction material that will last longer than the car itself.

Paper has an important role to play in agriculture, as well. In a Japanese orchard you are likely to see paper bags carefully protecting the fruit for a certain period of time before the harvest. One reputable manufacturer has made bags from traditional *washi* paper for more than 100 years, coating them with persimmon tannin. Today, its purpose-designed paper bags protect the fruit from wind,

rain and insects while repelling water and maintaining just the right amount of ventilation. Moreover, baggies for apples, placed over the fruit a month before harvest, keep out excess sunlight to control the production of chlorophyll and give a brightly colored effect. Mangos are also covered with bags, which are double-glued at the bottom to prevent the fruit from dropping out when fully ripe. These are just two of the bag types developed specifically for each fruit.

New paper materials offer potential for a brighter future

New materials are turning the whole idea of paper on its head, ever since Professor Isogai Akira of the Faculty of Agriculture at the University of Tokyo was awarded Sweden's Marcus Wallenberg Prize, which is considered the "Nobel Prize" of the forestry industry. Many corporations and universities are conducting research in cellulose nanofibers, a structurally refined material obtained from wood fiber, but his research lab was the first in the world to succeed in using a special chemical reaction to break down wood pulp to the structural unit level of microfibrils, which form strong bonds within the cell walls of cellulose and tend to be difficult to separate. This success led to the creation of an entirely new type of cellulose nanofiber.

"Cellulose nanofibers are five times stronger than iron, and five times lighter. They can also incorporate many metal ions. These advantages have led to developments promoting the commercialization of ballpoint pens with

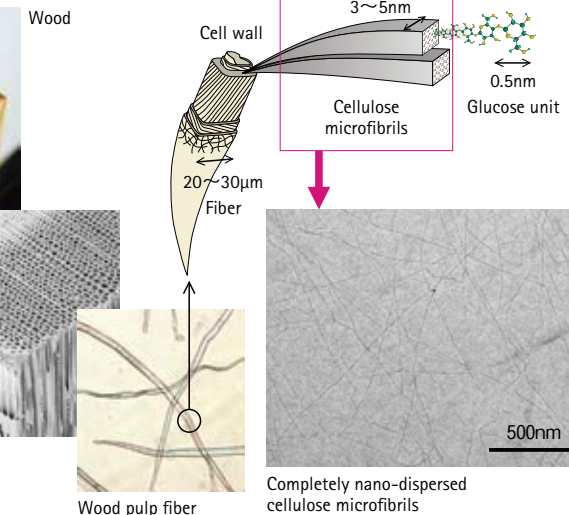


Photo: Natori Kazuhisa

Cellulose nanofibers made by stripping microfibrils from the cell walls of wood cellulose, then breaking them down. The nanofibers hold much promise for a wide range of future developments.



dependable ink flow, and paper diapers with more than three times the deodorizing power," explains Professor Isogai.

Because they have properties similar to carbon fiber, cellulose nanofibers show potential in the manufacture of aircraft and motor vehicles. And they hold the secret to achieving greater recycling and a more sustainable society by reusing wood from Japanese cedar and Japanese cypress trees, which make up about half of Japan's forests.

"The knowledge built up by engineers in the paper manufacturing industry is now being transformed into new industrial know-how, thanks to Japan's world-class, cutting-edge papermaking technologies," says Professor Isogai with evident pride in his voice.

Paper has played an important role in the everyday lives and industry of the Japanese for more than a thousand years. Today, those techniques are moving in new directions for the benefit of future generations.

Above right: Uni-ball Signo UMN-307 pens made by Mitsubishi Pencil Co., Ltd. The ink incorporates just the right amount of cellulose nanofibers for an even flow.

Below right: Professor Isogai Akira with a sample of the cellulose nanofiber his laboratory developed, and a testament of the Marcus Wallenberg Prize. (Photo: Natori Kazuhisa)



Paper Traditions Live On in New Ways

Washi paper has a history going back 1,300 years, and its traditions are alive and well today with growing possibilities for the future.

Photos: Miyamura Masanori

Washi and graffiti art: Graffiti artist TOMI-E

Ukiyoe woodblock prints had their heyday in the Edo period (1603-1867). Their subjects were often famous places or beautiful women, and they were incisive in depicting the times. A woodblock is used to print one color after another on the same sheet of *washi* paper to produce *ukiyoe*, but TOMI-E is very much a 21st century *ukiyoe* artist, spraying color on *washi* instead.

When he was 16 he went to the United States, where wall graffiti art was quite an eye-opener for him. He began working in the genre himself, and after returning to Japan he experimented in ways to express his own identity as a Japanese person through art. He came upon *ukiyoe*, and after that he decided to work with *washi*.

"*Washi* takes in ink well, giving a rich luster and colors that you couldn't get with canvass or a wall. When I saw that, I knew I'd found what I was looking for."

He was captivated. While studying the possibilities, he discovered *washi* made by the recognized Living National Treasure, Iwano Ichibei. Every one of Iwano's sheets has its own spirit, each with a slightly different thickness and texture. Making the most of Iwano's paper, TOMI-E's approach to his own art form changed.

"A wall can be painted and then repainted on top of the old, but with *washi* paper you have only one chance to get it right. So I tend to concentrate more than before when using *washi* paper."

Using spray to depict our own times on *washi* paper, TOMI-E is creating a new type of art.



Above right: Two works inspired by old *ukiyoe* prints of women. Whether the tones are vibrant or subtle, traditional *washi* paper brings them out beautifully, helping the artist achieve the expression he wants.
Right: TOMI-E in front of his graffiti art.

Three generations, linked by papermaking tools: Yoshida-ya Sashimono Joinery

Making *washi* by hand requires many kinds of tools. In Fukui Prefecture, where *Echizen-washi* paper is produced, such tools have been made by Yoshida-ya Sashimono Joinery for nearly 100 years. It is still making and repairing tools such as *suki-geta* (wooden frames), at a time when tool artisans are declining in number in Japan.

The person primarily in charge of work there is Yoshida Minoru. He is the third-generation owner and the father of the fourth-generation successor, Kiuchi Masa'aki. Wooden frames stand up well to water and are made with lightweight wood from a tree called *Aomori hiba*. It takes many years of experience to make a good wooden frame—for example, the thickness of the frame has to be calibrated to prevent them from bending under water pressure when the pulpy liquid is lifted. Masa'aki says, "I had a different kind of job before, but I didn't want to see my father's technical skills disappear with the passage of time." This is why he decided to carry on the family's work. They get orders from places throughout Japan. "It can be kind of stressful. But if we don't keep at it, techniques could die out."

Minoru's grandson, Masayasu, is training in this craft. "I've wanted to do this kind of work ever since I was a kid. My grandfather is awesome—he can sense right away what people want in their tools, and he makes them accordingly. I want to be able to do that." He certainly shows his dedication on the job.



Above: At the workshop. From left: Kiuchi Masa'aki, Yoshida Minoru and Yoshida Masayasu.
Left: Yoshida Minoru, checking the condition of a *suki-geta* wooden frame after repairs. A wooden frame can be used for about 20 years if maintained properly. Continual motion in water exerts a lot of pressure on it, so the joinery makes sure it will stand up well over many hours of use.

People from three generations working together—they show how treasured techniques are being passed down through the years, helping to maintain *washi* manufacturing.

Presenting *Edo-Karakami* decorative paper charms to the world:

Yanagi Tomoko, Interior Design Coordinator

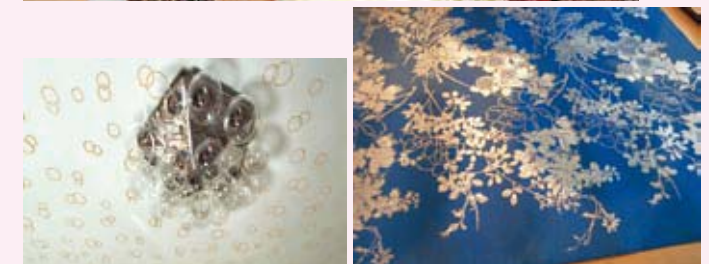
Edo-Karakami is a kind of *washi* with a wide range of decoration. Its ornamental techniques, which were developed in old Edo (now Tokyo), can be used to create just about any kind of pattern, by combining colors and *washi* paper. It is often used on *fusuma* sliding doors and *byobu* screens, and it was an important element in traditional Japanese houses. Today, Yanagi Tomoko is working at making *Edo-Karakami* better known outside Japan.

For her, it all started while searching for ways to use *washi* for retail space design. Then she happened to visit Tokyo Matsuya, an *Edo-Karakami* wholesaler.

"*Edo-Karakami* decorative paper expresses the essence of the traditions and craftsmanship seen in the patterns and colors which the Japanese have been fond of. I was amazed."

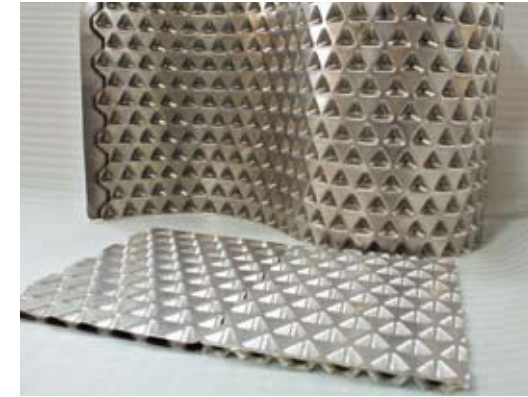
She had studied architecture in Italy, and the experience convinced her that people living outside Japan would appreciate the artistic effect of the paper. So she organized an *Edo-Karakami* exhibit in Italy. Until then, the paper had only been distributed in Japan. "I planned an exhibit that would depend on the beauty of the paper itself." She used large-size sheets, depicting a world of color and dynamism, and the people who came marveled at the artistry achieved by expanding the boundaries of humble paper. She received an order to decorate the ceiling of a private residence, and is now pursuing opportunities to market the paper abroad.

"I think it would be great if people all over the world used *Edo-Karakami* as a decorative feature in their homes," says Yanagi, her eyes lighting up at the possibilities ahead.

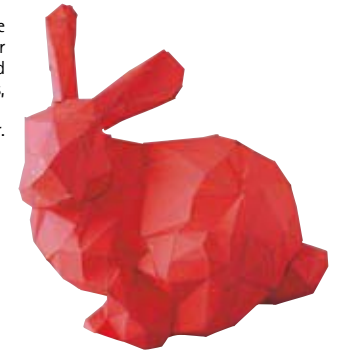


Top: Yanagi Tomoko (left) at her exhibition in Italy.
Above right: *Edo-Karakami washi* paper impressed with a peony motif on a deep blue background. A printing block and mica were used for the design and shimmering color.
Left: *Washi* impressed with golden mica decorates the ceiling of a house in Italy. The overlapping circle motif, called *wa-chigai* works well with the hoop-like lamps.
Tokyo Matsuya Inc.: <http://www.tokyoumatsuya.co.jp/>

Right: Map creased using *miura-ori* folds. When the map is closed, hold just the top left and bottom right corners, and then pull. The map will open up all the way in a flash. (Photo: miura-ori-lab)
Far right: "Diamond-cut" can, applying *miura-ori* folds. The connecting triangles make the can stronger, while keeping it lightweight. (Photo: Toyo Seikan Co., Ltd.)



Left: Truss Core panels are strong and can be made into many things, including a sound insulator or a heat insulator to withstand fire. Other expected uses include structural components for railway cars, aircraft and buildings. (Photo: Shiroyama Industry)
Right: Rabbit made with an origami-type 3D printer.



Innovation from Origami

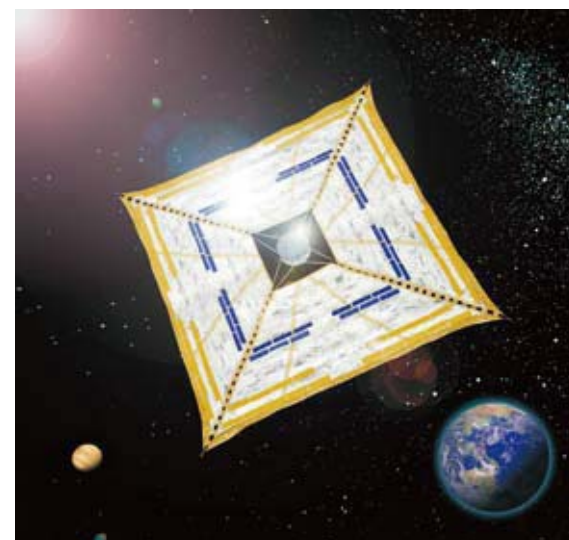
Collaboration: TAKEO Co., Ltd.

Make a bird, an animal, a plant or a geometrical shape by folding a single sheet of paper. Many Japanese became fond of origami in their youth.

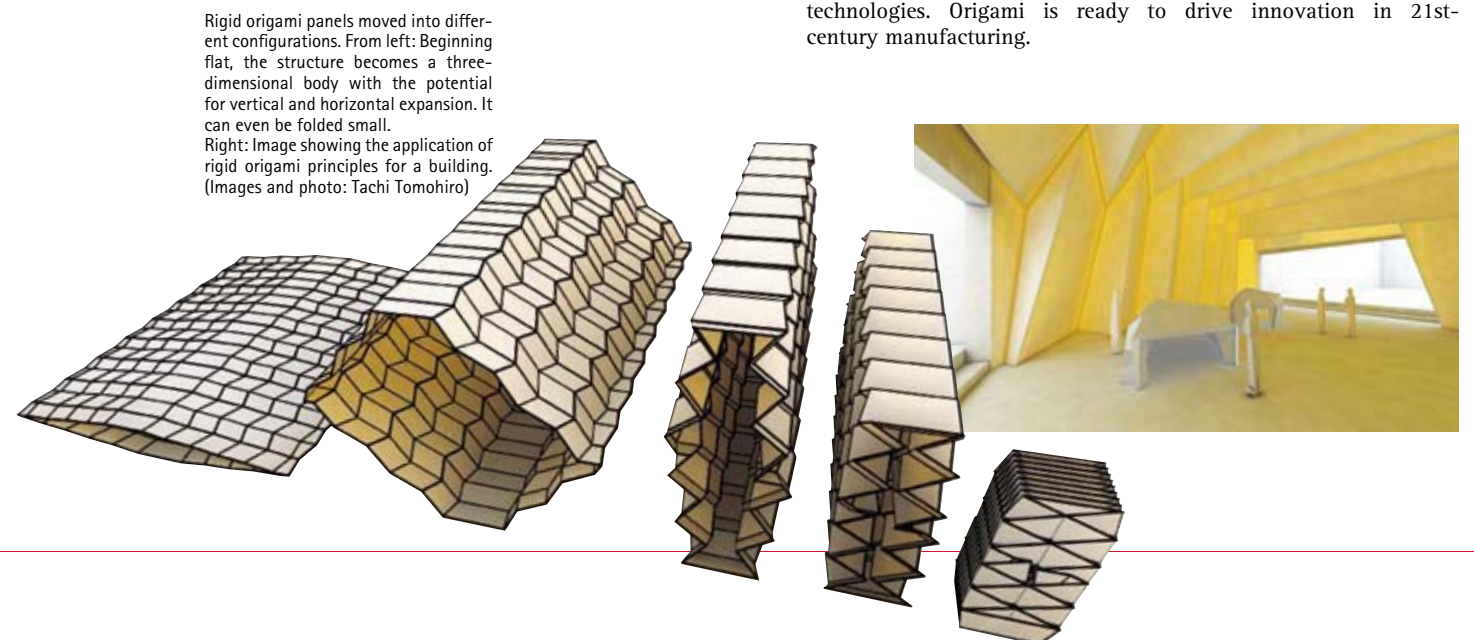
Origami is now attracting attention in the fields of science and technology as well. Origami engineering uses the techniques and special characteristics of origami to manufacture things. Using computer technology, engineers have developed design methods called computational origami, treating origami as a mathematical tool to expand the potential of a craft that was until recently a pastime for kids. The originality and methods of origami engineering are attracting world-wide attention, because they are being applied in many fields, from the space industry and automotive sector to medical treatment and fashion. Especially well known are *miura-ori* folds, a folding method developed for the design of structures for space exploration. Common examples of *miura-ori* folds are seen on maps and beverage cans.

"Origami's most famous example is the crane. But it doesn't look much like a real crane because it is simplified and abstract; in other words, we fold the piece of paper to make a simple shape that somewhat resembles a crane, or at least represents it. I'd say this is one aspect of the sensitivity of the Japanese and their interesting perspective on three-dimensional structures," says Hagiwara Ichiro, a professor at Meiji University in Tokyo. His research looks for ways to apply and promote origami engineering for different purposes. Truss Core panels, which he developed, were inspired by 3D origami concepts. Two panels, which are generally made of metal or plastic, are embossed with rows of triangular pyramids, and then placed face to face to make a structure that is light yet crush resistant. Truss Core panels are used in solar arrays to generate electricity.

Professor Hagiwara is also working on the development of an origami-type 3D printer. His system converts the 3D data of a three-dimensional object into a two-dimensional figure with many



Above right: *Miura-ori* folds made with colorful Fine Paper. (Photo: Hirata Masakazu, Hakuho Product's Inc. / Shown at the "Breathing of ORIGAMI" Mihoncho Honten Exhibition, TAKEO Co., Ltd.)
Right: Small Solar Power Sail Demon-strator for the world's first space yacht, IKAROS. The "sails" draw inspiration from origami. (Photo: Japan Aerospace Exploration Agency, JAXA)



Rigid origami panels moved into different configurations. From left: Beginning flat, the structure becomes a three-dimensional body with the potential for vertical and horizontal expansion. It can even be folded small.

Right: Image showing the application of rigid origami principles for a building. (Images and photo: Tachi Tomohiro)

plane faces. The figure is printed with an ordinary printer. The result is faster and cheaper than what could be obtained with a conventional 3D printer, which builds up layers of material. And his method can be used to make large three-dimensional objects. Expected uses include the manufacture of product samples and pre-production prototypes. This method could quite likely be used in urban planning, by reproducing buildings and other structures from aerial photographs.

Origami is unusual in a number of ways, especially the folding methods, how the object is formed, and its ability to be folded either in or out. All these features make origami concepts useful in building construction. Tachi Tomohiro, an assistant professor at the University of Tokyo, is researching ways to use origami techniques in architecture. The key to success, he says, is to use flat "rigid origami" panels and assemble them into a strong, flexible structure. The structural components are easy to fold in and out, offering applications like retractable roofs and furniture such as tables. And because the structures are light and easy to transport, they are suitable for short-term display facilities, or temporary housing for people displaced after a disaster.

"A fold-out pavilion used at an exhibition can be folded up and taken to a disaster-stricken area for shelter. The materials are reused, not thrown away. The building would have a built-in 'memory' for future use."

In the old days origami played a role in etiquette, when giving a present. Today there is still the *sen-ba-zuru* custom, folding 1,000 pieces of paper to make a thousand cranes, in a get-well wish for an invalid. Each fold, one after the other, expresses the desire to be of use. The desire to make something of use is alive in origami engineering.

Assistant professor Tachi explains origami's charm: "Origami has Japanese qualities, but it is also universal, global. Origami research extends across multiple disciplines to include engineering, mathematics, the natural sciences, medicine, education and design. So I feel it has lots of potential."

This traditional Japanese pastime for hands is being transformed by researchers in different parts of the world into cutting-edge technologies. Origami is ready to drive innovation in 21st-century manufacturing.



An origami crane. Have fun with origami, folding paper into different shapes. (Photo: Aflo)

The *Kami-nabe* Pot Why Doesn't the Paper Burn?

Photos: Oyama Yuhei Collaboration: Ginza Kojyu



As long as water remains inside, the paper will not catch fire.

When winter comes to Japan, hot pot is sure to be one choice on the menu. Everyone gathers around a big earthenware or iron pot at the dining table, and when the heat underneath gets everything piping hot the chopsticks get busy, transferring food from pot to dinnerware. It may be cold outdoors, but in homes and restaurants, happy voices ring out.

Enjoying a hot pot alone is also an option—then the pot is smaller and the meal's ingredients are for one. At traditional inns in tourist spots, the amazing thing recently is, the pot is often made of paper! The *kami-nabe* (paper pot) is just for you, with your own supply of solid fuel. As food from the sea and fields heats up and becomes ready to eat, its appearance and taste are star attractions at the table, creating long-lasting travel memories of a culinary feast.

Since the paper is thin, the heat spreads evenly and the ingredients cook more quickly. The pot absorbs froth seeping from the food, another benefit of using paper. Even if the heat comes in direct contact with the paper, the water never gets hotter than 100 °C, of course, whereas the ignition temperature of the paper is more than 300 °C. As long as there is water in the pot, the paper will not burn.

Today's paper pots are almost all made of machine-made paper treated to make it waterproof. But some specialty shops serve menus of *kami-nabe* made from traditional *washi* paper, which tends to be strong due to its long fibers. It is probably these qualities that inspired this intriguing idea, simmering food in paper.

"*Kami-nabe* are light, they can be stacked, and they are the perfect image of clean cookware. Paper pots—what a great invention!" says Okuda Toru, the owner of a Japanese restaurant called Kojyu. A chef there prepared the food photographed for these pages.

"Japanese people find being in nature soothing and relaxing, and we have long favored natural materials such as clay, wood and paper for many uses, and cuisine is certainly no exception. I suppose it was that appreciation of nature that led to the paper pot."

Taking pleasure in both the food and the dishes it is served in, while feeling close to the natural world, led to the eminently unique invention of the paper pot.



Far left: Simmered *wagyu* beef in a *shabu-shabu* hot pot, prepared in a paper pot.
Left: Okuda Toru, owner of the restaurant Ginza Kojyu, preparing a meal. He is one of Japan's top young chefs.
Opposite page: A lavish "paper hot pot" with *Ise ebi* (Japanese spiny lobster), Chinese cabbage, and *shimeji* mushrooms.





The red color of the Mino-bashi Bridge is most impressive. It is the oldest suspension bridge built in the modern style in Japan.



Home to Handmade Paper Recognized as an Intangible Cultural Heritage

Mino

Photos: Miyamura Masanori, Mino City Sightseeing Association,
and Mino City Government
Maps: Oguro Kenji

Hon-minoshi, now registered on UNESCO's Intangible Cultural Heritage list, is made in the Mino district of Gifu Prefecture (which is located in the middle of Honshu, Japan's main island). Mino is favored with the clear-running waters of the Nagara River, and paper has been made there continually ever since the earliest days of handmade paper in Japan, 1,300 years ago. Artisans use only *kozo*, and the paper is known for its beautiful white tones, and for two seemingly contradictory qualities, softness and strength. While some ateliers with centuries of heritage are disappearing, here in Mino, they are keeping old traditions alive by sharing workshops, as the next generation carries on the ancient craft of making paper.

Mino, home to one variety of Japanese traditional paper, lives up to its reputation with events associated with *washi*. The Mino Festival in spring is a time of spectacular scenes and excitement, when pieces of *washi*, dyed pink and shaped like cherry blossoms, are carried on *hana mikoshi* floats through the streets. The floats, some large, some small, number about 30 altogether, and with all their *hana* (blossoms), they give the impression of cherry trees in full bloom dancing energetically. In autumn, during the Mino-washi "Akari" Exhibition, highly unusual lanterns with *washi* shades create a fantastic scene, which is appreciated by many tourists every year. Light shining through the paper casts a magical glow over the street at night.



Top: Mino streetscape with *washi* lanterns. For two days in October every year, the Mino-washi "Akari" Exhibition becomes a pageant for works like these made with *Mino-washi*. At night, the soft light coming through the paper gives enjoyment through beauty: in the day (left), shapes and textures provide further delight.
Right: Scene during the Mino Festival in April. Hand-dyed paper flowers hang from *hana mikoshi* floats as they wend their way through the streets.





Architecture on Menoji-dori Street maintains its traditional style, with *udatsu* extending above the roof on both sides of each building unit. Left: A residence that was formerly a rice store. Right: This *udatsu* has a shape that is unusual even for this neighborhood.

Take a stroll along Menoji-dori Street near the city center and you will surely notice some unique roofs in this old, well-preserved district: above the tiled roofs of the row buildings are structures extending above the roofline at both ends of each unit. These fancy add-ons are called *udatsu*, which were originally built as firewalls dividing each unit, but over time merchants who became rich in the *washi* trade or other businesses constructed and decorated *udatsu*, as a sign of their wealth and perhaps to out-do their neighbors. *Udatsu* designs differ, depending partly on the time of construction and the depth of the original owners' pockets. At any rate, it is fun to look up and compare. One roof, for a sake brewery built around 1773, has an arched shape and interesting *udatsu*. It will certainly draw your eyes.

The area around Menoji-dori Street has a number of old houses renovated to serve as tearooms, eating and drinking establishments, and shops selling *washi* products. Stroll through traditional architecture highlighted by ornate *udatsu*, and savor tastes of nature in the form of local Mino chicken, *ayu* fish and edible wild plants. If you are looking for souvenirs, you will find a wide selection. How about decorative *washi* to stick on glass for a restful mood, or a *washi* mobile, or socks and towels woven from *washi* thread? All of these, and others too, express the subtle charm of Japan's own traditional paper.

Walk a little further, to the bank of the Nagara River, to see the suspension bridge with crimson railings, and the old-fashioned lighthouse with a stonewall foundation on the remains of a riverboat dock, reminding us of days long gone. Home to *washi*, Mino is a place of natural beauty and history that you will surely want to visit.



Left: Kawaminato Todai, the old lighthouse for the river port, which was once the center for local transportation. It still keeps its light glowing. Right: Decorative *washi* on window glass. The store Kaminoshigoto offers a rich variety of products featuring handmade Mino paper.



Top left: One stage of the paper-making process, called *chiri-tori*, involves carefully removing unwanted material stuck to the wood fibers. Top right: *Tororaaai* (sunset hibiscus) root fibers, which facilitate the blending of *washi* components, are softened by soaking in water, then strained. Bottom: These young artisans have been making paper at their communally owned atelier. From left: Hoki Miho, Takahashi Mayumi, Ieda Minako and Sugimoto Wakana.



Top left: *Osechi-ryori* meal for a festive occasion, although this one is made of *washi* and could fit on the palm of your hand. Top center: *Fumiko* perfumed packets containing crushed scented wood, wrapped in *washi*. The idea is to slip one into a letter before sending it. Top right: *Washi* birds for a mobile. (All three: Shiyu) Left: Saké brewed locally in Mino at Kosaka Shuzojo, a brewery with its own *udatsu* ornamental roof. Saké brand name: Hyakushun. Center: Locally raised chicken, sweetfish and wild edible plants are some of the ingredients used in Mino's own cuisine. (Tatsumiya Restaurant) Right: Take a break from strolling through the old town to enjoy sweet delicacies at a café that was remodeled from a private residence. (Sabo Tomiya)



A branch of the Itadori River rushes through Kataji Gorge. The natural beauty of the area changes with each season.

Mino Area Maps

Getting there

From Tokyo Station, take a JR Tokaido Shinkansen train to Nagoya Station (about 1 hour 40 minutes). From there, take a limited express train to Mino-Ota Station (45 minutes), then a Nagaragawa Railway train to Mino Station (30 minutes).

For more info

Tourist Guide to Mino City

<http://www.mino-city.jp/> (Chinese, English, Japanese and Korean)

Mino City Sightseeing Association

<http://www.minokanko.com/> (Japanese-language website)

① Tatsumiya Restaurant

<http://www.minokanko.com/guide/tatsumi.html> (Japanese-language website)

② Sabo Tomiya

<http://sabo-tomiya.jimdo.com/> (Japanese-language website)

③ Shiyu

<http://www.shiyu.co.jp/> (Japanese-language website)

④ Kosaka Saké Brewery

<http://www.kuramoto-kosaka.com/> (Japanese-language website)

⑤ Kaminoshigoto

<http://kaminoshigoto.net/> (Japanese-language website)

⑥ Mino-washi Museum

<http://www.city.mino.gifu.jp/minogami/> (Japanese-language website)



Souvenirs of



Japan 9



Collapsible Paper Lanterns

Chochin

Photos: Kawakami Naomi, Getty Images, PIXTA

Chochin are traditional Japanese lanterns, made by gluing *washi* paper on a framework of bamboo hoops. They are illuminated by a candle inside. When not in use, they can be folded small by collapsing the hoops upon themselves. They are made to be portable.

The design of *toro*, a lantern, was adapted around the end of the 16th century to make the bamboo hoop *chochin*. The typical shape has not changed much since then, although other shapes and sizes were developed later, with the paper displaying a name or family crest, and the lantern being carried by hand or hung from an eave as a kind of sign. Over time, brightly colored *chochin* came to be used in ceremonies to welcome the gods or the souls of ancestors, and different designs were created for decorating the interiors and exteriors of homes.

Even though electric lights have been common for a long time now, *chochin* still have a job to perform, as signs for restaurants serving Japanese cuisine and for *izakaya* eating and drinking establishments, as street decorations for shopping districts, and as extra color for summer festivals. Their role conveying a traditional Japanese touch or creating a special ambience on festive occasions would be hard to overestimate.

As a souvenir, *chochin* are an obvious choice for many people. Pop-style varieties, perhaps inscribed with a place name or decorated with an *ukiyo*e image, are almost sure to be sold in tourist spots. Even without a candle inside, they will add a fabulous Japanese touch to interior space.

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