

On the evolution of the notation system in Origami

by Laura Rozenberg*

***Abstract:** This research challenges the widely accepted idea that Akira Yoshizawa was the originator of the origami notation system. The existence of a graphic vocabulary – mainly, the so called mountain and valley lines –, was confirmed in Japanese bibliography and Western manuals prior to the advent of Yoshizawa. Arrows were also used before Yoshizawa but in a very limited way. The introductory page that summarizes the graphic elements at the beginning of every book was tracked down to the early 1930s, at least 12 years before the publication of the first diagrams by Yoshizawa. This research shows that the new vocabulary was part of a trend in the publishing industry that sought to attract a wider audience. The scope was broad enough to catch the attention of some pioneers of origami in the Western world, who began to use the elements of the symbolic language before becoming acquainted with Akira Yoshizawa. Based on these findings, this research concludes that while Yoshizawa did not create any of the basic components of the convention system, he contributed to its improvement by adding dynamic elements, resulting in an elegant, yet technically rigorous system, that opened the way for diagramming ever more complex models in a comprehensive way.*

This study attempts to clarify the evolution of the modern notation system in paperfolding, not only for historical interest but also because it represents a cornerstone on which the creative and collective body of origami in the last century has been built. The extraordinary production of origami models in recent years would be inconceivable without considering a system that facilitates the exchange and understanding of increasingly complex diagrams. Therefore, understanding its evolution not only is an important part of the history of paperfolding but it is also a way to pay homage to those who contributed to its conception and development.

Most origami books bear a page, usually at the beginning, that serves as an introduction to the symbols to be found in the diagrams. It is irrelevant whether the book is aimed at beginners or advanced folders; this sort of “tool box” is always there, either to inform the new folders or to avoid confusion among the most experienced. Although variations exist depending on the author's preferences, the basic components of the system are similar,¹ and the diagrams can be understood regardless of the language in which the publication is written.

Following the available literature about the origins of the notation system, the first aspect we observe is the consensus about the existence of a virtual division *before* and *after* the diagrams of Akira Yoshizawa, who is praised as the “father” of modern origami. Yoshizawa has been consid-

ered the creator of the current nomenclature for diagramming and even a date has been set up for this breakthrough –1954– the year when Yoshizawa published in Japan his first book, *Atarashii Origami Geijutsu*.

Now, imagine a straight line representing a timeline, and then again, imagine a knob that one can slide along the line: the knob slides to the left and stops by the name of Yoshizawa in 1954. According to the general perception, that would be the *zero* mark in the notation system. We will go back to this metaphor at the end of this study.

One should expect to find a revolutionary concept in *Atarashii Origami Geijutsu*, a way of diagramming different from any previous books. In order to confirm or reject this hypothesis, we need to compare that book with others that were published prior to the advent of Akira Yoshizawa.

But first, let's analyze the elements of the notation system that are present in *Atarashii Origami Geijutsu*. On page 10 of Yoshizawa's book, a summary of the symbols is featured as a single illustration or schematic code (Fig. 1, and Fig. 1-detail). The drawing represents a perspective view of a rectangular sheet partially folded and crossed by three lines. It is a simple and intuitive drawing, which allows the reader to immediately associate each graphic representation with an action:

- Starting from the left, the first graphic representation is a line crossed by a cutting instrument. It represents “paper cutting” (some early models of Yoshizawa had cuts with scissors).
- Next, the line with alternating dash and double-dots (- . - . - . -) is the “mountain” fold.
- On the right, the dashed line (- - - -) is the “valley” fold.

It is interesting to note an aspect that has not been stressed enough, and it is the use of *visual redundancy*, that is, the presence of components that represent the same thing, so their existence of them at once serves to the purpose of reinforcing the meaning but it does not offer any additional information. What we see in this graphic as redundant is the manner in which the rectangle appears folded, first as an inverted V and then a normal V strengthening the association between the line and its meaning. The *kanji* ideograms also operate redundantly: 山 (which reads as *yama* in Japanese), means “mountain” and 谷 (*tani*) means “valley”.

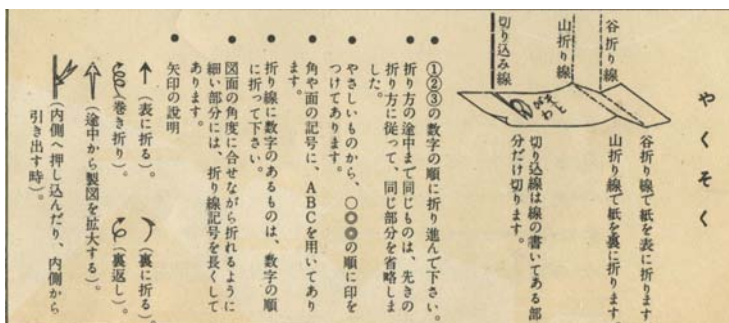


Figure 1: Schematic introductory illustration (“tool box”) in *Atarashii Origami Geijutsu*. The components are shown in the drawing and complemented with a series of arrows to the left.

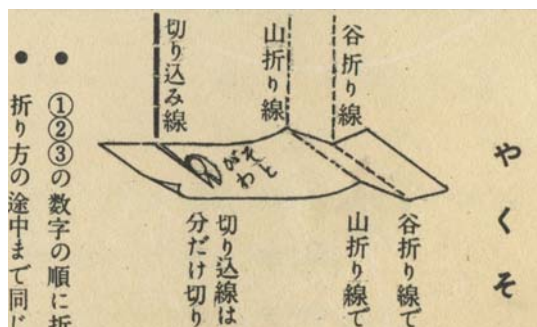


Figure 1, detail: Detail of the “tool box” in *Atarashii Origami Geijutsu*.

Clearly, this is the type of graphic that requires conceptualization in order to achieve synthesis and precision to fit in a very small space.

The importance of an illustration at the beginning of the book showing the elements of the notation system cannot be overlooked. Either in its compact format, as seen in *Atarashii Origami Geijutsu*, or in an extended form (a list of symbols organized as a chart in a single page), is present, as an essential part of most origami books.

However, despite its importance, most essays dealing with the origins of the notation system only considered the individual symbols. In this study, we will include not only the symbols but also the presence or absence of the introductory page as an element that may indicate an advancement in the development of the notation system.

We will try to elucidate whether Yoshizawa was the first person to use the notation system as featured in *Atarashii Origami Geijutsu*. But if we conclude that he wasn't, then the question is: who else contributed to the system and how did this system evolved to become the system that we know today?

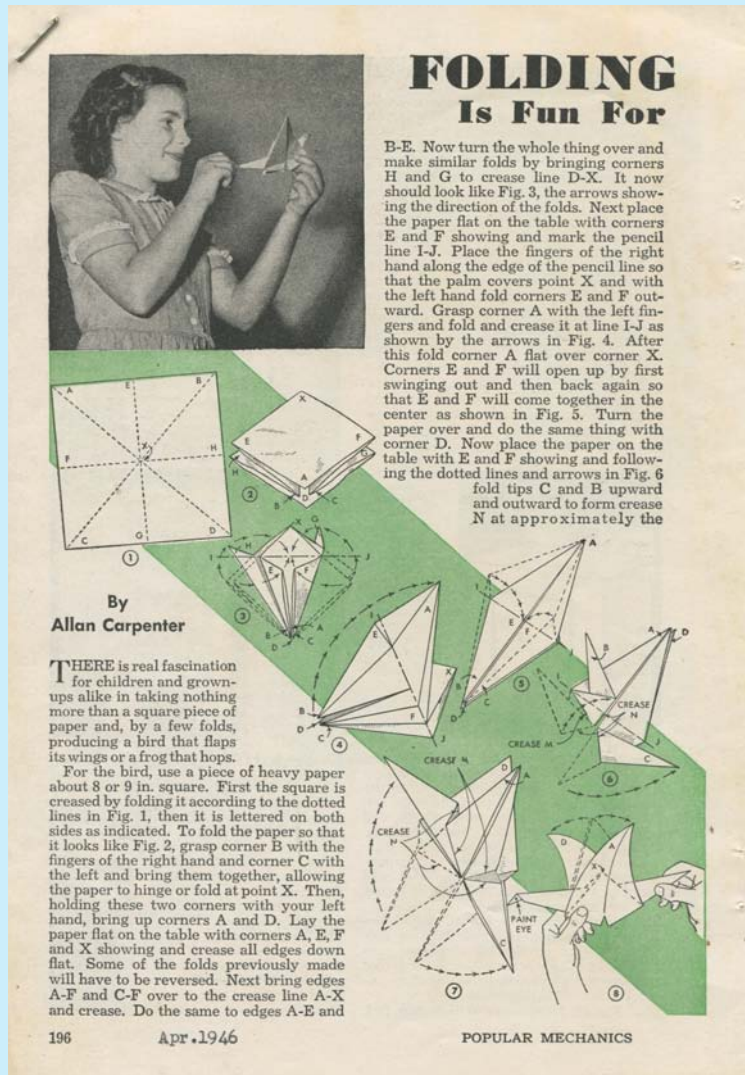
A HISTORY NOT MUCH QUESTIONED

As mentioned at the beginning, there are many publications that consider Akira Yoshizawa to be the creator of the diagramming notation system. Wikipedia echoes by stating:

In the 1950s and '60s, Akira Yoshizawa proposed a system of diagramming. He introduced its diagramming notation in his first published monograph, Atarashii Origami Geijutsu (New Origami Art) in 1954. He employed dotted and dashed lines to represent mountain and valley folds, and a few other symbols such as the “inflate” and “round” symbols.²

We must remember that *Atarashii Origami Geijutsu* became known in the West around 1955 and helped to spur the origami movement in countries such as the United States and England. Until then, the major limitation in the Western world had been the ab-

Inset 1



Before the 1950s, there was no consensus for diagramming. Some publications used the step-fold system (drawings or photos of each step) while others relied on shading, perspective, alphabetic letters and long explanations. The models could not go beyond a certain number of steps because the drawings became very complicated and difficult to understand.

The illustration above, published in *Popular Mechanics* (1946), explains how to fold the flapping bird. Although the title suggests that “folding is fun,” the diagram, crammed with lines, arrows and letters, probably discouraged more than one reader.

sence of a convenient method for diagramming. Some artists relied on complex diagrams with lots of lines crossed by alphabetic letters, others used perspective and shade. Those drawings did nothing but increase the feeling that paperfolding was something tremendously complicated, contrary to what the artists themselves were trying to promote (Inset 1).

Atarashii Origami Geijutsu appeared to be the “holy grail” that Robert Harbin from U.K. and Samuel Randlett from the U.S.A., had been seeking for quite some time. They studied the convention and added more symbols to represent certain operations (such as “rabbit ear” and “petal fold”).³ Once the new system was completed, the fact that it was in English facilitated its dissemination on a large scale.⁴

Presented in the book *The Art of Origami* by Samuel Randlett (1963), over time it was dubbed the Yoshizawa-Randlett-Harbin system. The name helped cement the belief that Yoshizawa had been the creator of that system.

Randlett and Harbin did not examine other sources (books that we will examine in the present study). In Yoshizawa's book they had found what they needed. In *The Art of Origami*, Randlett tacitly granted Yoshizawa authorship for the notation system: “*Akira Yoshizawa's code of lines and arrows (...) is rapidly becoming the international language of the origami world.*”

Yoshizawa had been gaining fame and reputation; it was reasonable to assume that in addition to his extraordinary ability as an artist he would have devoted himself to a more technical aspect of the trade: to envisage an effective way of diagramming the models.

Besides, there was no apparent alternative, no one else had stepped in to contest that “paternity”. Yoshizawa and the notation system seemed one and the same from the moment it appeared in the West. No one would have called it into question because there seemed to be no need. The Yoshizawa-Randlett-Harbin denomination established a convincing lineage.

However, while this notion prevailed for years, some authors, such as the late British historian of paperfolding David Lister, expressed reserve: “*I (...) always understood that the system of dotted lines and arrows was, indeed, devised by Yoshizawa, and while I cannot prove this at present, it seems most likely.*”⁵

Likewise, Peter Engel, the author of *Origami, from Angel Fish to Zen*, a classic of the '80s, considered that the books of Yoshizawa served to popularize the notation system.

In turn, Robert Lang opted for the term *development*, thus avoiding the question about the origin. “[*Akira Yoshizawa's*] (...) *more long-lasting contribution was the code of instruction that he developed –the arrows, dotted and dashed lines that we now take for granted.*”⁶

In the same vein, another knowledgeable historian of paperfolding Hatori Koshiro

considered that Yoshizawa “*contributed to devise the folding symbols which are currently used as standard for diagramming.*”⁷

None of the above authors considered Yoshizawa to be free of influences. So over-time, the extent of his contribution became an open question. In this context, the most emphatic contestator was Joan Sallas, a Catalanian historian of paperfolding who has been amassing an impressive collection of origami books and documents and has been an active member of online forums in which the history of paperfolding is discussed. According to him, the question whether Yoshizawa was the originator of the code is almost meaningless, because he had been able to identify precedents. “*It's been a big misunderstanding. People repeat like parrots what others say. It is obvious that Yoshizawa did not invent “his” symbols. Instead, he borrowed them from conventions that were already in use since the 19th century, in Western educational textbooks for cardboard boxes manufacture, especially in French and German. The dashed and dot-dashed lines were known as valley and mountain lines. Because Yoshizawa was a skilled draftsman in his home country, he was aware of the bibliography. He only borrowed the lines and adapted the terminology to his diagrams.*”⁸

The hypothesis of Sallas is logical, but in order to prove it, we had to understand the context in which Yoshizawa worked. In addition, Sallas referred only to the valley and mountain lines, without considering the introductory “tool box”, which, as we have seen already, was a component of particular importance. Was Yoshizawa the creator? And how about the dash and dot lines? And the verbal terms “valley” and “mountain”?

QUESTIONS, QUESTIONS...

Creativity rarely pops up out of nothing. Generally, the inventor or developer relies on pre-existing elements to shape a new mechanism or system that improves the qualities of the previous one. And there is nothing wrong with that. However, in the case of the origami notation system, the “official” story brought back a monolithic construction that placed Yoshizawa at the beginning of a sort of myth of origin. Before starting my research, I was unaware of Joan Sallas' approach, and I had only a vague notion about Yoshizawa's contributions until I started digging into a treasure trove of old documents.

It happened one day while I was sorting a stack of papers that belonged to the late Gershon Legman. He was one of the key figures of the early origami movement in the '50s and '60s and was the person who had “introduced” Akira Yoshizawa to the Western world and even helped him organize his first solo exhibition in Europe in 1955. Legman and Yoshizawa corresponded regularly, and the collection of letters had been kept in his archive in the south of France. I had been in contact with Legman's widow, Judith, who allowed me to study its content (I later purchased from her the complete archive of origami documents that belonged to Gershon Legman).

In one of the folders I found the first letter that Yoshizawa wrote to Legman on May 13, 1953. That letter and its date became an important piece for the puzzle I was trying to assemble. The letter was accompanied by a set of *Fujin Koron* magazines. That was the magazine in which Yoshizawa published his first diagrams as a free-lancer, starting in March, 1952 (Inset 2). Browsing through the collection, something caught my attention in the May issue of that year. A little rectangle with all the elements of the notation system, the same thing that a couple of years later Yoshizawa would include in his first book. I was thrilled to find that piece of information which, following our metaphor of a timeline, would allow us to slide the dial a little more to the left, down to 1952.

I tried to imagine Gershon Legman when he received those magazines: his excitement when he saw the diagrams for the first time. I assumed that they must have been a revelation to him as they exuded simplicity and they were organized so nicely in a remarkably small space. (Inset 2)

One day, however, that simple logic fell apart, and it was totally unexpected. It happened when I found a diagram that did not fit that chronology. It had been drawn by Legman himself using what I thought was the “Yoshizawa code”, but the publication was dated January 1953, that is, about three months before he received that letter and the magazines! I thought there might have been a mistake in the date, since Legman could not have been aware, as far as I understood, of Yoshizawa’s system so early that year. However, no mistake was found because the date corresponded to the issue number 273 of the *Phoenix* magazine¹⁰, and that issue was correlated with previous issues¹¹. The source that Legman had used to obtain the “Yoshizawa symbols” had to be something else, and it was a total mystery to me (Inset 3, Fig 3).



Figure 3: Cover of *Phoenix*, a magazine for magicians. Legman published his first diagram with the mountain and valley code in the issue number 273, January 1953.

INSET 2

In May 1953, along with the first letter from Yoshizawa, Legman received several copies of the magazine *Fujin Koron* that had been published one year earlier, in 1952. *Fujin Koron* was a post-war, housewife magazine printed on cheap paper with print runs that surpassed 100,000 copies. It was there that Yoshizawa first published the diagrams of his models for the masses. In a space that barely occupied 8cm x 12.5cm, he had to organize a dozen or more diagrams, including instructions. The “tool box” is the same illustration that Yoshizawa would use two years later in his first book: a dash-double-dot line (- . - . - . - . -) and dash line (- - - - -), with their respective verbal terms in *kanji*: 山 (*yama* = mountain) and 谷 (*tani* = valley).

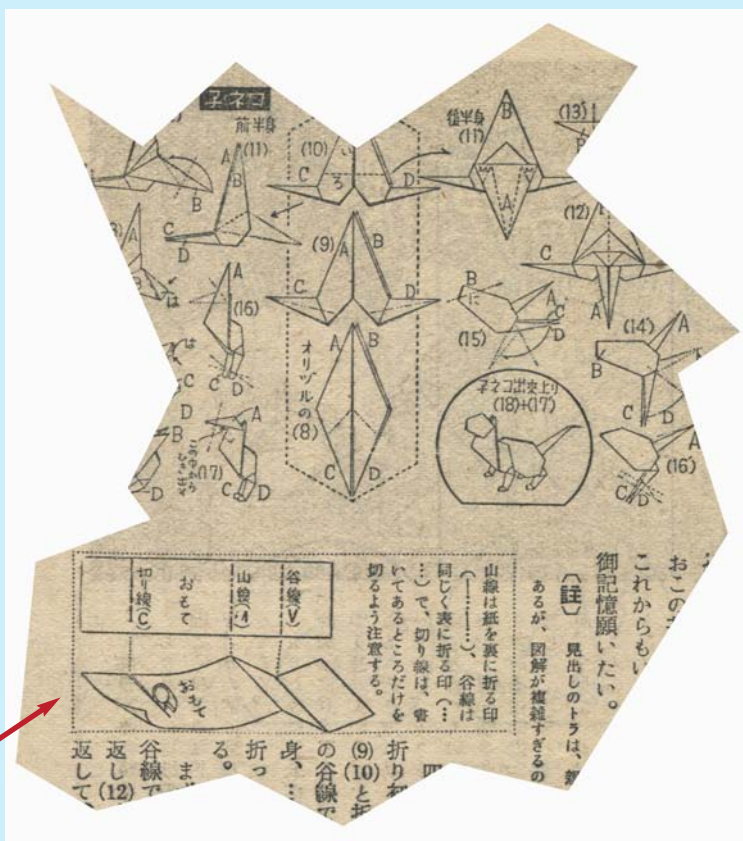


Figure 2: *Fujin Koron* magazine, Tokyo, May 1952. Yoshizawa's introductory “tool box” showing the symbols for the valley and mountain folds and the cut line, with their designations in *kanji*⁹

INSET 3

Legman began to use the terms “valley” and “mountain” and its corresponding symbols, before he became acquainted with Akira Yoshizawa. Figure 4b shows a section of a diagram by Legman which was published in *Phoenix* magazine (number 273, January 23, 1953). The dashed-dotted line and the dashed line are present. In the text, Legman indicated that his design was inspired by “*Le Jonque chinoise*” published by Th. de Moulidars in 1888¹², but said nothing about the source he used as an inspiration for the symbols. The French illustration does not distinguish between the two kinds of lines (Fig. 5), so Legman must have obtained the code from another source. The adoption of the code must have happened sometime in 1952, because another diagram by Legman, also published in *Phoenix* but in March, 1952, only had solid lines, although he did use the terms “mountain” and “valley” (Fig. 4a).

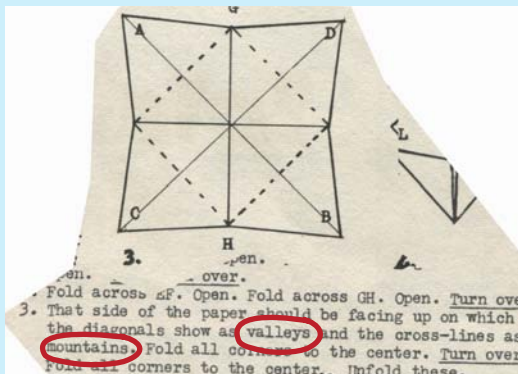


Figure 4a: In this diagram published in *Phoenix* on March 21, 1952, Legman used the terms “valley” and “mountain” but both were represented with a solid line.

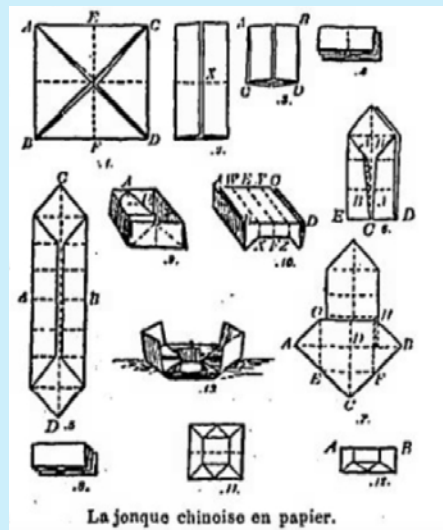
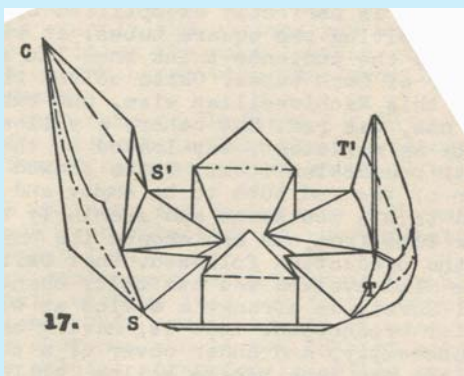


Figure 5: Legman was inspired by the Chinese Junk published in the “*Grande encyclopedie methodique, universelle, illustree, des jeux et des divertissements de l'esprit et du corps*”, page 339 (1888). The diagrams use dashed lines only.

Figure 4b: Partial view of the Chinese Junk, diagrammed by Gershon Legman and published in *Phoenix*, issue number 273, January 23, 1953. The dashed-dotted line and the dashed line are clearly marked.

THE MYSTERY GROWS

As I continued to search for clues about the source that Legman used for his 1953 diagram, more interesting elements emerged from the boxes of his archive. For example, in a 1952 letter to Neal Elias (a young and enthusiastic paperfolder living in Ohio), he jotted instructions on how to fold an elephant, including the symbols: “*After folding up the legs as indicated (- - - means fold as a valley; - . - . - means fold as a mountain range.)*”¹³ It could not be just a coincidence! However, he did not answer the question of how he would have known about the existence of such a code.

And there was something else. Ligia Montoya, the Argentinean with whom Legman had been corresponding since 1951, wrote him a letter on July 2, 1952, in which she included the diagram of a seal with the dashed and dashed-dotted lines and gave instructions to Legman on how to interpret the symbols¹⁴ (Fig. 6). I thought that maybe Legman had learned from Montoya, as her letter had been sent a few days before he wrote to Elias. But as all of this happened in a short period of time, I suspected there must have been another source involved.

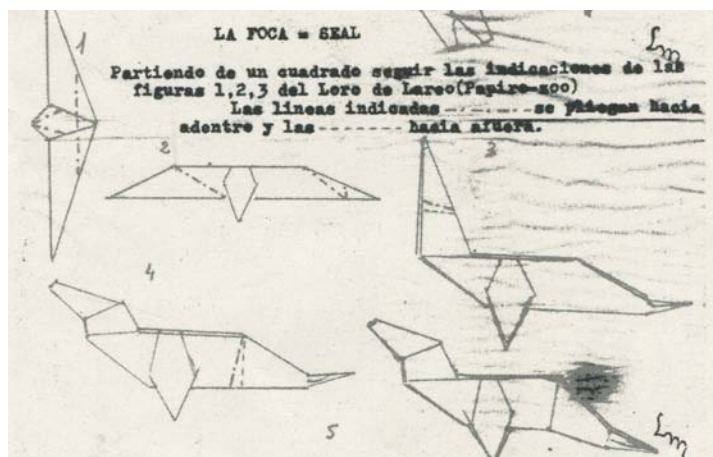


Figure 6: Letter from Ligia Montoya to Gershon Legman, July 2, 1952, in which she refers to the symbols with the following explanation (translated from Spanish): “- . - . - (fold inwards) and - - - (fold outwards).”

I was so disconcerted that I turned to some of my origami friends. But they, too, were surprised: “*How weird!*” No one could understand where and when they had acquired that vocabulary as early as in 1952, because all of us believed that Yoshizawa had been the only one who used it and, based on the general assumption, it could not have happened until 1954.

There must have been some common source of inspiration since it could not be a coincidence that both Montoya and Legman used the same graphic and textual language. Perhaps they had access to a certain publication in Japan that I was not aware of. Or perhaps they were both well versed in European manuals for the manufacturing of cardboard boxes. According to Joan Sallas, the latter was possible since those textbooks had been in circulation everywhere round the globe. In the

virtual forum Didactics and Research of Folding, Sallas said that Akira Yoshizawa used symbols “borrowed from cardboard manuals and children’s games publications such as ‘Joujoux en papier’ by Tom Tit, 1924 (Fig. 7). “The only thing new in Yoshizawa was the line-dot-dot-line for the mountain fold line.”¹⁵ The other graphic folding lines, including the line-dot-line for mountain,¹⁶ (another way of symbolizing the mountain fold) existed before him.^{17a}

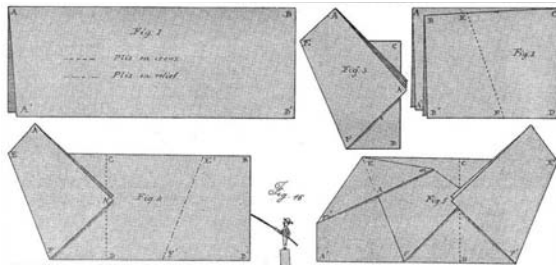


Figure 7: Page from Tom Tit's book (in French):
 --- "Plis en creux" (cavity fold); -.- "Plis en relief"
 (relief fold) (1924)^{17b}

Perhaps Legman and Montoya used the same source as Yoshizawa did. Still, I was not convinced. It would have been too much of a coincidence that halfway around the planet they had been having at once the idea of adopting technical manuals with the very same code. And the fact that, between the end of 1951 and the first half of 1952 Legman modified quite dramatically his style of diagramming using the valley and mountain lines instead of solid lines (Figs. 4a and 4b) made me think that he had discovered something really powerful during that period.

My intuition was that the source did not come directly from European textbooks. Instead, they may have had access to Japanese books written in the style of the European textbooks¹⁸. Had these material reached Montoya and Legman, then they could have taken advantage of any feature they found fit for their own work even before they learned about Yoshizawa and his way of diagramming. And that was possible, as both of them used to buy books from Japan via importers and bookstores. It sounded “plausible”, to use a term that David Lister was fond of.

MORE CLUES

I wondered if I could find other books that had been published in Japan prior to the advent of Yoshizawa, and I must say that I was lucky. I had the archive of Gershon Legman, an invaluable treasure for any origami lover, especially for someone interested in the history of paperfolding. But also, while I was writing the biography of the Argentine origami artist Ligia Montoya¹⁹, her sister gave me the collection of origami books that belonged to the artist. A group of four little books struck me with their colorful covers, although I didn't know the title or author, because they were written in Japanese.

But one day while browsing through their pages, I found the unmistakable calligraphy of Gershon Legman. It seemed that he had mailed the books to Ligia Montoya but before sending them, he had inscribed one page with the title and author, in black ink and heavy stroke. It was *Origami to Kirinuki*, by Saburo Ueda, published in Tokyo by Kokkado, in 1951²⁰ (Fig. 8).

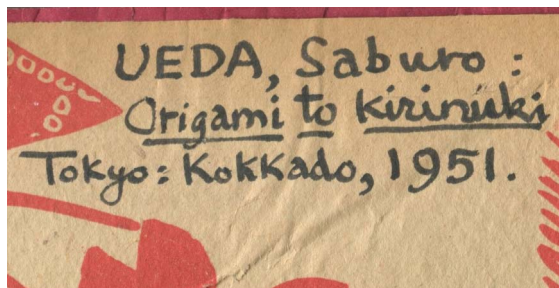


Figure 8: Handwritten by Gershon Legman, the book *Origami to Kirinuki* by Saburo Ueda, is part of Ligia Montoya’s library.

As we will see next, that gift from Gershon Legman became the *open sesame* from which I started pulling the strings about the evolution of the modern notation system.

I was familiar with Saburo Ueda, as I had seen references about him in some of the Legman's letters. Legman did not have the highest opinion of him, though, as he considered the books of Ueda to be a compilation of anonymous material and even some plagiarism.

Those details did not bother me, as I was interested in analyzing the type of diagramming system that he used (and, if possible, track its origins.) Fortunately, my curiosity was rewarded with a startling discovery. The introduction of the book had the symbols organized in a way that pretty much reminded of Yoshizawa's “tool box”. But instead of a single rectangle in which all the folding lines were defined, it consisted of three pairs of drawings corresponding to the actions “cut”, “mountain” and “valley” typified in *hiragana* characters and the dashed/dotted convention (Fig. 9). Perhaps this might have solved the mystery about the publication on which Legman and Montoya had based their own diagrams. Based on the dates, it was possible: the book had been published in 1951 and both Legman and Montoya's diagrams were dated in 1952.

However, even if they had based their own work on Ueda's symbols, the question about who created the system in first place remained opened. After all, Ueda was not an original creator. So whose invention was that?

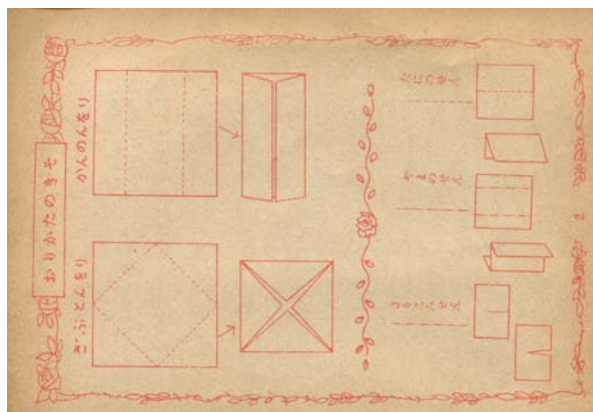


Figure 9: Schematic illustration of the symbols employed in the book by Saburo Ueda (1951) showing the dashed line, the dashed-dotted line and cut line. The names valley and mountain are in *hiragana* characters²¹.

THE SYMBOLS PAGE

Early in 1952 Legman began to gather information for a book on paperfolding (a project that he eventually abandoned when he discovered the works of Akira Yoshizawa and decided to devote his time to help him become better known in the West.) Obsessive as he was, he went on to review as many books as he could before starting his own work. He requested information from libraries, bookstores and antique dealers from around the world. In particular, he wanted to know more about diagramming techniques, since he lacked experience as a draftsman. He filled stacks of paper with hundreds of drafts, copying models found in other books to train his hand.

One day at the Library of Congress in Washington D.C., Legman found two books by a certain Japanese artist named Izumo Misaki. The books were *Shuko Origami to Kirigami* (1940) and *Origami to Kirinuki Tehon* (1947). As he usually did, he jotted down the folding instructions, copying each page in pencil. Fortunately, those sheets remained in the Legman archive, and I was able to inspect them one by one. What I found was really interesting. One of the drafts, corresponding to the second page of the 1940 book, had the instructional schematic illustration that I already had seen in Ueda's book. As the book by Misaki predated Ueda's by nine years, I assumed that the latter had copied the symbols from Misaki. Legman also noted the similarities in a brief footnote at the bottom of the page he had copied: "Ueda, 1951/2 and 1952/16" (that is: the second page of Misaki's book was similar to page 2 of the 1951 edition and page 16 of the 1952 edition by Ueda) (Fig. 10)²².

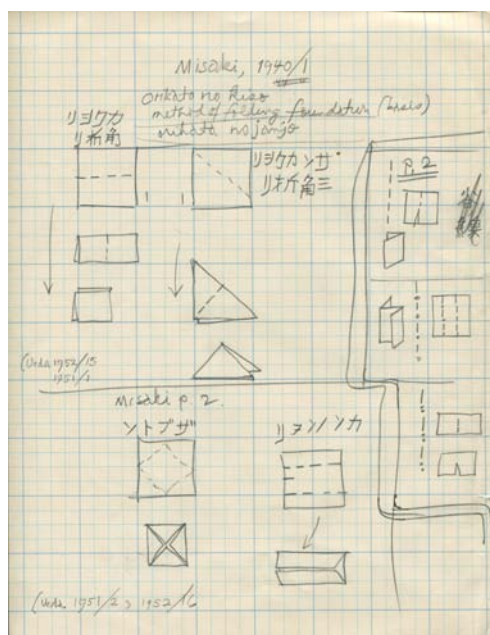


Figure 10: Diagrams copied by Legman. Misaki's "tool box" (1940), is shown on the right hand side. At the bottom, he noted that these graphics were identical to those found in Ueda (1951 and 1952 editions).

Intrigued about Misaki and his publications, I requested a copy from the Library of Congress in Washington D.C., but the answer was that the library did not have such books. Luckily, another edition, titled *Origami Shuko No Hon*, was found at the Princeton University Library. It was published in 1942 and in one of its pages I found the introductory illustration, identical to the sketch that Legman had copied for the 1940 book (Fig. 11).

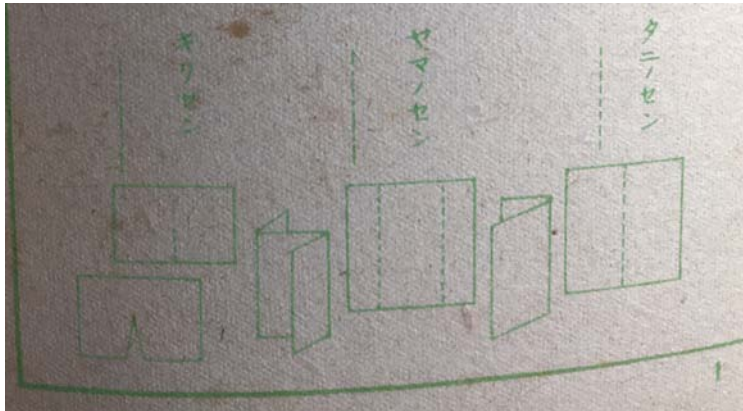


Figure 11: Schematic illustration (“tool box”) in *Origami Shuko No Hon*, by Izumo Misaki (1942).

Then, a copy of *Origami to Kirinuki Tehon* (1947) was located at Maryland University's Gordon W. Prange collection. The librarian e-mailed me a scanned copy of page 2 of that book (Fig.12). All the drawings were identical to those of the previous editions.

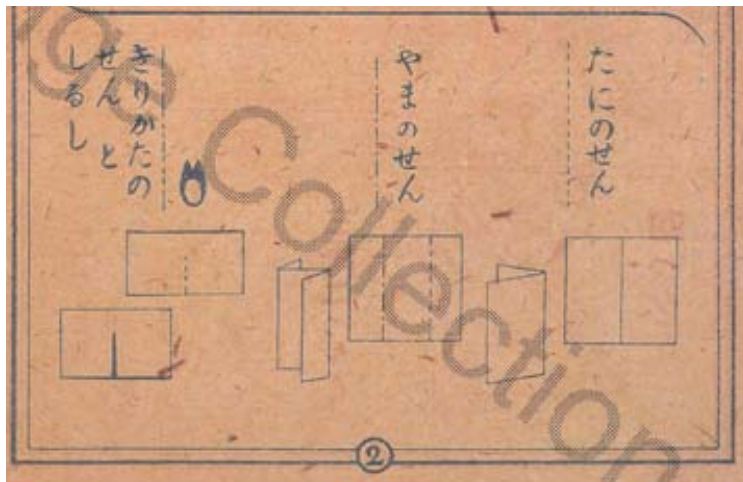


Figure 12: Schematic illustration (“tool box”) in *Origami to Kirinuki Tehon*, by Izumo Misaki (1947).

Finally, I got word from the University of Gokugei's Library, in Tokyo, that there was a much earlier book on paperfolding by Izumo Misaki. It went by the title *Origami Kirigami To Shuko* and was published in 1932.²³ Through the good offices of the New York Public Library, I received from Gokugei Library a copy of the second page of the book, as requested, for comparison with the other books by same author. I was thrilled to confirm that back in 1932 Misaki had already been using the notation system and the introductory page was the same as in later editions (Fig. 13)

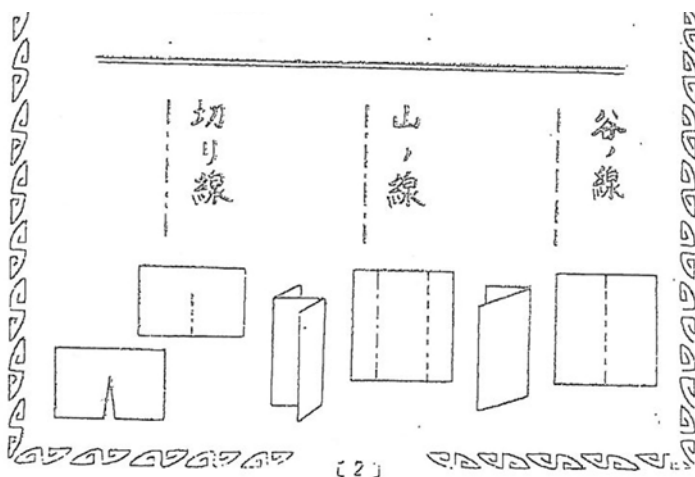


Figure 13: Schematic illustration (“tool box”) in *Origami, Kirigami To Shuko*, by Izumo Misaki (1932) is the same as in later editions.

The 1932 edition is the earliest reference of the schematic illustration known to date. That means that this type of notation had been in use for at least two decades before Akira Yoshizawa published *Ataharashii Origami Geijutsu* (and 12 years before Yoshizawa introduced it in *Origami Shuko*, as we will see next).

Was Izumo Misaki the creator of the introductory “tool box”? Did he get the idea of using the dashed/dotted lines from Western cardboard textbooks? Or he was just following directions from a certain publisher? We don't know. What we do know is that he was not a creator of origami models in the style of artists that came later, like Yoshizawa. His book, like those by Ueda, not only had origami but also kirigami and other entertainments with paper. For the origami section, Misaki devised a way of presenting his system of notation, and he diagrammed the steps in a way that was easy to follow. And although he was not the first to use the terminology of “mountain” and “valley” (as we will soon explain), he found a method to make it visually understandable (hence, the use of redundancy.)

It is plausible that he was a graphic designer hired to develop material for an audience increasingly interested in “modernity”. The '20s and '30s were years of extraordinary effervescence in the world of graphic design in Japan. Gone were the traditional engravings of the floating world (the famous Ukiyo-e). Posters of vibrant colors and geometric

shapes became very popular. They had been spawned by the Futurist Manifesto that influenced the world of graphic design. Izumo Misaki was not immune to the new vocabulary, and he skillfully mixed symbols of the consumer society in well balanced, unusual, geometric designs, evident in the drawings of human silhouettes that look like cigarette boxes which appeared in his book from 1931 (Fig. 14). We do not know whether Misaki worked for a publisher with precise indications or he presented his own ideas. It is possible that some designs, including the introductory “tool box”, were part of the publisher's design and layout branding. But it is also possible that it was Misaki’s exclusive idea. That, for now, we have no way to know.



Figure 14: Cover and inner page of the book by Izumo Misaki, *Origami Kirigami To Shuko*, 1932. Not every part of the book was about origami, as shown in the image below.

By mid 19th century, Japan opened its doors to international commerce after more than 200 years of isolation and the country experienced a wave of modernization that embraced every aspect of life, from business to industry, to education and arts. Schools, for instance, renovated their programs and adopted the kindergarten system, including the teaching methods developed by the German educator Friedrich Froebel. Western style paperfolding was part of the curricula and it found fertile ground among the Japanese children who traditionally had learned origami at home. Publishers responded to the demand with book titles that appealed to the general public. Misaki's books, like other books for entertainment, must be analyzed in this context.



During this investigation, Marcio Noguchi brought to my attention a few pages from *Teikoku Kogei*, a book published in 1931.²⁴ Intrigued by its nature I looked for its meaning on the Internet. I found that the title means (more or less, as the word “kogei” has not a straightforward translation) “imperial applied art to the industry”. It refers to a period between the First and Second World Wars during which the combination of arts and science led to the *Kogei* movement. According to Yoshinori Amagai, quoting Rozuko Yasuda, a scholar of the period, “after the Meiji Restoration (1868), Japan learned many things from the West, especially in scientific industry, which had been non-existent in Japan, and about mechanical and scientific methods as applicable to artistic industry. Japanese people, Yasuda says, believe that it is the mission of their nation to harmonize the inherent culture of the East with the modern culture of Europe and America, and thus produce a new culture. To realize this mission, Japan established applied art education from primary to higher grades. The fundamental training for applied art in primary school is drawing and manual work.”²⁵

The movement, then, favored the blending of ancient Japanese traditions of hand-made crafts with the scientific and technological progress imported from the West. The interest in industrial design that led to the rise of industries such as automobiles and photo cameras, went hand in hand with an increased awareness of traditions such as ceramics and woodwork. Crafts made out of paper, including paperfolding, were the subject of study from elementary schools onward.

It is not surprising, then, that a crease pattern appears on page 207 (Fig. 15) of *Teikoku Kogei*. The pattern distinguishes between mountain (dashed line), valley (solid) and a cut (dotted line).

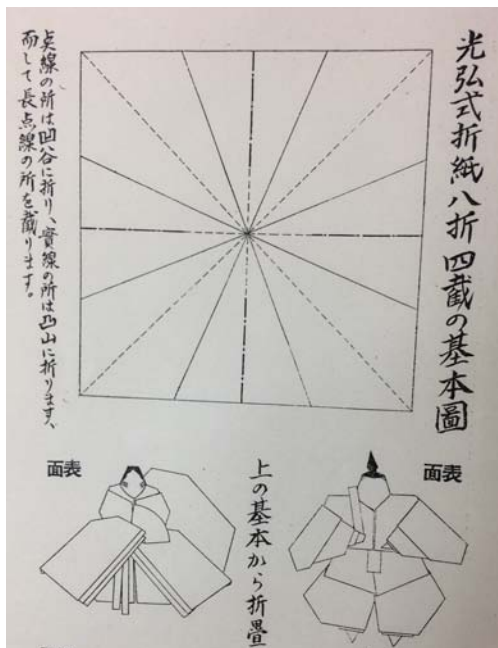


Figure 15: Page of *Teikoku Kogei*. Dashed line is valley, solid lines is mountain, dot-dash are cuts. The kanji for valley is 谷 and for mountain, 山).

Aside from the trend of mass production books and technical oriented books, there were authors who continued to produce material inspired almost exclusively in the ancient Japanese traditions (and probably their publications were much smaller in number of copies.) Such is the case of Michio Uchiyama, born in 1878, during the Meiji period. Uchiyama developed an elaborate vocabulary of bases, different from the one that would be defined years later by Randlett and Harbin. Both Uchiyama, the father, and his son Koho used scissors, something that was not at odds with the old Japanese tradition (in fact it was also a modality used by Akira Yoshizawa in his beginnings.)

What interests us here is that Michio Uchiyama, as early as in 1935, in his book *Shin'an Origami No Orikata Zukai* (1935), was already using the vocabulary “valley” and “mountain” with the corresponding linear representations (Fig. 16). The redundancy is striking because each folding symbol in every page and every diagram is accompanied by the *kanji* ideogram (山 = mountain and 谷 = valley). Of course, this would not have been necessary had Michio Uchiyama included an introductory chart explaining the symbols.

THE USE OF ARROWS

Uchiyama also used arrows, a graphic component that was rare in the origami literature of that time. However, they are static and do not represent any particular operation; they are only intended to stress the action of “fold”, which is, remarkably, another redundancy!

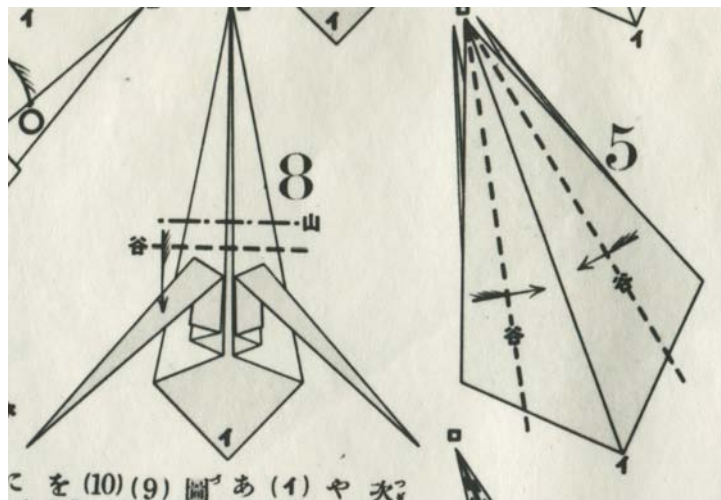


Figure 16: Section of a diagram from Michio Uchiyama's book, *Shin'an origami no orikata zukai* from 1935. On view are dashed-dotted lines (- . - . - .), dashed lines (- - - -) and the Kanji denominations: 山 (*yama* = mountain) and 谷 (*tani* = valley). Static arrows are used to reiterate the idea of fold, but do not specify a certain maneuver.

Worth noting is the use of arrows in Izumo Misaki's 1942 book. There are few throughout the book, and some are curved to represent the direction of the movement (e.g. “open”, “pull out” or “unfold”). We can call them “proto-arrows” to differentiate them from the “full-fledged” action arrows that will come years later with Yoshizawa. (Fig. 17).

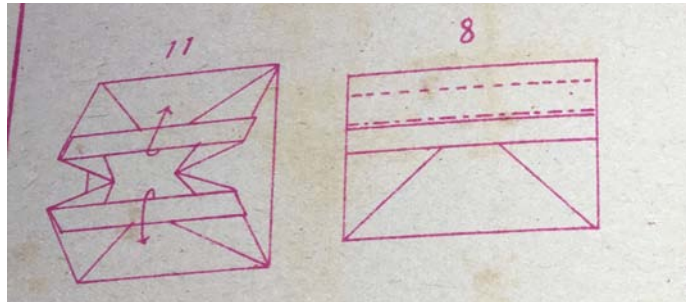


Figure 17: Example of Misaki's use of arrows to represent the the unfolding action

Ueda (1951) also made use of some arrows, but they were not as neat as Misaki's arrows and most of them do not seem to indicate a specific maneuver, saved in some drawings such as when he used curved arrows to represent the action: “turn this flap”, as shown in Figure 18. It is worth noting that the arrow is very similar to other action arrows that would later be used by Akira Yoshizawa (some readers may find surprising that this type of arrow appears in a book not written by him!)

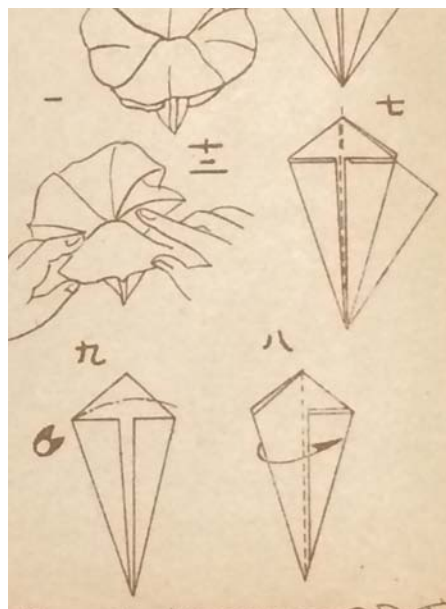


Figure 18: Example of Ueda's use of arrows for “turn flap to the right”

Another notable author was Isao Honda (1888-1975), who published his first origami book in 1931, one year before *Origami Kirigami to Shuko* by Izumo Misaki. Honda would eventually become one of the most popular and prolific origami authors of the 20th century. However, far from the best sellers that would become familiar years later, this first book, titled *Origami 1*, went by without pain or glory.

Luckily a copy can be consulted online from the National Diet Library Digital Collection of Japan.²⁶ It is a book that combines traditional folding (oriental and western) and some of his own creations. Although the author had artistic training and was a scholar of origami and its history, in this book he made no distinction between valley fold and mountain fold, nor is there an initial schematic illustration or code. The folds are marked with a single type of dotted line, so the reader often has to guess where the fold is going, whether backwards or forwards.

Instead, the modality of the initial schematic illustration, that appears for the first time in the Misaki book (1932), was the one that cemented the style of diagramming that years later Isao Honda would adopt, but only after he received the advice of a promising young artist, Akira Yoshizawa, who began his career as an origami creator by publishing his first models, by invitation, in Honda's second book: *Origami Shuko*.

Let's remember that in 1932, when Misaki published *Origami Kirigami to Shuko*, Yoshizawa was 21 years old, worked in a factory and origami was not his full-time occupation. He would only launch himself as an origami creator 12 years later. At that time, Yoshizawa could not have ignored the context and influences of the Kogei movement that promoted a blend between arts and technology. Actually, Yoshizawa was immersed in the world of industrial design, as he himself was a draftsman.

Everything we have investigated so far allows us to put into perspective the development of the convention formulated by Yoshizawa. To fully understand it, we must direct our attention to the moment when the master began to publish his own models under the auspices of sensei Isao Honda.

Isao Honda published his second book, *Origami Shuko*, in 1944, while the country was submerged in a bloody world war. Over the years, the book became so rare that not a single copy could be found. Legend has it that Isao Honda ordered the destruction of the entire edition because he was not happy with parts of its content; or perhaps because he was ashamed of having published it during the World War.

However, people interested in the history of paperfolding were intrigued by the rumor that Yoshizawa had contributed with some models of his own, the first ones he ever published. On this topic, David Lister commented: “*During the war, in 1944, some of Yoshizawa’s models appeared in Origami Shuko, a book published by Isao Honda.*”²⁷ Lister regretted not having had the opportunity to obtain a copy (although in one of his last essays he gave a broad description of so presumably he obtained a copy towards the end of his life).²⁸

I, too, was very interested in finding a copy to verify what type of diagramming system had been used. Once again, luck was on my side. In the archives of Gershon Legman a bunch of photocopies were sitting at the bottom of a box filled with Japanese stuff. They were wrapped in a strip of washi paper and, sure enough, the inscription *Origami Shuko*, 1944, clearly showed what it was. Reading through the letters and translations that accompanied that folder, I learned that the copy had been sent to Legman in the '70s. The sender had been Isao Honda and the purpose, as Honda said in his letters, was to clarify the suspicion that the book contained Yoshizawa models without the corresponding credit. As Legman was able to confirm, the suspicion was unfounded: each one of Yoshizawa's models had his name. Moreover, in order to avoid any doubt and to make sure Legman would not miss the name of Yoshizawa written in Japanese, Honda had underlined, with red pencil, each one of Yoshizawa's contributions and name.

As my interest was focused on the notation system, I looked at the diagrams and also turned to the first pages, where I found –surprise!– the introductory “tool box” that Yoshizawa would use eight years later in the magazine *Fujin Koron*, and subsequently in his book *Atarashii Origami Geijutsu*.²⁹ This means – and the red circle confirms it – that Yoshizawa was the one who contributed with the notation system in *Origami Shuko*. The illustration has the dashed line with double dots and its corresponding name in *kanji*: 山 (mountain), as well as the dashed line: 谷 (valley). (Figure 19)

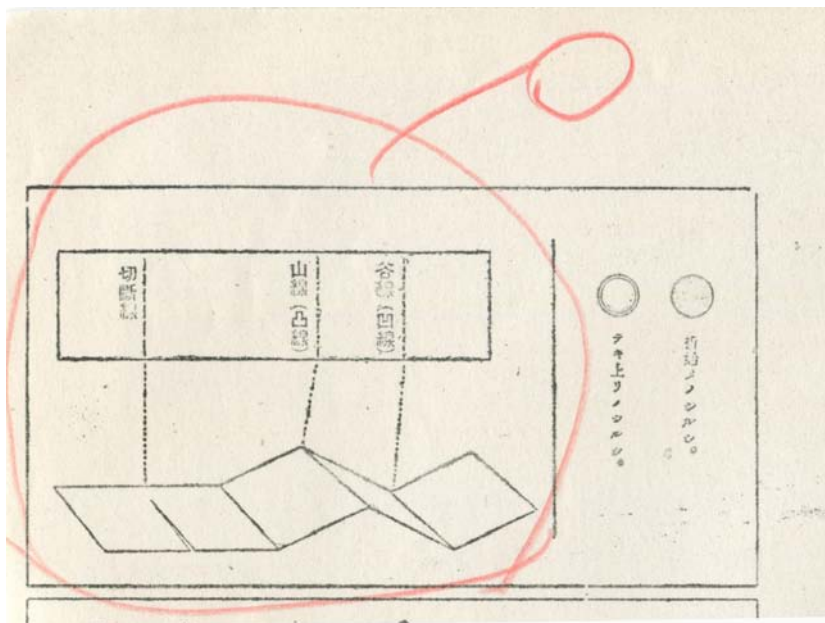


Figure 19: *Origami Shuko* code (1944). Isao Honda circled the illustration in red to indicate that the author of the introductory “tool box” was Akira Yoshizawa.

Thanks to our investigation, we are in a position to confirm that Yoshizawa was not the first to use the introductory illustration. We do not know whether he was inspired by Misaki or he just had the same idea. However, as this book came 12 years after Misaki's book, and Yoshizawa was certainly well aware of any publication in the market, it seems that rather than a coincidence, he was probably inspired by the existing material. What he did, and it is not a minor task, he improved it.

Among the improvements, we see that instead of six paired drawings, Yoshizawa opted for one single unit that incorporates all the information (the perspective view). As for the symbols of “mountain” and “valley”, the difference is the use of two dots between lines (- . . - . . . -) for “mountain” (this is not an improvement per se, but rather a personal “mark”).

Yoshizawa was prepared to cope with the challenges of design. He was immersed in a period when crafts and industry nurtured each other. He studied to become a draftsman, but he never disdained paper folding, which he learned during his childhood. And surely enough, he was aware of the new publications in which traditional folding was enhanced by a modern and attractive design.

In the 1970s, in response to a question during an origami convention, Akira Yoshizawa acknowledged that he had borrowed the idea of the mountain line with double dots from graphic representations that appeared in western mechanical engineering manuals (he did not mention what sources). That was the only clarification he provided and I was referred to that story by Mick Guy who was the person who asked Yoshizawa about the origins of his system of notation.³⁰ Yoshizawa never mentioned other sources, such as Misaki's publications.

But regardless of whether his style was the result of certain influences or not, the importance of his contribution is significant. In *Atarashii Origami Geijutsu*, Yoshizawa presented a series of action arrows, more specific than the static arrows that appear in Michio Uchiyama books. Each arrow represents the motion of paper to convey an action or maneuver: “forward”, “backward”, “turn”, “insert”, etc. (Figure 20), helping the reader understand the diagrams in a much friendlier way. The contribution did not go unnoticed by Harbin and Randlett, who, as we have already mentioned, adopted and improved a system that soon would become the standard for origami design.

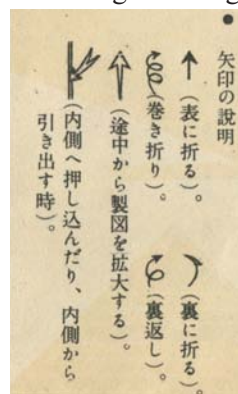


Figure 20: In his book *Atarashii Origami Geijutsu* (1954), Akira Yoshizawa introduced action arrows to indicate movement or maneuvers.

Not every paperfolder would follow Yoshizawa's model. For example, Isao Honda decided to differentiate from Yoshizawa after the publication of *Origami Shuko*. So, in subsequent books he slightly modified the code and, like an author's signature, used the dashed line with a letter “P” to indicate “peak”, instead of the line followed by a double-

Symbol	Isao Honda (1931)	Teikoku Kogei (1931)	Izumo Misaki (1932)	Michio Uchiyama (1935)	Akira Yoshizawa (in Origami Shuko by Isao Honda) (1944)	Saburo Ueda (1951)	Akira Yoshizawa (Fujin Koron, 1953)	Akira Yoshizawa (Ataharashii Origami Geijutsu 1954)
-----	Indistinct fold	Valley	Valley	Valley	Valley	Valley	Valley	Valley
-----		Cut	Mountain	Mountain		Mountain		
-----			Cut		Mountain	Cut	Mountain	Mountain
-----		Mountain						
-----					Cut		Cut	Cut
Introductory “tool box”	No	No	Yes (three pairs of drawings)	No	Yes (Yoshizawa’s contribution to this book)	Yes (three pairs of drawings)	Yes (single perspective)	Yes (single perspective + series of arrows)
Arrows	No		Yes (some are action arrows)	Static arrows only	Few and unspecified	Yes (very simple)	Yes (action arrows)	Yes (an elaborate battery of action arrows)

dots that was characteristic of the Yoshizawa designs.

RESULTS

The notation system helped create and disseminate increasingly more complex models. This breakthrough can be divided into three aspects: one, the graphic distinction between the orientation of the fold using two different types of symbols, one for valley and another for mountain. (While the valley symbol seems to be consistent throughout the bibliography, the mountain symbol varied among authors) (Table 1).

The second unprecedented advancement, was the introductory “tool box”. Every origami book, whether it is for beginners or advanced paperfolders, includes the summary of graphic elements in the introduction. As far as we have been able to investigate, this introductory “tool box” appears for the first time in the Izumo Misaki book of 1932, but it is recommended to review the bibliography as there might be other books that went unnoticed in the scope of this study.

The third and last development were the arrows, which in the beginning were static and informatively redundant (Uchiyama, 1935). Then they incorporated the notion of movement (Misaki, 1942). Fully-fledged arrows that indicate different types of motion are found for the first time in Yoshizawa's *Ataharashii Origami Geijutsu* (1954) .

CONCLUSIONS

This study found that part of the notation system used by Akira Yoshizawa was pre-existent to his work. In Misaki's book, *Origami Kirinuki to Shuko* (1931) all the elements are present, including the use of arrows but not as elaborate as the action arrows that Yoshizawa introduced 22 years later, in 1954.

Back to the metaphor from the beginning, when drawing a timeline with a “sliding dial”, the “zero” no longer falls on the name of Yoshizawa but we must run the dial backwards to the 1930s, to acknowledge the new ideas that flourished during the *Kogei* movement that promoted a fruitful exchange between arts and industry. In particular, the publishing industry became fertile ground for graphic innovation and in the case of origami, elements of mechanical and technical drawing were adopted and optimized. Publications targeting the masses, such as Misaki's books, and for the connoisseur, such as Michio Uchiyama's books, began to use symbols like “valley” and “mountain”, borrowed from Western reference books³¹. In Misaki's books, the introductory “tool box” also appeared for the first time.

Halfway around the world, Gershon Legman and Ligia Montoya, who were familiar with the latest publications in Japan, had been using the “modern” notation system before they knew about Akira Yoshizawa. Hence, their vocabulary resembled that of the Japanese books.

However, this should not diminish the weight of Yoshizawa's contributions. On the one hand, his diagrams were easy to follow and even clear for the amount of detail included. Gershon Legman noticed that Yoshizawa's drawings almost did not contain any text and yet they were very intuitive. For the magazine *Fujin Koron*, Yoshizawa was constrained to a space of 8.5 cm x 12 cm in which he had to place at least a dozen tiny drawings. Therefore, it was crucial to achieve a level of neatness that would allow the reader to follow the instructions step by step. Yoshizawa was familiar with the technical codes for draftsmen, and he must have been aware of the origami books in circulation, which had already picked up the code from some manuals and improved the layout with an introductory page. So Yoshizawa went that way and organized the layout in a manner that would be both pleasant and understandable, while minimizing written instructions. He did the job of a creative graphic designer and added his own contributions designing action arrows that would facilitate the understanding even more.

We conclude that Yoshizawa was not an isolated character; he was living in a period when graphic design was booming. He did not seek to break from old styles or generate a revolution, but rather he used the trend as a springboard for improvement.

It can be said that this closes a circle initiated in the West in the 19th century with technical manuals, that reached Japan after the trade opening in 1853. Japanese schools began to import educational material, including the Froebel system for teaching basic construction skills, with various exercises that included paperfolding. All of this prompted the production of popular books for entertainment and teaching arts and crafts. At the same time, independent artists, such as Michio Uchiyama, were also gaining weight in the field. In turn, Isao Honda's second book came out with improvements in the notation system, thanks to Yoshizawa's contribution that, following in the trend of the industry, used one page to explain the system in a single graphic, which included two kinds of lines to differentiate valley and mountain folds.

It is worth noting that the mountain line with double dots became a sort of hallmark of Yoshizawa's work. The same happened with the "Peak" line designed by Isao Honda. Thus, with this unique symbol, both sought to differentiate from each other and at the same time they distanced themselves from the massive publications of the moment.

Does it mean that when conceiving his own convention of symbols Yoshizawa did not consider the works in vogue but was based exclusively on his knowledge of technical drawing? Or, with an eye on popular publications, did he look for ways to refine the system by adding the details that appeared in his first book? Yoshizawa always thought of himself as a son of technical drawing, ignoring other influences (in particular, those that in his opinion were not up to his creations.)

However, we should not forget that Yoshizawa was a student of the existing literature and certainly was aware of the circulating material at the time. His own system coexisted with the one of other Japanese authors.

But let's go back to the moment when Legman became acquainted with Japanese origami books, such as the Misaki and Ueda books. That is when the West-East-West circle closes, since from that moment, Legman focused on a more practical way of diagramming, more advantageous than the diagrams with nonspecific lines that he had been using. A couple of years later Legman discovered the diagrams of Yoshizawa, and while the details were not completely novel to him, he found them to be remarkably clear and dynamic. His admiration for Yoshizawa's artwork prompted him to offer his seemingly unstinting support which led to the first exhibition of Yoshizawa in the Western World (in Amsterdam). Meanwhile, Robert Harbin asked Legman for information about Japanese paperfolding, which was used in the preface of his first book. Although Harbin mentioned the work of Yoshizawa, he did not use his notation system (the book was ready for the press), but the following books were diagrammed according to the guidelines that he and Randlett developed after studying the system from Yoshizawa's publications. As a matter of fact, that

“code” would appear complete for the first time in the book *The Art of Origami*, by Sam Randlett.

David Lister was right when he left open the possibility of questioning the origins of the current system of diagramming, as was Joan Sallas when he proposed to investigate the authors before Yoshizawa. Today the convention is known under the name of “Yoshizawa-Harbin-Randlett system”. I don’t mean to suggest that this name be modified, since it is firmly established by the usage and it would be a fruitless enterprise to attempt a change; however, we should note that the denomination is not entirely accurate because history suggests the existence of a context prior to Yoshizawa that involved other authors.

Up to here we were able to give a glimpse of the evolution, but I am sure it is far from complete. We now know Misaki, for instance, but we do not know if he was really the first to add important components to the notation system or there were others who played a certain role. So this research will not be complete until the Japanese bibliography of paperfolding before 1930 is fully revised (and this is an invitation to Japanese paperfolders as they know the language and they are closer to valuable bibliography), which can still give us some surprises in terms of other authors who might have helped develop the current nomenclature. Last but not least, it would also be interesting to investigate further the effect of the *Kogei* movement in the launching of Akira Yoshizawa's career as an origami artist.

*This investigation started in New York in 2014 and was finalized in Argentina and Uruguay, where I currently live. I want to thank Marcio Noguchi for his help in the translation of this paper that I wrote originally in Spanish; to Joan Sallas, Mick Guy and Robert Lang for their suggestions and comments during the early stages of this investigation; to Karen Reeds, who helped locate and scan a copy of Izumo Misaki’s book at Princeton Library; to the librarians at Gokugei Library, Maryland University’s Gordon Prang Collection, and the New York Public Library; to Patsy Wang for edits; and to Judith Legman. I want to express my sincere thanks to the Folding Didactics (www.forum.foldingdidactics.com), a forum where all things historic are being discussed among people interested in the history of paperfolding.

Notes

¹ For a comprehensive review of the origami diagramming conventions, the search for its standardization and the difficulties in overcoming small discrepancies (which is beyond the scope of this research), see Robert Lang's essay: www.langorigami.com/article/origami-diagramming-conventions

² Wikipedia: www.en.wikipedia.org/wiki/Yoshizawa-Randlett_system.

³ The idea of “basic foundations” in the Western World also appears in the book *Paper Making*, by Margare Campbell (1937), although the bases are quite different from those later proposed by Randlett and Harbin.

⁴ Samuel Randlett said that he “cleaned the excesses of Harbin”. “I don't know if I was necessary, I don't know if I did anything that Yoshizawa couldn't have done, but Yoshizawa's books were not in English”. (*The Paper*, Issue 115, Spring 2014, pages 16-18).

⁵ www.britishorigami.info/academic/lister/origin_of_symbols.php.

⁶ Robert Lang regards the action arrows to be one of Akira Yoshizawa's most important innovations. "(H)is background was in metalworking; he would have been very familiar with the use of different line patterns as used in technical drawings to convey different information." Personal communication, July 6, 2014.

⁷ *Origami Tanteidan Digest*. Volume 27, issue 162. March 2017 (English translation digest)

⁸ Personal communication, 2015

⁹ *Fujin Koron*, April 1952. Diagrams by Akira Yoshizawa. (Source: Legman Archive)

¹⁰ "Phoenix" was a magazine targeting an audience interested in magic tricks and sleight of hand. It was published several times a year, and the owner was Gershon Legman's friend Bruce Elliott, from New York.

¹¹ Moreover, the *Phoenix* magazine, where Legman published the diagram, was prepared several weeks in advance, so Legman must have sent his work to the editor, Bruce Elliott, in the second half of 1952.

¹² Th. de Moulidards. *Grande encyclopedie methodique, universelle, illustree, des jeux et des divertissements de l'esprit et du corps*. Librairie illustree. (1888), pg. 339.

¹³ Letter from Gershon Legman to Neal Elias, undated, but it was written between July and August, 1952 because it correlates with letters by Elias from the period.

¹⁴ And that was certainly the case, since the diagrams of that time used shaded drawings, or very cumbersome figures that combined lines and letters.

¹⁵ Two dots between dashed lines: - . - . - . - . -

¹⁶ _ -

^{17a} "In my research about this subject I suppose that high probably (sic) Yoshizawa and Randlet 'borrowed' this system from a convention of the cartilage industry, and that the only new in Yoshizawa was the line-dot-dot-line for the mountain fold line. The other graphic folding lines (including the line-dot-line for mountain) existed before him." Joan Sallas, the Folding Didactics website. November 29, 2011. www.forum.foldingdidactics.com.

^{17b} On page 71 of Tom Tit's *Joujoux en papier* (1924), there is the following reference: "Rappelez-vous bien que les plis marqués en lignes faites de petits traits sont des plis en creux, tandis que les plis marqués par des lignes faites de points et de traits sont des plis en relief." (Translation: Remember that the fold marked as dashed lines correspond to a hollow fold, while the fold marked with dots and dashes are the relief folds)

¹⁸ Both were avid collectors of all kinds of materials related to paper folding. They wrote directly to publishers in other countries to purchase imported books. They sent money orders and the books were received by mail. Legman also obtained them through importers and collectors of "orientalia" (oriental art and literature).

¹⁹ *Paper Life*, by Laura Rozenberg, Createspace, 2016.

²⁰ The other book, as I was able to find out later, was the 1952 edition, hence the fact that they were very similar.

²¹ My friend Masao, from Origamiteca Argentina, helped me identify the characters in hiragana that describe these lines: たに is pronounced *tani* and means valley, while やま is pronounced *yama* and means mountain.

²² In March 1952, he wrote a letter to Izumo Misaki. Among other things, he said: "(I) have been studying for over a month now your books *Origami to kirinuki tehon* and *Shuko Origami to Kirigami* from which I have learned more new folds and principles than in all I have studied for the last three years combined". In a handwritten note at the bottom of the letter Legman noted that Mis-

aki never answered him.

²³The 1940 issue was possibly a reprint of the one published in 1932.

²⁴The book belongs to JOAS library, Tokyo.

²⁵Amagai, Yoshinori; “Japanese concept of Kogei in the period between the First World War and the Second World War”, p. 105-109. In: Wong, Wendy Siuyi; Kikuchi, Yuko & Lin, Tingyi (Eds.)

²⁶dl.ndl.go.jp/info:ndljp/pid/1879609?itemId=info%3Andljp%2Fpid%2F1879609&__lang=en

²⁷<http://www.britishorigami.info/academic/lister/yoshi1.php>

²⁸http://www.britishorigami.info/academic/lister/honda_books.php

²⁹The perspective view in *Origami Shuko* is more sketchy. It does not have the “graceful curve” (to use an observation made by Robert Lang in a personal communication) that appears in the introductory unit of Ataharashii Origami Geijutsu's.

³⁰“*I asked Harbin in the early days why the mountain fold had two dots and not one. He did not know citing Yoshizawa as his source. This came up when we first met Yoshizawa in Birmingham. Yoshizawa was originally an engineer (sic) and would have been taught that a long dash and a dot represented a centerline on an engineering drawing. So, he adopted it rather than using a thin crease line that Harbin and Randlett subsequently came up with. Of course, this meant that he had to modify the mountain fold line so he added another dot.*” (Mick Guy, personal communication, April 23, 2015).

³¹As Mick Guy was able to confirm, Yoshizawa adopted—and adapted—, drafting conventions that were in use in technical manuals. Joan Sallas also said that Western books on how to make cardboard boxes used the “dash/dot” system. In *Folding Didactics* (the forum), Sallas mentioned the following bibliography regarding books of the “cartonage industry” that used the convention of dashed and dots: “*We know today that the valley and mountain folding lines were used for other authors before Samuel Randlett and Akira Yoshizawa proposed them to the origami community. They are enough witness of that, as Tom Tit [Pseud. of Arthur Good, 1853 - 1928] in "Joujoux en papier" ([1924]), J. C. Max in "Kartonarbeid" (6th edition 1933) or Erich Wittich in "Papierspiele. Band I." (Borna, Nov. 1945) and "Papierspiele. Band II." (April 1946).*”

Because Yoshizawa recognized that he used symbols that existed in “engineering drawing”, we can assume that those books had been in Japan since at least the early 20th century. Since Yoshizawa presented his “tool box” in 1944 (in Isao Honda’s *Origami Shuko*), the only references that would count from the list that Sallas provided are *Joujoux en papier* (1924) and *Kartonarbeid* (1933 and earlier editions) but there might be other books that eventually reached Japan.

Juan Gimeno rightly pointed to the fact that the present study “*does not address clearly the influence of the European industrial design representations in the Japanese industrial designs and how, in turn, these publications influenced the paper folding publications*”.

I was not able to review in depth the European and Japanese bibliography on the subject from the 19th and early 20th century, and also do not have means to track what European books were imported to Japan (or used as references for new books in Japanese.) I would strongly encourage other researchers to pinpoint the bibliography in a more comprehensive way, because, over time, unchecked understanding tend to become background to the general thinking an perception—just the type of problem we tried to tackle in this study.
