Robert Lang and the Global Reach of Origami

Susan Orlean

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By Susan Orlean

One of the few Americans to see action during the Bug Wars of the nineteen-nineties was Robert J. Lang, a lanky Californian who was on the front lines throughout, from the battle of the Kabutomushi Beetle to the battle of the Menacing Mantis and the battle of the Long-Legged Wasp. Most combatants in the Bug Wars—which were, in fact, origami contests—were members of the Origami Detectives, a group of artists in Japan who liked to try outdoing one another with extreme designs of assigned subjects. They engaged in the Bug Wars after one of the Detectives displayed what the group's Web site calls "an incredible secret weapon"—a horned beetle with outspread wings, which he had folded from a single sheet of paper. "Then the origami insect war got full-scale," the English translation of the Web site continues. "They compared their confident models with others at their monthly meetings, and losers left with chagrin." During the Bug Wars, Lang was not yet a professional origami artist; he was a research scientist at Spectra Diode Labs, in San Jose, who did some paper folding on the side. He was busy at work—in 1993, the year of the Menacing Mantis, for instance, he patented a self-collimated resonator laser and worked on fibre-optic networks for space satellites—so he usually wasn't able to travel to Japan to hand-deliver his bug of the month. Instead, he would e-mail his design to an ally in Tokyo, who would fold it and present it to the Detectives on Lang's behalf.

Lang's beetle

At the time, Lang was in his thirties. He had been doing origami—that is, shaping sheets of paper into figures, using no cutting and no glue—for twenty-five years and designing his own models for twenty. He has always considered himself very much a bug person, but his earliest designs were not insects; in the nineteen-seventies, he invented an origami Jimmy Carter, a Darth Vader, a nun, an inflatable bunny, and an Arnold the Pig. He would have liked to have folded insects, but, in those years, bugs, as well as crustaceans, were still an origami impossibility. This was because no one had yet solved the problem of how to fold paper into figures with fat bodies and skinny appendages, so that most origami figures, even television characters and heads of state, still had the same basic shape as the paper cranes of nineteenth-century Japan. Then a few people around the globe had the idea that paper folding, besides being a pleasant diversion, might also have properties that could be analyzed and codified. Some started to study paper folding mathematically; others, including Lang, began devising mathematical tools to help with designing, all of which enabled the development of increasingly complex folding techniques. In 1970, no one could figure out how to make a credible-looking origami spider, but soon folders could make not just spiders but

spiders of any species, with any length of leg, and cicadas with wings, and sawyer beetles with horns. For centuries, origami patterns had at most thirty steps; now they could have hundreds. And as origami became more complex it also became more practical. Scientists began applying these folding techniques to anything—medical, electrical, optical, or nanotechnical devices, and even to strands of DNA—that had a fixed size and shape but needed to be packed tightly and in an orderly way. By the end of the Bug Wars, origami had completely changed, and so had Robert Lang. In 2001, he left his job—he was then at the fibre-optics company JDS Uniphase, in San Jose—to fold paper full time.

Lang's Goliath's beetle

Lang is accustomed to being surprising. Some years ago, he was the mystery guest on the television game show "Naruhodo! Za Warudo"—the Japanese version of "What's My Line?"—and he amazed the audience and the contestants, because they couldn't believe that an American could be an origami expert. People who know him as a scientist are flabbergasted when they hear that he is one of the world's foremost paper-folding artists, and are often surprised that such a thing as a professional origami artist even exists. People expecting him to be kooky—or, at the very least, Japanese—find his academic accomplishments and his white male Americanness puzzling. Recently, he was commissioned by Lalique, the French crystal company, to demonstrate folding at a launch for its new collection of vases, which are rippled and creased in an origami-like way. The launch was at a Neiman Marcus in Troy, Michigan, on a cold night just before Christmas. It was intended for Neiman Marcus's favorite customers, and there was music playing and waiters offering hors d'oeuvres and glasses of wine. Lang was set up in the china-and-crystal department, behind a Regency-style desk. On one side of the desk was a stack of thin, square sheets of Japanese origami paper, as brightly colored as a roll of Life Savers. He had with him a laptop computer, and during a break he showed me software that he was designing with his brother, a botany professor, which simulates the growth of cherry trees and will allow farmers to test pruning and fertilizing techniques on a computer, rather than in their orchards. Lang is now forty-five. He is tall, with slim, fine-looking hands, a tidy Silicon Valley-style beard, and the clean, comfortable good looks of a park ranger. That evening, he was wearing a Glen-plaid sports jacket, a tie, and slacks. He settled into his chair and began creasing a sheet of paper into what would become perhaps a bird or a dinosaur or a tarantula. A woman in a knee-length shearling coat wandered over to watch. She stared at Lang's hands and then took fuller stock of him. After a moment, she nudged her husband, who was standing beside her, slightly bent under the weight of four shopping bags.

"My God, look," she said, pointing to Lang. "He's in a suit!"

Lang stopped folding and looked up at her.

"It's just . . . to see an artist all clean and dressed, and in a suit," she sputtered.

Lang smiled and said, "Well, my kimono was at the cleaners." He resumed folding.

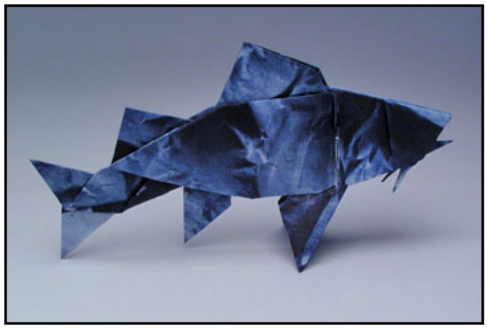
"You're good at the origami," the woman said. "Have you done other jobs?"

Lang said, "Yes, in fact, I have. For years, I was a physicist."

The woman grabbed her husband's arm again and gasped, "Oh, my God!" While she was recovering, two men ambled up. "Do people, like, pay you?" one of them asked. Before Lang could answer, the other guy, brandishing a baby lamb chop, asked if he knew how to make the Statue of Liberty.

"Yes, I do," Lang said. "I'm not going to make it right now, but I do know how to do it." He put aside the piece he was working on, and took a new sheet of paper from the stack. He creased it, flipped the paper over, creased it again, lined up the edges, smoothed the sides together, pinched it here and there, and tugged on one edge. He did this with quick, meticulous movements, his hands crossing back and forth over the sheet as if they were tracing a melody. Suddenly, the sheet of paper crumpled and then opened into a shape—a tiny violinist, sawing away at a violin.

"That's just crazy, man," the guy holding the lamb chop said. "I mean, wow."



Lang's goatfish

Lang grew up outside Atlanta. He was given an origami book when he was six by a teacher who had run out of ways to keep him entertained during math class. Lang took to origami immediately. He was fascinated by the infinite possibilities within the finite-seeming—the characters and the creatures that could almost magically come to life from an ordinary square of paper. He worked his way through the designs in one book and then another and another. He had many interests—stamps, coins, plants, bugs, mud—and he was, as his father, Jim Lang, says, "a super-duper math whiz," hooked on Martin Gardner's recreational math column in Scientific American. But paper folding engaged him most. He started designing his own origami patterns when he was in his early teens. He diagrammed them in detail on letterhead from the Chrysler Corporation Airtemp Division, where his father was in sales.

Lang went to college at Caltech, where he studied electrical engineering. "Caltech was very hard, very intense," he told me recently. "So I did more origami. It was a release from the pressure of school. I'd fold things, record the design, and then throw the model away." He had never met anyone else who did origami, and he didn't tell people about his pastime. His wife, Diane, whom he met at Caltech when they both had roles in a campus production of "The Music Man," remembers visiting his apartment in Pasadena for the first time and finding little paper ants lining the shelves. "I guess I thought it was a kid's pastime that I hadn't grown out of," Lang said. "I was a little embarrassed about it." In the back of one of his origami books, he noticed the name and address of the Origami Center of America, which was founded by Lillian Oppenheimer, and was the precursor to OrigamiUSA, the national organization for paper-folding enthusiasts. Through the group, which is based in New York and now has close to two thousand members, Lang met other recreational folders and also people known in the origami world as "masters," including Michael LaFosse, John Montroll, Joseph Wu, and Paul Jackson. LaFosse trained as a marine biologist but left his job in environmental management in 1994 to open the country's first origami-only gallery, in Haverhill, Massachusetts, and was getting as much as twenty thousand dollars for such commissions as a Pegasus for an Hermès window display on Madison Avenue. Wu was a commercial illustrator, in Canada, who did origami most of the time, and Jackson, now in Israel, was an artist working with folded paper. Montroll, the son of a well-known physicist, had

quit his job as an electrical engineer and become an origami-book publisher to support his folding habit. Montroll, in particular, inspired Lang: his animals were elegant and meticulous and his approach to design was totally original. He also made origami models of complex polyhedra that no one had thought possible. "John has done models in origami of all the Archimedean solids! All the Platonic solids! All the Johnson solids!" Lang said excitedly. "He did all the polyhedra!"

Lang's moose

Lang kept folding while earning a master's in electrical engineering at Stanford and a Ph.D. in applied physics at Caltech. As he worked on his dissertation—"Semiconductor Lasers: New Geometries and Spectral Properties"—he designed an origami hermit crab, a mouse in a mousetrap, an ant, a skunk, and more than fifty other pieces. They were dense and crisp and precise but also full of character: his mouse conveys something fundamentally mouse-ish, his ant has an essential ant-ness. His insects were especially beautiful. While in Germany for postdoctoral work, he and Diane were taken with Black Forest cuckoo clocks; the carved casings, pinecone-shaped weights, pendulums, and pop-out birds wouldn't seem to be a natural for origami, but Lang thought otherwise. He started a job at NASA's Jet Propulsion Laboratory, in Pasadena, in 1988, shortly after he had finished folding a life-sized cuckoo clock. It had taken him three months to design, and six hours to fold, and it made Lang a sensation in the origami world.

The Japanese have been folding paper recreationally for at least four hundred years. For the first two hundred of those years, designs were limited to a few basic shapes: boxes, boats, hats, cranes. Folding a thousand cranes—all of white paper, which was the only kind then used—was thought to bring good luck. The principle was simple. The sheet of paper was the essence: no matter what shape it became, there was never more paper and never less; it remained the same sheet. Japanese folding probably didn't spread directly to the West. There is no definitive history, although David Lister, a retired solicitor in Grimsby, England, and the author of more than a hundred essays on the subject, suggests that paper folding developed independently in countries all over the world. In the nineteenth century, schoolchildren in Germany, France, and England made paper horses with riders, and boxes to trap flies, and it is reported that paper folding flourished in Spanish villages and prisons.

In 1837, a German educator, Friedrich Fröbel, introduced the radical idea of early-childhood education—kindergarten. The curriculum included three kinds of paper folding—"The Folds of Truth," "The Folds of Life," and "The Folds of Beauty"—to teach children principles of math and art. The kindergarten movement was embraced around the world, including in Japan, where Fröbel's simple folds merged with traditional origami. Japanese magicians of the time also began doing paper tricks as part of their conjuring. By the eighteen-sixties, Japan's isolationism was ending, and in the following decades those magicians travelled to Europe and the United States to perform. Suddenly, the kindergarten exercise appeared mysterious and wonderful. A square of ordinary paper creased and crinkled could come to life as a flapping gull; a sheet of parchment could take shape as a lion or a swallowtail. Professional magicians in Europe and the United States loved origami, and a number of them wrote books about it. In 1922, Harry Houdini published "Houdini's Paper Magic: The Whole Art of Performing with Paper,

Including Paper Tearing, Paper Folding and Paper Puzzles." (He regularly did a trick known as "the troublewit," turning a piece of paper into an endless number of different shapes without any cuts.) In 1928, the stage magicians William Murray and Francis Rigney published "Fun with Paperfolding," with chapters on square folding, diagonal folding, and a complete paper-folding stage routine titled "How Charlie Bought His Boat."

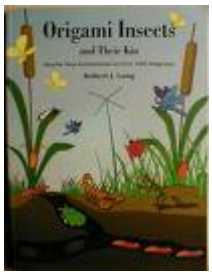
Lang's trumpet vine blossom

In the mid-nineteen-forties, the American folklorist Gershon Legman began studying origami. Legman was a man of diverse inclinations: he collected vulgar limericks, wrote a book about oral techniques in sexual gratification, and is credited with having invented the vibrating dildo when he was only twenty. After becoming interested in origami, he made contact with paper-folders around the world—most significantly, Akira Yoshizawa, a Japanese prodigy who, before being recognized as an extraordinary talent, made a meagre living by selling fish appetizers door-to-door in Tokyo. What made Yoshizawa extraordinary was that he presented the art for the first time as a medium that could be creative and expressive—he devised tens of thousands of models, and was particularly famous for his gorillas. In 1955, Legman organized an exhibition of Yoshizawa's work at the Stedelijk Museum, in Amsterdam. Yoshizawa got even more notice the following year, when Robert Harbin published his book "Paper Magic." Harbin was the preëminent British magician—he was the first to appear on television, and he developed the now classic "Zig-Zag Girl" illusion, in which the magician puts his assistant into a cabinet and saws her into thirds. His book, a best-seller, praised Yoshizawa, whose work was such a departure that it might have seemed that there was no further you could go with a single piece of paper and some folds.

One clear, chilly day not long ago, I met Lang at Squid Labs, a high-tech research-and-development company headquartered in an enormous concrete building that used to be part of the Alameda Naval Air Station, near Oakland. Lang and his wife and their teen-age son live about twenty miles east of Oakland, in a comfortable ranch-style house that has a separate studio building in the back yard, where Lang works amid a clutter of math books, seashell guides, computers, and a menagerie of paper animals. He was spending the day at Squid Labs to use its industrial laser cutter to help him crease paper for some complex folds. He said that he may be the first origami artist to use a laser cutter, which he dials down to a smidgen of its power, so that it scores the paper rather than slices it. Lang was working on paper prototypes for two commissions—one for an interior-design piece to be made of metal, another for a leather fashion accessory—and on a design he was making for himself, which he didn't want to describe, in case he jinxed it. All three of the designs were so intricate that it would have taken him hours just to crease the paper in preparation for the final folds. He was using large squares of tweedy-looking mauve Hanji paper from Korea, which is sturdy but still slightly translucent, like the flesh of a fish. It is one of his favorite papers; he buys it in bulk from an online supplier. Other papers he likes, which he gets from art stores in San Francisco and Japan, when he visits, are lokta, from Nepal; unryu, from Thailand; and kozo and gampi, from Japan. When he makes his most complex insects, he uses handmade paper from Michael LaFosse's studio. For a while, in fact, LaFosse had a paper in stock called Robert

Lang Insect Paper.

Lang was, by all accounts, good at his science jobs: he wrote more than eighty technical papers and holds forty-six patents on lasers and optoelectronics. All the while, he was plotting how he would find time to write origami books. He published several while he was still in the laser world, starting with "The Complete Book of Origami," in 1989, but he knew that it would require all his time to write the one he had in mind, which, instead of providing patterns for folders to follow—the typical origami book—would teach them how to design their own.



(http://www.amazon.com/Origami-Insects-Robert-J-Lang/dp/0486286029/sr=8-1/qid=1172497733/ref=pd_bbs_sr_1/102-2417624-9265730?ie=UTF8&s=books)

The bad luck of the dot-com bust turned out to be good timing for him. Beginning in 2000, JDS Uniphase, which supplied components to computer companies, lost much of its business, so Lang's duties shifted from overseeing research and development to managing pay cuts and plant closings. "Laying people off was a lot less fun than inventing things," he said. "There were plenty of people doing lasers. The things I could do in origami—if I didn't do them, they wouldn't get done. Deciding to leave was a convergence of what I wanted to do plus what was happening at my company." Given his personality—composed, moderate, painstaking—it seems like an unimaginably audacious move. A lot of people, throughout history, have walked away from respectable careers to become, say, poets or jazz musicians, but there are viable markets, albeit small and competitive, for those pursuits. Becoming a professional paper-folder is chancier, since there is still no established market for origami as a collectible art form, and, until recently, it was not much promoted as one: Yoshizawa published books of his designs but never sold any of his pieces. I wondered if Lang's family wanted to kill him when they heard of his career plans. What he did, after all, is analogous to, perhaps, quitting a job as a neurosurgeon to take a shot at becoming a professional knitter. Diane has said that even though the transition seems as if it should have been scary, it wasn't. His parents were also sanguine. They'd had a somewhat similar experience when Lang's sister, who had been studying for a master's in microbiology, left her field to become an interior designer. Lang's mother, Carolyn, recalls, "I think I jokingly said, 'Are you going to be able to feed your family?' But I know Robert, and I knew he would have had it all planned."

The first part of his plan was to write the book he'd been contemplating while still at JDS Uniphase—"Origami Design Secrets," which was published in 2003 and lays out the underlying principles of origami and design techniques. He then set to work full time on designing new models and refining his old ones. In truth, Lang is not entirely out of the science world: he was just named the editor-in-chief of the Journal of Quantum Electronics, published by the Institute of Electrical and Electronics Engineers, and he does part-time laser consulting for Cypress Semiconductor. He has also had a number of origami assignments that are specifically scientific. Most are for products that need to fold and unfold in a predictable and compact way. He was commissioned to design a pouch for sterile medical instruments that could be opened without having a non-sterile surface touch any sterile surface, and a cell-phone antenna that had to fit inside the body of the phone. One medical manufacturing company hired him to figure out

how to fold a heart implant—a mesh heart support designed for people with congestive heart failure—so that it was compact enough to be implanted via a skinny tube but, when released from the tube, would unfurl properly around the heart. Lawrence Livermore National Laboratory had him work on a similar folding problem, but this time the thing being folded was a telescope with a lens a hundred metres in diameter which had to be packed into a rocket so it could be sent into space.

Many of Lang's commissions are less technical. He recently designed toilet-paper origami animals for a Febreze commercial, which were folded by a fellow origami artist, Linda Mihara, and last year, again assisted by Mihara, he created an origami world—forest, fields, deer, Victorian houses, a dragon—for a thirty-second Mitsubishi spot. He was hired to make a life-size Drew Carey for "The Drew Carey Show" and some airplane seats for the cover of Onboard, an aircraft-seating magazine, and to fold dollar bills into any shape he wanted (a birthday gift for a well-known fashion designer). He sells quite a few pieces to origami lovers—his most popular piece is a Hanji-paper bull moose, which is about nine inches tall and is available through his Web site for eight hundred dollars. Lang's favorite commission was to fold an endangered Salt Creek tiger beetle for an entomologist who collects Salt Creek tiger beetle art. "For me, that commission was like manna from Heaven," he said. "I'll never be done with bugs."

Lang's dragon

The laser cutter was growling away, scoring one of Lang's Hanji sheets. He twiddled with his computer. On the screen was a lacy geometric pattern. Lang had designed it with software he started writing in 1990 called TreeMaker, which is well known in origami circles; it was the first software that would translate "tree" forms—that is, anything that sort of resembles a stick figure, such as people or bugs—into crease patterns. Another program he wrote, ReferenceFinder, converts the patterns into step-by-step folding instructions. This secured his position as the most technologically ambitious of the origami masters. In 2004, he was an artist-in-residence at M.I.T., and gave a now famous lecture about origami and its relationship to mathematical notions, like circle packing and tree theory. Brian Chan, a Ph.D. candidate in fluid dynamics at M.I.T., told me recently, "That was a huge lecture. It got everyone talking." It inspired Chan to put his hobby of blacksmithing on hold and take up origami; he and Lang are now regular participants in an annual competition that is a friendly continuation of the Bug Wars. Last year's theme was a sailing ship. Lang wasn't happy with his entry—a sailboat with its sails down, revealing its skeletal masts—but talks enthusiastically about Chan's. From a single sheet, Chan created a brig under full sail being attacked by a giant squid.

Something about origami's simplicity and its apparently endless possibilities appeals to people. In 2003, the Mingei International Museum, in San Diego, mounted an exhibition called "Origami Masterworks," which included several of Lang's pieces. It was supposed to run six months, but attendance was so robust that the show was extended for six months, then for eight more. In Japan, the "Survivor"-style show "TV Champion" has often featured contestants engaging in extreme origami—folding with their hands in a box, or while balanced on stools with the paper suspended above them, or while snorkelling in a fishtank. A surprising number of countries have origami organizations; the

Origami Society of the Netherlands has more than fifteen hundred members—probably the highest per-capita membership in the world. There is a soothing element in the monotony of folding and unfolding. In fact, origami as therapy has its proponents: in 1991, at the Conference on Origami in Education and Therapy, a mental-health professional presented a paper detailing her origami work with prisoners. "The most rewarding of experiences," she wrote, "was that of observing the effect that Origami had on psychopathic killers."

Lang's crane

A few months ago, I went to a meeting of the Orange County offshoot of the West Coast Origami Guild, which is one of several groups near Los Angeles. (Its motto is "We fold under pressure.") Lang was active in the group when he was at Caltech, and members talk about him in the most admiring tones, but with comfortable familiarity. One of the interesting things about origami is its egalitarianism—experts consort with hobbyists, and share the secrets of their work. The meeting was held in the craft room at the home of Carol Stevens, a tall, jolly woman who teaches paper arts in schools and senior centers; I had been sent directions to her house by a guild member who signed her e-mail "Merry Creasemas!" When I arrived, Carol was setting out refreshments. A few people were working from a book titled "Multimodular Origami Polyhedra: Archimedeans, Buckyballs, and Duality" ("We can fold them," one of the folders said to another, "but we don't know how to pronounce them"); another group was flipping through "Jewish Holiday Origami"; and a retired computer engineer named John Andrisan was creating a bra out of a dollar bill to illustrate a story he was telling about a lunch he once had at Hooters. At a back table, an older Japanese man was teaching four people how to make a twisted box. "Madam," he chided one of the students, "you may know how to handle men, but you don't know how to handle paper." During a break, I asked the instructor how long he had been doing origami, and he said, "In 1986, I lost my son, I got divorced, my life . . ." He stopped and winced. "Origami was my savior."

Lang believes that there is still much more to do in origami. "It's like math," he said to me one day, as we were having lunch at a burger joint near his studio. "It's just out there waiting to be discovered. The exciting stuff is the stuff where you don't even know how to begin." He wants to improve his human figures, work with curved folding, and keep refining his insects. He wants to fold a better mousetrap and a better mouse. His primary interest is in the art of origami, but he has great faith in its expanding practical potential—solar sails, air bags, containers, shelters, medical implants. He had a recent message on his voice mail from someone who wanted to discuss using origami in the manufacture of plastics. We were about to leave the restaurant and head back to his studio. Before we left, I couldn't help but ask him to do something pretty with his placemat. It was just a flimsy rectangle and had a few grease spots from his sandwich, but he flipped it and folded it and did some magic, and left the waitress with a perfect white boat.

Lang's baby

Susan Orlean is the author most recently of My Kind of Place: Travel Stories from a Woman Who's Been Everywhere (http://www.amazon.com/My-Kind-Place-Stories-Everywhere/dp/0679462937/sr=1-1/qid=1172417889/ref=pd_bbs_sr_1/002-9121528-9419251?ie=UTF8&s=books).

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