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The Art and Design of Spider Silk, September 27, 2019 – April 19, 2020

Since ancient times, fiber production and weaving have been associated with spiders and their silken webs, long enchanting artists around the world. Spider silk is a unique and extremely rare material: its tensile strength, heat conductivity, fineness, and elasticity remain unmatched, and its natural golden color is lustrous and astonishing.

Artists and designers have recently been joined by a host of engineers looking to reimagine new applications for this biodegradable and immensely sustainable material. For many researchers, the ultimate goal of replicating spider silk is to wean consumers off petrochemical-based fabrics such as nylon and spandex.

This exhibition highlights recent low-tech and cutting-edge examples in the evolving artistry and biotechnology of spider silk. These works are presented in conversation with historical design examples celebrating spiders and their webs.

Laurie Anne Brewer
Associate Curator, Costume and Textiles
RISD Museum

CHECKLIST OF THE EXHIBITION

Golden orb spiders (*Nephila* genus) are found around the world. *Nephila pilipes* lives in Australia and much of Asia, and *Nephila clavipes* is native to areas of North and South America. *Nephila madagascariensis* is found in Madagascar, off the coast of Africa.

To harvest spider silk, a *Nephila* female must be captured, restrained in a harness, and "silked"—much like a cow is milked—for several minutes before being returned to the wild. During one silking session, a female spider produces between 40 and 100 meters of filament. Twenty-four of these filaments were twisted together to create the golden spider-silk thread shown below. Malagasy artisans at Godley & Peers wove hundreds of natural spider-silk threads together to make the yellow-orange shawls.

In contrast, Microsilk is a laboratory-produced fiber inspired by natural spider silk. Bioengineers mimicked spider silk's genetic code and grew it in a laboratory in a yeast liquid; it was then extruded and spun into yarn. The lingerie is made of Microsilk.

Simon Peers, British, b. 1958
Nicholas Godley, American, b. 1969
Spool of Golden Orb Spider Silk
Spun and plied golden-orb (*Nephila madagascariensis*) filament
Anonymous loan TL129.2019

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Bolt Threads, American, established 2009
Cone of Microsilk Yarn, 2019
Microsilk
Bolt Threads, Inc. TL130.2019

Golden Orb (*Nephila*) Spiders
Nephila pilipes, collected in Boac, Marinduque, Philippines 186.05
Unidentified *Nephila* 203.03
Courtesy the RISD Nature Lab TL84.2019.1-.2

Process + history timeline

Before the 1880s

Both then and now, nearly all textiles referred to as silk are created from fibers from silkworms from the *Bombyx mori* moth. Silkworm silk textiles are different from spider silk textiles, which are exceedingly rare.

The ability to weave with shimmering spider-silk fibers has eluded most textile artists. Only a few investigations into producing spider silk were carried out before the 1880s, none of them to great success.

Late 1800s

Harvested from Nature

In the 1880s and 1890s in Madagascar, French missionary Paul Camboué experimented with filaments harvested from harnessed golden orb spiders. Longstanding processing practices employed in Madagascar were adopted by the French, and the first spider-silk textiles were brought back to Europe.

The First Extruded-Fiber Experiments

Early artificial-silk textiles attempted to replicate *Bombyx mori* moth silk using wood or cotton pulp. Swiss chemist Georges Audemars invented the first artificial silk around 1855, and in 1884 French chemist Hilaire de Charbonnet patented a cellulose-based fabric known as Chardonnay silk. By 1894, British inventors Charles Cross, Edward Bevan, and Clayton Beadle patented the material we know today as viscose rayon.

1900s

Continuing Extruded-Fiber Developments

In 1910, Avtex Fibers commercially produced the first artificial silk in the United States. After 1924, this material became widely known as rayon.

The many textiles created by DuPont, an American chemical company, include extruded nylon (1935), an early synthetic attempt at replicating the luster of spider silk. Kevlar (1964), developed to mimic the tensile strength of natural spider silk, is often employed in making body armor. In 1994, DuPont filed a patent for producing synthetic spider silk in *E. coli* bacteria.

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2000s

Harvested from Nature

In the early 2000s, Godley & Peers began investigating historical spider-silk harvesting techniques in Madagascar, collaborating with local artists to weave spider silk using Indigenous *lamba mpanjaka* textile patterns.

Next-Generation Extruded-Fiber Experiments

The American company Bolt Threads created fiber from fermented brewer's yeast. Their latest development is the bioengineered-protein fiber Microsilk (2016).

The Canadian corporation Nexia Biotechnologies genetically modified goats to produce milk that contains the protein found in the silk of golden orb spiders (*Nephila clavipes*). The Biosteel goats were acquired by Utah State University in 2009.

In 2013, the Japanese biotech startup company Spiber released Qmonos, a synthetic spider-silk material. Its name is based on the Japanese word *kumonosu* (spiderweb). The base protein in Qmonos is drawn from fermented *E. coli* bacteria.

AMSilk GmbH, a German biomaterials company, partnered in 2016 with Adidas to produce a performance shoe made of biodegradable Biosteel fibers.

Nicholas Godley, American, b. 1969
Simon Peers, British, b. 1958
Shawl, woven September 2009
Golden orb spider (*Nephila madagascariensis*) filaments, handwoven in Madagascar
On loan from Simon Peers and Nicholas Godley TL76.2019.2

Historically, fisherman in Madagascar have plied strands from the massive webs of golden orb spiders into their fishing lines and nets.

This extremely rare textile was woven from silk harvested from *Nephila madagascariensis* spiders. Silk collection takes place during Madagascar's warm rainy season, when the spiders are most active and their fibers are of the highest quality.

"We have become sort of the defenders of these spiders, something we never thought we'd be," said Godley, who calls himself a committed arachnophobe. He adds, "They really are very regal-looking creatures."

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Nicholas Godley, American, b. 1969
Simon Peers, British, b. 1958
Shawl, woven May 2011
Golden orb spider (*Nephila madagascariensis*) filaments, handwoven in Madagascar
On loan from Simon Peers and Nicholas Godley TL76.2019.1

Although spider silk is very strong, it is easily altered in appearance and structure by moisture. The artists who created this finely woven shawl wore gloves as they worked at the loom, as perspiration from their hands would pucker the surface of the textile or change the golden color of the silk. If you look very closely at this work, you can find small areas with this reddish-brown color change.

Spider-silk fibers are also remarkably lightweight. This shawl weighs a mere 2.9 ounces (82 grams)—the approximate equivalent of 1 small apple or 82 Skittles.

Strumpet & Pink, design label, British, 2002 – present
Carey Brett, designer and maker, Scottish, b. 1964
Bolt Threads, fiber engineers, American, 2009 – present
Willow's Web, 2019
Hand-crocheted Microsilk, embellished with seed pearls
Museum purchase and gift of Bolt Threads, Inc. TL114.2019

Willow's Web—a collaboration between an American research firm and a UK-based design firm—makes its debut here. Crocheted in Microsilk, a laboratory-generated fiber based on the genetic code of a spider's web, this garment uses the material's unique properties of strength and moisture-induced supercontraction to excellent effect. Willow's Web is a completely modern sensual garment designed to empower and quite literally stimulate its wearer.

Bolt Threads engineers are known for developing sustainable and often vegan biomaterials for the fashion industry, while Strumpet & Pink is celebrated for creating sumptuous works that redefine lingerie.

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Sruli Recht, Australian and Icelandic; b. Israel, 1979
An Emperor's New Untangling, 2012
Machine-knit and hand-sewn Biosteel, with heat-fused seams
Mary B. Jackson Fund 2012.95.2

Artist Sruli Recht's design journey often begins with a fascination with materials, as was the case with this shirt. The disturbing yet compelling story of the material, Biosteel, is in keeping with many of Recht's other projects, which employ everything from his own flesh to stillborn lamb pelts to whale foreskin. Here goats farmed in a biofactory were genetically modified to produce the protein of the golden orb spider (*Nephila clavipes*) in their milk, which was then used to produce the extruded synthetic fiber marketed as Biosteel.

Nearly invisible, this shirt plays on Hans Christian Andersen's "The Emperor's New Clothes" by evoking the vanity of the king in that tale and commenting on the unfathomable costs of creating "transgenic" organisms.

Supreme, design house, American, 1994 – present
James Jebbia, founder, English, active in America, b. 1963
Spider Web Shirt, 2016
Printed cotton with enzyme wash
Courtesy Otto Schusterbauer TL86.2019

This limited-edition shirt—a collaboration between the designer Supreme and Marvel Comics—is an iconic garment within the skater community. Denim became a preferred material in the late 1980s, when skateboarding moved from ramps (where knee pads and protective gear were worn) to the streets, necessitating more understated appearances and heavyweight protective fabrics. Printed with a dynamic motif that evokes Japanese techniques and the urban acrobatics of Spiderman himself, this outstanding example of skater attire effectively combines material, imagery, and silhouette.

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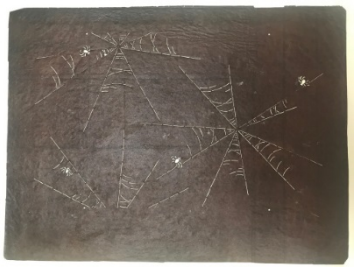
Raf Simons, Belgian, b. 1968
Spider Web Sweater, Radioactivity, Autumn/Winter 1998-99
Wool jersey knit with handknit cotton, mohair, and leather web overlay
Mary B. Jackson Fund 2016.56.8

This black wool sweater arrayed with webs comes from designer Raf Simons's *Radioactivity* collection. The intricate overlay was crafted entirely by hand, and no two sweaters from the collection are alike. The base of the sweater is a standard jersey knit, but the designer's deft choice of materials for the web elevates this garment into something special. The choice of mohair evokes the haze of a spider's web, and the use of leather refers to its strength.



Japanese
Textile-printing stencil (*kumo katagami*), 1850–1907
Mulberry paper (*kozo*) with fermented persimmon tannin stain (*kakishibu*)
Gift of Mrs. Gustav Radeke 07.116X

Used to resist-print textiles, this stencil was made from a web of natural fibers. *Kozo* bast fibers from the mulberry tree were boiled in a vat, pounded into pulp, swirled with a gelatinous material, and drawn out with a reed strainer. The resulting mass dried into a strong and stable base. A fermented persimmon stain (*kakishibu*) was then brushed on, preserving and waterproofing the paper, into which a craftsperson carved the design. The spiders and web were depicted using the thrust-carving (*tsukibori*) technique. Rice paste (*mochiko*) would have been brushed through the stencil and the process repeated over the length of a textile. Once the paste dried, the fabric was submerged in a dye vat.

Endo Taigaku, Japanese
Swallow and Spider, 1830 - 1844
Polychrome woodblock print
Gift of Mrs. John D. Rockefeller, Jr. 34.072

These two works are skillful examples of polychrome woodblock printing, with multiple blocks used for each color. In Japan, spiders are often thought to predict the visit of a good friend, although in these images the spider appears to be the prey of both the swallow and the sparrow.

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Utagawa Hiroshige, Japanese, 1797-1858
Gengyo Basotei, Japanese, 1817-1880
Sparrow and Spider, 1853.12
Polychrome wood block print
Gift of Mrs. John D. Rockefeller, Jr. 34.201

Sally Gall, American, b. 1956, (RISD BFA 1978, Photography)
Web # 4, 2009
Gelatin silver print
Georgianna Sayles Aldrich Fund 2012.75.2

Pearl-like beads glisten on a pair of spiderwebs as the shadow of a tree branch arches across the background of this photograph. The dew enhances and adds graphic contrast to the web's otherwise transparent structure. The artist says she seeks "to immerse viewers in a visceral and sensual contemplation of nature and our place within it."

French
Dress, ca. 1927
Silk net with embroidery
Gift of L. J. Cella III 1990.129.44

Cinema often plays a role in setting fashion trends, and in the late 1920s the Chinese silent film *Pan si dong* (also released as *The Cave of Silken Web* and *Cave of the Spider Women*) inspired a number of spider-web-embellished garments in Europe. From this lace dress embroidered with webs to the Vionnet gown decorated with a glass-bead web at the hip, it was in vogue to be a "black widow."

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French; Possibly
Textile Trim, ca. 1915
Cotton plain weave with appliqué, needle-lace joins, net insertions, and embroidered motifs
Gift of L. J. Cella, Jr. 1991.169.26

French
Textile Border, ca. 1927
Silk warp-knit machine lace
Gift of Edward Cella 1999.7.9

French; Possibly
Textile Border, ca. 1915
Silk warp-knit machine lace
Gift of L. J. Cella III 1991.098.56

Jim Hodges, American, b. 1957
Untitled, 1992
White brass chain
Gift from the Collection of Mr. And Mrs. Barnet Fain 2001.80.27

Jim Hodges created this work when he was facing extreme personal grief and a sense of fragility as AIDS ravaged his close group of friends. At the same time he was exploring the use of metal jeweler's chains, Hodges was drawing ink doodles of spiderwebs and blurring them with his saliva. In all his interpretations, the web came to symbolize the fleeting nature of existence and the strength to survive. "I wasn't interested in holding onto the evidence of things. In fact, I created projects that were about not holding on to the evidence of things."