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Sticky Layers and Shimmering Weaves: A Study of Two Human Uses of Spider Silk

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Abstract

Spiders can produce up to seven different types of silk, each with different properties— some silks are sticky and elastic, while others are dry and tough. This paper examines and compares two ways in which humans have used this diverse material to design fabrics: the weaving of dry silk threads, and the layering of complete spider webs. The study investigates how these fabrics are formed by both the properties of the material and differing human perceptions of it, and the actions of the spiders themselves. It proposes that in order to develop a broad ecological approach to design and design history, attention should be given to the role of non-human animals.

Keywords: animal making—ecology—material culture—silk—spiders—textiles

Introduction

Spiders are particularly productive animals. Orb-weaving spiders, which create the archetypal circular webs, can produce up to seven different types of silk in their glands, each with different properties—some silks are sticky and elastic,¹ while others are remarkably strong. Spiders use their silk for a range of activities, including the capture of prey, the protection of eggs, transport, courtship and communication. This versatile thread has enabled spiders to adapt to a huge range of environments, and has also been an attractive material to humans. The silk of spiders has been collected and used for centuries in different parts of the world to create dressings for wounds, crosshairs for optical devices, fabrics, jewellery, fishing lures and musical instruments, and in the research and development of synthetic spider silk.²

How might we define these spider silk things? Are they natural forms, whose material and properties are dependent upon the species and ecology of spiders, or are they artificial objects, formed through the skill and innovation of humans working in a specific period and culture?

In this study I focus on two spider silk objects in order to consider the role of non-human animals in human design processes. Both objects are made from the silk of the female *Nephila*, or golden orb spider—so called because its silk is a bright yellow colour.³ The first example is a woven spider silk cape exhibited at the Victoria & Albert Museum in London in 2012. The second example is a ‘hood’ made from layered spider webs during the early twentieth century in the South Pacific island of Malakula in Vanuatu, and now stored in the collection of the Science Museum in London.

I examine these two examples to address the ways in which the design and making of these objects involve the material properties of spider silk and the differing human perceptions of it, and the actions and ecology of the spiders themselves. I will argue that these material and non-human elements must be considered when examining the design of artifacts, in addition to their historical context. By identifying the effects of materials and animal activities on human design in the past, I aim to situate design processes within a broader ecology in which human activities form only a part. From a wider perspective, I believe that this approach is vital if we are to understand the effects these activities have had on our environment, and to tackle what ecological or sustainable design might be in the future.

This article aims to contribute to recent debates in ecological design, with its concern for cultural and environmental sustainability.⁴ Although this movement has developed

substantially over the last twenty years, all design processes, including ecological design, must, as Clive Dilnot has argued, be understood historically.⁵ In addition, ecological design requires an interdisciplinary approach, in order to understand the relationship between humans and their environment.⁶ This approach has productive overlaps with current work in anthropology, which in addition to drawing from a range of disciplines, emphasizes how our relationship to our environment may be differently perceived and used across human societies.⁷ These differences in perception and use are particularly apparent in the design of the spider silk objects. Why does one culture weave with this material, while another creates layers?

This article aims to take these debates further by addressing how the actions of non-human animals also affect what humans design and make. Rather than being simply a material resource, the spider changes its material according to the environment in which it spins. In addition, the ways in which humans use spider silk differs according to how spiders and their silk are historically and culturally perceived. As such, in order to understand how two different designs—the woven cape and the layered hood—have developed from what appears to be the same material, it is necessary to bring the historical and ethnographic literature on the design and making of these textiles together with studies of spiders and their silk. This ecological approach to design and design history is vital if we are to understand not just how objects have been designed in the past, but how they might be transformed in the future.

Design and making across species

Within design, the shapes and materials that animals make tend to feature as the inspiration for certain structures, such as beehive forms in architecture,⁸ or as potential new biomaterials, such as waterproof glue made from the secretions of marine gastropods.⁹ To address the effect of animal activity on design more generally, however, requires a leap across the historical divisions between humans and other animals. The difference between human and animal making often hinges on whether the process is considered planned (human) or innate (animal). This distinction is not without moral judgement, but it is intrinsic to the notion of human superiority to, and separation from, nature. As Karl Marx argued in his definition of labour, the web of the spider differs from human production because the human creates the object in his imagination ‘before he erects it in reality’.¹⁰ In this sense, human making is apparently unique because unlike the practices of all other species it requires intellect, imagination and intention—abilities that imply not just difference, but superiority.

While I have no problem with acknowledging the importance of intention in design, the possibility that intention or purpose are easily definable boundaries that distinguish one maker (human) from another (animal) requires the impossible task of detecting and isolating the idea for a design, for example, from all other cognitive processes—and of being able to detect the absence of this within all other animals. Such distinctions do not address how human innovation, techniques or objects might be intimately entangled in the forms and materials made by non-human animals, and in the bodies and behaviours of the non-human animals themselves. This is not to deny difference between human design and a spider’s web—rather, that this difference cannot be divided between a ‘knowing’ making and a ‘not knowing’ making.¹¹

Attempts to identify the relationship between human and animal making tend to get caught up in these debates over terms. Trying to decide whether a spider has intention when it makes its web, or is itself a designer in the same way as a human, is neither necessary nor helpful if we want to understand the effects that animals and what they make have on human design. First, this is because human perception of animals and their behaviour differs across cultures—in one culture, the spider may sometimes be perceived as malevolent, in another it may be a central figure in the concept of life and death. These perceptions, and the ways in which they

affect the design of objects, reveal a complex and contradictory relationship between humans and spiders that would be lost if we started with the claim that spiders did or did not have intention. Secondly, by applying a term such as intention that historically has defined exclusively human design and making, we restrict our concept of how these activities may overlap and engage with the broader ecology. To be open to these connections, it is necessary to consider that the vast majority of animals that make things are not human, and that their activities may be neither enhanced nor revealed to us by using exclusively human definitions of design.

To fully address the design of the spider silk objects, the variability of spider silk and its specific relationship to the spider that produced it must also be considered. Spider silks are proteins formed as a liquid in the spider's silk-producing glands. They are then spun into solid threads of silk as they are pulled from the spider's body—either by the wind, or by the movement of the spider. However, the properties of spider silk vary according to the type of silk produced, the species of spider and the spider's environment. The strength, stretch and thickness of a line of silk may alter according to what and how recently the spider has eaten, its age, its cycle of reproduction, the outside temperature, the climate humidity, and the weight of the web (increased, for example, by the number of flies hanging on it).¹² The variation and adaptability of spider silk suggests that the human uses of this material cannot be understood solely through its properties, but rather as part of a bodily system of production that occurs in relation to the spider's specific ecology.¹³

The human uses of spider silk involve diverse cultural and historical associations, variable materials and specific spiders and ecologies. The two objects of this study were both created from the silk of the *Nephila* spider, but using different techniques: weaving and layering. Historical evidence of weaving with spider silk is largely found in Western Europe and its colonies during the nineteenth century and in North America, while evidence of layering with spider webs to create fabric is found only in a small corner of the South Pacific nation of Vanuatu.

To weave with spider silk requires the collection of millions of dry strands pulled directly from the spinnerets of living spiders and twisted together to create a thread thick enough to work on a loom. It takes a long time, and a huge number of spiders. In contrast, layered spider web fabric is created by gathering many spider webs on top of each other on a frame—their sticky strands becoming enmeshed until they create a bond of sufficient strength that the fabric can be removed from the frame and keep its shape. To trace the design of these objects, I will follow their specific metaphorical, material and bodily associations—both human and spider.

Shimmering weaves: the golden cape

In January 2012 an exhibition of cloth woven from the silk of the golden orb spider of Madagascar went on display at the Victoria & Albert Museum in London. It was the culmination of an eight-year project organized and overseen by English textile manufacturer and historian Simon Peers and his American business partner Nicholas Godley. Working with a team of Malagasy weavers and embroiderers, they had collected the silk of millions of golden orb spiders, from which they created two objects. The first was a *lamba akotifahana*, a traditional Malagasy woven cloth, measuring eleven feet by four feet. This was exhibited for the first time at the American Museum of Natural History in New York in 2009, and then travelled to the Art Institute of Chicago where it was displayed in 2011 as part of the inauguration of their new African galleries. During this period, Peers and Godley had already embarked on creating the golden coloured cape that made its debut appearance at the Victoria & Albert Museum. It was the centrepiece of the exhibition, gleaming under spotlights inside a large glass case.

Peers has lived and worked in Madagascar for over twenty years, during which time he established a textile and embroidery company of Malagasy weavers, with the aim of reviving nineteenth-century Malagasy silk weaving techniques. While researching the history of these textiles, Peers came across a story of a ‘spider farm’ that had once existed in Madagascar and this inspired him to explore the possibility of weaving with spider silk. This ‘spider farm’ was established by the French colonial government at the end of the nineteenth century in the École Professionnelle in the capital Antananarivo, with the aim of creating a spider silk weaving industry. The only fabric to be created from this project was a set of spider silk bed hangings that were exhibited at the 1900 ‘Exposition Universelle’ in Paris. However, these disappeared soon after the exhibition closed and have never been found. The cape Peers and Godley created is therefore the largest known woven spider silk fabric in existence.

Peers describes the form of the cape as echoing the spider’s action of wrapping its prey.¹⁴ He writes that it is ‘a nod to every self-respecting superhero perhaps, but also to the vestments and robes of priests, the chasuble or dalmatic’.¹⁵ It is embroidered with images of spiders and plants on either side. Where it joins together at the front are three cascades of threads, hanging unweaved in bundles. It does not have the delicate draping appearance of the lamba, but seems surprisingly thick—perhaps because of the additional layers of lining and embroidery. The texture of the fabric varies, catching the light in different ways. This is particularly true of the embroidery threads, and the bundles of silks at the front. Both retain something of the glow of a spider web, while the woven areas appear a more solid, matt yellow.

The golden cape first appeared to the public in newspaper images and television reports during the weeks leading up to the exhibition. Worn by a model, and photographed in the Victoria & Albert galleries, these images illustrated a tantalizing possibility that few would experience—that of wearing or even touching the cape. For most people, it was an object to be displayed and looked at, rather than worn. It demanded to be looked at, both in terms of publicity and in the reflective, enchanting glow of its colour and material. To weave with spider silk, as contemporary newspaper reports suggested, was to achieve something seemingly impossible—the cape was an object more suited to fairy tales and dreams than material reality. The challenge, Peers and Godley describe, was to make ‘something impermanent, permanent’.¹⁶ As Godley said in an interview: ‘A spider web is here today and gone tomorrow, but we have found a way to harness that and turn it into something lasting.’¹⁷ Peers writes that without the selection, extraction and weaving of the spider silk, it would have been ‘spun into webs and dispersed in the wind’.¹⁸

In contrast to its strong visual presence, the silk of the *Nephila* is a material that feels, literally, of nothing. When I interviewed Peers, he offered me some strands of the spun silk threads.¹⁹ They appeared in my hand so brightly golden that I sensed the colour reflecting onto my face, but I could feel nothing. Peers describes the sensation as ‘like an invisibility cloak, you almost wouldn’t know you were wearing it’.²⁰ However, perhaps rather than being an ‘invisibility cloak’, the golden cape is highly visible but almost intangible.

The making of the cape

To create the cape silk was extracted directly from the spinnerets of over a million *Nephila madagascariensis*—the golden orb spiders of Madagascar. This is the spider’s dragline thread, which is dry, tough and, in this case, golden coloured. To be able to weave with spider silk, only this one type of silk can be used—weaving with the sticky threads is impossible. During the spider spinning months, there was a daily routine. Starting early in the morning between sixty to eighty people would scour the area around Antananarivo for golden orb spiders, in the bushes and telegraph poles where they had woven their huge webs. The spiders were collected in boxes and taken to the ‘spidery’, where twenty-four were placed inside individual

holders with their legs strapped down tight to their body to stop them cutting the silk with their legs. This would therefore allow a single unbroken thread of dragline silk to be drawn from their bodies. Silk was pulled from each individual spider, and threaded through a single ring. On the other side of these rings, the threads of each spider were twisted together and wound onto cones. The 'silking' process took about twenty-ve minutes, until between thirty and fifty metres of thread was collected. The spiders were then returned outside at the end of the day.²¹

History of weaving with spider silk

The story of the Madagascan spider farm that inspired Peers is one of many tales of people trying to weave with spider silk. A common factor in these examples is the enthusiasm with which the possibility of establishing a spider silk industry is grasped, followed by the realization that it would require millions of spiders and a vast amount of time to create even one woven fabric—as Peers and Godley proved. What is particularly striking about the history of weaving with spider silk is that in Europe and its colonies no other technique for designing a fabric with this material was ever considered, in spite of spider webs having their own method of sticky attachment. The history of this textile, and the design of the Golden cape, reflects a specific historical and cultural context in which the messy aspects of a spider web are removed from the design, while the ephemeral and glowing aspects of the dry silk are retained.

The first recorded attempt to weave with spider silk was conducted in 1709 by François-Xavier Bon, president of the court of accounts in Montpellier and stemmed from his desire to create a spider silk industry to compete with that of the silk-worm.²² Using a similar process to creating silkworm silk, he boiled the egg cocoons of spiders, carded the silk and wove the threads on a knitting-frame into three pairs of spider silk stockings and gloves, two of which he presented to the Académie Royale des Sciences in Paris and the third to Sir Hans Sloane at the Royal Society in London. Although Bon was not successful in harvesting enough spider silk to establish any kind of industry, fifty years later Abbé Ramon de Termeyer, a Spanish Jesuit priest, discovered that silk could be extracted directly from a spider's body and set about designing a machine that could harvest and spin the threads. However, he too was unable to create any substantial spider silk fabric.²³

In each of these historical examples, the spider whose silk seemed to be most often used for weaving was the European garden spider—an orb-weaving spider common in the northern hemisphere, with a pea-sized body and a white cross on its back. With the craze for colonial exploration and collection during the nineteenth century, European travellers began reporting sightings of large spiders with huge webs, and these became the new hope for establishing a spider silk industry. One English traveller in Brazil, after his straw hat became caught in the web of the 'giant spider', reported in 1839: 'The spider's web, which, in single threads, could support a straw hat, must be much stronger and tougher than the frail tissues of our own country, and might certainly be manufactured into articles of wearing apparel, if a proper quantity of it could be obtained.'²⁴

As one English traveller to Bermuda wrote in 1866, there seemed to be so many of these spiders making giant webs that 'if collected together and kept within proper inclosures [sic], they would prove a source of much profit to the owners, and a benefit to manufacturers of silk material'.²⁵ These European travellers were not the first to realize the potential uses of large spider webs. John Matthew Jones, travelling in Bermuda during the 1850s, reported that after collecting the silk of a golden orb spider, he was informed that the 'Mudian ladies made use of it for sewing purposes'.²⁶ Significantly, at the end of the nineteenth century, during the period in which the Madagascan 'spider farm' was under way, an English newspaper reported that 'the silk of the great spider at Madagascar is used by the natives for fastening flowers on

sunshades and for other purposes. The thread has a golden colour.²⁷ It seems, therefore, that the tale of weaving with spider silk intersects with these other practices, whose stories are less visible in the written history.

The associations between spiders and weaving

Although spider silk was first used as a potential weaving material in the early eighteenth century, it was already associated with weaving through language and mythology. The word 'web' has its roots in Indo-European words for weaving, while the Sanskrit word for 'spider', *ūrṇavābhi*, means literally 'wool-weaver'.²⁸ The word 'spider' in English has a similar root in the human perception of spider behaviour, as it stems from old northern European words for 'spin'.²⁹ These associations suggest an early link that is perceived between the material production and behaviour of spiders, and the weaving activity of humans.

Historically in Graeco-Roman cultures, weaving was the preserve of women, perceived as a domestic, and virtuous, task.³⁰ Yet working with threads was also viewed with suspicion, as a deceitful or even deadly activity. The Classical historian Eve D'Ambra describes how a woman spinning threads was perceived in Ancient Rome as associated with death—with the cutting of the thread of life:

The sight of a spinner, particularly upon awakening in the morning, leaving the house, or setting out on a journey, was a grim reminder of the inexorable Fates, Clotho, Lachesis, and Atropos, who spin a thread for each person at birth and cut it off at death. If wool is the raw material of life, then the spun thread represents the extent and duration, the narrative, of that life.³¹

In Western Classical mythology, the Graeco-Roman tale of Arachne tells of the mortal Lydian girl Arachne whose pride in her skill at weaving was so great that she was turned into a spider by the goddess Athene, fated to spin forever. The pre-Socratic philosopher Democritus argued that the practice of weaving was inspired by the human observation of spiders.³²

The association between spiders and weaving does not stem from a history of humans weaving with this material, or even the possibility of doing so. Rather, it implies that there was an analogous understanding of the relationship between a spider and its web, and a spinner and her weave. The actual term 'spider silk' first appears in written English in the 1728 edition of Ephraim Chambers' *Cyclopædia*. Under the entry for 'Spider-Silk' is written: 'the Secret has been found in France, of procuring and preparing Silk of the Webs of Spiders'.³³ This is probably a reference to Bon's attempts a few decades before to weave with spider silk. The date for the appearance of the term 'spider silk' would suggest a similar human/spider production to that of 'web' and weaving. When the technique for harvesting and spinning with spider silk was developed in the early eighteenth century, it became necessary to invent a term that described a separate silken thread, rather than an entire web. It was therefore given the name of a material that it most resembled in appearance, behaviour and potential use: silk.

Golden glow

The metallic luminosity of the spider silk often seems responsible for first catching the eye of spider silk weavers. In 1830, Daniel Rolt wrote in a letter to the Royal Society of Arts in London that he had extracted silk from a spider by attaching its thread to a steam engine. He writes that he was attracted to the idea by the 're-fection of the light on the immacuable [sic] webs' in his garden.³⁴ The colour of the silk of the golden orb spider seems to have a particularly enticing effect. It is described in nineteenth century newspaper articles as 'more

beautiful than the ordinary silk, possessing a strange, glowing, old-gold lustre in its natural state’;³⁵ it is like ‘spun gold’.³⁶

What is the effect of this luminosity? In a 2007 paper, anthropologists Mikkel Bille and Tim Sørensen discuss what they term ‘the agency of light’ to be found in luminous objects. They write that ‘light becomes “contained” in the matter’ but it also ‘penetrates the outer “shell” of objects and bodies’.³⁷ In this sense, the luminosity of golden silk suggests at once that the material contains some active ‘life’ of its own, and that it blurs the clear boundaries of objects. It is not simply the attraction of a glowing spider web that is significant, but the importance placed on retaining this glow once the material is woven together.

The woven cape exhibited at the Victoria & Albert Museum is not a uniform golden colour, but varies from a pale silvery yellow to a bright yellow gold. These changes in the colour of the silk depend upon the light conditions of the environment in which the spider spins its web. In shady areas, the web will be silver or a very pale yellow, while in sunlight the spider will spin a bright yellow-orange silk. It appears that these threads of silvery gold are particularly attractive to passing insects, as they associate the colour with their food source of yellow and white flowers.³⁸ However, fixed within the cape these differing colours tell something of the space and time in which the object was created. It acts as a map and a narrative of the changing light over the three years it was made—the lighter gold perhaps tracing the overcast days, while the bright yellow threads mark the days in which the sun filled the room. The relationship of bodies to their environment is also responsible for the slightly pinkish tinges within the cape. During a particularly hot summer, the hands of the embroiderers began to sweat as they worked on the cape, and the sweat turned the silk pink.³⁹ The colour of the cape—from light yellow, to orange gold, to pink—traces the relationship between the makers, the material and the environment in which it was formed. These subtleties, less noticeable than the embroidered images, tie the making of the object to a particular body, moment and location.

To fix the ephemeral

The history of weaving with spider silk implies an awkward and contradictory desire: to make the impermanent, permanent—to fix the ephemeral.

A particular awkwardness seems to occur when specific properties of silk are selected as attractive or valuable—for example the luminosity and golden colour of silk. Although the spider forms these material qualities in relation to its prey and environment, they are perceived as a property of a material rather than the result of a process. As a property of a material, it is therefore considered possible to extract the specific luminous golden silk and weave it unchanged into an object. However, once this extraction has taken place it is no longer visually associated with spider silk, instead it resembles the more commonplace silkworm silk. To deal with this problem the makers of the golden silk cape include some reference to the ‘original maker’ by including embroidery or drawings of spiders on their objects. In this sense, the spider’s processes of making is removed and then replaced through illustration.

A woven spider silk cloth effectively fills-in the empty spaces of a spider’s web to create a highly visible, unbroken and permanent plane of fabric. The golden silk cape seems to work as an homage to a culture and a history that desires materials, and their shimmering qualities, to be fixed timelessly in an object. In doing so, it must remove the messy material aspects that would mean the object was never finished, elements that facilitate continuous attachments and transformation: the stickiness of things.

Sticky layers: the spider web ‘hood’

In the storage rooms of the Science Museum in London is a fabric object described in the museum catalogue as a 'smothering hood'. It is formed entirely from layers of spider webs. According to the collection notes, it was made sometime between 1880 and 1910 in the New Hebrides—now Vanuatu.⁴⁰ It was almost certainly from a region in south-west Malakula, one of the islands in Vanuatu where the majority of this spider web fabric is created. It is the shape of an elongated cone, a metre in length, with an opening at its base and a thin rope at the top where it tapers. From a distance, its colour is a yellowy brown, but on closer inspection the different layers of spider web appear, each a slightly different hue. These layers are so entangled that they are indivisible, and their sticky threads still hold the flies, hairs, and splinters of wood that they captured over a century ago.

It is light in weight, and drapes across my arms as I hold it. I must wear gloves when handling museum objects, but I roll up my sleeve and put the inside of my bare wrist against the cloth. It feels soft, but with the scratch of captured bodies poking through.

The Wellcome Collection purchased the 'hood' at Steven's auction rooms in London in 1928, and it became part of the collection of the Science Museum during the 1980s. The museum catalogue describes it as follows: 'Smothering Hood. Made of spider-webbing. For killing widows after the death of the husband. New Hebrides.'

Widows were usually smothered or strangled so that they might continue their wifely ministrations to their husbands in the next world. This had to be done immediately after the man's death, so that they might be buried together, otherwise their spirits might miss each other on their way to the land of the dead.⁴¹

The description of the hood as a method of executing widows is a case of complete misidentification. Not only is there no evidence of widow strangling taking place in south-west Malakula,⁴² but the permeable spider cloth is unlikely to have been a very effective method of execution if worn over the head—its wearer could still breathe.

This misidentification can be found in the cataloguing of similar Malakulan hoods held in other British museums. In the Pitt Rivers museum in Oxford, a Malakulan hood is defined as a 'cap of death'; it is recorded as an instrument of 'torture' and 'punishment', used in a similar way to the object in the Science Museum. The museum label reads: 'It was drawn over the widows' eyes when they were strangled at the husbands' funeral'. Similarly, Samuel Ella of the London Missionary Society wrote in 1896 that these caps or hoods were 'placed, loaded with spiders, on the head of the criminal, and pulled over his head and shoulders for a certain space of time'.⁴³

The actual creation and use of this object by the people of south-west Malakula is tied to the cycle of life and death, but in a very different way from that described in the museum catalogue. Rather than being a 'smothering hood', this object is a type of spider web headdress predominantly used in specific initiation ceremonies, to be bought and worn by the candidate as he enters a higher social grade. The anthropologist Kirk Huffman, curator of the Vanuatu Cultural Centre from 1977 to 1989, has written in an essay of 2009 that the creation and use of spider web cloth in Malakula is a 'ritual activity with profound spiritual connotations and is also important and essential for practical purposes'.⁴⁴ It is used to create bags, masks, funerary mannequins and entire 'tunics', and is formed from the webs of two species of female golden orb spiders.

Malakula is the second largest island of the Republic of Vanuatu, an archipelago of over 200 islands situated in the south-west Pacific between the Solomon Islands and New Caledonia. Malakula covers 2,069 square miles, and is inhabited by just over 20,000 people. Thirty-five

different languages are spoken on Malakula, and it is an area renowned even within Vanuatu for its ‘variety and scope of [. . .] spiritual and religious activities’.⁴⁵

Spider web cloth is made in south Malakula, where it plays a central role in the two male grade systems: the *nimangki* society and the *nalawan* society. Huffman confirms that wearing spider web cloth on the head is a ‘marker of extremely high rank in the Nimangi grade’.⁴⁶ He writes that the length of the head covering increases with the rise up the grades, and an individual may purchase the cloth or be entitled to wear that of his deceased ancestors. As the cloth ages, it becomes blackened with soot from its storage within the men’s hut.⁴⁷

It seems likely, therefore, that the so called ‘smothering hood’ in the Science Museum is an example of one of these head coverings, created for and worn by a member of the *nimangki* as he is initiated to the higher ranks. Its fresh yellowy colour, however, implies that it perhaps did not spend long enough in Malakula to become blackened with soot before it became part of a Western traveller’s collection.

A layering aesthetic

As with many other Oceanic cultures, Malakula has no tradition of loom weaving. The associations between weaving and spiders are therefore not found in this region. Rather, the technique of layering echoes the technique of making bark cloth prevalent across Melanesia, although rarely used in Malakula.⁴⁸ Bark cloth is ‘mostly stiff and covers the body rather like a hull or shell’.⁴⁹ In contrast, spider web cloth can be wrapped and draped around a body or object. Further, it is durable, strong and waterproof—making it an ideal material for use in protecting, covering or carrying.

In her 1996 essay on the ‘non-cloth’ aesthetics of the Abelam people of Papua New Guinea, Brigitta Hauser-Schäublin argues that the Abelam have specific aesthetic values that differ from that of weaving cultures, based on ‘the line, the strip, the string, and fronds’ rather than on the ‘homogeneous plane’ of cloth.⁵⁰ The spider web cloth seems to suggest quite a different aesthetic from both of these, one that is neither wholly ‘line’, nor ‘plane’. Instead, it seems to combine these elements—the lines of silk do not disappear in the surface of the cloth, yet the cloth also retains the appearance of many ‘planes’ of web layered together. If we consider the two aesthetics that Hauser-Schäublin compares—the line of a non-cloth culture, and the plane of a weaving culture—it seems that a third possibility should be added: the depth of a layering culture. What makes spider web cloth so distinctive is that it exhibits line, plane and depth at the *same time*.

Hauser-Schäublin writes: ‘Almost without exception, cultures producing woven textiles or other cloth (such as bark cloth, finely plaited mats) have used the symbolic potentialities of cloth in its material properties as well as cloth as an essential agent in social and political contexts.’⁵¹

In examining the techniques used in Malakula, it is therefore necessary to consider how a fabric formed through layering, sticking and entanglement might have ‘symbolic potentialities’ that are different from those associated with the warp and weft of loom weaving.

Discussing the stickiness of spider silk requires a consideration of both its thread and its viscous coating as indivisible elements. In other words, this is not the same stickiness as that of tar or treacle, nor is it just a bundle of string. It is a material that entangles and sticks at once. Unlike the woven golden cape, the spider web hood in the Science Museum is not a finished object, having never lost the trapping potential of both the material and the spider. Through sticky accumulation it can grow larger and transform.

The making of the 'hood'

The spider web cloth is formed specifically from webs spun by *Nephila plumipes* spiders and the smaller *Nephila pilipes*.⁵² Both are species of golden orb spider, and in the Botgate language of the area their webs are called *nangangao*.⁵² This term is used exclusively to describe the webs produced by these spiders, emphasizing their importance in the formation and use of the spider cloth. As with the golden orb spider of Madagascar, their silk is a golden colour. However, this colour changes once the webs are layered together, combining with trapped flies and dust in the material, so that it loses its golden glow. This is particularly interesting, as Kirk Huffman writes that although deposits of gold exist on the island, it is not a material valued by the Malakulans, and the colour has no particular significance.⁵⁴ Although these spiders are known in English as 'golden orb spiders', for the people of south-west Malakula the dominant, and more valued, characteristic of the spider's web is not its colour. Rather, as Huffman has written, it is the spiders themselves that are respected.⁵⁵

There is a particular design to the web of *Nephila* spiders that resonates with the appearance of depth in the layered spider web fabric. They produce archetypal orb webs, strung up between branches, but the webs, and the spiders, are of such a large size that the spider must also create a series of support threads behind the spiral web. These webs are not on one 'plane', as a European garden spider's web might appear to be. Rather they extend backwards—they have depth, appearing as a mass of threads. When the spider web cloth is made, the sticky spiral threads of these webs bind together with the dry silk to form a fabric that still retains its depth, and the various bodies it has captured.

In his *Ethnology of Vanuatu*, written at the beginning of the twentieth century, the anthropologist Felix Speiser describes the process of creating the spider web fabric using a bamboo frame split to create a funnel on which the spider webs are then collected.⁵⁶ Because of the strength and size of these webs, the person collecting them would have to move the bamboo frame with a sort of continuous winding movement against the web—otherwise the frame could become caught. Kirk Huffman describes the motion of collecting the webs as 'pushing and pulling, twisting or twining'.⁵⁷ He writes that it is a 'normal male activity early in the morning [. . .] if one is the first to pass that day on a narrow jungle path, to carry a small split bamboo funnel frame to collect [. . .] spider web that may be crossing the path'. Sometimes, once the web has formed a thick enough fabric it is beaten together to form larger cloths. The entire process is a sacred male activity—'women are not permitted to see this preparation [. . .] nor have anything to do with it'.⁵⁸

The spider web is collected from the surrounding jungle, but Huffman writes that the spiders are also collected and carried in 'leaf containers and/or woven pandanus baskets tied tight' back to the village. The men 'will capture as many of them as possible and place them (to live) on special sacred barricade hedges where they live and often produce "walls" of web'.⁵⁹ These 'sacred barricades shield the men's hut from public view'.⁶⁰

There are therefore two interconnected techniques of using spider silk: the making of the cloth, which requires the frame to be brought to the spider, and the making of barricades, which requires the spider to be brought to the frame. The first technique is achieved because of an understanding of the particular spider's ecology—it weaves its new web at night or in the early hours of the morning, therefore the best time to collect the web is at the beginning of the day. In the second process, the men have created an environment in which a spider can live and spin its web, so that the creation of the barricades is beneficial to both parties.

Spiders, life and death

Throughout Malakula, spider spirits are central figures to the journey a person must take once they have died. Huffman describes the importance of the spider in the voyage of the dead in the Botgate speaking region of south Malakula. As the dead person travels down a path, the way before him forks. One path is clear, while the other is blocked by a 'giant spider web' in which sits *Nendengele Hurae*, the spider spirit. Huffman also describes this spirit as 'the pig attractor'. He writes that if the dead person used pigs well when he was alive, and learned rituals correctly, then he will know that the path is forked, and that he must take the more difficult path blocked by the spider. Further on the journey, another spirit will test the dead person's knowledge of the labyrinth, drawn in the sand. Only if he can complete the drawing can he proceed to the world of the dead. As Huffman writes, once the spirit of the dead man has been in the world of the dead, he can then 'begin revisiting the World of the Living'.⁶¹ The passage of the dead, and their return to the living, implies a circular motion, in which the dead and the living are never entirely distinct, but rather exist at once together.

The highest rank in the grade systems of south-west Malakula is that of a 'living dead man'. In their 1981 essay on death practices in Malakula, Remo Guidieri and Francesco Pellizzi write that 'the man who reaches this level is said "to be dead." This means that even though he is still alive, he has in some sense attained the condition of the ancestor.'⁶² As the writers describe, 'Death, whether as apparition or condition, is within the system of the living.'⁶³ There is no clear boundary between the living and the dead—rather, they are indivisible. Indeed, as Guidieri and Pellizzi state, 'death in these cultures, through the medium of totemic identification and ancestral reincarnation, is closely connected to the powers of generation'.⁶⁴ As the spider web fabric is worn by higher grades that are closer to the 'living-dead man', it suggests that the fabric itself has associations with both high rank and the status of 'living-dead'.

In south Malakula death is not conceived as the cutting of the thread of life, as in the Ancient Greek myth of the Fates. Rather, it seems to echo the 'all at once' of the indivisible layers of the spider web cloth. Death exists with 'the powers of generation', just as the spider's web is produced only because the spider has eaten—and it only eats because the web has trapped its prey. Further, each evening the spider eats its web and builds a new one—perhaps to be gathered up in the morning with other webs on a bamboo frame.

The layering of spider webs is made possible by the combination of sticky and entangling threads produced by spiders, but it is also formed by and forms specific practices of making that emphasize depth. In the spider web fabric of Malakula, the appearance of the cloth as formed of layers of entangled lines mirrors the 'all at once' aspect of how life is perceived as indivisible from death. This association between the spider web material and the concept of life and death is continued through the Journey of the Dead, and in the spiritual and practical uses of the spider web cloth. A particularly significant aspect is that the cloth forms part of a performed and continuous practice: it is collected daily during spider season and is worn by moving or dancing figures [6].

Discussion

This study of two spider silk objects has examined the way in which their design consists of material, mythical, historical and bodily associations that are entangled in the making processes of specific spiders. Although both the woven cape and the layered 'hood' were created from the silk of the *Nephila*, the different designs are tied to the cultural, natural and historical ecology in which they were formed. In the case of the woven cape, the desirable property of silk—its golden glow—was isolated from the sticky excesses of the web by extracting and harvesting silk directly from the spider. Yet the value and magic of the object lies in the fact that it is made of such an unlikely material—as such, the 'signature' of the maker must be reintroduced into the fabric through the embroidered images of spiders.

In contrast, in the Malakulan ‘hood’ this signature is not necessary. Partly, this may be because those who use and make the material are in close contact, but it may also be that the material continues to act like and resemble a spider’s web. Rather than being drawn to a specific material property, which is then selected and extracted, importance is placed on the spider’s process of making, which reflects the perception of the cyclical process of life and death. As such, the fabric is an accumulation of webs with the potential to grow.

The visibility of the golden silk cape is also due to its luminosity, a quality of spider silk that is used by the spider to attract prey. In the case of spider silk weavers, this luminosity draws them to this material and resonates with other valuable luminescent materials, such as gold and other precious metals. It might be that the reflective properties of spider silk are also valued in the use of spider web barriers positioned around the men’s hut in south Malakula. Rather than attracting people, as with the woven silk, these barriers act to obscure the hut from women and the uninitiated. As such, the glow of the webs might both resonate with the power of those within the hut, and act to ‘blind’ those who do not have access.

There are significant overlaps in the relationship between the techniques used to create these objects and in the cultural perception of life and death. Within Classical literature and history, weaving and spinning are associated with cutting the thread of life; an absolute divide between life and death. In the Malakulan tradition, death is considered as indivisible from life, a belief that is echoed in the indivisible sticky threads of the layered fabric. As such, these different uses of spider silk suggest an association between concepts of life and death and that of objects and making: the woven cape is an attempt to complete and define an object as distinct from its sticky threads.

The history of weaving with spider silk seems to point to a contradictory desire—to fix the ephemeral nature of things into a lasting object. The misidentification by the early collectors of the spider web ‘hood’ as an instrument of torture suggests partly why the layering of spider webs was not used to make fabrics in the West; the sticky silk is perhaps associated with viscous materials and unstable forms—and works against the Western desire for a complete and finished object.

These findings have two methodological implications for how we might understand the history and design of objects. The first is to consider the role of non-human animals. Their activities form materials and transform the environment, and may affect how and what humans design and make. The subject of spider silk objects lends itself particularly well to such a focus, and the links may be less explicit in other examples. However, I would argue that this methodological openness in looking at the historical effects of non-human activities on design can inform what we mean by ecological design now and in the future. The second implication is that the anthropological approach that I have drawn from in analysing the design of the spider silk objects reveals cultural differences in the perception and use of materials—and vitally, it highlights their cultural specificity. A broader awareness of how spider silk is woven in one culture, but layered in the other, allows us to trace the particularity of such designs and how they are formed of specific historical, material and ecological associations.

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Notes

1 Not all orb-weaving spiders create sticky silk—rather than making viscous sticky silk to catch their prey, cribellate spiders produce crimped, ‘puffy’ threads almost like Velcro, in which legs become entangled.

2 E. Morgan, ‘Making with Spider Silk: The Entangled Processes of Human and Nonhuman Animals’, Ph.D. thesis, University College London, 2013.

3 In all known examples of humans using spider silk, silk is only extracted from female spiders. Like most other species of spider, the female *Nephila* are larger than the males, but in the case of the *Nephila* the size discrepancy is remarkable. The males are about a tenth of the size of the female, so that one or more might live on her web at any one time, feeding on the prey she captures in her web and sometimes mating without her seeming to respond or notice.

4 I draw the definition and development of sustainable design from the 1987 United Nations Brundtland report, which defines sustainable processes as those that meet the needs of present natural and social ecologies, without compromising those in the future. However, as my article argues, there is a longer history to our engagement with non-human ecologies in design processes.

5 C. Dilnot, ‘The Question of Agency in the Understanding of Design’, *Journal of Design History*, vol. 26, no. 3, 2013, pp. 331–7.

6 On the importance of an interdisciplinary approach to ecological design, see N. Stegall, ‘Designing for Sustainability: A Philosophy for Ecologically Intentional Design’, *Design Issues*, vol. 22, no. 2, 2006, pp. 56–63.

7 For a discussion of the productive links between anthropology and design, particularly in relation to ecology, see, for example, M. Anusas & T. Ingold, ‘Designing Environmental Relations: From Opacity to Textility’, *Design Issues*, vol. 29, no. 4, 2013, pp. 58–69.

8 M. Pawlyn, *Biomimicry in Architecture*, RIBA Publishing, London, 2011.

9 J. Benyus, *Biomimicry: Innovation Inspired by Nature*, HarperCollins, New York, 2002.

10 K. Marx, *Capital: An Abridged Edition*, Oxford University Press, Oxford, 1999, p. 548.

11 For a possible example of spiders learning, see A. M. Heiling & M. E. Herberstein, ‘The Role of Experience in Web-building Spiders (Araneidae)’, *Animal Cognition*, vol. 2, no. 3, 1999, pp. 171–7. Although difference in web building had been observed between species of spider, and between individuals of the same species, Heiling & Herberstein’s research suggested that individuals might change their web building with experience in order to catch more flies.

12 F. Vollrath, ‘Biology of Spider Silk’, *International Journal of Biological Macromolecules*, vol. 24, no. 2–3, 1999, pp. 81–8.

13 I am in agreement here with the anthropologist Tim Ingold’s argument for what he calls an ‘Ecology of Materials’, which includes the movements and actions of non-human living organisms to understand processes of making. T. Ingold, ‘Toward an Ecology of Materials’, *Annual Review of Anthropology*, vol. 41, no. 1, 2012, pp. 427–42.

14 B. Jones, ‘Arachnophobe creates cape woven from spider silk’, CNN

<<http://edition.cnn.com/2012/01/25/world/>

[europe/spider-silk-cape-on-display/index.html](http://edition.cnn.com/2012/01/25/world/europe/spider-silk-cape-on-display/index.html)> accessed 21 August 2012.

15 S. Peers, *Golden Spider Silk*, V&A Publishing, London, 2012, p. 44.

16 S. Peers, interviewed by author, Victoria & Albert Museum, 15 December 2011.

17 Jones, op. cit.

18 Peers, *Golden Spider Silk*, op. cit., p. 47.

- 19 Peers, interviewed by author.
- 20 Jones, *op. cit.*
- 21 Peers, *Golden Spider Silk*, *op. cit.*; Peers, interviewed by author.
- 22 M. Bon, 'A Discourse Upon the Usefulness of the Silk of Spiders', *Philosophical Transactions of the Royal Society*, vol. 27, nos. 325–36, 1 January 1710, pp. 2–16.
- 23 Morgan, *op. cit.*; Peers, *Golden Spider Silk*, *op. cit.*; R. M. de Termeyer, 'Researches and Experiments Upon Silk from Spiders, and Upon Their Reproduction', B. G. Wilder (trans.), *Essex Institute Proceedings*, vol. 5, Salem, MA, 1866, p. 8.
- 24 'Silk from the Spider', *Liverpool Mercury*, 11 October 1839.
- 25 'The Late Ministry', *The Leeds Mercury*, 10 July 1866.
- 26 J. M. Jones, *The Naturalist in Bermuda: A Sketch of the Geology, Zoology, and Botany of that Remarkable Group of Islands; Together with Meteorological Observations*, Reeves & Turner, London, 1859, p. 226.
- 27 'Natural History Column'. *Nottinghamshire Guardian*, 7 June 1894.
- 28 *The Oxford English Dictionary*, 2nd edn, Oxford University Press, Oxford, s.v. 'weave, v.1'.
- 29 *The Oxford English Dictionary*, 2nd edn, Oxford University Press, Oxford, s.v. 'spider, n.'.
- 30 E. D'Ambra, *Private Lives, Imperial Virtues: The Frieze of the Forum Transitorium in Rome*, Princeton University Press, Princeton, NJ, 1993, p. 157.
- 31 *Ibid.*
- 32 J. Barnes, *The Presocratic Philosophers*, Routledge, New York, 2002, p. 620.
- 33 E. Chambers, *Cyclopædia: or, An Universal Dictionary of Arts and Sciences*, London, 1728, s.v. 'Silk'; *Oxford English Dictionary*, s.v. 'spider', *op. cit.*
- 34 D. B. Rolt, Letter from Mr D Bransdon Rolt to the Royal Society of Arts, 1830, *Royal Society of Arts Manuscript Transactions*, vol. 121, part 4, 1829–1831.
- 35 'Training Spiders', *Los Angeles Times*, 5 January 1902, p. C6.
- 36 'Silkworms and Spiders', *The Bradford Observer*, 9 September 1869, p. 7.
- 37 M. Bille & T. F. Sørensen, 'An Anthropology of Luminosity: The Agency of Light', *Journal of Material Culture*, vol. 12, no. 3, 2007, pp. 263–84.
- 38 L. Brunetta & C. L. Craig, *Spider Silk: Evolution and 400 Million Years of Spinning, Waiting, Snagging, and Mating*, Yale University Press, New Haven, CT, 2010, p. 156.
- 39 Peers, interviewed by author.
- 40 New Hebrides (Vanuatu), Smothering Hood, Spider web, 1910 1880, A173615, *Science Museum*, London, *Ethnology & Folk Medicine*.
- 41 *Science Museum*, *op. cit.*
- 42 Although it did occur on the island of Aneityum in south Vanuatu, and in Fiji. See N. Thomas, *In Oceania: Visions, Artifacts, Histories*, Duke University Press, Durham, NC, 1997, p. 292.
- 43 S. Ella, 'The Samoan Cap', *The Journal of the Polynesian Society*, vol. 5, no. 3, 1896, p. 190.
- 44 K. Huffman, 'Land of the Living Dead: Respect for the Ancestors in Southern Malakula, Vanuatu, Oceania', in *Overmodeled Skulls*, A. C. Aufderheide (ed.), Heide Press, Duluth, MN, 2009, pp. 17–75. Quotation from p. 49.
- 45 Huffman, *op. cit.*, p. 20.
- 46 Huffman, *op. cit.*, p. 49.
- 47 Huffman, *op. cit.*
- 48 J. Bonnemaïson, *Arts of Vanuatu*, University of Hawai'i Press, Honolulu, 1996, p. 338.
- 49 B. Hauser-Schäublin, 'The Thrill of the Line, the String, and the Frond, or Why the Abelam Are a Non-Cloth Culture', *Oceania*, vol. 67, no. 2, 1996, pp. 81–106.
- 50 Hauser-Schäublin, *op. cit.*, p. 82. 51 *Ibid.*
- 52 Huffman, *op. cit.*
- 53 Huffman, *op. cit.*
- 54 K. Huffman, email to author, 2 July 2012.
- 55 Huffman, email to author.

56 F. Speiser, *Ethnology of Vanuatu*, C. Hurst & Co. Publishers, London, 1998, p. 694 (rst published in German, 1923).

57 Huffman, 'Land of the Living Dead' op. cit., p. 49. 58 Huffman, email to author.

59 Huffman, email to author.

60 Huffman, 'Land of the Living Dead' op. cit., p. 49. 61 Huffman, 'Land of the Living Dead' op. cit., p. 68.

62 R. Guidieri & F. Pellizzi, 'Shadows: Nineteen Tableaux on the Cult of the Dead in Malekula, Eastern Melanesia', *RES: Anthropology and Aesthetics*, vol. 2, pp. 5–69, at p. 17.

63 Guidieri & Pellizzi, op. cit., p. 20. 64 Guidieri & Pellizzi, op. cit., p. 11.