奄美大島を通して見た絹の再考

Re-visioning Silk Through Amami Ōshima

LISA ONAGA and ANNE MCKNIGHT
Editors

For our mothers

Re-visioning Silk
Through Amami Ōshima

「奄美大島を通して見た絹の再考」

Biomaterial Matters:

Fitting Humans in Cocoons, a Speculative Prototype

生体材料への関心：人間から蚕繭へ、つながるプロトタイプ

概略

このプロジェクトは科学史家のリサ•オオナガ、デザイン•リサーチャーのローラ•フォーラノ、テキスタイル・プロデューサーのガリーナ•ミハレヴァと文学史家のアン•マクナイトによる共同プロジェクトです。このプロジェクトは、生地屋で見ることができる「パターン・ブック」という書物からのインスピレーションを得ています。パターン・ブックとは、裁縫をする人々が衣服のデザインの見本を見て、自分なりに衣服をカスタマイズするためのカタログです。さらに、江戸時代の小袖着物のデザインを載せている雛形本からもヒントを得ています。「生命と物質：人間から蚕へ、つながるプロトタイプ」展では日本の南部、沖縄と中国の間に位置している奄美大島の原絹織物から造られた、着られるプロトタイプを中心に扱っています。

展覧会にあわせて作成されたパンフレット、「絹の再考」は三つに分かれています。第1部では絹織物の歴史的背景を説明しています。第2部は超拡大された微視的な写真から構成されており、それらの写真から絹の細かなパターンが自然界をなぞるようなものであることを見てとることができます。第3部ではプロトタイプの制作方法を説明しており、プロトタイプと奄美大島の絹の歴史からヒントを得た絹紬糸・機織り物の作品を一つ紹介しています。

奄美大島の絹の考察を通じて私たちはもう一つの絹の歴史を認識させられ、それらは絹織物から縫合、そしてタンパク質まで及ぶ日本の絹の歴史の考察を促します。タイトルの「絹の再考」は、それまで親しまれてきた絹に対して新しい見方を与えてくれるという意味である一方、絹の帝国主義的、資本主義的な発展に纏わる物語の再編成の試みという意味でもあります。私たちはこの共同プロジェクトがまだ知られることのなかった背景での、絹のアイデンティティの確立、歴史の記述化とそれらの言説分析の研究へのきっかけになってくれることを願います。

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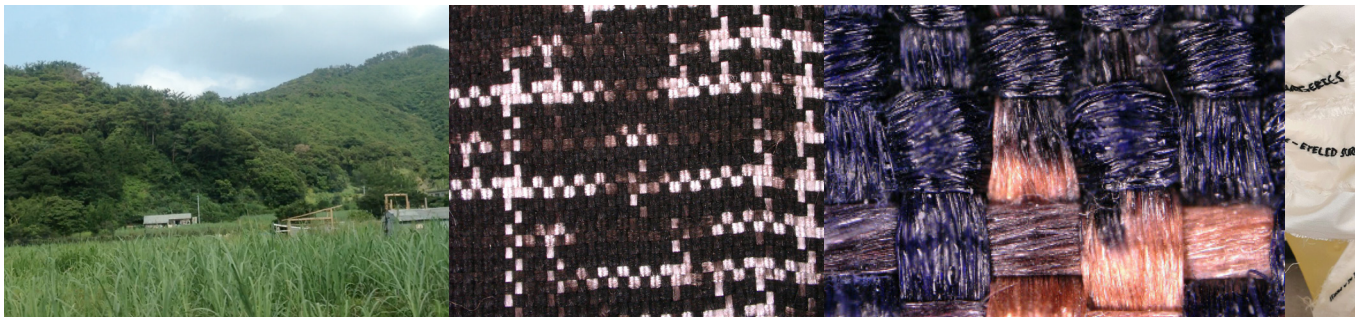






PART III

For a glossary and additional information, please visit www.biomaterialmatters.org.

前書き
奄美大島を通して見た絹の再考

オオナガ・リサ
アン・マクナイト

LISA ONAGA and ANNE MCKNIGHT

Introduction:
Re-visioning Silk with Amami Ōshima

Fig. 1: The centrality of Amami Ōshima has allowed the island to serve as a stepping stone between various regions of East and Southeast Asia. Image: Mapresources file, customized by Xinyi Lum

The design of *Re-visioning Silk* takes its inspirational cue from a genre of publications known as pattern books. While not for sale themselves, pattern books were commonly used like catalogs in fabric stores to suggest prototypes of garments and other textile objects that could be made by people sewing at home. Such books guided readers in the creation of objects and established standards like prices and sizes, as well as the actual step-by-step process of making the object. People of varying levels of expertise, from beginners to the more experienced and nearly professional, used pattern books to select a model that mapped the process of sewing or knitting a garment or objects so that it could fit a specific body or space. In the general convention of the pattern book, a drawing or photograph of a finished product is often provided, along with text, sequences and other illustrations that suggest and material manipulations necessary to create the object or create variations of it. Like recipe books, these commercial instructional publications may also result from having tested the workability of the object of instruction such that modeling can be done by the book—but also allows for imagination and customization of the prototype.

The concept of *Re-visioning Silk* differs from the established pattern book contents because we focus on a fiber, silk, thus making the inquiry into a single specialized "section" of the pattern book genre, turning the viewer's attention to materials rather than the imagined forms of finished objects. The process of prototyping has formed a methodological core for *Re-visioning Silk* by engaging with perspectival shift from the macroscopic and external view of silk textiles to the microscopic and inside-out view from among silk proteins. The prototype object we create is not a conventional skirt, dress, or throw pillow. The design, introduced as "Fitting Humans into Cocoons" at the Making and Doing exhibition of the Society for the Social Studies of Science Annual Meeting in Boston, 2017,

Fig. 2: Agricultural products such as sugar cane, rice, and sweet potatoes grow in Amami Ōshima's subtropical climate. The size of the island (712.4 km^2) is almost equal to that of Singapore (719.1 km2). Image: Lisa Onaga.

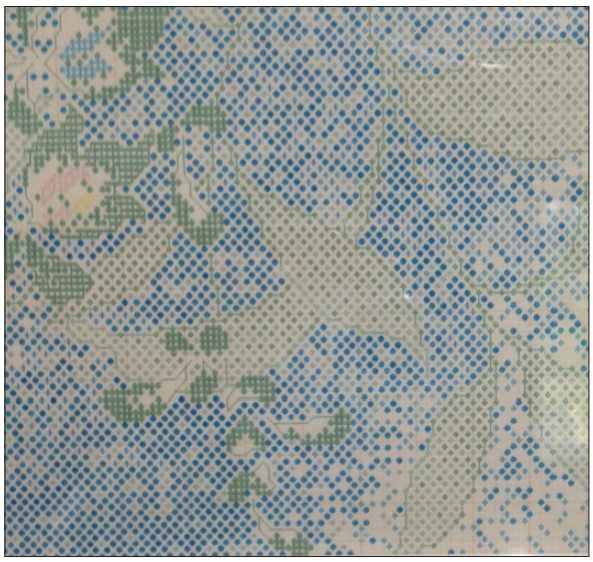


Fig. 3 The design plan, or sekkeizuan (設計図案), for dyeing the warp and weft precisely, a step preceding weaving. Displayed at the Amami Ōshima Tsumugi Mura (Ōshima Tsumugi Village). Image: Lisa Onaga

fabricates a means of mimicking the cocooned metamorphosing silkworm. The resulting design is the first of a series of pieces that incorporates research from trans-national histories of design and science and in turn generates different historical consciousness about silk as a biomateriality. As a group of researchers in art, design, history, science, and literature, we made interdisciplinary inquiries into less prominent meanings of silk as a biomaterial. These histories and documentations, made possible by funding to study "Biomaterial Matters" (Singapore Ministry of Education Tier 1 Grant No. M4011485), led to creating a series of expressive objects that showcase the humanities-based research that has sought to open up questions spurred by the creation of silk objects apart from textiles and in the face of declining Japanese raw silk exports during the late twentieth and early twenty-first centuries. The title *Re-visioning Silk* thus refers to both a renewed view of highly familiar silk and a refashioning of how we have recounted the story of silk, tied to imperial and liberal capital production. This collaborative project serves as a springboard for the identification, documenting, and narrating of silk in less familiar settings and spaces.

Our research focused on alternative narratives that consider silk as a biomaterial used in contexts outside of conventional textile industries. This different take on silk counterbalances a view of a world concretized by economic historians who understandably recognize and discuss the value of silk, processed into skeins and traded as a global commodity. The symbiotic link between a commodity and its history represents a relationship that all other analysts and artists must work around. By seeing silk as a protein, once can readily understanding that silk is, in fact, constantly reshaped, refashioned, and remade depending upon the time and geography of silk-work. There is nothing singular about the process of making silk. In a *British Journal of Sociology* essay entitled "When things strike back," Bruno Latour (2000) stressed that social scientists must represent how objects have produced consequences and uncertainties – and fast enough so as to document all known or possible

objections to it. To put it another way, there is no universal reveal about the structure of the world or a society that can be made because of knowledge of the particulate or molecular constitution of silk. Through this publication, we show how a proteinaceous view of silk recognizes multiple kinds of threads or liquid or solid states of silk. This view of silk can alert one to different concerns and aspects about silk itself and raise different perspectives that help raise a variegated historical consciousness – disturbing, in effect, the hold upon any one narrative of silk.

By seeking out silk practices that exist alongside but not congruent to dominant assumptions about the purpose or place of silk, we have aimed to sharpen and deepen understandings of the meanings of particular silk-making processes. While many approaches could be taken, we focus on silk dyed and woven on an island in the former Ryūkyū Kingdom: Amami Ōshima (奄美大島). By recasting this island as a central node, our interdisciplinary team has been forced to pay attention to the formation of silk practices, knowledge, and the making of silk itself at the oceanic crossroads of Japan, China, and Southeast Asia. The present endeavor documents, studies, and uses the handcrafted silk of Amami Ōshima as a first step toward building a path between an archipelagic history of silk-making and a deep historical context for biomateriality. The island's interstitial location has helped us to explore new narrative strands and potentials for discussing silk as an object of convergence that ties together science, technology, art, and the humanities. The result exceeds the parameters of the conventional "pattern" of silk stories, which tend to emphasize national modernization, development, and industrial histories. By seeing silk as a protein, a shift in thinking about the relations among objects, people, and design practices helps us consider how silk is valued and transformed over time and space—not a garment, not a fabric, and not a national economy. This publication therefore reflects the very lively process of ideation and execution, interwoven with mini-essays that contemplate the history of silk biomateriality.

The shift in consciousness we seek can be tracked in the forms documented here. The objects of expression in *Re-visioning Silk* show the process of turning ideas into objects, as we collected sketches and textiles, took photographs, conducted micrography, and made prototypes of sewn and knitted objects. These activities, described in three parts, collectively show how historical research can result from collaborative conversations between and among different kinds of scholars, museum experts, and artists and is in turn expressed creatively. We have prototyped objects that critically engage with the research findings as a supplement or extension to the conventional format of the academic research article.

Part I begins with Lisa Onaga's essay "**Re-Visualizing Silk As a Biomaterial: A Perspective on Proteins and Places.**" The essay discusses in greater detail the historical context of silk on the island of Amami Ōshima and in relation to the rest of Japan. In doing so, the essay outlines the reasons why displacing the central nodes of silk-making from either textiles or the home islands of Japan helps clear a way to study the formation of silk biomateriality holistically and over a long duration. The essay contains photographic examples of weavings that illustrate the handwork of Amami Ōshima weavers. Among our thought processes have emerged concerns about women, labor, and public displays of mobility via fashion. While we do not have a dedicated section for gender or women in this project, we are aware that silk labor and consumption in the modern era are typically feminine domains. The signature pop culture motif of this feminized quality is the cocoon, which may seem like a refuge or "pause" from ongoing patterns of life. Anne McKnight's short sidebar focuses on the cocoon as motif for development in literature and comics for young girls—perhaps the original biomaterial character. These contemplations bring to the fore questions about the way that pressure to "develop" in specific ways might be narrated, contrasted or contradicted. While the novels frame development in personal terms, the national pressures of the twentieth century came to the fore in Japan using similar rhetorical frames, making personal and national histories run along similar lines of allegory.

In Part II, *Re-visioning Silk* pursues questions spurred by rethinking silk as protein. These questions stem from an awareness that contemporary interests in silk as an engineering material must rest upon prior knowledges that span across different locations. By privileging the protein as object, it has become possible to consider the meanings of multiple narratives and possible uses of silk de-linked from the intellectual patterns that typically regard two-dimensional fabrics as the endpoint of the global silk trade. This emphasis on the shift from cloth to protein proves especially important for the case for silk in Japan, where silk was once an object that was hotly traded worldwide. Instead of accepting the narrative of decline in Japanese silk exports in the twenty-first century as the predictable endpoint of the "story of silk," our research and process have underscored the necessity of engaging with material objects and ways the values attributed to them change as part of the research method. One can envision the narrative thread of new silk biomateriality as one composed of multiple short-fiber yarns, unarranged in any linear story of progress. Only then can one make more full sense of

the meanings of phrases like "New Silk Road" (e.g., to define twenty-first century Chinese economic partnerships) or "reverse engineering silk" (e.g., used by Tufts researchers Fiorenzo Omonetto, David Kaplan, and others to describe the development of liquefied silk protein), which point to alchemical or pragmatic breaks in time and in the practices of silk-work that have preceded the now.

The role of technology is prominent in this project, as Part II reckons with the complicated multi-step dyeing and weaving of Amami Ōshima silk and the determination of its quality and authenticity. The use of a Keyence VHX-5000 light microscope motivated us to study the silk samples from a new angle, especially in search of the "fish eye" motif. Under the title of "**More than meets the eye: Journeying across the silk terrain of warp and weft**," the micrography essay by Nicole Ong Yii Mei and Lisa Onaga show how visualization technologies encouraged an artistic exploration of (1) the dye-work and (2) the protein strands that formed the less-readily sighted spaces in between warp and weft, including the edges of the silk, or imperfections. The centrality of this ocular work has also drawn new attention to the technology of suturing, beginning with the iconic double-eyelid surgery perfected in Japan using silk sutures. Onaga's short piece on sutures points to the multiple purposes of surgical sutures for repair and enhancement. Sutures also relate to thoughts about public and private, wherein the results are clear to the gaze of the external viewer's naked eye but are otherwise obscuring the underlying infrastructure.

The result of this research is to put forward, in Part III, a series of objects that serve to defy conventional logics that silk follows an historical trajectory as a commodity to be differentiated only by branding, marketing, and price. The previously mentioned wearable work of textile art designed by Galina Mihaleva is introduced with an essay by Laura Forlano and Lisa Onaga, "**Fitting Humans into Cocoons: A Speculative, Interspecies Encounter**," on the ideation around the notion of biomateriality. The process of creating the prototype shows how Amami Ōshima textiles and braided silk sutures come together in patterns and stitch work, as documented in "**Prototype Production Notes**" by Ong Xin Hong and Galina Mihaleva. Most interesting attention is given to the ocular motif, which is manifest in a sewn pockets and a jabara (accordion) structure with "the island of Amami Ōshima" embroidered in the center. Finally, Emily Anderson takes on textile art and historical reflection in an essay entitled "**Cocoon as topography: Knitting a history of Gunma with the silkworm**," reflecting upon on the silken interior of Japan and its relation to religion, the legacy of a father, and working with mixed textile media.

Together, this three-part chapbook offers perspectival shifts that ultimately invite readers to envision a different weave to the history of a textile that has been of immense value to human culture since the domestication of the silkworm several thousand years ago. The "patterns" in *Re-visioning Silk* thus do not fix limits. They function as "prototypes" that reflect our meditations upon the multiple surfaces and starting points from which the history in question has been engaged with. Experimenting with the elements and design of conventional pattern books has further allowed for expressions and explorations that exceed the boundaries of text. Thinking with design, fashion, and art has encouraged an unorthodox exploration of the history of silk itself and how its uses has changed in the twentieth century, which has allowed a motif of the eye to emerge from and connect together our repositioned perspectives. By thinking and working with found objects and the creation of new forms, a revisionary history of silk emerges.

Fig. 4: Bolts and samples of silks derived from Amami Ōshima were collected, examined, and photographed throughout the project. Image: Lisa Onaga

生体材料としての絹
地理とプロテインの視点から

オオナガ・リサ

LISA ONAGA

Re-visualizing silk as a biomaterial: A perspective on proteins and places

Escaping the seduction of silk poses a challenge. That seduction is neither characterized by silk's shine, softness, or strength, nor by its association with opulence or with cultures exotic to oneself. The historiographical seduction of silk as a good traded along the Silk Road to contemporary times can propel the narrative of the fiber's modern history as one that joins a number of commodity histories like that of sugar, corn, and cotton, which reckon with mechanization, mass production, and globalization as an intractable end point. Such narratives easily weigh down other histories from surfacing. Struggling for air from beneath the seductive narrative of silk exchanged for capital is a story of silk seen as protein.

In recent years, scientists in a variety of fields and around the world have researched the age-old material of silk to develop new silk materials. Their efforts to produce proteins that are biocompatible with the human body have fascinated me, not least because of how new silken innovations produce a desire to overcome the animal-human machinery of conventional textile creation. Unlike the processing of silkworm cocoons to produce silk filament fibers for woven textiles, the rendering of "new" purified silk into three-dimensional scaffolds cannot depend solely on silk protein arrangements spun by a silkworm and its DNA. Twenty-first century desires for silk proteins with new potentials have involved scientific and engineering processes that in a previous world would have been called alchemical. Most "silk scientists" have once had ties that support the making of conventional silk, but the materiality of silk that has started to allow for unconventional forms represents a broadening scientific interest and expertise. Whether it involves "reverse engineering" silk into purified protein solution or bioengineered yeast to bypass the silkworm, silk as we know it faces a core change in the meaning of who is a maker and doer.

Defamiliarizing silk

Approaching a familiar object from a different angle can disturb one's assumptions and broaden the mind to new analytic possibilities Before concentrating the gaze upon contemporary silk biomateriality exclusively, I have found that distributing part of that gaze upon the history of silk in Japan offers a highly productive way to learn about the meanings of silk that brings me to a focal space beyond the framework of nation and empire. Japan sat at the pinnacle of the pre-World War II silk trade and the legacy of that period has thus meant that anyone dealing with the science of silk today must engage with Japan. Including the proteinaceous perspective to consider silk in a new context encourages a look at silk-making in "Japan" not from the vantage of the nation-state but from the outlying island edges that give the country its modern geographic shape. The diverse locales that contribute to a richer, more informed notion of silk itself thus become as much an object of inquiry as the biomateriality that seems to enter the new field of view.

A new field of view can arise in different ways. A focus upon the insect instead of the textile might be akin to shining a light up at the underbelly of silk production that disturbs the dominant narrative of what we know about silk. To realize the labor of a six-legged creature may even surprise those who have had mainly the experience of consuming silk. Over a century ago, Marx and Nietzsche used the silkworm to illustrate

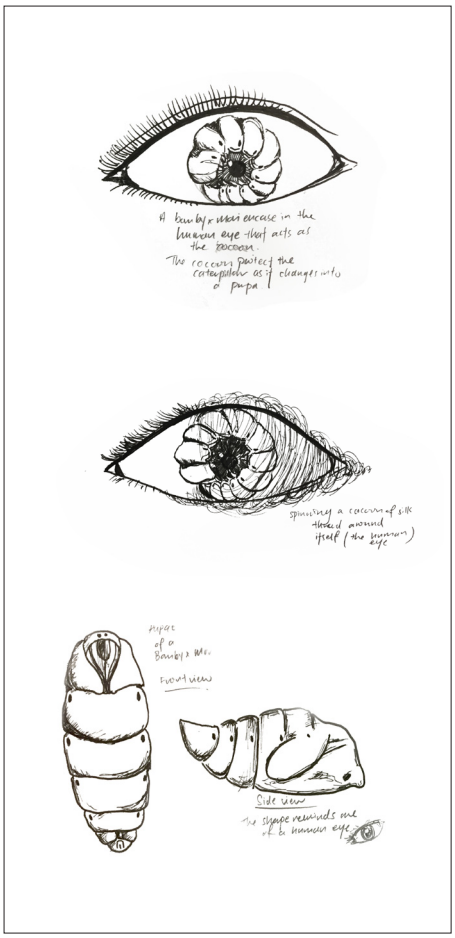


Fig. 5: The convergence of silkworm body with the sensory phenomenon of sight, as represented through the eye, is explored as part of the process of re-visualizing the history of silk as a biomaterial.
Images: Nicole Ong Yii Mei.

wage-work and the fallacy of free will. Lafcadio Hearn wrote of evolution and Buddhism while pondering the work of the silkworm in Japan. Although the silkworm continued served as a resource to discuss labor through the early 1900s on both sides of the Pacific and the Atlantic and today figure into the fictional worlds of W.S. Sebald, Jeffrey Eugenides, Karen Russell, and J.K. Rowling (under pseudonym Robert Galbraith), the actual proximity of our human lives with silkworm lives grows ever more distant. The silkworm grows ever more unfamiliar, foreign and grotesque to people in countries that once worked with the worm or its products. This could stand to change today, but chances are that it might not.

As I thought about the meaning of a narrative shift that views silk as insect, I found myself turning two questions over and over in my mind. First, I wondered *why* people had such different ideas about where silk "came from" — beyond a geographic question, this refers to a physiological one (was it from the body of the silkworm? Mulberries? Extract of the cocoon? The silkworm's posterior?). Why did such a disconnect exist between the source of this animal fiber and a layperson's knowledge? I second grappled with how a focus on the insect and scientific knowledge did not *necessarily* challenge the narrative of a globally traded silk textile.

The emergent scenario prompts questions about what geographical and sociohistorical conditions preceded silk's recent rendition as a biomaterial. Silk, in short, can be known through one of these facets (geography, the socio-historical, the bioscientific), but it is in its triangulations by the points of these facets that can sharpen an understanding that recognizes the dynamism of silk over time and space. As I think about silk anew, not as a mere textile but as a protein responsible for ushering innovations in biomedicine, food, and design, I consider the significance of this quietly radical turning point in an erstwhile "textile" history and reflect upon what yet remains untold about the stuff of silk. This less familiar view toward silk need not facilitate a violent break in silk itself, but it would allow for a more deep understanding of what has made this "old" material newly attractive to people today. The geographical distinctions among where silk is farmed and typically processed and where new silk materials are being rendered offer important challenges for thinking differently about the localities of silk.[1] The history of twenty-first century silk, in other words, is one that must reckon with understanding earlier renderings of silk not only as that which is intimately tied to cultural bodies, but physiologically integrated.

Silk as protein serves as an historicizing prompt

To consider silk more seriously as a protein, I remain conscious that demarcating the insect and its heredity from the tales of textiles does not automatically innoculate one from joining in the making of assumptive stereotypes about the history of silk. Explorations of how breeders and scientists exploited the heredity of the silkworm do not mandate an analysis of textiles, and thus, the provocation to resist the allure of silk fabric may seem irrelevant to this exercise of centering the silkworm species, its silk proteins, or less dominant histories of silk production such as that of Amami Ōshima tsumugi (pongee) silk. The scientific and sericultural passions for the silkworm shared among Japanese historical actors in the years preceding World War II deserve to be told, but with an awareness that these can be joined by additional, not alternative, frameworks. In recent feminist animal-centered science studies, approaches ranging from companion species to multispecies relations have taken scholars beyond the singular scope of animals that merely work in the name of reinforcing the

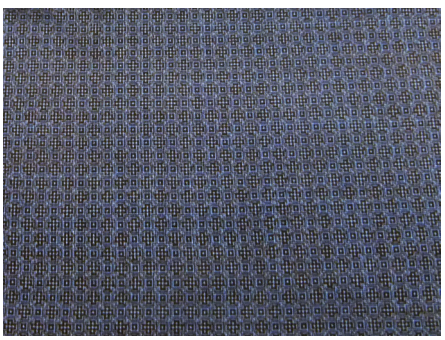


Fig. 6: Cross-like patterns represent the "fish eye" motif signifying the ubiquity or importance of fish for Amami life. This design forms the basis for other designs, especially those that reflect the island's subtropical nature and manmade artifacts. The brown color reflects the combination of the te-chigi plant, as it is called in the Amami language, and mud-dyeing. Image courtesy Ginza Motoji

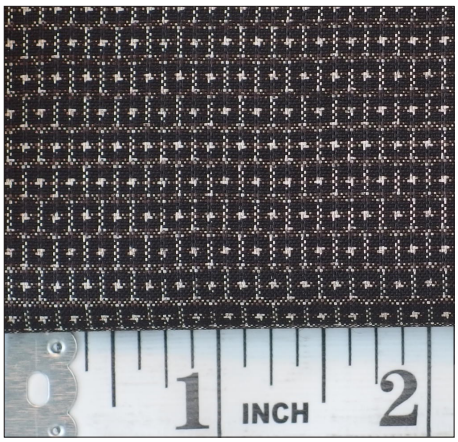


Fig. 7: Amami Ōshima silks undergo a strict appraisal process before they are sold to the public. Here, macrophotography allowed us to understand the thread-level of precision required to dye the warp and weft. An undated vintage Amami Ōshima silk sample exhibits the kikkō, or turtle shell, motif. Image: Biomaterial Matters

knowledge cultivated generations ago by predominantly male scientists. Posing perhaps a challenge for the study of an agricultural insect, already tightly knitted to a history of genetics and nationhood in Japan, the time seems apt to rigorously reconfigure how we know what we know about silk.

Focus: Amami Ōshima tsumugi

The focus upon Amami Ōshima tsumugi silk helps me dwell upon the question of how ordinary knowledge or familiarity with a particular type of weaving has developed. Once part of the Ryūkyū Kingdom, the demure Amami Ōshima tsumugi weavings were made of hand-spun short-fiber silk. As a waystation between Tang Chinese and Japanese courts and commerce, the silk products of Amami Ōshima, characterized by pre-dyed warp and weft to produce intricate designs, have occasionally been used as tribute items traveling in either direction. Many things mark Amami Ōshima silk, from its often natural dyework create from the *sharinbai* or *te-chigi* plant (*Rhaphiolepis umbellata*) or rice paddy mud. The way these deep brown-black dyes (as well as other dyes, including synthetics) are bound to specific portions of the warp and weft create Amami Ōshima silk's signature design, which are variations of what seem to resemble pixels on a computer screen. In reality, these are variations of motifs ubiquitous to the nature surrounding the group of Amami islands, as well as man-made objects. A fish eye shape, resembling a cross with dots in each quadrant, lies at the crux of many of the more complicated patterns that make Amami Ōshima silk recognizable.

By the late nineteenth century, the technological intricacy of the woven designs grew and thus gained popularity in cities as far as Osaka. Now, Amami Ōshima tsumugi are woven with high-quality, unbroken raw silk filaments. More curiously, over the late twentieth century, these silk textiles from the southern islands grew synonymous with mainstream, postwar, middle-class Japanese, "ordinary" culture, while remaining caught between cultures and also political situations, especially after World War II and the occupation period (1946–1953), which limited, if not prohibited the sale of the textile.

Evidence of Amami Ōshima tsumugi goes back to as early as the Nara period (710 – 794 A.D.), but the textile itself represents a dynamism that reflects its cultural tenacity. The Amami people continue to manage ways to make the textile relevant, relying upon an adapted form of tribute to the nation, if not to the court. The significance of Amami Ōshima tsumugi is, in part, preserved within a time capsule created for the 1970 Osaka Expo. The bolt of mud-dyed *shōken*, or "true silk" (i.e., intact raw silk filaments), contributed by the Tabata Tsumugi weaving company, was appraised as one of the three most valuable textile objects buried fifteen meters below the Osaka Castle Park grounds.[2] The time capsule gestured to the surging popularity of Amami Ōshima tsumugi in high-growth postwar Japan, casting an intriguing contrast of "traditional" technology against the ramping up of light electronics industry and reliance upon nuclear power. A cornerstone year for Amami Ōshima tsumugi took place in 1972. That year, the U.S. "returned" Okinawa to Japan, which elated many Amami people who had been working in Okinawa. That year, the Emperor and Empress of Japan also visited the Amami islands as part of their travel to Kagoshima, where the 27th National Sports Festival summer games were held.[3] Tabata presented a 12-maruki bolt of high-quality silk featuring a pattern of sangobana (coral flower) to commemorate their visit of the Imperial Family's visit.[4] Shortly thereafter, the Ministry of International Trade and Industry officially registered a definition of Amami Ōshima tsumugi in 1980, which the Honba Amami Ōshimatsumugi Cooperative Association helps to maintain.[5] As a thought exercise, I wonder which patterns of woven cloth did the Emperor of Japan see when he and his family visited Amami Ōshima. How would that Imperial visit have had an impact on re-branding "tradition" in the eyes of the Amami people, or Japan? Who is doubly made to protect their intellectual property embodied in silk textiles? The pursuit of such questions make it necessary to examine silk in a finer geographical and sociohistorical vein.

Jewel of kasuri

Despite a Ryūkyū past intent upon retaining its identity, a willingness to change has played a key role in Amami Ōshima tsumugi's ability to stay relevant to Japan. Like a jewel with many facets, the history of this product has multiple surfaces to focus upon that each provide fodder for analysis and discussion. From the development of dyeing technologies to the movement of know-how to Kagoshima and protests against woven "fakes" from South Korea, to the variation of woven patterns, going

deep into the fiber of silk itself enables a figurative light to shed new light upon the fabric. Those in the business of promoting Amami Ōshima often call it the "jewel" of *kasuri* (splash-dyed) silks. While the phrase invokes a preciousness amongst like kinds, what shines at a pragmatic level is a combination of the silk protein that gives it an actual shine, and the woven gleam of tiny fish eyes that ripple through the ocean. Going beyond face value and questioning the assumptive allure of the florid and gorgeous "beautiful kimono" to seek the meaning of the ordinary complements thinking about silk as a biological material. The approach of separating handwork from insect-work and bringing the two back together again is an analytic exercise of repetition, a figuring-out process of new meanings.

The fish eye, too, represents an "ordinary" thing to Amami weavers. In the course of this research, I corresponded with an expert in Amami to query the significance of the *yunmu*, the fish eye motif. It is impossible to trace back to a particular kind of fish – like air and water, it just *is*. The woven fish eye is sometimes more a picture frame than picture, with its variations arranged to make other patterns. The notion of re-visualizing the history of silk has necessitated a method of repetition, in which repeat approaches toward the same object or series of objects from multiple vantages and disciplines give way to a multifaceted textual, visual, and tactile critical design analysis. The standard explanation for an eye did made sense, but it also prompts a continual pulse of asking, "is it really just an eye?" Amami Ōshima tsumugi authenticity has mandated that at the end of a bolt of silk the name of the Amami Ōshima tsumugi guild be woven. Then, an intricate set of "chops" (trademarks), red ink stamps, and hole punches that indicate authenticity of the product further help lay claim that the silk is one of their own.

Confirming the origin or place of production when only a garment is available is challenging, for kimono-makers must snip off the part of the silk bolt containing the afore-mentioned information that authenticates it. In such garments, the woven pattern is what communicates clues about authenticity. Yet, these and scrap textiles do not always come with their authenticity markers. Such textile pieces constitute a perpetual puzzle, offering their viewers an opportunity to meditate about the meanings of and issues concerning authenticity, reproduction, repetition, and social adaptation. From this reflection upon the proteinaceous perspective, the Ryūkyū Kingdom island emerges as key player in making something that is rendered a Japanese kimono textile during the postwar period.

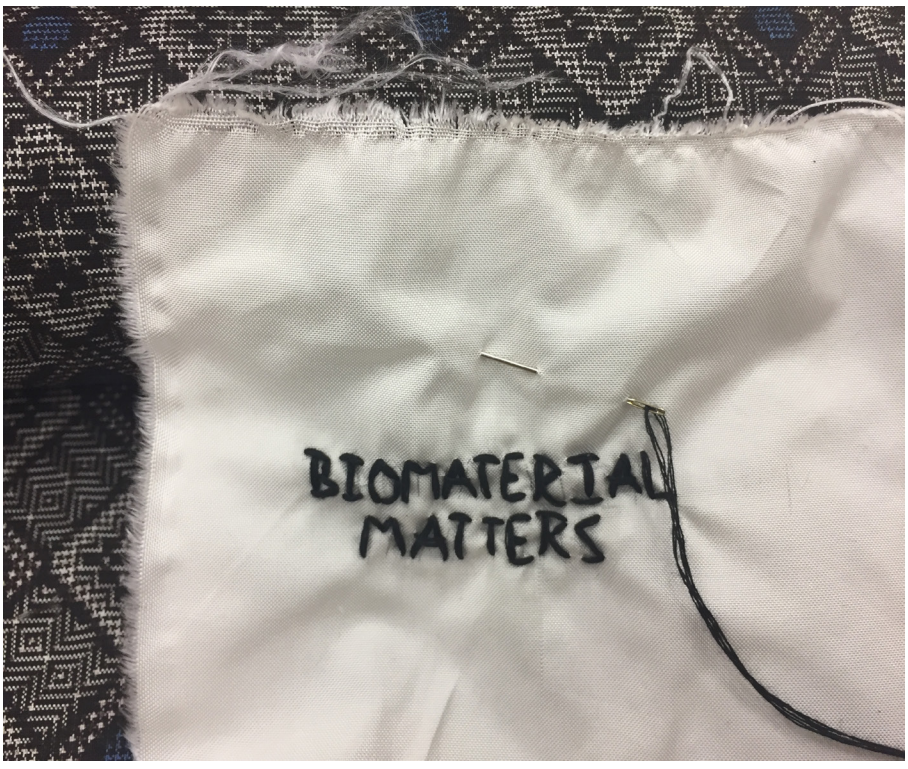


Fig. 8: Relevant terms and phrases are embroidered and sutured into the prototype to encourage a new reading of silk textiles. The project title is embroidered on white Amami Ōshima silk. Placed over backdrop of Amami Ōshima silk exhibiting fish eye pattern. Embroidery: Nicole Ong Yii Mei.

[1] On the technics of rendering molecular and macro abstractions to human-scale that informs this discussion, see Natasha Myers, *Rendering Life Molecular: Models, Modelers, and Excitable Matter* (Durham: Duke University Press, 2015).

[2] Panasonic, "Taimu kapuseru EXPO'70 gaiyō," (n.d.): http://panasonic.co.jp/history/timecapsule/overview/index.html.

[3] Imperial Household Agency, "Amami Gunjima Nihon Fukki 50shūkinennshikiten: Heisei 15nen 11gatu 16nichi (nichi) (Amami shinkōkaikan)," (n.d.): http://www.kunaicho.go.jp/okotoba/01/okotoba/okotoba-h15e.html.

[4] One count of maruki equals a unit of 80 dyed silk threads.

[5] Requirements include being made of 100% silk, handmade, a plain-weave, with dye prepared according to the binding method that creates the highly detailed *kasuri* (ikat) design, and on a particular kind of loom that enables the specific *kasuri* patterns to show properly when the warp and weft align.See http://www.tumugi.co.jp/tsumugi/oshimatsumugi.html

繭の詩学

アン・マクナイト

ANNE MCKNIGHT

The Poetics of Cocoons

But in recent years, certain shrewd Kyoto people have started to lavish every manner of magnificence on men's and women's clothes and to put out design books in color. With modish fine-figured patterns, palace style hundred-color prints, and bled dapple tie-dye, they go the limit for unusual designs to suit any taste. Such behavior by wives and the marriages of daughters have drained the household finances and impaired the family business of countless merchants.
~Ihara Saikaku, Japanese Eternal Storehouse (日本永代蔵)[1]

In 1688, documenter and connoisseur of popular culture Saikaku could write: "a merchant wearing fine silks is an ugly sight."[2] The Tokugawa military government issued sumptuary laws in the 1680s and accorded rules and privilege that followed a four-class system of samurai, farmer peasants, artisans and merchants. The rules and regulated how—and whether—you could flaunt a bold underlayer, show a shot of purple, or in the case of commoners, wear a fancy fiber like silk at all.

Saikaku's tone here suggests (perhaps feigned) alarm in the face of a disordered world. But regulation of weaving, dying, embroidery, garments, materials and accessories provoked others in the merchant and performing arts walks of life to ever-more inventive styles and displays of these styles. The material potentials of silk and its layering possibility were at the heart of this story. It is no wonder then that the social mobility tied to silk is freighted and flouted with even more potential in the modern era, in its most narratable social type—young girls and women, otherwise known as *shōjo* (少女).

If youth is the modern genre par excellence, its female character is

FIG. 9: Cocoon surface magnified, 20X. Image: Nicole Ong Yii Mei

crystallized in the genre of *shōjo* literature that emerged in the 1920s writings of Yoshiya Nobuko and others.[3] The *shōjo* character is, in fact, the very portrait of biomateriality.The *shōjo* character possesses intense potentials for growth when it intersects with the movements, forces, and molding she encounters in late adolescent and early adult years—after leaving the cocoon shelter. Since the 1920s the genre of *shōjo* literature has dwelled in the inner thoughts and fleeting emotions of girl protagonists, put on paper. These are displayed in the graphic forms of materialized asterisks, ellipses, and white-spaces that conveyed a three-dimensional idea of the girl's mind in a two-dimensional form on the page as she thinks and feels. For example, the narrator of Yoshiya's story "Yellow Rose" describes the main character's career choice to be a teacher in a place called: "xxxxx, so distant from the city of Tokyo that she had been so used to and that had all the things that Japan's modern life and culture had to offer. Her classmates called it her 'refuge from marriage'—" Stream-of-consciousness style, and the graphic representation of its movements and pauses, then, create opaque spaces that are cocoon-like in their ability to pause and create small, nested alternate narratives of experience contrary to the developmental narrative of marriage desired by the character's family. This dimensionality would be later arranged in the panels of manga pages that depicted the vivid inner lives of their characters, ones that, like silk, could be transformed in an infinite variety of directions.

Writings in the 1950s and 1960s used silk to show how connoisseurship could help you make your way in the world, and subtly broadcast it to those in the know. Kōda Aya's popular serial novel *Kimono*, for instance, made silk kimonos part of her character Rutsuko's negotiation of a shifting social world. Kōda's narrator lets the reader into Rutsuko's growing connoisseurship, as she deploys proper styles and patterns, all the while the knowledge base about kimono becomes rarified away from the daily lives of most people.[4]

But it is cocoons—with their pending world of potentiality, a closed world waiting but not sleeping, biding its time and internally moving while time goes on all around the character—that captured the sense that entering adulthood was a definite threshold, beyond which potentials became material and forever affected by time.[5] Whether the sheltering pupa form launched a butterfly or sheltered a silkworm, fiction and manga put this state of pending life at the center of dramas about mobility, both social and geographic. These subversive alternatives to the slumbering pupa state of a Sleeping Beauty include Kyō Machiko's manga *Cocoon*, as well as TV dramas like the Netflix production *Atelier* (2015), the story of a young woman named Mayuko (繭子, meaning a girl pupa) from silk-producing region Nagano Prefecture who moves to Tokyo to make it big in the world of couture lingerie. *Atelier* spins aspirational dreams through the story of silk merchandisers, stylists and creators, if not the worms themselves. Mayuko is a stand-in for all the processes that go into making silk the material of social mobility through stasis—biding your time until you enter the market on your own terms.

[1] Donald H. Shively, "Sumptuary Regulation and Status in Early Tokugawa Japan," *Harvard Journal of Asiatic Studies* 25 (1964): 127.
[2] Ihara Saikaku, *The Japanese Family Storehouse*, trans. G. W Sargent, University of Cambridge Oriental Publications 3 (Cambridge: Cambridge University Press, 1959), 27.
[3] See Yoshiya Nobuko, *Yellow Rose*, trans. Sarah Frederick, second ed., (Glendale, CA: Expanded Editions, 2016).
[4] Michiko Suzuki, "Reading and Writing Material: Kōda Aya's Kimono and Its Afterlife," *Journal of Asian Studies* 76, no. 2 (2017): 333–61.
[5] The trope of the slumbering girl in conventional fairy tales is offered by Honda Masuko, who put the field of *shōjo* literary studies on the map. See Masuko Honda, trans. Tomoko Aoyama and Barbara Hartley, "The Genealogy of *Hirahira*: Liminality and the Girl," in *Girl Reading Girl in Japan*, eds. Aoyama and Hartley (Oxford: Routledge, 2010), 19–37.

見ること以上に表すもの
顕微鏡写真について

オオナガ・リサ
ニコール・オン・イーメイ

LISA ONAGA, Micrography by NICOLE ONG YII MEI

Micrograph Essay:
More Than Meets the Eye
Journeying across the silk terrain of warp and weft

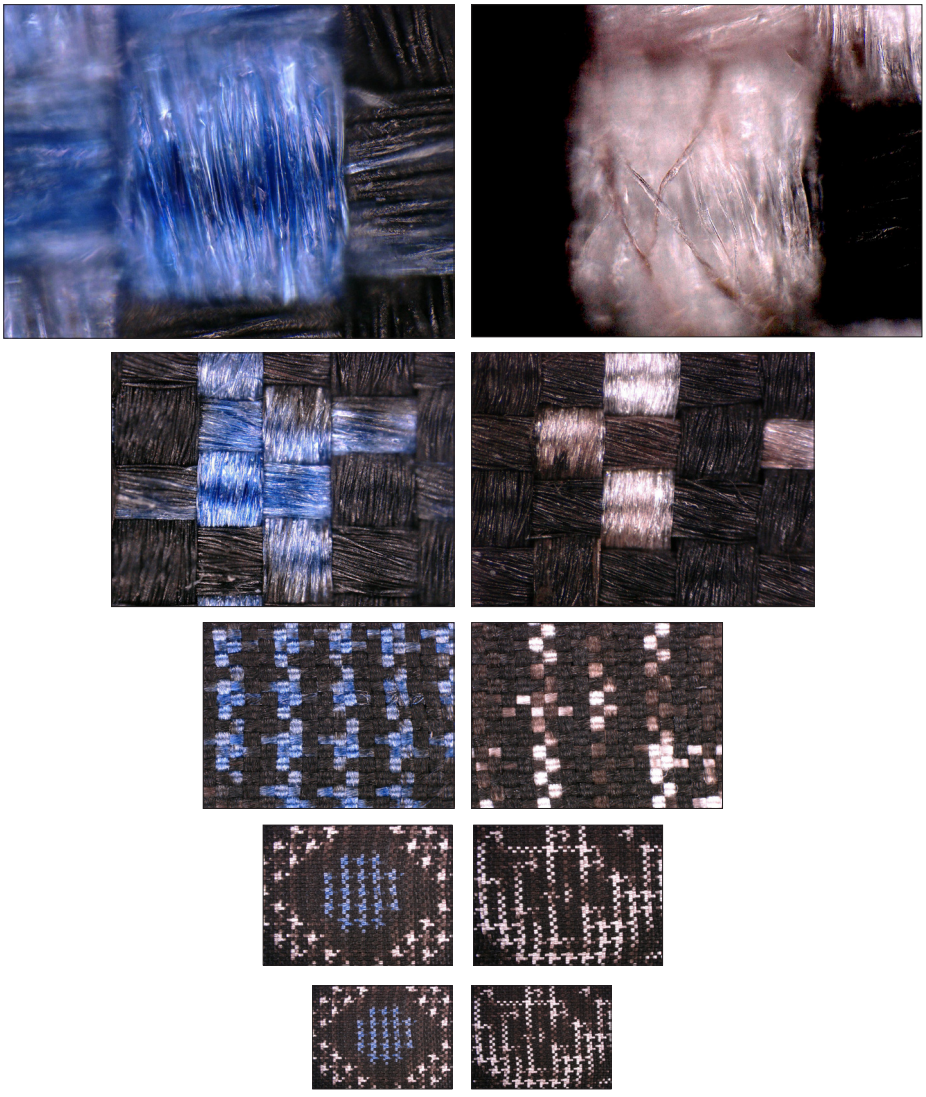


Fig. 10: Curated selection of micrographs of Amami Ōshima silk exhibiting a variation of the "fish eye" motif.

Some silkworms can look larger than life because of two artificial eyespots that appear on a protruding segment on their backs. By applying greater scrutiny, one may see that the silkworm's eyes, which are each smaller than a pinhead, in fact, sit nearly underneath these fake eyespots near the mouth. This example of biomimicry has inspired the Biomaterial Matters visual documentation of Amami Ōshima tsumugi textile samples. As we considered the fine line demarcating the natural and synthetic, or what defines authenticity, we began to question what we ourselves were able to view using the naked eye or basic photography. We wished to understand these textiles, known for their high-precision hand-dyework of warp and weft, by accessing a view of hand-dyed silk at the level of the woven stitch.

The macro photography of twenty-four textile silk samples collected at a Kyoto shop known for its expertise and wide collection of used and vintage tsumugi silks, and one sample of Amami Ōshima silk acquired from kimono merchant Mr. Motoji Kōzo of Ginza Motoji in Tokyo, who specializes in artisanal silk made on that island (as well as in silk spun by cutting-edge silkworm varieties). Photography with the Olympus Stylus XZ-3 under natural light conditions allowed us to document and digitally compare these samples in order to understand their patterns. Through this photography of 2x and 3x magnification, we sought to understand pattern distinctions and how they provided the foundations for more complicated designs. We wanted to go beneath the surface of the plain-eye view.

The VHX Digital Microscope 5000 was used to generate a more three-dimensional view of the silk in order to further the methodological aim of examining the surface of 2-dimensional photographs of textiles. A desire to understand how the dye-work and weaving together created the pixellated

Fig. 11a: Keyence VHX-5000 microscope used to examine silk textile samples up to 2000x magnification. Image: Nicole Ong Yii Mei

Fig. 11b: Variations of the basic "fish eye" motif are seen in Amami Ōshima textiles that are patterned after conventional forms. This contemporary textile design known as the *tatsugōgara*, combines imagery of natural elements such as the cycad and the back of the habu snake with hibiscus flower patterns. Image: Biomaterial Matters

patterns undergirding the textiles, also connected to a desire to comprehend the lines between understanding silk as textile and silk as protein. In collaboration with biological anthropologist Laura Longo at Nanyang Technological University, some of our team members were trained in light microscopy and began to document each silk textile at magnifications from 2000x, 1500x, 1000x, 500x, 300x, 200x, 150x, 50x, 30x, to 20x. Struggling between finding accuracy and beauty, the process of visualizing the textile at a high magnification afforded the means

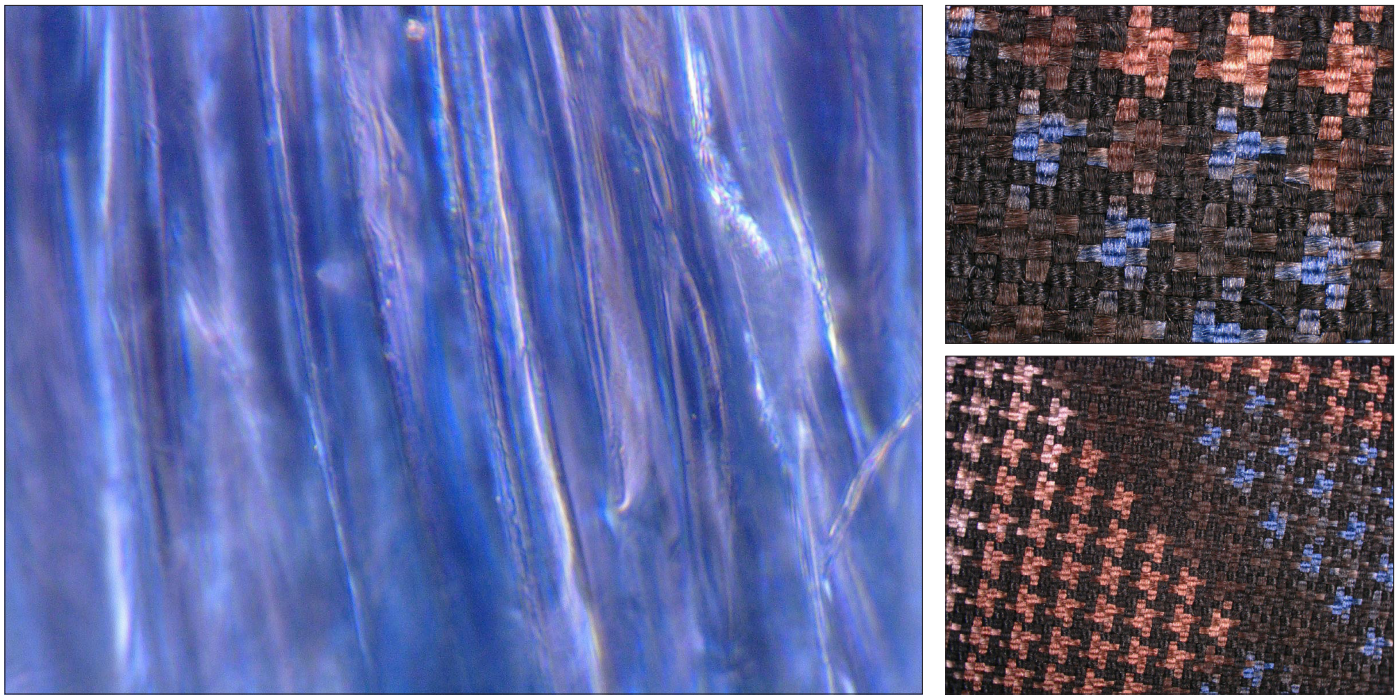


Fig. 12: A bolt of silk cloth can contain millions of warp and weft intersections that can be dyed to collectively represent a precise design. Unlike painted textiles or embroidered brocades, Amami Ōshima weavings exhibit a look that interestingly reminds of a pixelated computer image.

to reach a completely unexpected and different aesthetic understanding from the probable intents of the weaver.

Our natural, naked eye, now sutured to the ocular lens of the digital microscope, has become enhanced. In our interdisciplinary approach to the study of textile samples, this micrographic endeavor to work outside-in reflects not only reflection, but a more bodily endeavor to envision empathetically, from the worm's eye view. This cyborg state of journeying microscopically across the terrain of a silk textile has taken our methodological process to new depths that allow new critical insights to emerge. Our student microscopist Nicole Ong asked, "Is not the artificiality of silk sutures that have historically enhanced the eye like the microscope that enhances our view?" Silk sutures enter the anatomical world of the human. Questions such as this illustrate an airing of assumptions and not just about the motifs that constitute the distinctive patterns of Amami Ōshima we sought to read on our samples. This question relates to shedding another assumption raised at the beginning of this project, that that silk is only a garment worn upon the human body. We were not entirely sure what we would find as we digitally spelunked into the crevices between warp and weft, but traveling deeper in resolution between the threads led us to ponder upon the meaning of re-visualizing silk from the insect's perspective.

日本の縫合についての検証

オオナガ・リサ

LISA ONAGA

Seeing Sutures in Japan

Silk cocoons spun by silkworms provide a safe space for insect metamorphosis. Interestingly, the silk suture is a fairly safe, bio-inert medical technology used in surgery. Perhaps it is a stretch to call surgery a form of human metamorphosis, but many procedures may remind one of great bodily transformations. In surgeries today, silk sutures are often used for closures and ligatures, as well as in microsurgeries, skin surgeries, caesarian operations, and ophthalmic surgeries. A suture, which must be FDA-approved before use, is more than just silk. In fact, raw silk filaments are degummed to remove sericin, the stickier of two silk proteins that constitute raw silk. The fibroin protein that runs through the filament core is woven or braided to produce a desired suture diameter, and it is then waxed and often treated with silicone to ensure its lasting effectiveness.

Stemming from at least 150 A.D. when Greek physician Galen of Pergamon recorded its use, the silk suture remains relevant today. Indeed, the uses of silk in the human continue to grow, from stitches to repair the body, to replacement bones, blood vessels, and skin. Still, there is reasonable worth in considering a sociohistorical perspective connected to geographies distinct from the Galenic west. When or how did silk come to matter in surgery in Japan, which has a peculiar place in East Asian history of medicine for working around Confucian-based rules that cautioned against puncturing the human body, which was to remain intact, whole, and thus filial?

Alongside manuals and books, Dutch surgeons who filtered through the island trading post of Dejima during the Edo period (1603 – 1868) taught surgery to Japanese apprentices. In that growing network of surgeons, silk sutures pragmatically connected European and Japanese medical knowledge in operations like cataract surgery by the late nineteenth century. An 1896 paper by surgeon Mikamo Mitsutaro described an operation that took ophthalmic procedures into a new direction when he described a procedure of fusing three silk sutures to pull back the skin of the upper eyelid. Four to six days after the operation, the removed sutures left behind "natural-looking" double eyelids. This iconic and early record of silk sutures in Japan signaled a shift from using stitches to repair to using stitches to enhance or transform the human body. Mikamo's use of silk sutures in surgery initiated the phenomenon of the double eyelid, which gained popularity among actresses in the 1920s and 1930s Japan, and surged again in the 1980s as pop-idols redefined Japanese beauty.

Although different materials are used these days in similar surgeries, it is clear that much of the creativity and imagination that surgery and medicine depends upon has a connection to something silken. What biomedical engineers call biomaterial involves the complicated task of rendering fibroin into a malleable state that can lead to new silk architectures. Silk may seem to sit at a turning point as people continue to look into nature's clues and engineer new materials. Still, the silk suture will not disappear any time soon, especially if it must be used to fix these new objects into the body.

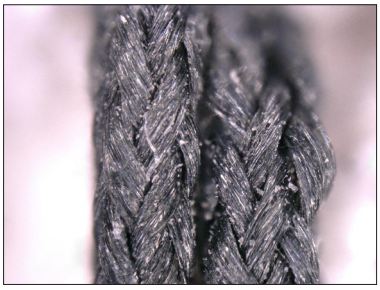


Fig. 13:a Black braided silk sutures magnified 200-fold with Keyence VHX-5000 microscope shows the texture of wax and silicone. Image: Nicole Ong Yii Mei

Fig. 13b: White braided silk sutures on Amami Ōshima silk, 50x (left) and 300x (right) magnification. Images: Nicole Ong Yii Mei

Recommended Reading:

Fiorenzo G. Omenetto and David L. Kaplan, "New Opportunities for an Ancient Material," *Science* 329 (2010): 528–31.

Mikami Mitsutaro, "Gankenseikei kowaza," *Chūgai iji shimpō*. 396 Sept. (1896): 9–13.

S. Suzuki, R. A. Dawson, T. V. Chirila, A. M. A. Shadforth, T. A. Hogerheyde, G. A. Edwards, and D. G. Harkin, Treatment of Silk Fibroin with Poly(ethylene glycol) for the Enhancement of Corneal Epithelial Cell Growth," *Journal of Functional Biomaterials*, 6 (2015): 345–366.

Thomas M. van Gulik and Yuji Nimura, "Dutch Surgery in Japan," *World Journal of Surgery* 29 (2005): 10–17.

人間を繭に当てはめること
思索的な種と種の出会い

ローラ・フォーラノ
オオナガ・リサ

LAURA FORLANO and LISA ONAGA
Illustrations by NICOLE ONG YII MEI and GALINA MIHALEVA

Fitting Humans into Cocoons: A Speculative, Interspecies Encounter

What does it mean to fit the human into the cocoon? This interspecies design project uses a speculative design approach in order to understand the history of silk and silkworms in Japan around themes such as future(s), objects that move from different places and historical times, and adaptation and gender as well as familiar binary descriptors of human and non-human, real and artificial life. The silkworm's silk is regarded as a material that is biocompatible with human tissue and, as a result, it is used in the medical field in the form of silk sutures for surgery. This project shifts the attention from the human as a user of natural materials to the ways that biomaterials shape human life and its things, and how those very materials possess histories that inform this interaction. Biomateriality seems to emerge as a hyper-contemporary issue, but looking closely at this in an historical scope also shows how the designs of silk cultivation, weaving, industry, and science informed our understandings of the biomateriality of silk.

In recent years, scholars and designers have been exploring more creative, inventive and generative ways of working that draw on a variety of making and doing practices.[1] Here, making, doing and designing are themselves processes of knowledge creation and inquiry not unlike the process of writing in scholarship.[2] While our essays and images articulate the key themes in specific vocabularies, the cocoon prototype, on the other hand, allows for people to engage with these concepts in a more physical, visceral and embodied way. In design as inquiry, knowledge emerges in the studio (as well as its distributed counterparts) through new relations with diverse materials, stakeholders and spaces. In this project, fabrics, motifs and patterns in silk from the field site of Amami Ōshima, an island in Japan, make up some of the materials through which new knowledge is made in a distributed collaboration between a historian, a humanities scholar, a design researcher and a fashion designer. While the primary studio space is located in Singapore, many more geographies are linked through this project including: USA (Chicago, New York, San Francisco, Phoenix), Japan (Tokyo) and Germany (Berlin and Lüneberg).

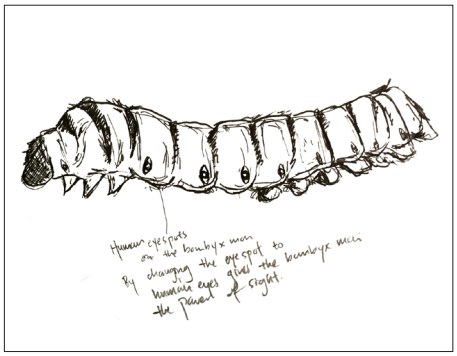


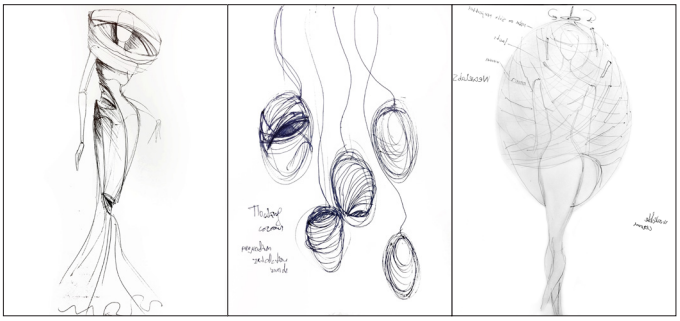
Fig. 14: The false eyespots of Bombyx mori are not for sight but for deterring predators. Silkworms appear in all sorts of varieties, and most false eye-spots are located behind the head, somewhere above the six prolegs at the front of the caterpillar body. The sketches here imagine the placement of multiple eyes in unlikely areas of the body. Image: Nicole Ong Yii Mei

Speculative design approaches such as design fiction, speculative fabulation, experiential futures and speculative civics are often used by scholars and practitioners in order to shape the creation of alternative possible future worlds.[3] Rather than using design as a mode of problem-solving, design functions here as a way of *inventive problem-making*, and poses critical questions that become articulated in the form of nuanced utopias, dystopias and situations that complicate common assumptions about the world.[4] In this project, speculation also engages deeply with historical materials, narratives and bodies.[5] Designerly ways of knowing

become explicit in this historiography as it privileges pattern synthesis, forms of knowledge available to everyone who cares to learn, and the use of non-verbal thinking in the production process. We build on discussions around posthumanism as well as multispecies ethnographies and speculative narrative forms in order to reflect upon the pragmatic and semiotic relations among humans, silkworms and fish, and ultimately, to articulate theories and controversies in a physical form.[6] The key instance of these forms is the physical—operational and epistemological—form of the eye. The prototype has an eye-like motif and shape in order to reference three specific research themes: the false eyespot of some common silkworm strains, the fish eye motif in the weavings from Amami Ōshima, and double-eyelid plastic surgery. Through this project, we have sought to understand what has made raw silk, unwound from silk cocoons, into a biomaterial that has traversed these histories to become commonly used to literally tailor the human body. Through the work of prototyping, we show how silk biomateriality results from a dynamic process of steadily changing practices in sericulture, weaving and related technologies, medicine, science, and engineering, at least.

The materiality of the piece – prototyped as a human-sized cocoon-like silk garment that can be tried on – offers the possibility of engaging in an embodied interaction that experiments with scale and fits the human into a cocoon. The design plays on what is visible, present, invisible and nonetheless present. What is real, non-real, or modified, is thus negotiated at the site of the eye. The silkworm's false eyespot draws out why this matter of biomimicry bears significance. Our interdisciplinary perspectives (again, a multiplicity of eyes) help us apply a refractive lens to understand the multiple significances of biomateriality in sociohistorical contexts. Since there is much discussion of the silk sutures fitting into the human body, we are interested in what it might mean to fit the human into the cocoon. What would it mean to "try on" the cocoon, so to speak? What new relations might emerge from this unique arrangement of organisms and materials? In this way, we can explore new ways of knowing, make scholarly debates more tangible and visible and, at the same time, find new ways of connecting with diverse audiences.

(c)



(a) (b) (d)

Fig. 15 a-d: Early ideation and design sketches by Galina Mihaleva imagined how Amami Ōshima textiles could be read to encourage a profoundly different sensory experience and historical consciousness about the protein and fiber, silk. Designs in this collection include a gown with headpiece (15a), affective sensory ornaments (15b), or a spinning habitable space as an alternative to a wearable technology (Figs. 15c, d)

[1] Celia Lury and Nina Wakeford, *Inventive Methods: The Happening of the Social* (New York: Routledge, 2012).

[2] Nigel Cross, "Designerly Ways of Knowing: Design Discipline Versus Design Science," *Design Issues* 17, no. 3 (2001): 49 – 55.

[3] For an overall approach, see Anthony Dunne and Fiona Raby, *Speculative Everything: Design, Fiction, and Social Dreaming* (Cambridge, MA: MIT Press, 2013). And for the four specific approaches, please see Julian Bleecker, "Design Fiction: A Short Essay on Design, Science, Fact and Fiction," (2009), http:// www.nearfuturelaboratory.com/2009/03/17/design-fiction-a-short-essay-on-design-science-fact- and-fiction/; Donna J. Haraway, "Sf: Science Fiction, Speculative Fabulation, String Figures, So Far," *ADA: A Journal of Gender New Media & Technology*, no. 3 (2011): http://adanewmedia.org/2013/11/issue3-haraway/; Stuart Candy and Jake Dunagan, "Designing an Experiential Scenario: The People Who Vanished," *Futures* 86-, (2017): 136 – 153.

[4] Inventive problem-making is mentioned in Mike Michael, ""What Are We Busy Doing?" Engaging the Idiot," *Science, Technology & Human Values* 37 (2012): 536.

[5] Laura Forlano and Megan Halpern, "Reimagining Work: Entanglements and Frictions around Future of Work Narratives," *Fibreculture*, no. 26 (2016): online, http://twentysix.fibreculturejournal.org/fcj-189-reimagining-work-entanglements-and-frictions-around-future-of-work-narratives/.

[6] Laura Forlano, "Decentering the Human in the Design of Collaborative Cities," *Design Issues* 32, no. 3 (2016); Eben Kirksey and Stefan Helmreich, "The Emergence of Multispecies Ethnography," *Cultural Anthropology* 25, no. 4 (2010): 545 – 576.

プロトタイプ制作のプロセス

オン・シン・ホン
ガリーナ・ミハレヴァ

GALINA MIHALEVA and ONG XIN HONG

Prototype Production Notes

Product	Amami Ōshima silk inspired garment
Medium	Amami Ōshima silk and silk surgical sutures
Method	Sewing with machine and traditional hand stitch
Year of Production	2017
Project's Title	Biomaterial Matters

Fig. 16: The prototype is a hooded garment outfitted with long sleeves with embroidered extensions. These pay homage to the silkworm's prodigal silk glands that generate fibroin and sericin proteins as well as a world of silkcraft in Amami Ōshima. Photograph shows production at the final stage of assembly. Image: Galina Mihaleva

PROJECT DESCRIPTION

Conceptual quality

Our prototype is made with authentic Amami Ōshima silk and embroidered using surgical braided silk sutures from Japan. Through our specific selection of materials, we want our viewers to look closely into the history and materiality of silk and experience the end product with their own senses of sight and touch.

Conceptual translation

To invite our audience to interact with the silk garment visually and somatically, we have incorporated small pockets with flaps on different parts of the wearable cocoon, which people can open to peer into and beneath the surface. Short phrases and words have been delicately hand-embroidered onto the inner layer of silk to reference hand-sewn sutures in medical treatments. Embroidery in Japanese and English also appear on white rouched silk that elongate the normal sleeves.

Aesthetics

We have selected geometric shapes and created three-dimensional forms in the silk garment to describe the silkworms. The "eye" on the back of the garment describes the spiracles dotting the dorsal side of the *Bombyx mori*. The hood mimics the cocoon that wraps the silkworm and the white flowing arm pieces represent the two internal silk glands of the silkworm larvae, ultimately reflecting the gracefulness and fragility of the spinning process. This fabricated mimicry aims to spur viewers to consider the meaning of silk not only as textile but as protein.

Uniqueness

Our garment uniquely combines the historical materiality of silk and its potential biomaterial uses. *Bombyx mori* silk is not only valued for its aesthetics in the form of woven fabric; it is also becoming highly valued as a source of protein suitable for use within the human body in medical treatments, from sutures and cornea transplants to cardiovascular tissue engineering, to cosmetics.

Figs. 17a-c: The source cues for this prototype include the silkworm cocoon (the surface magnified at 200x shows the texture created during the spinning process), the fish eye motif in Amami Ōshima weavings, and Tomoko Nakamichi's circular jabar. Images (left to right): Lisa Onaga; Biomaterial Matters 2017; Laura Forlano.

OVERVIEW

The prototype making process for this Amami Ōshima silk inspired garment involved a two-year process that began with brain-storming sessions that were followed by multiple development sketches, mock-ups and trials to reach an outcome.

We have made a few references to Tomoko Nakamichi's book *Pattern Magic 2* and made variations to the pattern-making process to suit the design concept better.[1] One example would be our creation of the circular jabara in an oval shape instead of a circular shape to mimic the shape of an eye. The shape of an eye has followed us closely in the making process – from the "eye" of *Bombyx mori* to the eye of the needle and to the process of threading along the contour of the "eye" as we made the oval jabara.

The "eye" on the back of the garment represents the spiracles dotting the back of the *Bombyx mori*. It can be push inwards to stretch into a longitudinal tube, mimicking the air-tubes branching from the spiracles, which acts as air vessels for respiration. In addition to the "eye" on the back, we have chosen to sew small pockets on the arm, chest and head to invite our viewers to open and peer into the garment's interstitial space as a form of interaction. On the pocket lining, we have hand embroidered short phrases and words that refer to the history and materiality of silk. Hidden beneath a flap, white silk pocket lining is meant to represent the human flesh and features embroidery made with surgical sutures to convey the idea of stitching the human tissue with silk.

The act of sewing an armpiece to the abdomen section of the garment serves the purpose to bind and wrap the garment around the wearer just as the cocoon wraps the silkworm in the larvae stage. This emotional experience of being physically surrounded by silk may vary from an uncomfortable, suffocating one to an intimate, assuring one, depending on the wearer's mind. On the front of the garment, we have a small pocket at the heart-level to encourage a closer look at the silk fabrics.

[1] Tomoko N. (2011), *Pattern Magic 2*, London, United Kingdom, Laurence King Publishing.

CONCEPTUAL DEVELOPMENT
Sketched Designs

Fig. 18: Mihaleva's design employs an oval or oculus-shaped jabara designed to signify the eye and notion of re-visualizing silk through attention to the histories of Amami Ōshima textiles and biomateriality. The garment invites the wearer to experience a perspective of being cocooned, restricted, yet considering a phase-change. In addition to the hood, sleeves snap onto the torso area in order to arrest the wearer's arm in a temporary state of suspension, as if in metamorphosis. The dress lining is fitted with boning to provide the garment with unique dimensionality that creates a feeling of isolated space. Image: Galina Mihaleva

CONCEPTUAL REFINEMENT
Technical drawings of patterns

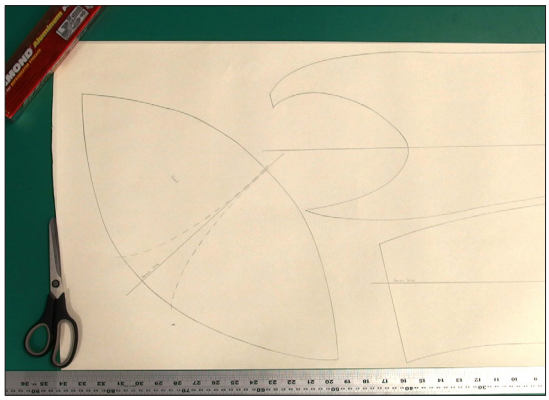
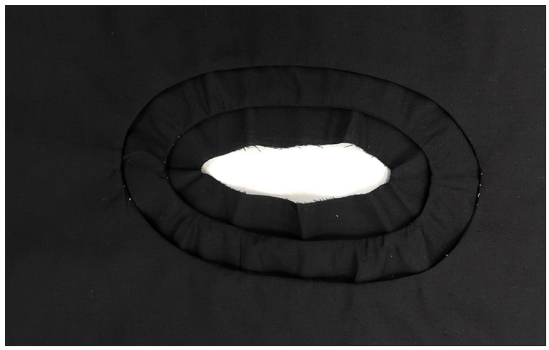


Fig. 19: The concept is transferred to paper patterns necessary to eventually cut and prepare the fabric for the prototype.
Image: Ong Xin Hong

CONCEPTUAL EMBODIMENT
Trials, errors and solutions while testing miniature models / actual scale mock-ups / prototype



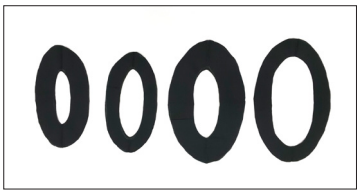
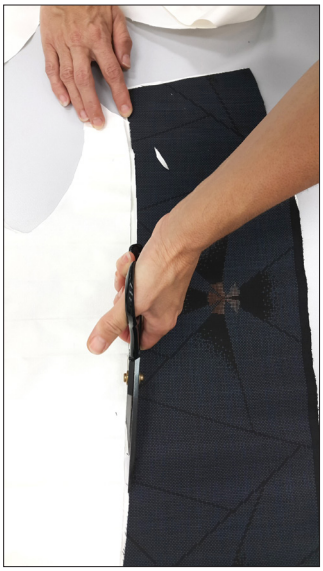


Fig. 20: Mock-up for oval jabara using slip fabric, adapted from the circular jabara pattern published in Nakamichi's *Pattern Magic 2*.
Images: Ong Xin Hong

During the trials, we encountered the following difficulties:
• misalignment of flap and pocket due to error in the calculation of allowance
• stretched fabric in stitches due to uneven tension
We had to re-stitch several times to achieve the ideal outcome.

OUTCOME:
1.2cm circumference allowance for machine sewing or 6mm allowance for hand sewing. Machine sewing achieves a more precise stitching outcome and a more accurate, neater contour; however the machine posed difficulties when turning the piece along the round edges. Hand sewing provided greater flexibility along round edges.

PROCESS WORK



STEP 1: Draw out the patterns on paper to make templates.

STEP 2: Using a chalk, trace the contour of the templates onto the outer fabric (navy blue) and the inner lining (white) before cutting the fabric along the outlines

Fig. 21: Mihaleva cuts the fabrics to make the sleeves and the back of the garment. Images: Ong Xin Hong

STEP 3: Embroider short phrases and words

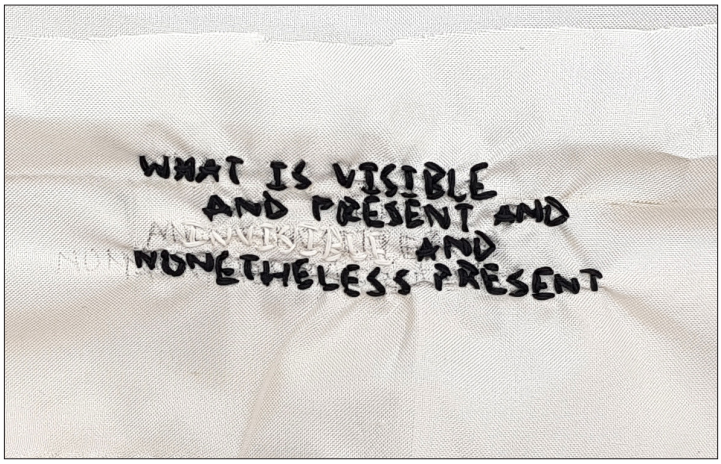
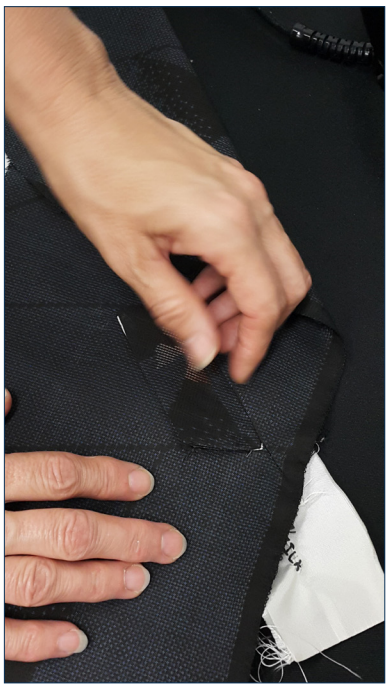
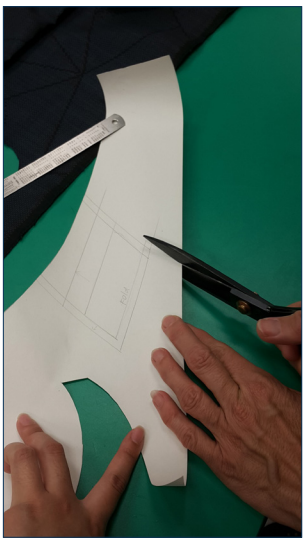


Fig. 21.1a: The kanji character for silkworm (kaiko) embroidered using black braided silk sutures. Left: The handwork employs cross-hatched stitches inspired by the Amami Oshima fish eye motif. Below: Embroidery using black and white thread to highlight writing about the prototype ideation. Images: Nicole Ong Yii Mei

Fig. 21.1b: Embroidered key terms and phrases from the project are strategically sewn into and on the prototype. Image: Lisa Onaga

STEP 4: Make the pockets and flaps





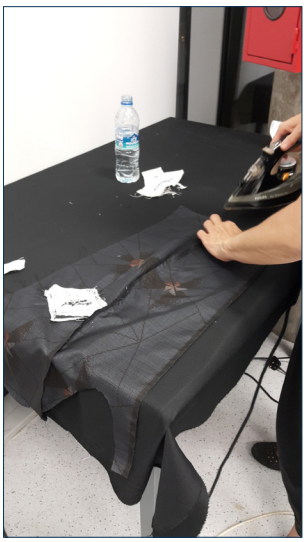
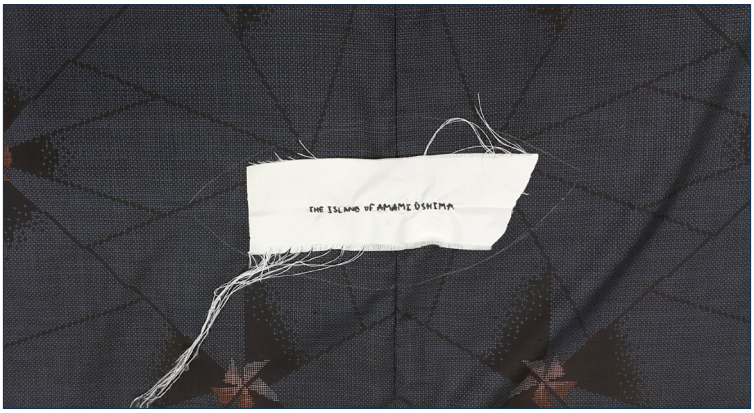


Fig 21.2: The desired pocket size is drawn and cut. The parts are sewn to the lining of the outer fabric and ironed to flatten. Mihaleva checks that the flap is aligned to the pocket. Images: Ong Xin Hong

STEP 5: Cut an oval hole in the back of the fabric, make the "eye" and sew the pieces together.



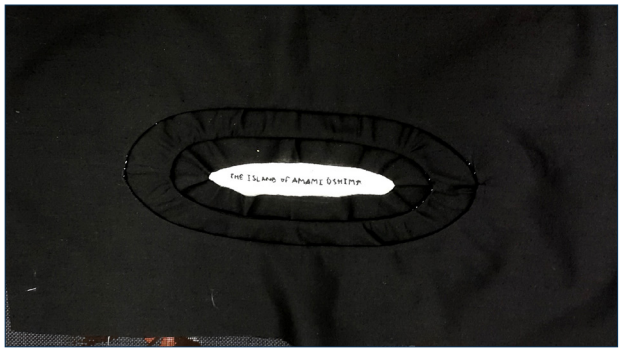


Fig. 21.3: The mock-up is used as a guide to place the "eye". Images: Ong Xin Hong

STEP 6: Attach the arm pieces

Fig. 21.4: Mihaleva would later attach the arm pieces after the embroidering completed. Note the miniature pocket on the right sleeve, which is covered by a flap in the finished piece.

STEP 7: Sew everything together

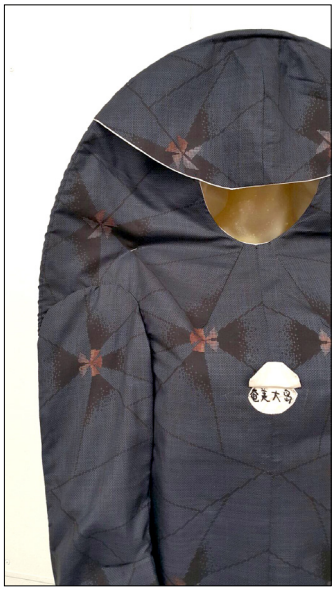


Fig. 21.5: Left: Hood, sleeves, pocket flaps, and embroidery are assembled, in preparation of the final sewing steps. A small oculus-pocket fitted with a secret word sits at the heart level of the prototype. Top right: The back of the hood exhibits an eye-shaped jabara that opens and makes "THE ISLAND of AMAMI ŌSHIMA" visible. Gently pressing into the pocket flap creates an inward accordion of concentric rings that mimic the act of breathing through the spiracles of Bombyx mori. The resulting breathing eye signifies the centrality of the island to the project of understanding how a holistic comprehension of silk as a biomaterial must reckon with histories of silk told from different material and geographic perspectives. Images: Lisa Onaga and Galina Mihaleva

地理学としての繭
一つの歴史を編む
エミリ・アンダーソン

EMILY ANDERSON

Cocoon as Topography:
Knitting a History of Gunma

I am a scholar, but I also consider myself a maker, coming from a long line of makers before me. I was raised in Japan by another scholar/maker, for my father was an artist who just as easily could have been a professional scholar, and who taught me to read copiously, study the history of place, the names of mountains, and the feel of trees, while also schooling me on the practical skills of working wood and the value of discipline. During the time we lived in a suburb of Tokyo, his love of the mountains and his work led him all over the country, and so I also visited isolated mountain villages, participated in religious rituals, and met all sorts of characters who told me their stories. To "make" about history feels right, and is a wonderful challenge to learn to find new expression through my hands—this time, not with wood, but with yarn.

My intellectual interest in the Biomaterial Matters Project—and in making for this project—stems from the ways it brings together in a serendipitous way aspects of my scholarship and my more recent creative work in knitting. While I am primarily a scholar of Christianity in Japan, I have never been very far from silk. For my research, I have visited Gunma Prefecture on many occasions to study the unique old churches that dot the landscape. For a variety of reasons, this region was home to churches starting in the late nineteenth century. These churches were mostly paid for and built by Japanese congregants, not financed by foreign mission boards. I was interested in understanding how different landscapes, topographies, and rhythms of life might shape different church ministries and even ideas and beliefs. So in addition to pouring over documents in various archives, I took to the road and drove the country highways of Gunma, visiting the now rather depressed towns that were once the center of thriving sericulture and merchant life, feeling the gradual shift from the northern edge of the Kanto Plains to the dramatic and imposing rise of the mountains that cradle the Agatsuma River gorge.

In these places, I tried to imagine the past, one dominated by a vibrant and astonishingly diversified sericulture industry. Not only is this region, like neighboring Nagano, long associated with the mighty silkworm (or "*okaiko-sama*," as they are sometimes called), but it was also home to the first modern silk reeling mill, the Tomioka Silk Filature. But today, monuments to the bounty of the silkworm, in the form of locally-sponsored "tourist attractions" and recreated dioramas, can be found all over the prefecture. You are never far from sericulture. And while the subjects of my research were only marginally associated with the various stages of producing silk, the industry is ever present in the background of the Protestant community of Gunma.

It was through actually visiting the towns and villages, looking for old churches and other evidence of the emergence of Christianity in these places, that I also felt the ubiquity of silk. On

Fig. 22: Emily Anderson's prototype design represents the topographic diversity of the parts of Gunma where sericulture was historically a key industry. The materials in the knitted object include silk thread made from saris, Amami Ōshima silk strips, and silk dyed with cochineal. The details in blue and pink are knitted to reflect the fish eye pattern frequently seen in Amami silk. Image: Emily Anderson

these trips, my father, who occasionally accompanied me—he was always up for a trip through the countryside—would point out the oversized loft spaces that sit atop many of the local old farmhouses. This is knowledge he had gained through his curiosity about the relationship between place and history. Even as I gained an increased understanding of the many layers of people, networks, topography, and social and political circumstances that laid the foundation of Christianity, I also began to see where silk, in its many forms, was always present.

Even in church histories that are more concerned with recording how faithful early members joined together to build their sanctuaries, details about silk work are inevitably mentioned in passing. An excellent example is the early history of the Annaka church, founded in 1878 as one of the first congregation-financed churches. Two of its first members, Yuasa Moyo and her son Jiro, owned and operated Aritaya, a local successful soy sauce and miso maker. Already influential, once they became Christians they turned their attention to evangelism and financially supporting the nascent Christian community.

Early stories of the Yuasas' evangelistic efforts give glimpses into the rhythms of life in a sericulture region, as well as the dominance of the silkworm in general. The Yuasas, like many other wealthy peasant families in the area, had a building (or perhaps several) on their property with the iconic loft necessary for raising silkworms indoors. When Jiro began visiting the treaty port of Yokohama on a regular basis to conduct business with foreign merchants there, he began purchasing English- and Chinese-language books, and founded the first private non-circulating library in Japan. He housed his collection in the building used to raise silkworms; after he converted and before a formal church was built in Annaka, he used the loft space in this same building to hold church meetings.

Not only did sericulture literally frame the gradual emergence of Christianity in this area, but its networks also formed evangelical networks. Yuasa's mother, apparently quite a formidable woman, traveled the region visiting her customers and taking orders; in addition to soy sauce and miso, Aritaya also sold silkworm eggs. She used these visits to evangelize her customers as well. Silk networks became church networks. And they were often intertwined: the rhythms of church life in this region were also marked by the needs of the silkworm. The small churches located along the Agatsuma gorge in the western part of the prefecture often closed during the period where all family members were expected to stand close watch over the silkworms.

In recognition of this entangled history between place, silk, and religion and the ways these have intersected my own research, I wanted to bring together the landscape and topography of Gunma in my pattern design for this project. The general shape evokes the silkworm cocoon, the source of wealth for families like the Yuasas that were able to financially support a burgeoning Protestant community in this area. The furrows and varied texture of the overall surface of the piece mimics the shifting and changing landscape of the region, ranging from the low-lying flat lands around Annaka and Tomioka, to the steep gorge along the Agatsuma River into the mountainous and cold interior. It is a three-dimensional object that can be viewed from any angle, reflecting the multi-dimensional and complex role of silk in the region. I have populated this background with the motifs characteristic of Amami Ōshima silk, the fish eye pattern, as homage to the regional diversity and richness of sericulture across Japan, and the central role silk production played in Japan's modern history.

執筆者一覧 Contributors' List

Aishah Alhadad *(research assistant)* is a recent graduate of the History programme at Nanyang Technological University who assisted with research and analysis on the histories of silk and biomateriality.

Emily Anderson *(writer/maker)* is an independent researcher and museum consultant with clients including the Japanese American National Museum, Densho.org, and the San Diego Museum of Man. She is the author of *Christianity in Modern Japan: Empire for God* (Bloomsbury, 2014) and the editor of *Belief and Practice in Imperial Japan and Colonial Korea* (Palgrave MacMillan, 2017) as well as a number of articles and book chapters on religion and imperialism in Japan and the Pacific. Anderson is also the creative behind Imoriknits, a line of knitted accessories that fuse Japanese design aesthetics with Scandinavian techniques.

Sanchir Enkhzol *(research assistant)* is a recent graduate who majored in Bioengineering at Nanyang Technological University. He assisted with the research of archival documents about sericulture in Taiwan during the Japanese colonial period and the history of silk sutures. He is extremely interested in medical technologies.

Laura Forlano *(social scientist/design researcher/writer)* is associate professor at the Institute of Design and Affiliated Faculty, College of Architecture, Illinois Institute of Technology. Forlano is Director of the Critical Futures Lab. One of Forlano's current research projects focuses on recent developments in computational fashion including digital fabrication and wearable technologies in order to understand relationships between the digital and the material, the past and the future, and the natural and the artificial.

Emiko Inoue *(translation editor)* is an MA student specializing in contemporary art history at the Graduate School of Language and Society at Hitotsubashi University in Tokyo. She is currently finishing an MA thesis on the artist Félix Gonzalez-Torres.

Laura Longo *(microscopy; textile curation advisor)* is associate professor at the School of Art, Design and Media, Nanyang Technological University. She integrates the humanities and sciences in her research on archaeological collections in order to examine the complexity of human behaviour and of coupled human-ecological systems comprehension. She has also worked as a museum professional for about 20 years, using a trans-disciplinary method of bridging communication between scientific and humanistic cultural approaches. Longo provided generous guidance and access to the use of the microscope equipment that made *Re-visioning Silk* possible.

Lum Xinyi *(creatwe designer)* is a final year Visual Communication undergraduate with a penchant for the spaces between words. Beyond the likes of design, she is a keen observer and is fascinated by human behaviour and anthropology. Lum developed the layout and design for *Re-visioning Silk* (2017).

Anne McKnight *(literary historian/translator/editor)* is an associate professor at Shirayuri University in Tokyo. She has published works on postwar Japanese fiction and activism (Minnesota), experimental Japanese film (camera obscura), and is presently working on translating a book-length memoir by the director Kurosawa Akira (Minnesota). She also runs the design-oriented press Expanded Editions, which publishes English translations of retro Japanese genre fiction, including SF and shōjo literature.

Galina Mihaleva *(prototype; fashion and textile designer)* is an assistant professor at the School of Art, Design and Media, Nanyang Technological University where she teaches Technology, Art and Fashion. Prior to joining NTU, Mihaleva taught at Arizona State University for over 15 years. Her research explores the extent to which we experience fashion (emotional, intellectual and sensual aspects) and how we might be able to accomplish a higher state of connectivity between the body and our clothing. Her work examines the idea of the body having both a physical and a psychological relationship with responsive, wearable technology.

Lisa Onaga *(historian/writer/editor)* is Assistant Professor of History at the School of Humanities, Nanyang Technological University. Onaga is presently completing a book manuscript, *Cocoon Cultures* (Duke University Press, under contract), on the historical development of sericultural knowledge in relation to silkworm genetics in modern Japan. In addition to conceptualizing the Biomaterial Matters project, Onaga is also an active member of The Body of Animals working group in the capacity of Senior Research Scholar in Dep. III, Artefacts, Action and Knowledge, at the Max Planck Institute for the History of Science.

Nicole Ong Yii Mei *(research assistant/microscopist)* is a recent graduate of the History programme at Nanyang Technological University and a Microscopist who has been assisting with the research about the history of biomaterials and documenting silk samples using the Keyence VHX-5000 digital microscope and photography. Ong's passion for the Arts is demonstrated in various sketches that appear throughout *Re-visioning Silk* and assisted with the archiving of textiles and making the embroideries for the prototype, in addition to conducting research about silk sutures.

Ong Xin Hong *(research assistant/writer)* is an undergraduate student in the School of Art, Design, and Media at NTU who assisted with the prototype fabrication. As a Product Design major, Ong is enthusiastic in the exploration of design and technology in both traditional and novel techniques.

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Eimei & Yoko Onaga
Naoko and Tamae Onaga
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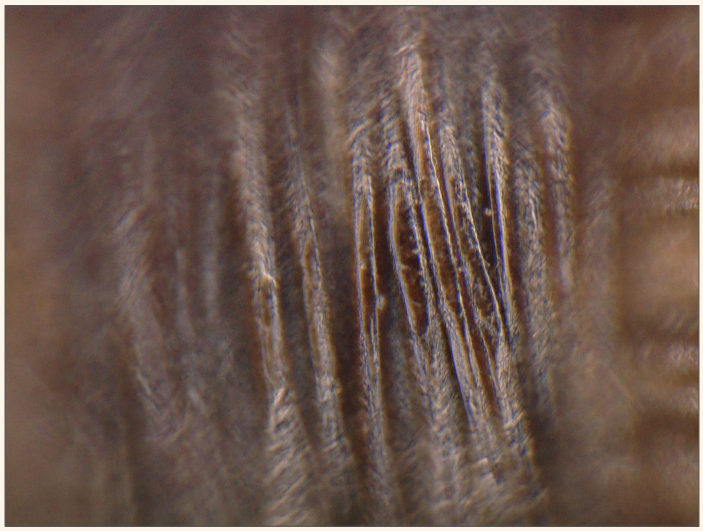
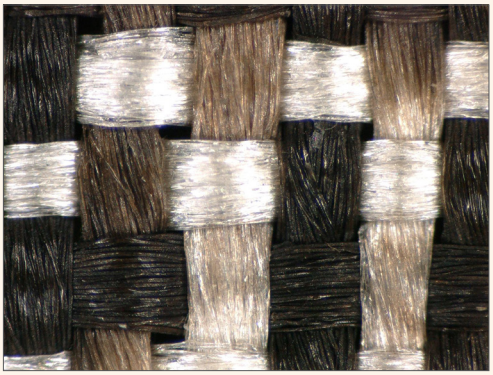
Cover Image:
Embroidery using black and white braided silk sutures by Nicole Ong Yii Mei, on plain undyed Amami Ōshima woven silk.

Back Cover Image:
"Fitting Humans in Cocoon, A Speculative Prototype," a collaborative work of the Biomaterial Matters Project, created in the studios of Galina Mihaleva.





The terrain of Amami Ōshima tsumugi silk as seen through a micrographic exploration of warp and weft, from “More than Meets the Eye”, p. 18.


奄美大島