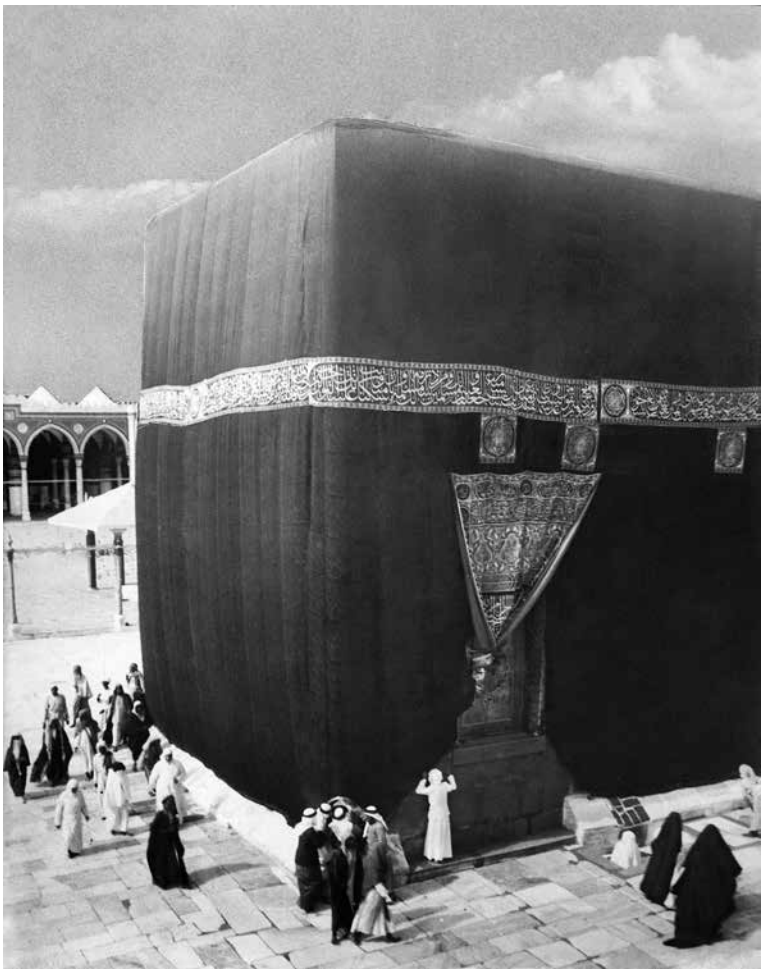
Studio Anne Holtrop

ETH Zürich

design studio **FS21**

MATERIAL GESTURE:

TEXTILE



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KAABA, Mecca, 1910

BIG AIR PACKAGE, Christo, Germany, 2013

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‘Hanging carpets remained the true walls, the visible boundaries of space. The often solid walls behind them were necessary for reasons that had nothing to do with the creation of space; they were needed for security, for supporting a load, for their permanence, and so on. Wherever the need for these secondary functions did not arise, the carpets remained the original means of separating space. Even where building solid walls became necessary, the latter were only the inner, invisible structure hidden behind the true and legitimate representatives of the wall, the colorful woven carpets.’

— Gottfried Semper in THE FOUR ELEMENTS OF ARCHITECTURE AND OTHER WRITINGS, 1851

In times of constant and unpredictable change, we look at textile as one of the most adaptive and comforting materials. Adolf Loos, resonating Semper, wrote, 'The architect's general task is to provide a warm and liveable space. Carpets are warm and liveable. He decides, for this reason, to spread one carpet on the floor and to hang up four to form the four walls.' In Loos's houses, textiles appear to also cover the windows, as he told Le Corbusier once, 'A cultivated man does not look out of the window; his window is a ground glass; it is there only to let the light in, not to let the gaze pass through.'

With textiles in architecture, the tents used by nomadic tribes come first to mind. Nomads have no conception of dwelling as a thing of permanence, and their tents do not erect a clear boundary between inside and outside. These are ideals that in our highly mobile lives are embraced (until recently), but in which we have adopted few of the tools from the nomads. Within the nomads' possessions – almost all containers, from the bags to the tent, along with the mats, rugs, and cushions – are made of textiles.

The last revival of an all-over textile presence in architecture was probably in the 70s, when fashion designers and editors, amongst others, had their

houses designed as tented interiors. Stefano Mantovani designed Valentino Garavani's penthouse in Rome, in which each room took a different, but always textile-based theme. The living room was, for example, made as an Ottoman tent, where ceiling, walls, curtains and sofa were covered in the same fabric. Possibly the hero of these interiors is Renzo Mongiardino, who designed for people like Marella Agnelli, Guy de Rothschild and Lee Radziwill, who weren't exactly embracing Hans Wegner and Pierre Paulin for their houses, but instead chose to exorbitantly furnish their interiors with pattern-rich textiles. Jonathan Anderson, whose fashion label J.W. Anderson and work for Loewe is modern in the extreme, has long counted Mongiardino among his lodestars. 'You have an entire world in his spaces, every detail considered. Fundamentally that is a modern act,' he says.

Adolf Loos pointed out in his text, 'The Principle of Cladding', the problem with building a house out of carpets alone. He argued (much in line with the tent), that a structural frame is necessary to hold the tapestries in the correct place: 'to invent this frame is the architect's second task'. 'It was in this sequence that mankind learned how to build. (...) Man sought shelter from inclement weather and protection and warmth while he slept. The covering is the oldest architectural detail.'

The ‘covering’ in architecture was rediscovered during modernism, as new construction methods became possible. Mies Van Der Rohe wrote on his design of the Two Glass Skyscrapers of 1922, that in modern building techniques, especially in high-rise, new structural principles in the form of steel skeletons are available. Designing outer walls that carry weight was therefore not necessary anymore and new materials for façades could be explored to express the gained possibilities. In a charcoal drawing of his second iteration of the glass skyscraper, the façade proposed in glass has a curtain-like expression, which hangs loosely around its inner structure. The separation of structure as a necessary support, and walls as non-load-bearing elements that define the spatial qualities, is especially interesting for us in relation to textiles. Textile, in this view, could regain its position as the main space-defining material, such as we can see in works, for example, by Smiljan Radic and Shigeru Ban.

Gottfried Semper established an argument and understanding of the origin of architecture in man’s need to cover himself, initially with tree bark and later on with textiles. The intrinsic link between the covering of a wooden stick structure to make a tent, the covering of an interior to create a comfortable and expressive room, or the covering of a whole building, all, in a way, relate

to the dressing of ourselves. We wear cloth to adapt to our environment (and recently to protect others from the spread of a virus). The style of cloth we chose is an expression of our social, personal and cultural identity, which eventually come to symbolise us. Our taste for architecture is defined by similar interests.

Anni Albers pointed out in her text 'On Weaving', the beautiful and rich characteristics of textile, from its abilities to enclose and extend space, to painterly elements, such as light, shadow and colour, to textural elements of the inherent structure of the material and our marks of working it. In order to understand what creates the material aspects of textile, we have added an extensive, though summarised, outline of different weaving techniques and their characteristics, as well as different knitting, colouring and pattern-making methods, and sewing and other binding techniques. With the focus on textile, we can study space as an adaptive environment, from rugs and tents that can be travelled with, to technologically advanced woven fabrics that can adapt to changing conditions, such as climate or acoustics. Or we can use textiles that express our personal and cultural identities and lifestyles, or those we wish to connect with. In all possibilities, textile will be our main space-defining material for the architecture we will work on in this semester.

DESIGN STUDIO

When we take all aspects of the material into consideration – the geology, the sourcing, the industry, the different properties, the craftsmanship, the specialised techniques and the cultural significance – we can deploy the full potential of the inherent qualities of the material itself and our way of working it in what we call MATERIAL GESTURE.

In this design studio, you will define your gestures of making and working with material(s) through research and experiment, and in response to the topic of the studio. You are required to produce an architecture that results from your specific engagement with the material and the spatial condition you construct with it. The architecture that results from this approach does not reference or represent something, but simply attempts to exist as a physical spatial reality in its own right.

Your research should be supported by the knowledge made available by our studio, and engaged through you with the use of available resources and facilities at departments of the ETH and from external specialists / fabricators.

Throughout the whole semester, and for your final presentation, we require that you work with physical (fragment) models of your building in the actual material(s). It is important, in this design studio, not to make a complete building, but to show and support the found values of the material engagement in a spatial way, based on the full potential of the inherent qualities of the material itself and your way of working it.

ASSIGNMENT

The assignment for this semester starts with the 'Codes of Maison Margiela', combined with our verb list of gestures of making in relation to architecture. The codes were developed by artistic director John Galliano and present a way of working that remains visible in the design process.

In 2018, we also used these codes, like 'dressing in haste' and the accents décortiqué for a new architectural identity for the stores of Maison Margiela. One of the core elements in our design was the gypsum cast in textile formwork. Due to the flexibility of the textile, the cast resulted in a different form every time. After removing the textile formwork, the imprint of the textile remained visible on the surface of the walls and columns – together with the pleats of the textile and volume of the gypsum that pushed the

CODES OF MAISON MARGIELA ① BRANDING Four white stitches of label • to bind, to knot, to inlay, to impress, to hook, to suspend, to hang, to pair, to tie, to join, to mark, to tighten, to bundle, to gather • fixtures, joints, signage, ornament **② ANONYMITY OF THE LINING** Refers to the concept of taking the lining and making it a visible element of the design- as opposed to concealing the inside you are making a feature of it. For example the lining of a man's oversized coat becomes a couture evening dress • to twist, to split, to disarrange, to lift, to expand, to light, to fold • interior as exterior, back sides, transparency, flexibility **③ UNCONSCIOUS GLAMOUR —DRESSING IN HASTE—ANCESTRAL HAND-ME-DOWNS** Began with the story of Madame Le Pidgeon sitting on a wet park bench—she was unaware of the paint imprint on the back of her outfit symbolising an unconscious glamour. The concept encompasses elements which are not conventionally viewed as elegant but give more of a sense of collateral beauty. It appears accidental or unintentional, maybe a dress is worn inside out or appears to be twisted as if the wearers was dressing in haste—the result is unconventional but effortless nevertheless. As opposed to fighting or trying to rectify a mistake you accept, embrace and glorify it. Rather than trying to achieve perfection and 'iron out the creases' we can learn to exploit the happy accidents and not just stick to what we know • to roll, to dapple, to tear, to chip, to droop, to flow, to swirl, to scatter, to wrap, to fire, to spill,

to smear, to crease, to drop, to crumple, to misplace, to splash • 'architecture without architects', patination and ageing of material, visible marks of a building process, crack, misfit, uneven surface, piling up, building mistake

④ DÉCORTIQUÉ Décortiqué is the name given to the process of taking a garment down to a skeleton or cage. All that remains is the core components which enable you to recognise what the item once was. It entails cutting around the seams to emphasis the structure and detailing • to cut, to remove, to open, to expose, to erase • structure, border, skeleton ⑤ ROOTED IN AUTHENTICITY To look to authentic garments for initial inspiration— even if all that remains in the final piece is a memory of a garment—it will provide something that people can easily relate to and identify • to simplify, to collect, to continue, to arrange, to weave, to refer • recognisable items such as door, window, column, etc, proportion, typology ⑥ APPROPRIATE THE INAPPROPRIATE Collecting references of a range of pastimes, anything from sailing and skiing to gardening and visiting the beach. Nail down exactly what it is people wear during these past times before attempting to make them inappropriate. By taking the clothing out of its intended and expected context the garment becomes inappropriate- for example what you would wear to a spa may influence what you wear walking down the street • to mix, to differ, to complement, to twist, to laminate, to bond • tent as living room, table as bench, window as door.

formwork out. The walls and columns are typical architectural elements. They are the primary space definers of the stores.

We will not work for this semester with textile as formwork material for casting, but continue an architectural exploration of the codes in relation to the assigned material of textile. We have added verbs to each code with the idea of translating the codes to gestures of making; and secondly, we have added readings of these codes in architecture. You are free of course to explore other readings and verbs.

There is no given programme for the architecture you develop, or a given site. This should be chosen in the development of your project and should support the spatial and material conditions that you have set out.

We work in a workshop-like setting where you research, design and test the proposed material and the spatial conditions you create with it. The material and the ways of making are not a presentation outcome of the design studio but rather, an integral part of a process of working, researching and designing. You are required to work individually in the design studio.

Along with many models, material experiments and research throughout the semester, the final outcome is a physical model of your work, or a fragment of it, in a scale of 1:15. The model should show the material and the gestures (the ways of making) and the specific spatial conditions it constructs. This is the key element of your presentation, along with samples of the material research and test models. You are required to display the material gesture research, drawings of the project and photos of the model alongside your model on portrait A2 sheets.

The A2 material will be collected in print and digitally in PDF format for the material gesture archive. A semester result book will be made after the presentation. From a selection of a maximum of three projects, the models and material research will be crated and archived for future exhibitions.

SCHEDULE

INTRODUCTION
Feb 23 & 24, 9–18 h

On the first day we will give an introduction on MATERIAL GESTURE and the specific topic of this design studio. In addition, we will introduce the workshop spaces, tools and give a presentation of selected works by previous students. The day is concluded with talks by Mariana Popescu on knitted formwork and Philip Ursprung on the work of Gottfried Semper. On the second day Abeer Seikaly will present her architectural work, Rebecca Jeffs will talk about her textile design practice and work at Loewe, Francesca Simone will speak on the work of Renzo Mongiardino, and Chiara Klinger Mazzarino will talk about the historical Venetian textile company, Rubelli.

STUDIO WEEK 2
Mar 2 & 3, 9–18 h

Individual discussions with Stephan and Yuiko

FIRST REVIEW
Mar 9 & 10, 9–18 h

Research and First Experiments.
In this review you will present your material research, your first experiments and ways of making.
In particular, one primary architectural spatial element, think of a column, a room, a window, a floor, a roof, a wall, etc. This element should be made in the scale of 1:15 and should relate to the materials' engagement, its properties, and spatial possibilities.
In this review, your material research will be discussed, and you are to present the sources and specialists / ETH departments involved that are essential to your research. The material research and experiments should be documented through photography, material samples, text, and drawings.

STUDIO WEEK 4
Mar 16 & 17, 9–18 h

Individual discussions with Stephan and Yuiko

SEMINAR WEEK
Mar 22–26, 9–18 h

Due to Covid 19 related regulations, no Seminar Week will take place. This week will instead be used as a 'breathing space'.

SECOND REVIEW
Mar 30 & 31, 9–18 h

Space.
In this review you will present an architecture that fully explores the material gesture with a strong focus on spatial development. We will discuss the architectural articulation and cultural significance in relationship to the material research and ways of making.

EASTER HOLIDAYS
Apr 2–11

STUDIO WEEK 8
Apr 13 & 14, 9–18 h

Individual discussions with Stephan and Yuiko

INTERMEDIATE REVIEW
Apr 20 & 21, 9–18 h

Construction.
In this review we will elaborate and speak in-depth about the construction techniques and applications that you will develop from your material research and their spatial consequences. You will be required to present your projects through architectural drawings – floor plans and sections – and initial detailed construction drawings. An individual mid-term assessment will be given to clarify what are the strong and weak points of the project. Guests will be announced during the semester.

STUDIO WEEK 10 **Apr 27 & 28, 9–18 h**	**Individual discussions with Stephan and Yuiko**
FOURTH REVIEW **May 4 & 5, 9–18 h**	**Structure.** **In this review we will continue our discussions from previous reviews of your work, together with structural aspects, construction techniques and organisations. One of the guests will be Mario Monotti, professor at the Accademia di architettura in Mendrisio.**
STUDIO WEEK 12 **May 11 & 12, 9–18 h**	**Individual discussions with Stephan and Yuiko**
FIFTH REVIEW **May 18 & 19, 9–18 h**	**Full Preview.** **The aim of the fourth review is to have a semi-final presentation of your project. The minimum requirements are: an introductory text that explains the concept of the project, drawings of a site plan, floor plan, a technical horizontal or vertical section, (fragment) model of your work with the chosen material(s), material experiments, and photographic documentation. It is important to show and support the found values of the material engagement in a spatial way based on the full potential of the inherent qualities of the material itself and your way of working with it.**

STUDIO WEEK 14
May 25 & 26, 9–18 h

Together with Stephan and Yuiko, you will work on the final presentation with an exhibition of final models, material samples, drawings and photos.

FINAL REVIEW
Jun 1 & 2, 9–19 h

Guests will be announced during the semester.

EXPERTS

PHILIP URSPRUNG

Since 2011 Philip Ursprung has been a Professor of History of Art and Architecture at ETH Zürich and Designated Dean of the Department of Architecture. He earned his PhD in Art History at Freie Universität Berlin in 1993 after his studies in Geneva, Vienna and Berlin and his Habilitation at ETH Zurich in 1999. He taught at the University of Geneva, the Hochschule der Künste Berlin, the GSAPP of Columbia University New York, the Barcelona Institute of Architecture, and the University of Zürich. Philip Ursprung served as advisor to the Swiss Federal Government as a member of the Eidgenössische Kunstkommission from 1997 to 2004. He was the president of the Fondation Nestlé pour l'Art from 2003 to 2014 and president of the Jury of Akademie Schloss Solitude in Stuttgart from 2007–2011. Since 2013 he had been president of the scientific board of Zentralinstiut für Kunstgeschichte in Munich. Philip Ursprung's research deals with the history of modern and contemporary art and architecture with a focus on North American art in the 1960s and 1970s and European architecture since the 1980s. Among other publications, he is the editor of Herzog & de Meuron: Natural History (Lars Müller Publishers, 2002).

ABEER SEIKALY

Abeer Seikaly is a Jordanian Palestinian interdisciplinary creative thinker and maker, working across architecture, design, fine art, and cultural production. Her practice is deeply rooted in the processes of memory and cultural empowerment, expressing architecture as a social technology that has the power to redefine how we engage with-and within-space. Seikaly challenges traditional notions of belonging and identity, and her work strives to be in constant dialogue with perceptions and contemporary understandings of time, materiality, and the role that women play in the shadow of a patriarchal structure. After receiving her BArch and BFA from the Rhode Island School of Design in 2002, she pursued an architecture career in luxury retail design and mixed-use developments. In 2012 she won The Rug Company's Middle East Wallhanging Design

Competition for exploring the duality between nostalgia and the labor of new craft. The following year she was awarded the international Lexus Design Award, for a performative structural system which explored the social implications of creating homes for displaced communities. In 2015, she co-founded and co-directed Amman Design Week, a participatory learning initiative that seeks to promote and foster a culture of design and collaboration in Jordan. In addition to numerous features including the MoMA in New York, the MAK in Vienna, and the Stedelijk Museum in Amsterdam, Seikaly is also a frequent speaker, panelist, and visiting lecturer.

MARIO MONOTTI

Mario Monotti graduated from Zurich Polytechnic with a degree in Civil Engineering and subsequently earned a PhD in Technical Sciences where he focused his research on the plastic analysis of reinforced concrete slabs. Since 2009 he has held the position of Professor of Structural Design at the Accademia di Architettura in Mendrisio, Switzerland. He is also the founder and owner of the Monotti Ingegneri Consulenti SA in Locarno. His company specialises in structural design in architectural contests in the public and private sectors on national and international levels. Mario Monotti works collaboratively with young architects. His name is associated with the school of Leutschenbach of C. Kerez (European steel design award 2011), the House on Two Pillars of C. Scheidegger and J. Keller (Betonpreis 2017), the National Pavilion of the Kingdom of Bahrain for Expo Milano 2015 of Anne Holtrop and many other project and exhibition pavilions.

MARIANA POPESCU

Mariana Popescu is a post-doctoral researcher at the Block Research Group (BRG) at the Institute of Technology in Architecture at ETH, involved in the NCCR Digital Fabrication. Popescu is an architect with a strong interest in innovative ways of approaching the fabrication process and use of materials.
She studied architecture at the Delft University of Technology, before obtaining her PhD at the BRG in 2019. Her research focuses on the development of KnitCrete, a novel, material-saving, labour-reducing, cost-effective formwork system for casting of doubly-curved geometries in concrete using 3D knitting.
She is the main author of the award winning KnitCandela shell and has been included in the MIT Technology Review Innovator Under 35 list in 2019.

MITUL DESAI

Mitul Desai graduated from Washington University in St. Louis in 2008 with M.Arch, followed by an internship at Studio Mumbai. This engagement evolved and continues in his work as a collaborator for publications, exhibitions and installations in India and abroad. Today Mitul has his own architectural practice and continues to engage with various design institutions in his hometown, Surat. A self-taught photographer, he rigorously documents the ever-changing Indian landscape. Cities, urban fringes, industrial landscapes, demolition, material studies and informal architecture are a few of many photographic interests that he considers crucial for his ongoing dialogue with Bijoy Jain. Architecture, photography, research and teaching are seamless and interdependent entities for his ever-growing interest in culture, anthropology and habitat.

FRANCESCA SIMONE

Francesca Simone is the granddaughter of architect Renzo Mongiardino. In 2016 she was a consultant in the curation of the exhibition (translated): 'A Homage to Renzo Mongiardino (1916-1998), Architect and Scenographer', curated by Tommaso Tovaglieri at the Castello Sforzesco, Milan. Simone also contributed to the 2019 edition of the book 'Roomscapes, Renzo Mongiardino', originally published in 1993 by Rizzoli.

RUBELLI

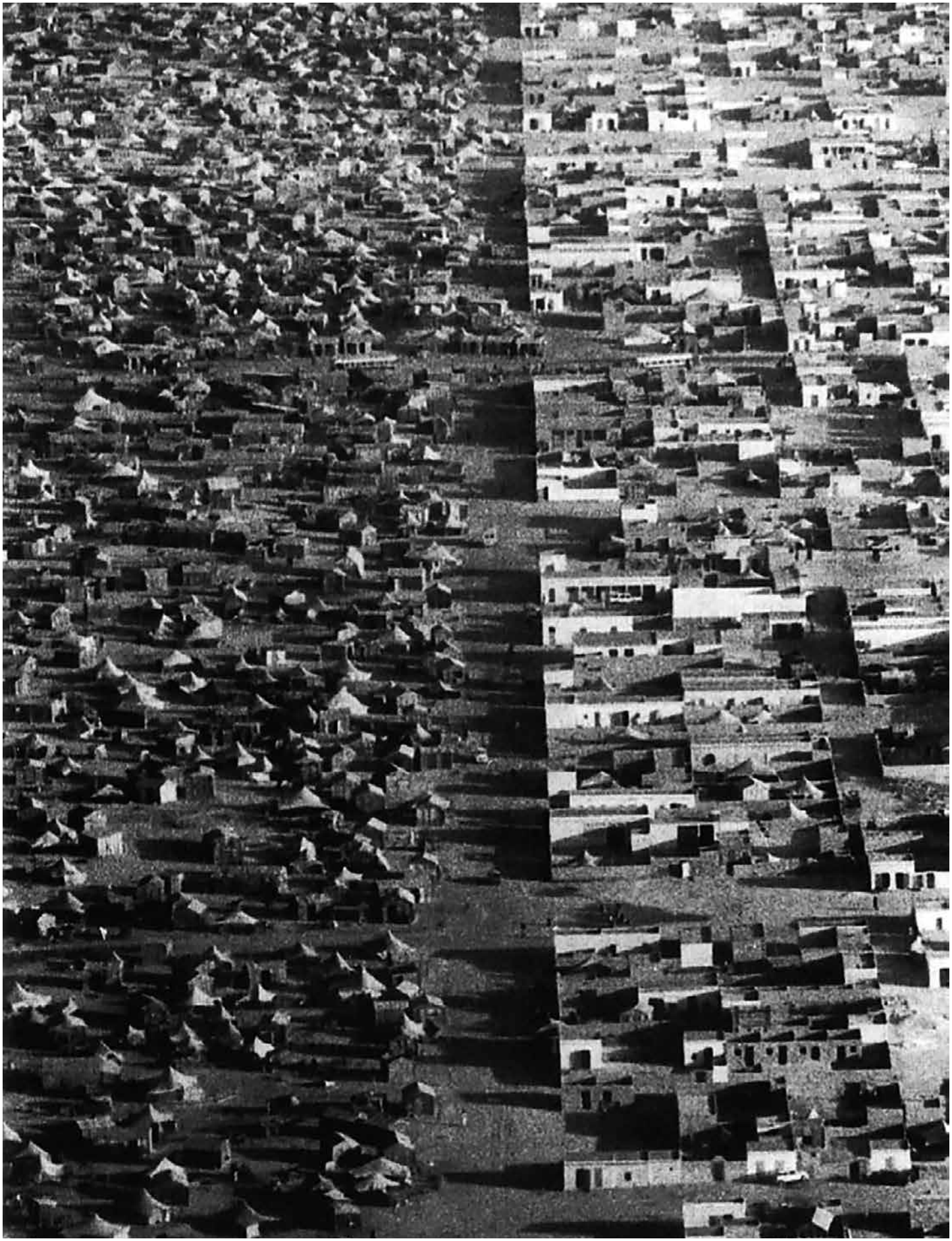
Rubelli is a historic Venetian textile company that creates, produces and sells furnishing products, in particular fabrics, for both residential and contract use. The brand portfolio includes; alongside Rubelli Venezia and Rubelli Casa, the proprietary brands Donghia and Dominique Kieffer by Rubelli, as well as Armani Casa exclusive textiles by Rubelli license. Rubelli is able to monitor all phases of the production process thanks to its style department where designers with technical, artistic, and historic skills work, and to its own mill in Como which produces over five hundred thousand meters of fabric a year. The company also owns a comprehensive historical archive of over seven thousand textile documents, a precious source of inspiration for new collections and for special projects. Rubelli has a presence in over eighty countries, With links to the world of culture and the arts, through this Rubelli supports museums and young designers, organises exhibitions, and periodically promotes events.

REBECCA JEFFS

Rebecca Jeffs is a fashion designer who graduated from Central Saint Martins University with a Masters Degree in Fashion Design: Womenswear in 2018, winning the L'Oréal Professional Creative Award with her MA Collection. The collection won praise for its innovative and tactile use of textile on the body, from fringing, embroidery, knotting, gathering and stretching fabrics, to incorporating unusual elements such as feathers and shells. Jeffs began her career in fashion with internships at Alexander McQueen, Maison Margiela under Matthieu Blazy and at Dior under Raf Simons. For the last three years, she has been working as a textile designer at Loewe in Paris, France. She specialises in incorporating textiles, embroidery and fabric manipulation into the women's and men's ready-to-wear collections, directed by Jonathan Anderson. The fabric techniques of her designs are developed by artisans around the world, including India, Italy, France, and Madagascar.

More guest critics of the midterm and final reviews will be announced during the semester.

TENTS, RUGS AND TEXTILE SPACES: A VISUAL ESSAY



NOUAKCHOTT, Mauritania, Nomads Outside the City
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NOMAD CAMP in Mauritania
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BENDER SHELTER with stove
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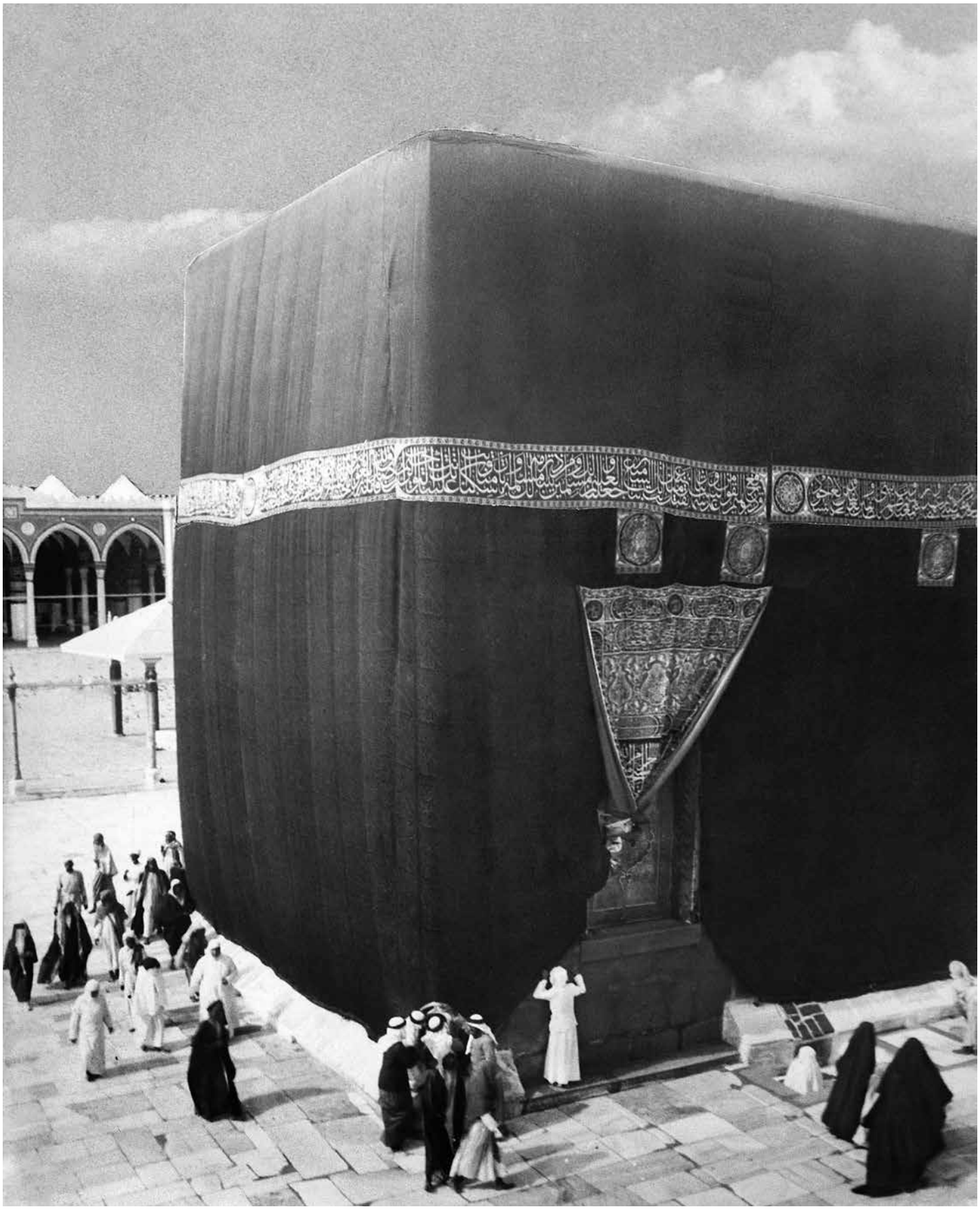

KAABA, Mecca, 1910
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BIG AIR PACKAGE, Christo, Germany, 2013
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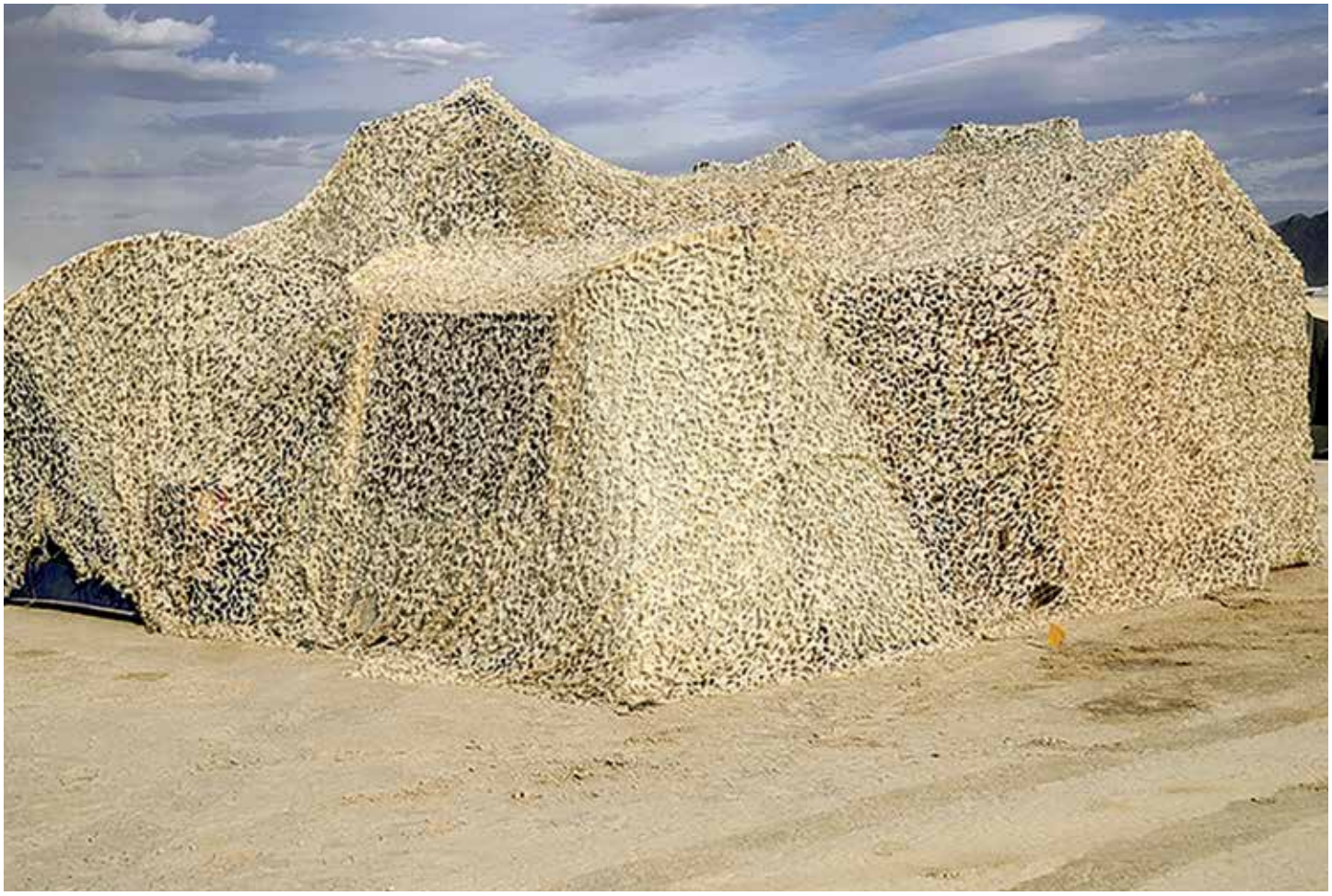


CAMOUFLAGED TENT, Burning Man Festival, Nevada

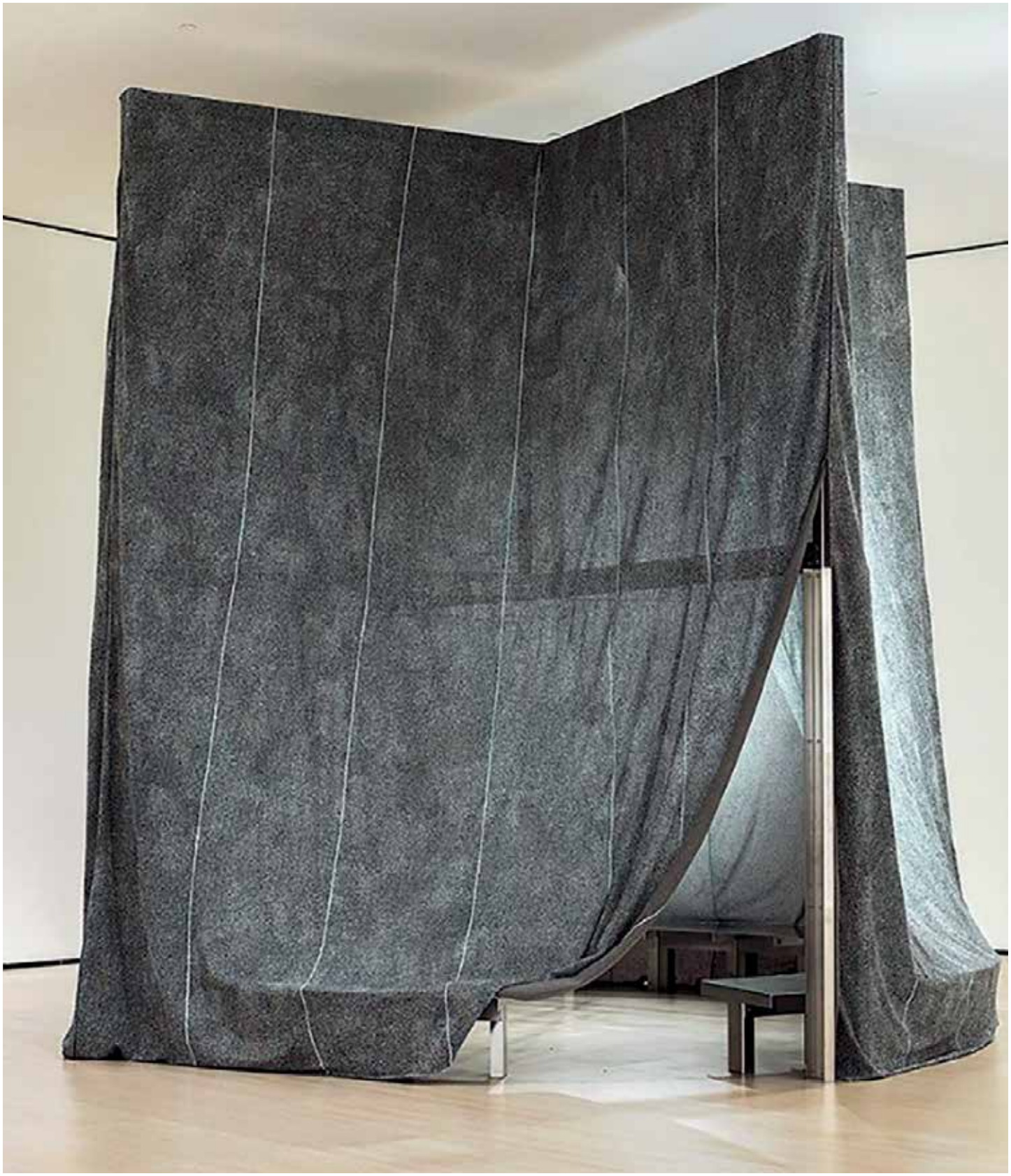
photo Philippe Glade

NOMADIC BLACK TENT

photo Safak Cakir

MONGOLIAN YURTS

photo Oleh Slobodeniuk, Getty Images



A TENT WITHOUT A SIGNAL, MOS Architects, Guggenheim Museum, 2019
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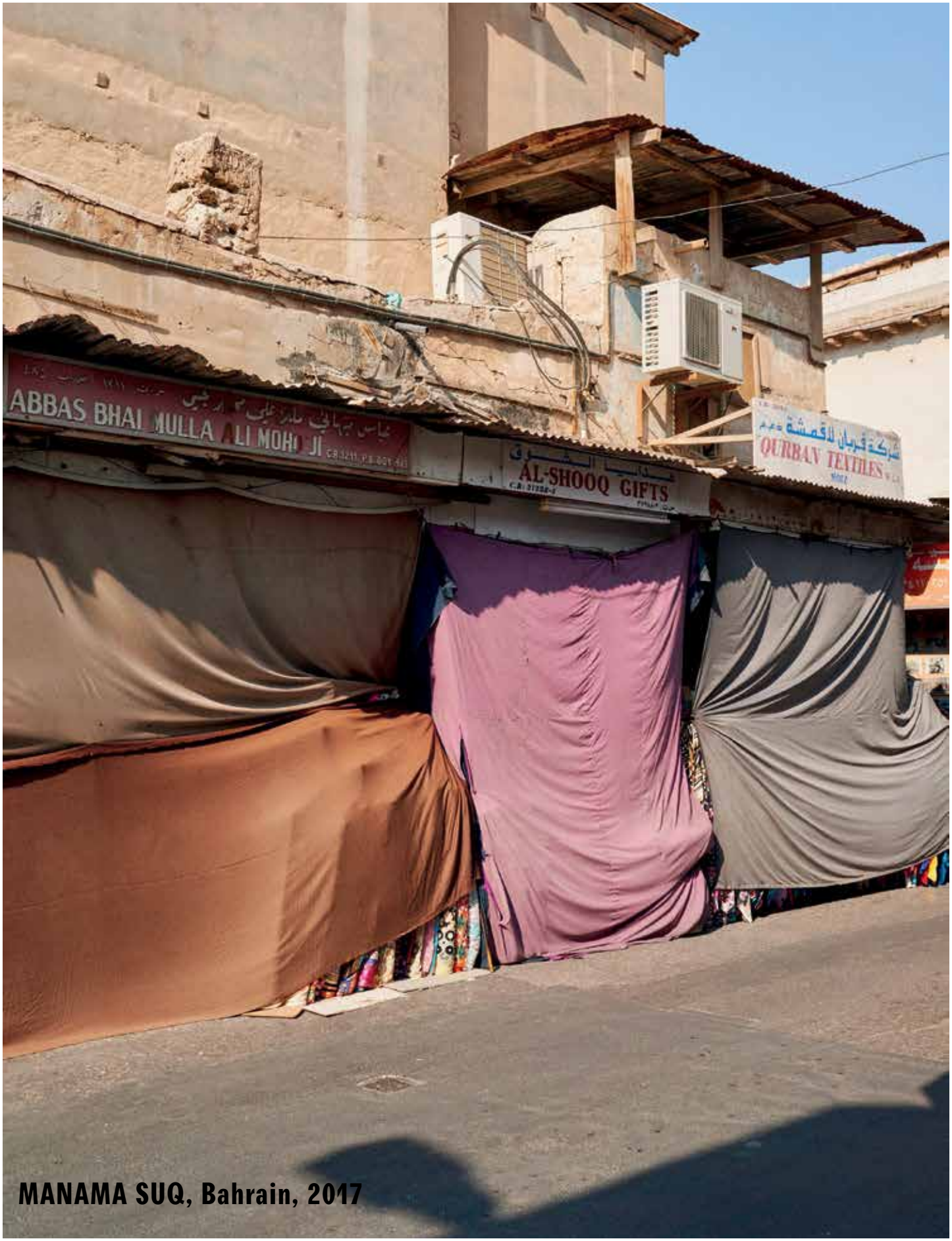
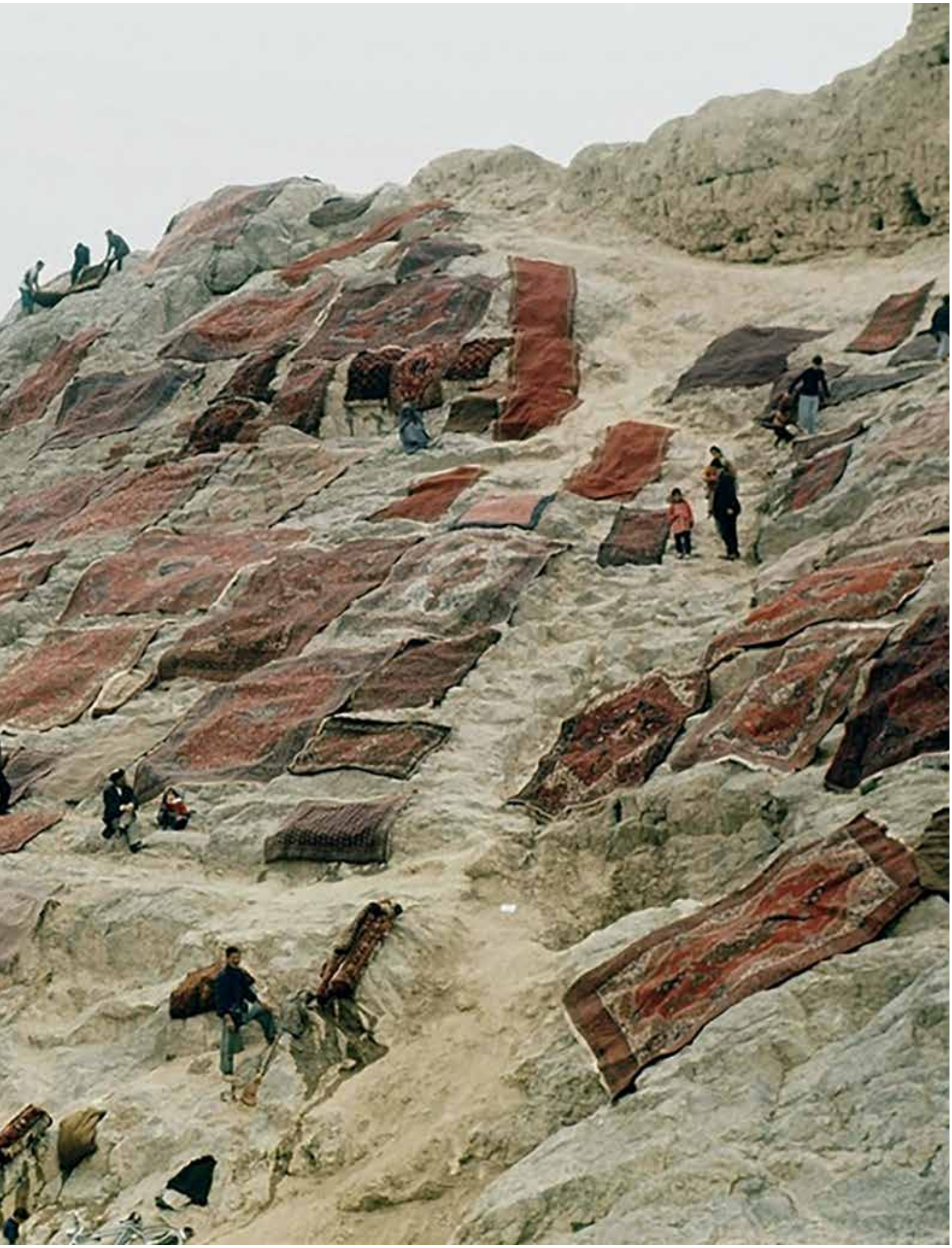
DOMESTIC UMBRELLA AS BACKYARD BAND, Eric N. Mack, 2016

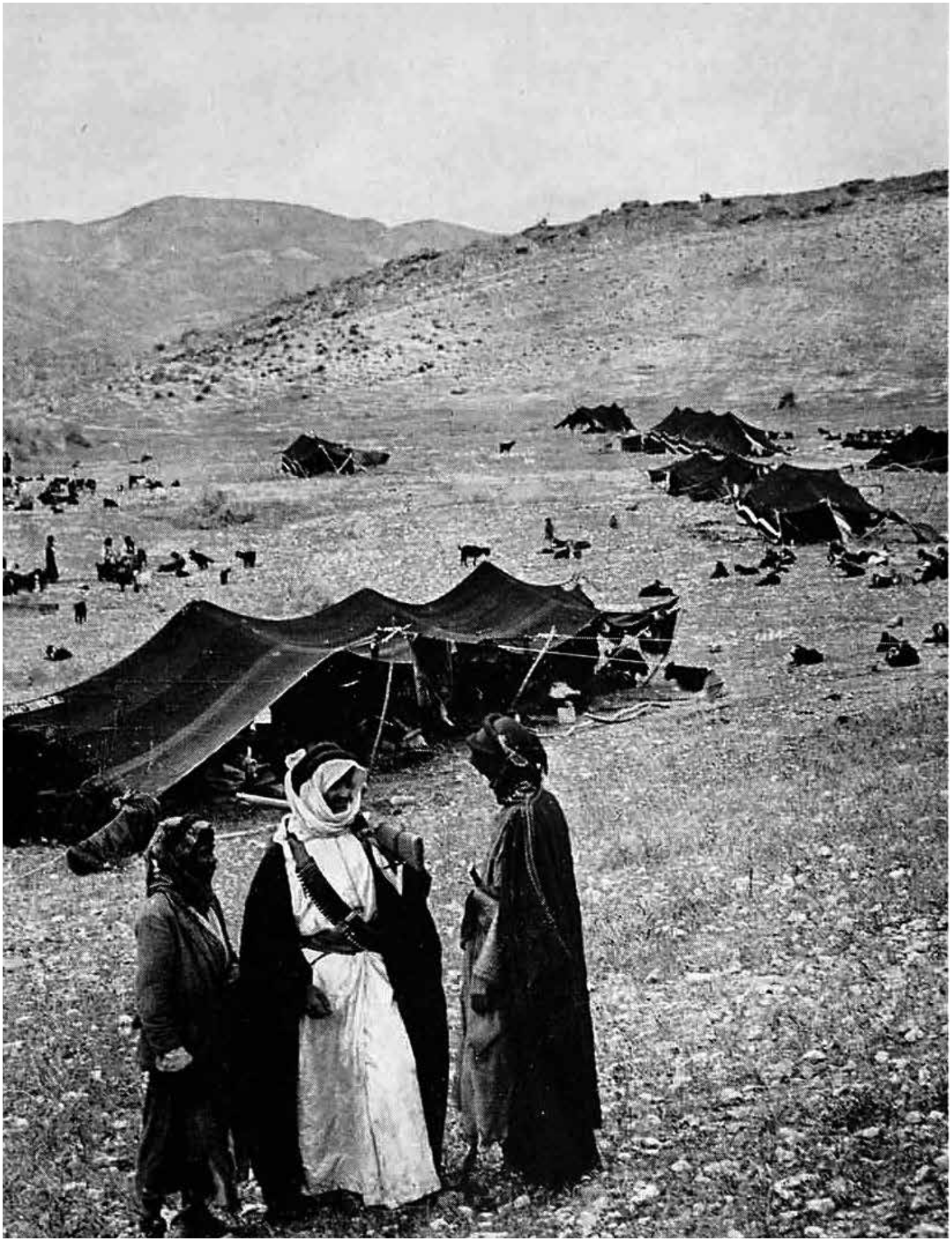


MANAMA SUQ, Bahrain, 2017

photo Fabian Frinzel

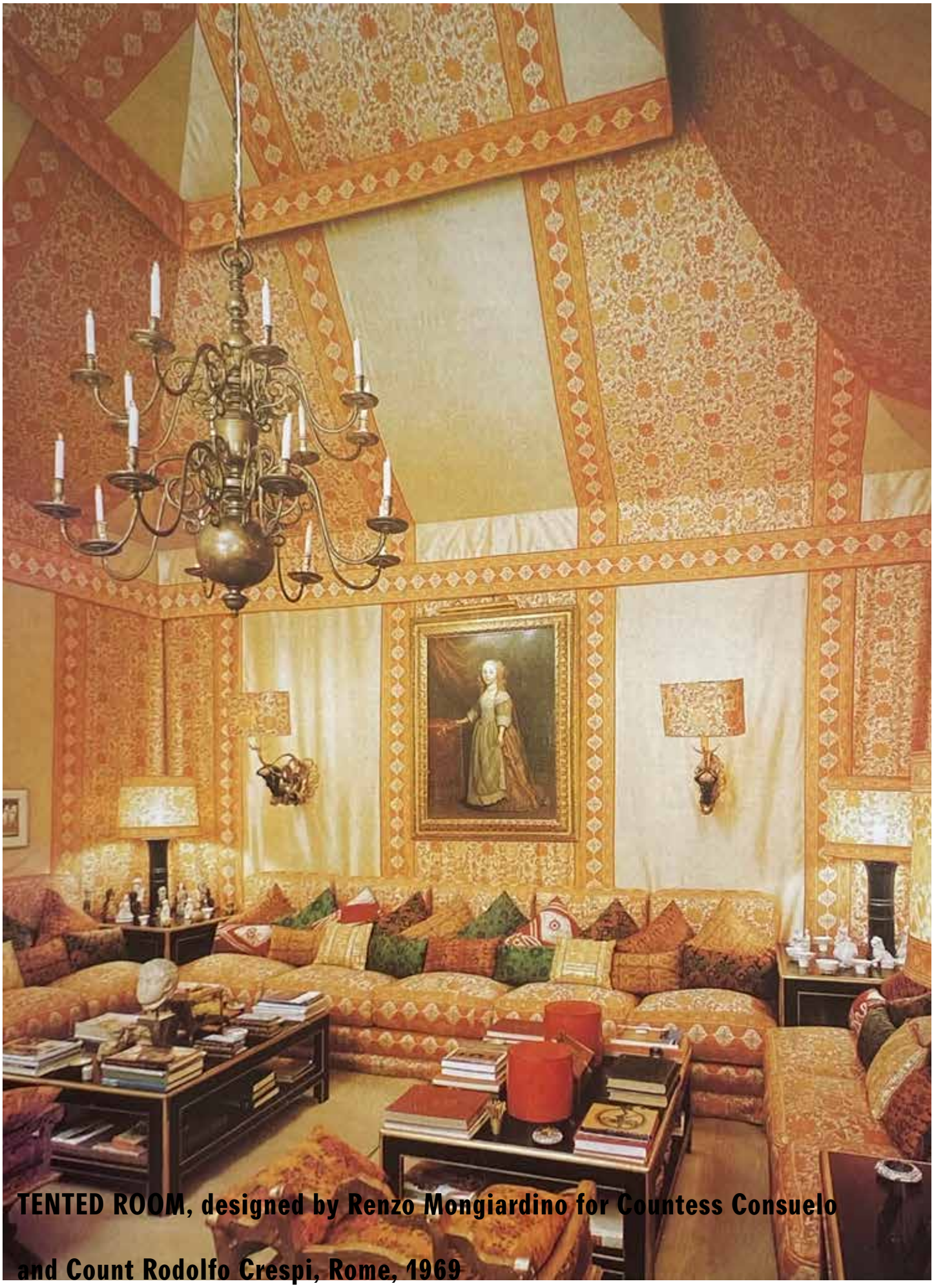
RUG DRYING AFTER WASHING AT CHESHMEH ALI, Iran



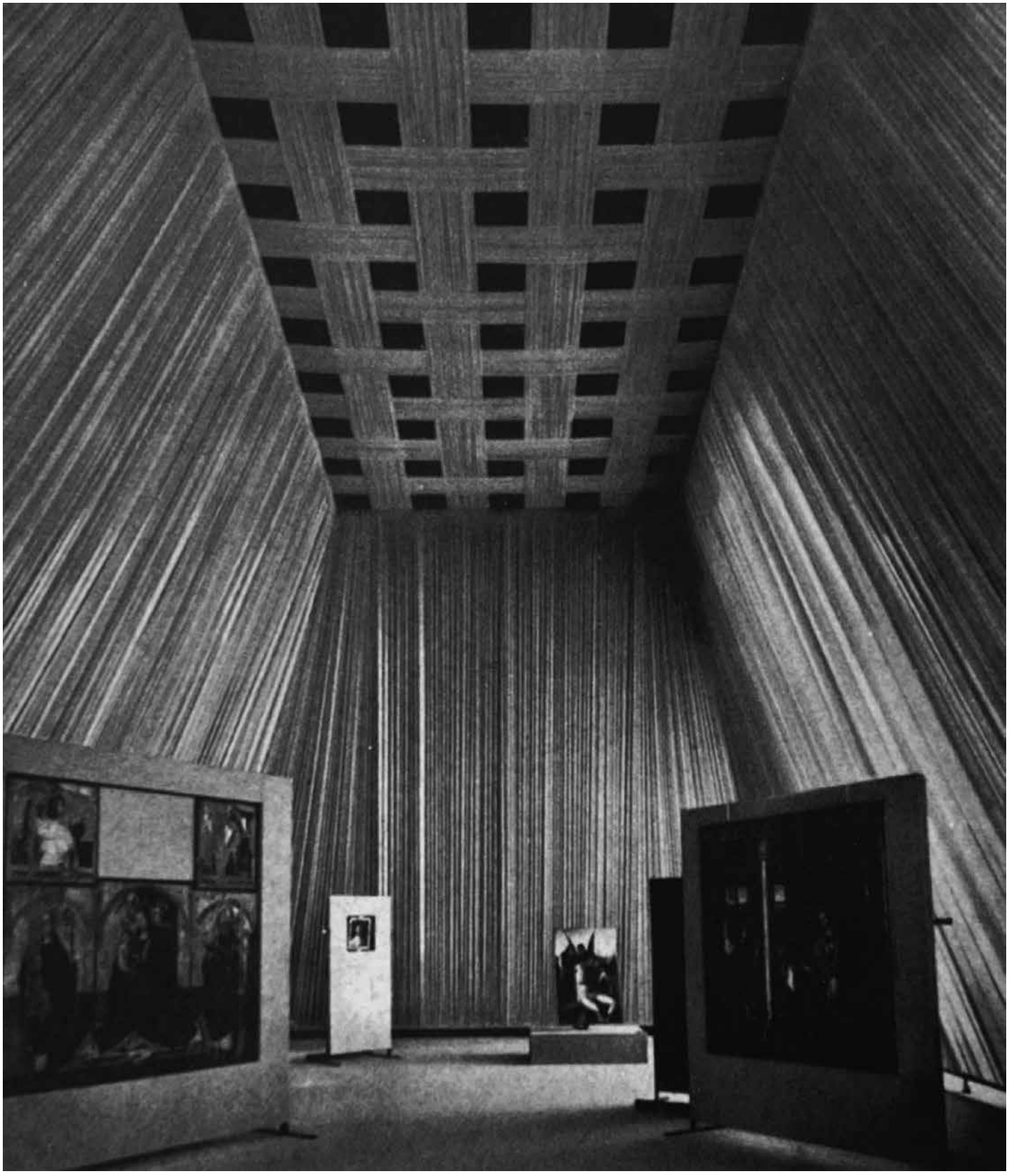


NOMADIC BEDOUIN TRIBE AND THEIR BLACK TENTS, 1922

FABRIC ROOM INSTALLATION, Studio Tord Boontje, 2007



TENTED ROOM, designed by Renzo Mongiardino for Countess Consuelo and Count Rodolfo Crespi, Rome, 1969



EXHIBITION DESIGN BY CARLO SCARPA, Works by Antonello da Messina,

Palermo, 1953
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SMILJAN RADIC, Habitaciòn, Chile, 1992
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INTERIOR VIEW OF A TWO-POLE TENT with classical Turkish embroidery,

Ottoman, part of the Dresden tent collection, before 1714
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MUAMMAR AL-GADDAFI WITH HOSNI MUBARAK, Cairo, 1999
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DOUBLE-COLUMNED TENT WITHOUT STRUTS, with canopy,

late 17th century, Istanbul
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THE TENT ROOM IN CHARLOTTENHOF PALACE, Karl Friedrich Schinkel,

Germany, 1824
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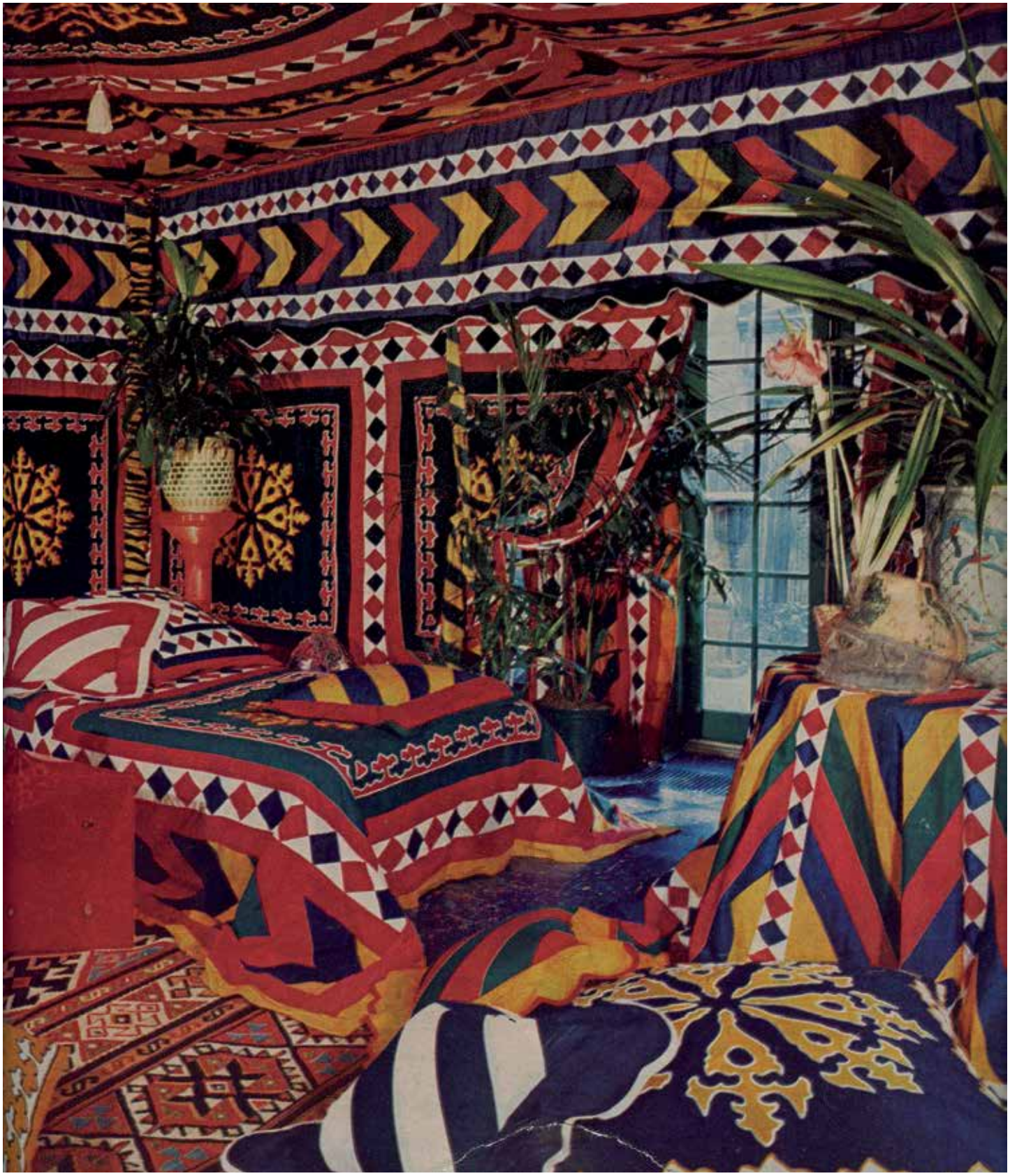
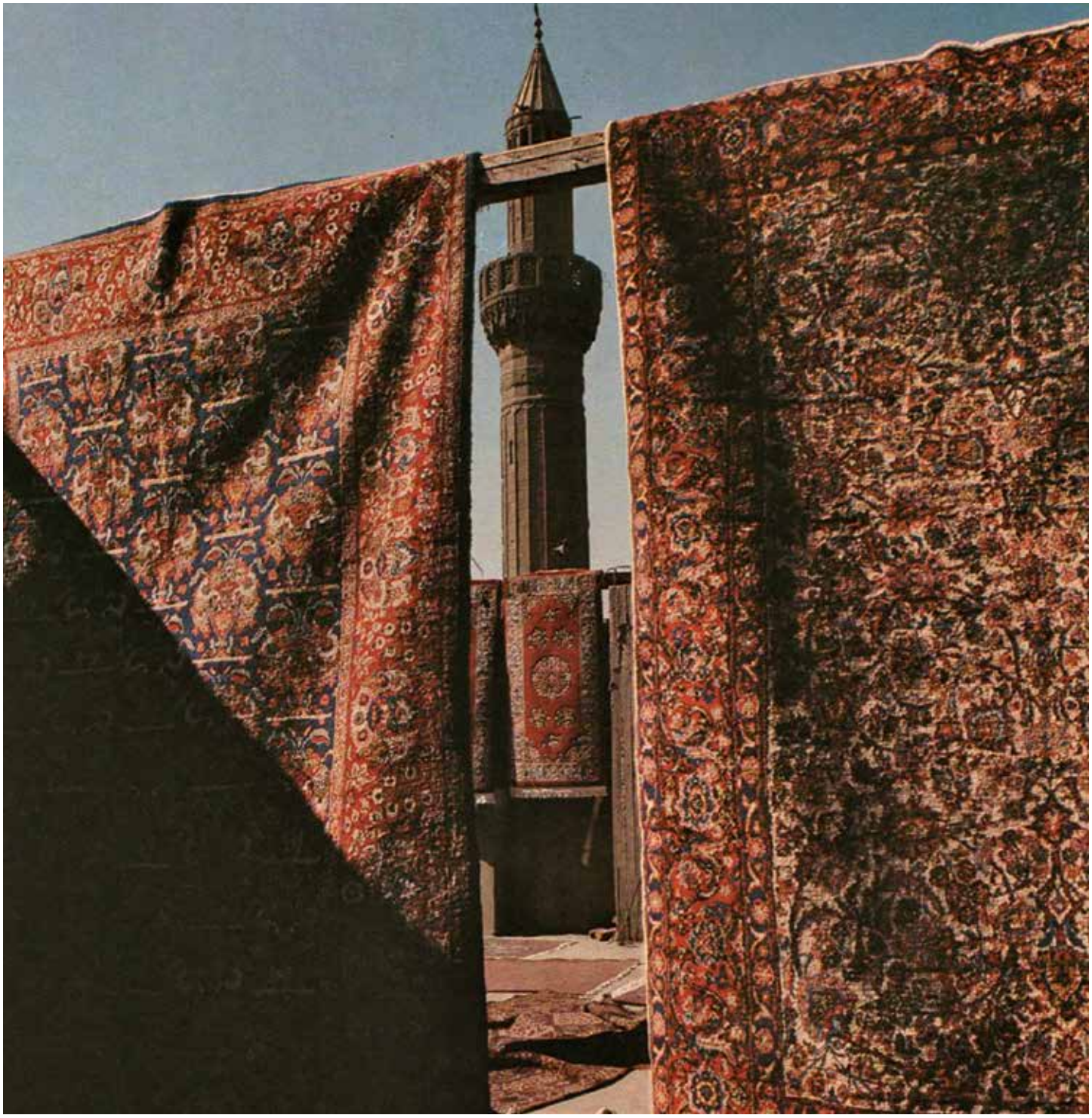


AFGHAN WEDDING TENT by Ira Seret,

installed in the New York home of Angelo Donghia, 1971



HANGING RUGS, Cairo, 1985

photo Robert Laffont

CAFE SAMT & SEIDE, Lilly Reich and Ludwig Mies van der Rohe,

Berlin, 1927
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SHAHI LAL DERA, Mughal Tent, 17th Century
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BEDROOM OF LOOS'S WIFE LINA, Adolf Loos, Vienna, 1903 (reconstruction)

photo Peter Kainz

COUNT AND COUNTESS BRANDOLINI D'ADDA in their Venetian Palazzo

by Renzo Mongiardino, 1966, photo Cecil Beaton
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LEE RADZIWILL in her drawing room designed by Renzo Mongiardino,

London, 1966, photo Cecil Beaton

INDOOR TURKISH TENT ROOM designed by Stefano Mantovani for Valentino

Garavani, Rome, 1970, photo Horst P. Horst
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Diana Vreeland in her 'GARDEN IN HELL' living room

designed by Billy Baldwin, 1979, photo Horst P. Horst

TENT WALL WITH WINDOW AND DOOR, found in Ukraine, c. 1750

ORNAMENTAL TENT WALL WITH WINDOW, Tunisian drapery fabric

17th–18th century
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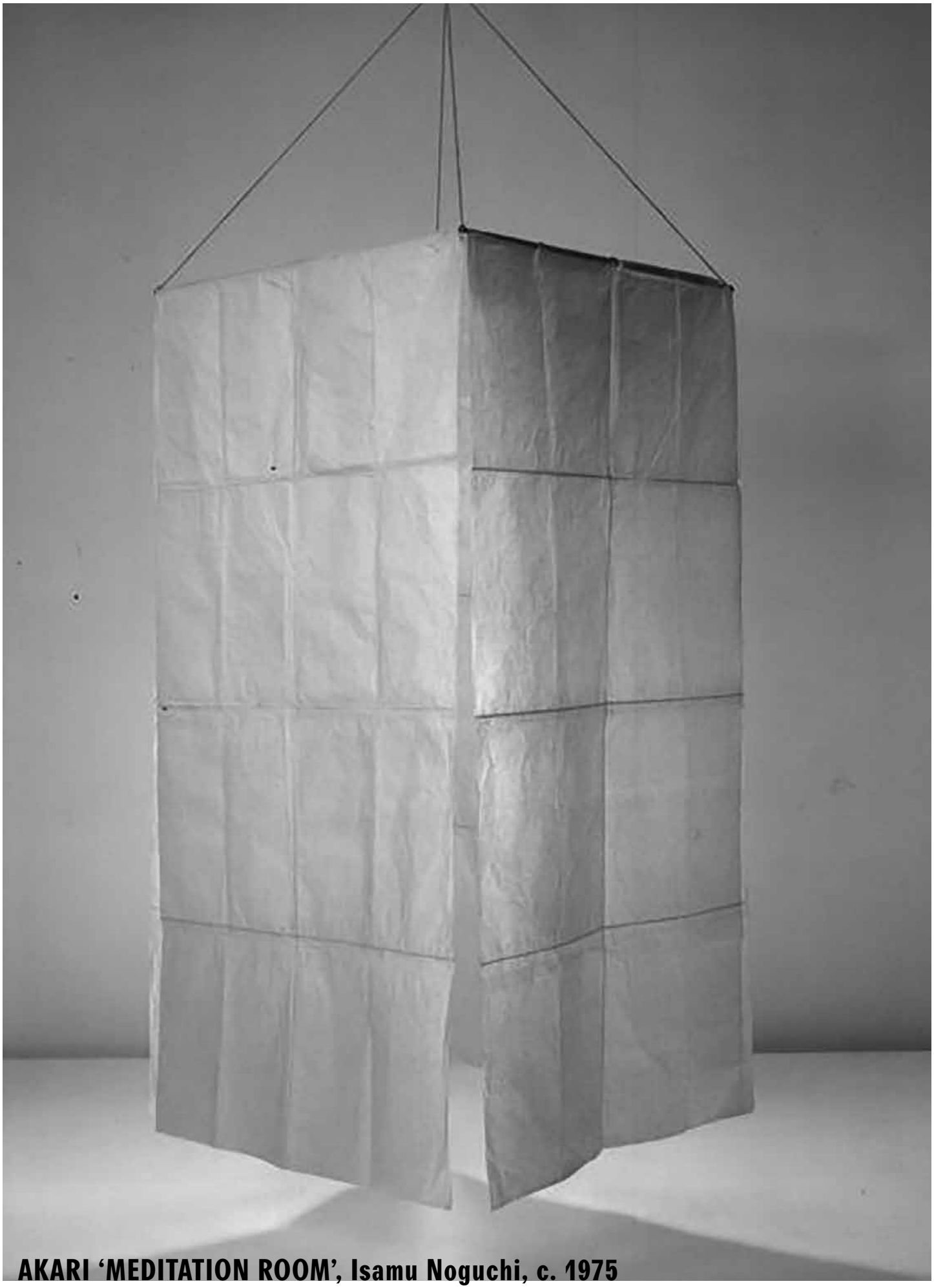

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UNTITLED, Ruth Asawa on bed working on looped-wire structure

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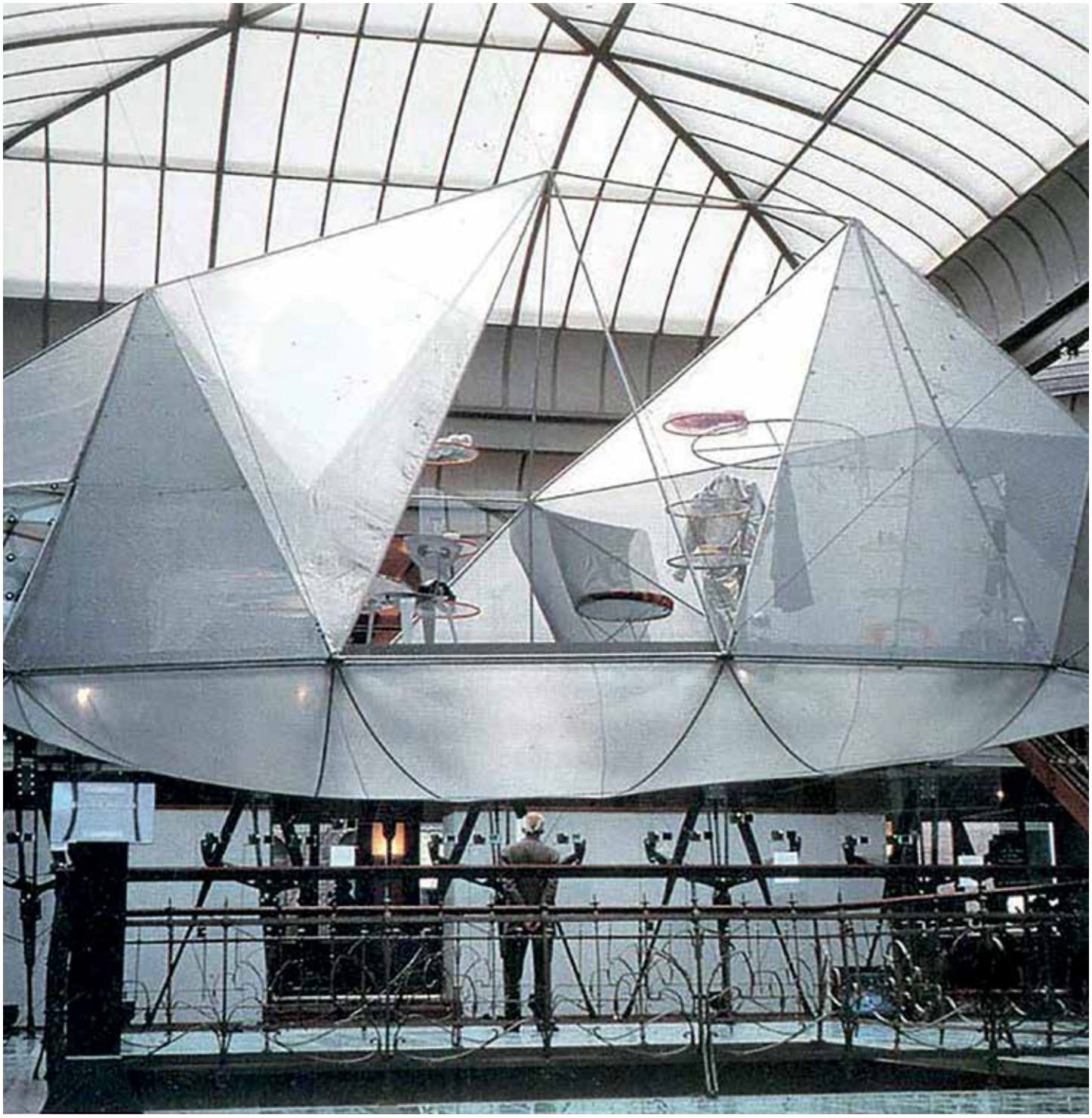

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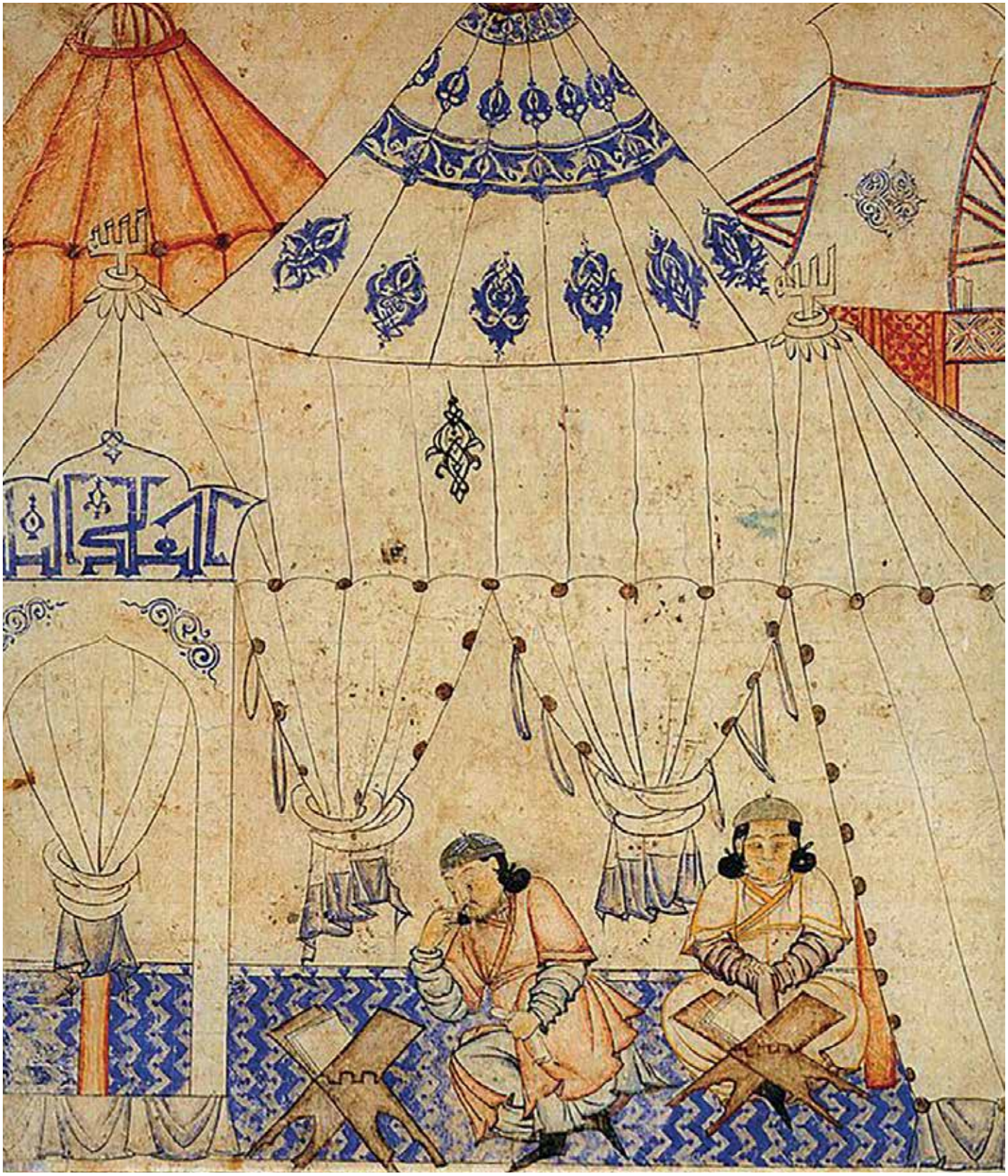

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photo George Rinhart/Corbis via Getty Images
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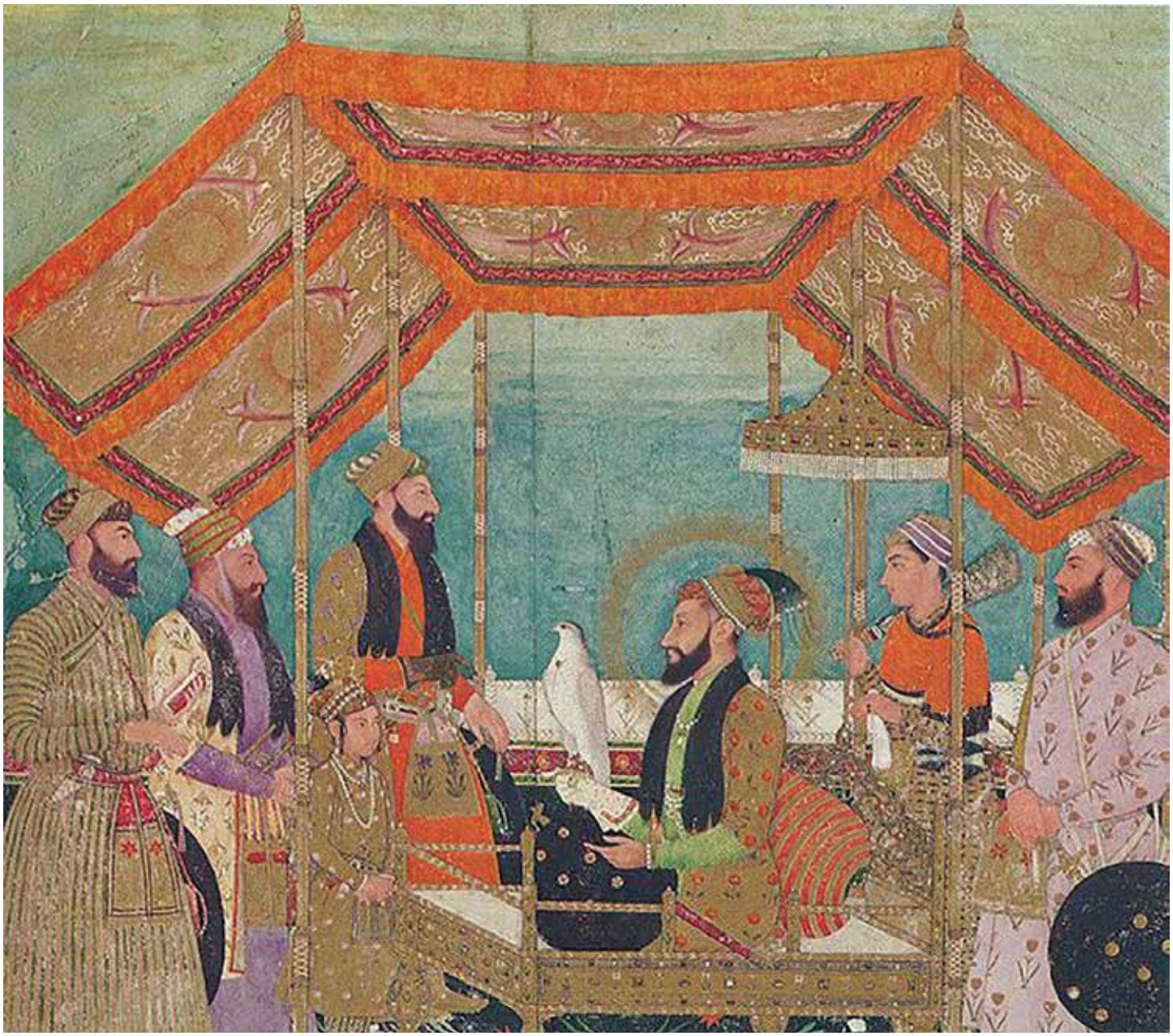

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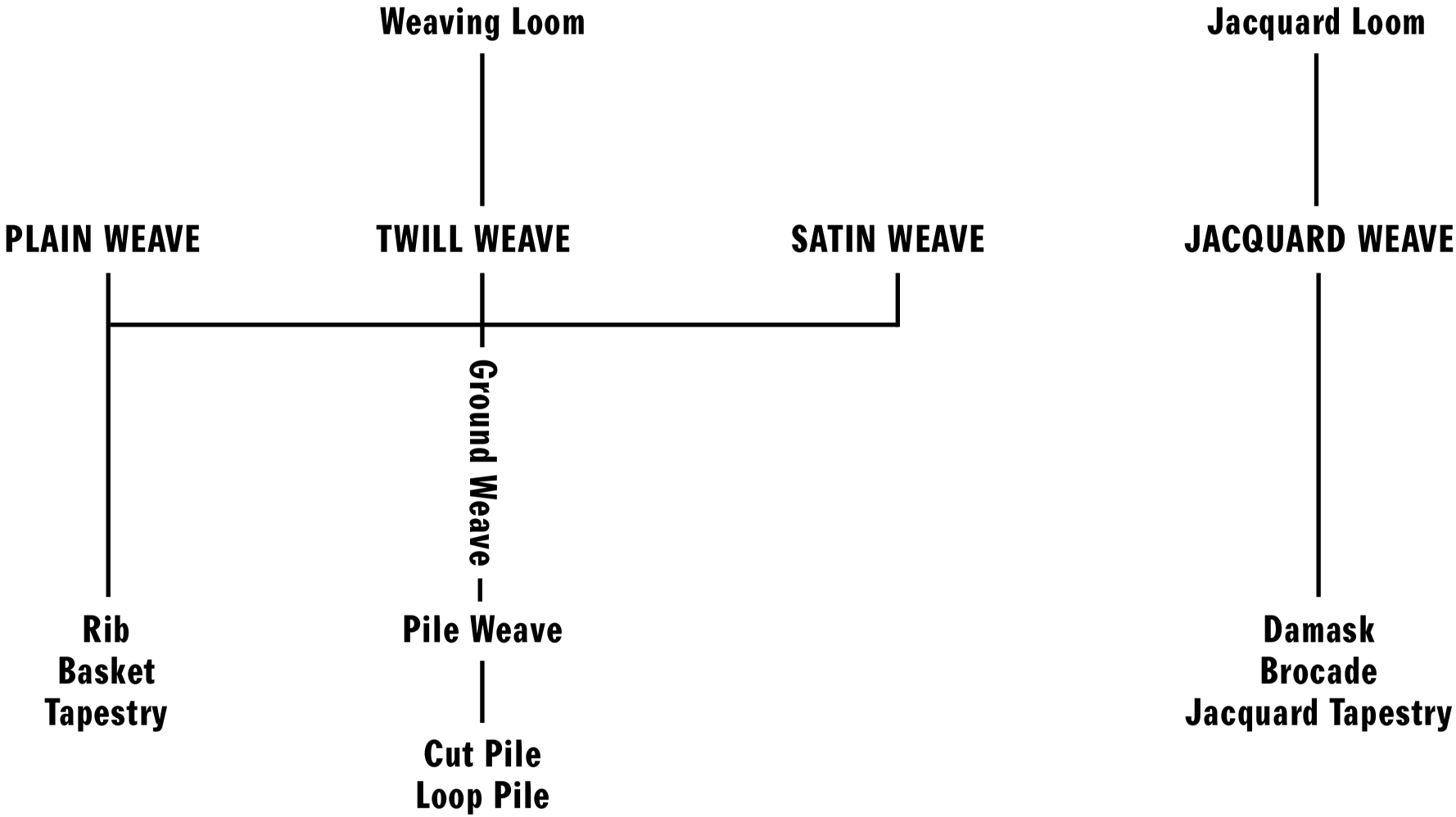
TEXTILE TECHNIQUES


Weaving Loom
Jacquard Loom
PLAIN WEAVE
TWILL WEAVE
SATIN WEAVE
JACQUARD WEAVE
Ground Weave
Rib
Basket
Tapestry
Pile Weave
Cut Pile
Loop Pile
Damask
Brocade
Jacquard Tapestry

WOVEN TEXTILES

To summarise the distinction between textile constructions: the entwining of horizontal (weft) threads around taut vertical (warp) threads is a woven fabric. If a singular thread is used to construct the textile, then it is a knit or crochet fabric, and if the threads loop and knot around each other, then it is a net fabric. Furthermore, the field of textiles can be expanded into non-woven textiles, which include felt. It is these textile constructions listed above that this semester topic will focus on.

All woven textiles stem from three basic weave constructions: Plain, Twill and Satin Weave.

PLAIN WEAVE

Construction: The most fundamental form of woven fabric, often referred to as 'calico', where the warp and weft merge in a regular fashion forming a strong, durable and versatile textile. The Plain Weave is the fastest type of weave to produce, requiring basic equipment and uses a minimum amount of thread compared to other woven fabric constructions.
Characteristics and Applications:
A plain weave is firm and inelastic, holds strong under tension and is a balanced weave with a uniform surface on both sides. A plain weave holds a rectangular or square shape well as it is stiff in nature. Light is able to penetrate through this weave easily as the warp and weft threads aren't pushed together too tightly. A plain weave should be used when strength and solidity are required without the possibility of the fabric being snagged. This is because, due to its perforated nature, it can easily be damaged if caught. Otherwise, it remains hard-wearing due to its uniform construction, making it a perfect service weave, for example, for furniture coverings, bed sheets and canvas.
The plain weave is used by nomadic tribes to build the textile roofs of their black tents, the most common nomadic dwelling. It is the most suitable type of weave as it is strong, durable and allows light in and smoke out. The black tent can be positioned into two main groups: the western Arab type, which includes the Bedouin black tent, woven using goat hair; and the

eastern Persian type, which includes the Tibetan black tent, woven using Yak hair. Both tent types are woven into long rectangular strips using a horizontal loom and then sewn together widthwise. They are then mounted and hang from tension ropes fixed at the folds of the cover and supported with exterior poles.

Rib Weave Construction: The rib weave is in essence an unbalanced plain weave, where either the warp or weft yarns are heavier. The heavier yarn allows more weight to fall in one direction, contributing to the rib effect.
Characteristics and Applications:
A rib weave builds a reversible ribbed pattern with various levels of three-dimensional texture depending on the type of thread used and the slight variations of the weaving technique. This weave is relatively heavyweight and durable unless the ribs are too pronounced, which weakens the structure, and are often used for outerwear and trousers.

Basket Weave Construction:
Fundamentally the same as a plain weave but modified so that two or more warp yarns alternately interlace with two or more weft yarns, forming block patterns.
Characteristics and Applications:
A basket weave lacks the structural integrity of a plain weave. The realised fabric is not very durable, but instead more pliable and decorative with a chequered appearance. In this way, different coloured yarns can be used to build patterns. This type of weave frays easily but drapes well and can be decorative in structure so is best used for clothing and outerwear.

Tapestry Weave Construction:
A tapestry weave is a decorative form of the plain weave where various coloured weft threads are woven back and forth forming patterned areas.
Characteristics and Applications:
Tapestry weaving is mostly pictorial in nature and builds an image that can be symbolic or purely decorative. This type of weaving is a step away from the rest as it requires a high level of freedom in terms of placing. The work is in the hand of the independent maker, expressing and transforming matter into meaning.

TWILL WEAVE

Construction: A twill weave is built by passing weft yarns under and over multiple warp yarns in an alternating sequence, building a diagonal ribbed pattern. The face and back of the fabric are normally the reverse of one another, producing an unbalanced weave, although it is possible to build a balanced twill weave. On the face, the weft diagonal pattern is dominant (weft twill

weave) and on the back, the warp diagonal pattern is dominant (warp twill weave). Derivatives of the Twill weave are: Interlocking Twills, Steep Twills, Reversed Twills, Shadow Twills, Herringbone Twills, Undulating Twills, Pointed Twills, Shadow Twills, Twill Damask. Characteristics and Applications: A twill weave is more pliable and softer compared to the plain weave. Due to its diagonal pattern, it can be stretched on the bias yet remain stiff in shape if pulled horizontally and vertically, making it an ideal weave for tailoring. A twill weave is more tightly woven than a plain weave, creating a fabric that is durable yet malleable; a perfect weave for work clothes including denim and wool tweeds, all tweed fabrics are a twill weave.

Pile Weave Construction: The most common technique for carpet weaving. Woven pile fabrics are three-dimensional structures where supplemental threads are woven into the ground weave (normally a twill) warp- or weft-wise. These extra threads build raised loops, known as a loop pile weave, that can then be cut, known as a cut pile weave. Characteristics and Applications: A pile weave produces a highly rigid, non-reversible, plush, absorbent and resilient textile, most commonly used for carpets and towels, as well as in tapestry creations.

SATIN WEAVE

Construction: A satin weave is fundamentally the same as a twill weave but modified to produce fewer tightly woven intersections of warp and weft. A satin weave can only be unbalanced, meaning the face and back of the fabric are different, yet it is not always noticeable as the structure of the weave is not obvious and visible.To compare; in order to construct a plain weave, there is a minimum requirement of two warp and two weft threads; in a twill weave the minimum requirement is three of each; and a satin weave needs a minimum of five warp and weft threads. This means that a satin weave produces the softest and most supple fabric out of the three basic weave constructions. Characteristics and Applications: A satin weave is comfortable, fluid and very pliable, often with a glossy texture if a shiny thread such as silk is used. In stark contrast to the plain weave, a satin weave is used when a more luxurious outcome is required, such as for leisurewear and soft drapery. Sateen is a textile made by satin weaving spun yarns (often cotton) instead of filament, producing a silky glossy finish on the face of the fabric and a matte finish on the back. If it is built using cotton with a high thread count, sateen is a relatively durable material most commonly used for luxurious bedding, curtains, shirts and blouses.

JACQUARD WEAVE

Jacquard Loom A Jacquard is a textile where the pattern or design has been woven into the weave instead of being printed, stamped or embroidered. Jacquard fabrics include damasks, brocades and tapestries. The Jacquard loom is a specific weaving tool that creates custom patterns, where punch cards denote which yarns are raised during the weaving process.

Damasks Damask textiles refer to a group of woven fabrics produced on a jacquard loom. The most familiar damasks are made by combining a warp-faced satin with a weft-faced satin or, less commonly, a warp twill with a weft twill, the end result being a reversible decorative pattern where the face and back of the fabric have the same pattern but reverse colours.

Brocades Brocade is an additional technique built into a ground weave, where the added yarns emerge from the base weave and skip over a section of the fabric's face in order to form a pattern before reverting back into the weave. A brocaded fabric is not reversible as it has groups of threads that have been cut off or left floating on the back of the textile.
Brocade is most commonly created on a jacquard loom but can be made by hand in a similar way to embroidery. Brocade differs from embroidery in the way that the floating threads run parallel, either weft-wise or warp-wise, whilst in embroidery they cross over in any direction.

ADDITIONAL WEAVES

Double Weaves Double weaves are fabrics with two diverse layers, which can interchange with each-other on one side, both sides or at chosen points where the fabric's pattern requires. In this way, two differently patterned sides to the fabric are produced. Double weaves have the potential to be rather intricate as the loom has to be set up with twice as many warp threads and two shuttles, producing two different weaves that can be merged accordingly. This weaving technique is often applied to haute couture coats, blankets and wall hangings as it produces a heavy fabric.

Leno Weave / Gauze Weave / Cross Weave Construction: A leno weave is where two warp yarns twist under and over consecutive weft yarns to form a spiral pair, 'locking' each weft in place. The twisted warp threads have the potential to bundle the weave into groups, building a pattern as seen in the Anni Albers example.
Characteristics and Applications:
A leno weave is used when you want to prevent any shifting of

weft threads within loose open fabrics. It builds a gauze-like fabric which is light and breathable and, depending on which type of thread is used, has the ability to be flexible. Ordinarily used for mosquito nets, sheer, semi-sheer fabrics and casement cloths (a coarsely woven sheer fabric).

THREAD / YARN

If the weave is the construction technique and the loom is the equipment, then the thread is the building material. It is important to be aware of thread variables, how it is spun and what it is made from.
There are two main types of thread formations: spun and filament. Spun threads are built by overlapping and twisting shorter synthetic or natural fibres, like cotton and wool, into thread. The resulting yarn is hairy in feeling, less glossy and has a tendency to pill (pills are small accumulations of fibres that build on the surface of the fabric after extended use). Filament threads are built from long continuous synthetic or natural silk fibres twisted together, creating a smooth and lustrous thread. They are quite slippery in feeling and have a tendency to snag. It is important to note that fabric finishings, coatings, dyes and chemical washes are other factors to consider, which have the ability to dramatically change the dynamic outcome of a woven textile. Depending on what material fibers the thread is made from will greatly affect the outcome of the weave, such as, a soft wool thread used in a structural pile weave will produce a stiffer fabric than assumed from the nature of the wool itself. The same thread used in different weaves can produce contrasting outcomes, for example using a silk thread in a plain weave will produce taffeta, a creased and rigid fabric, but a silk thread used in a satin weave will produce satin, a very soft, luxurious and pliable fabric.
Each weave has a range of suitable partner thread types. Wool or cotton thread is most advantageous in a twill weave, as a wool thread in a plain or satin weave is likely to snag and lose its ability to preserve warmth due to the weaves being less tightly packed than the twill. Silk or cotton thread works advantageously in a satin weave, as it builds a fabric that is very workable in terms of its ability to drape. A plain weave works with a multitude of thread types, double-ply cotton threads woven tightly together build a tough canvas fabric, but single-ply cotton threads loosely woven build a muslin, which can be draped. Silk threads tightly woven creates taffeta fabric, but if loosely woven creates an organza fabric which is sheer.

TRADITIONAL WEAVING TOOLS OF NOMADIC TRIBES IN ASIA

Weaving is one of the oldest crafts in the world; a form of artistic expression and a practical survival technique that can be dated back to the fourteenth century BC. Despite the development of industrial weaving, the principle technique has remained relatively unchanged.

Loom A loom is a structure that keeps the warp threads under tension so that the weft threads can be woven through. Nomadic tribes most commonly use a horizontal loom where the frame rests on the floor and the warp threads are looped and tied around warp beams connected to stakes forged into the ground, producing looser and finer textiles. A vertical loom can often be found in villages. It is upright and permanent in structure, able to produce much more compact weaves. The nomadic lifestyle requires the horizontal loom to be readily moveable, therefore the fabric is often rolled up and transported mid-weave. Consequently, the tension of the warp threads is disturbed each time, resulting in the traditional nomadic rug having an irregular shape.

NOMADIC WEAVING TOOLS

Weaving Shuttle A tool to carry the widthwise weft threads through the taught lengthwise warp threads. It is spindle-like in form.

Tapestry Needle A needle with a blunt tip and a large eye which carries the weft up and over the warp threads. As the name suggests, it is predominantly used for tapestry weaving.

Weaver's Sword At various intervals of the weaving process, a weaver's sword is used to comb down the weft threads in order to compress and pack the fibres more tightly together.

Heddle Rod A tubular-shaped stick, normally balanced on two rocks either side of the weave, which suspends certain warp threads by looping additional strings (called heddles) by looping additional strings that are tied to alternating warp threads around the rod, thus lifting them. This facilities the weave by creating openings between alternating warp threads.

Shed Rod A flat wooden rod which separates and elevates certain warp threads, to facilitate the weaving of weft yarns.

COMMON TRADITIONAL WEAVING TECHNIQUES OF NOMADIC TRIBES IN ASIA

Asymmetric Knot (Persian Origin)
An asymmetric knot is a type of pile weave, where one end of the weft thread passes under one warp thread, it then loops over and around the parallel warp. It can either be 'open to the left', where the direction of the weft yarn is carried to the left, or 'open to the right', where the weft yarn is carried to the right.

Symmetric Knot / Knotted-pile weave (Turkish Origin) A symmetric knot is also a type of pile weave. This knot is made by looping the weft thread around two warp threads.

Weft Wrapping A weaving style where coloured weft threads are wrapped around the warp threads to form a pattern.

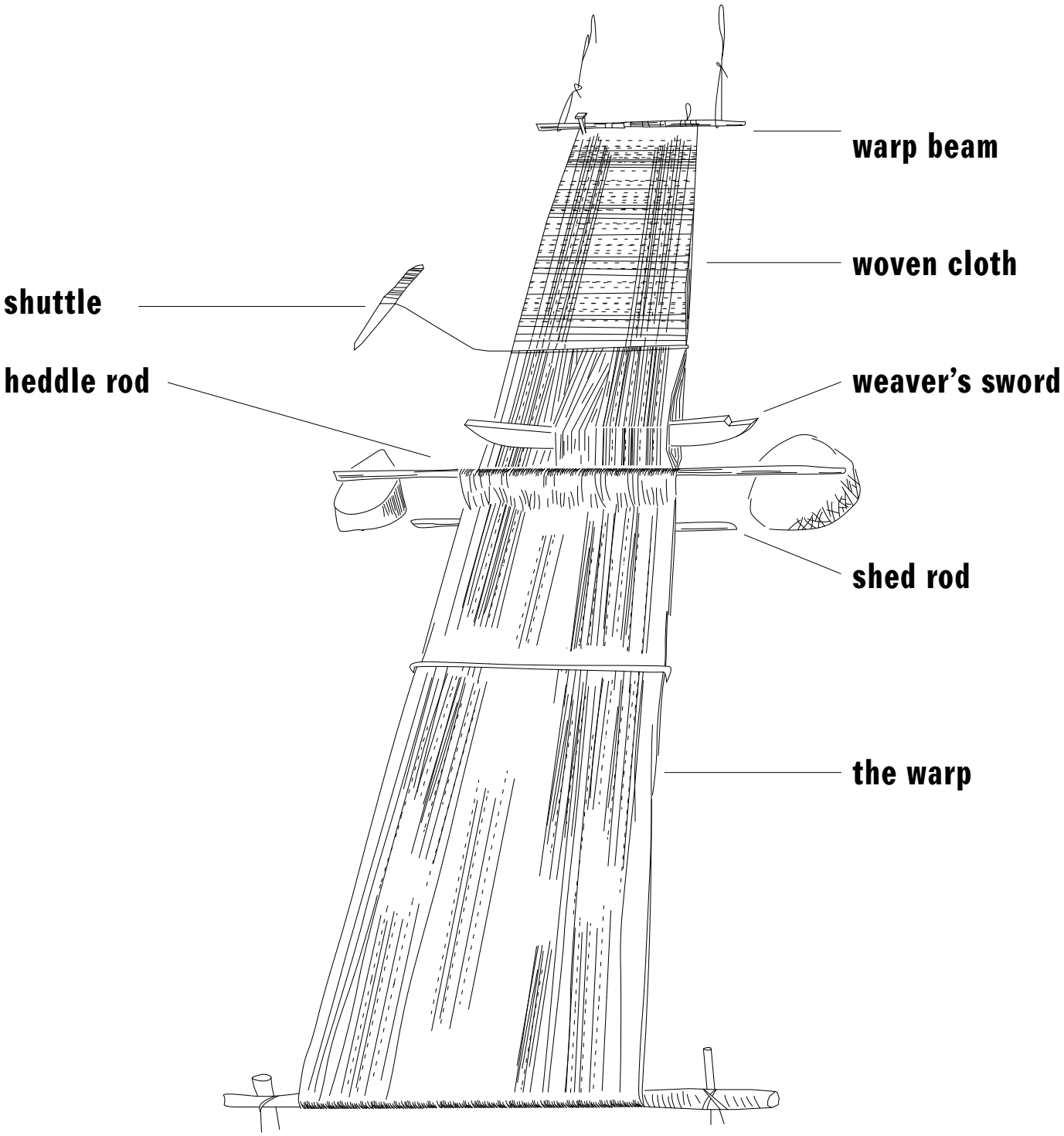
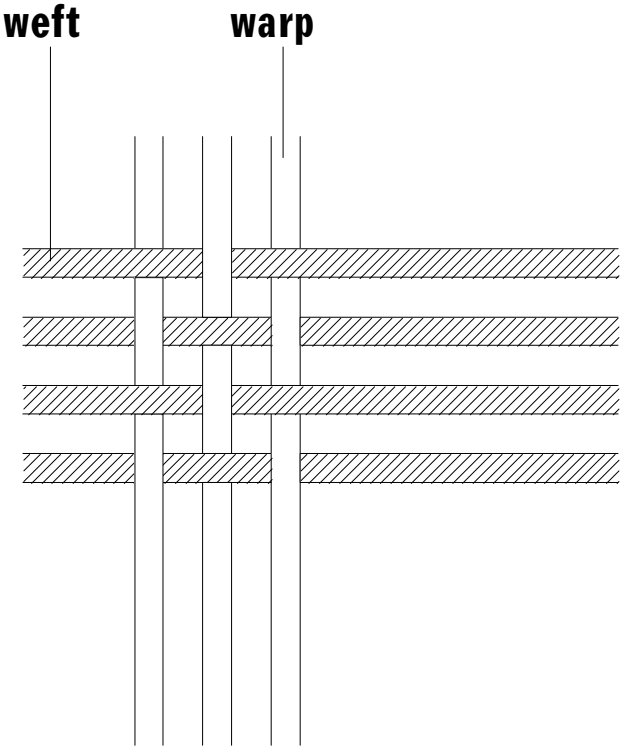
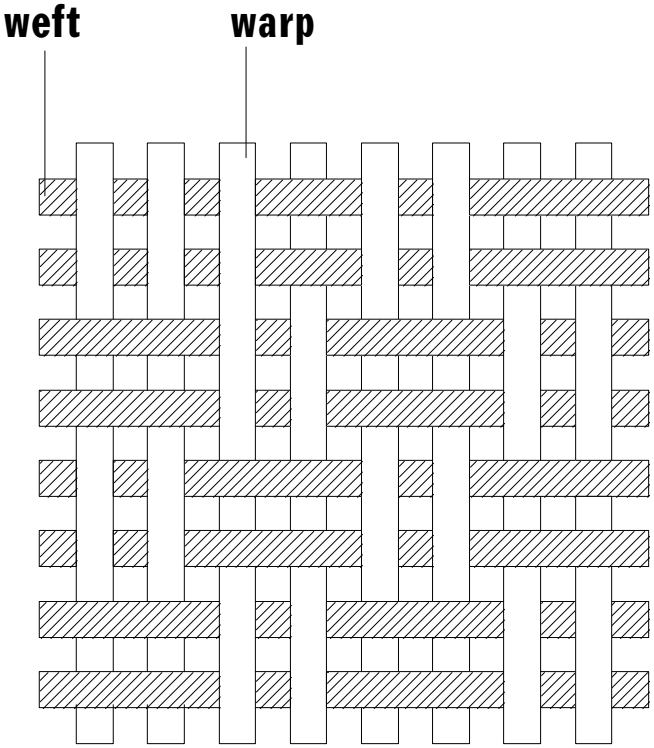
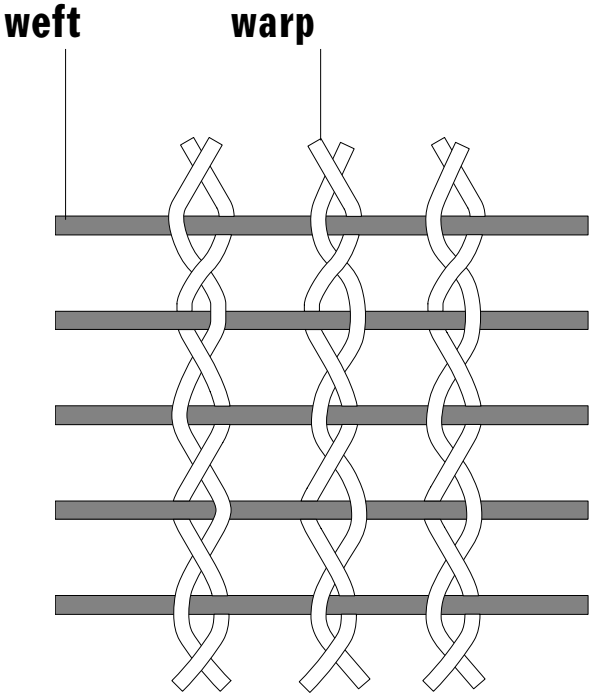


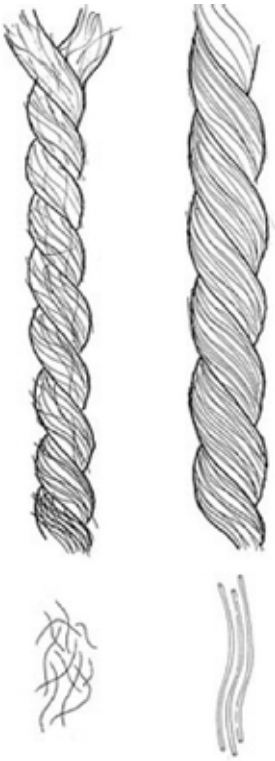
Diagram of a Nomadic Horizontal Loom



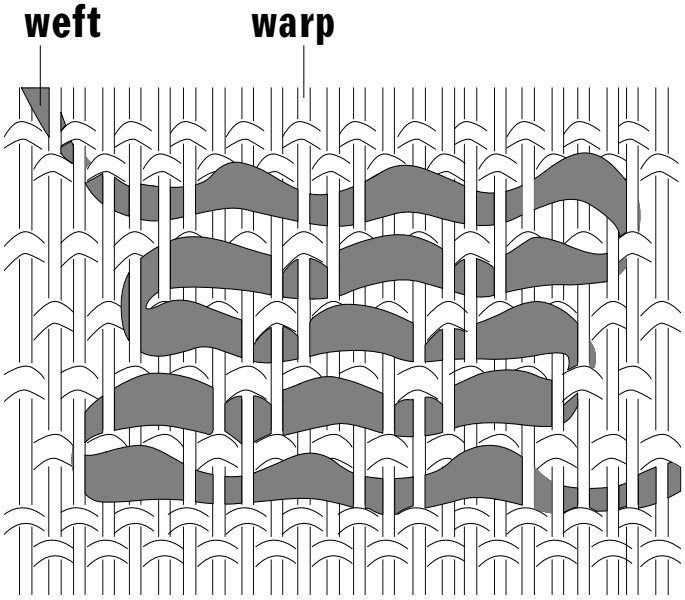


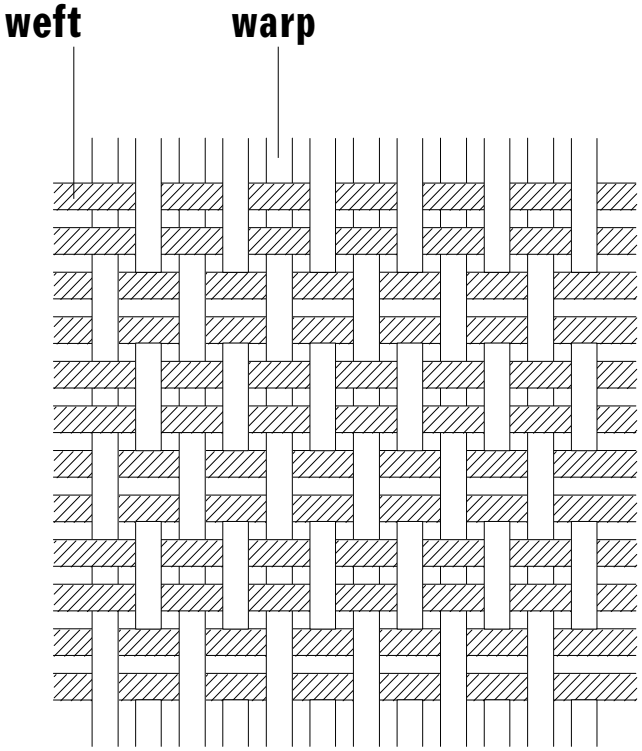
Plain Weave Diagram, Basket Weave Diagram



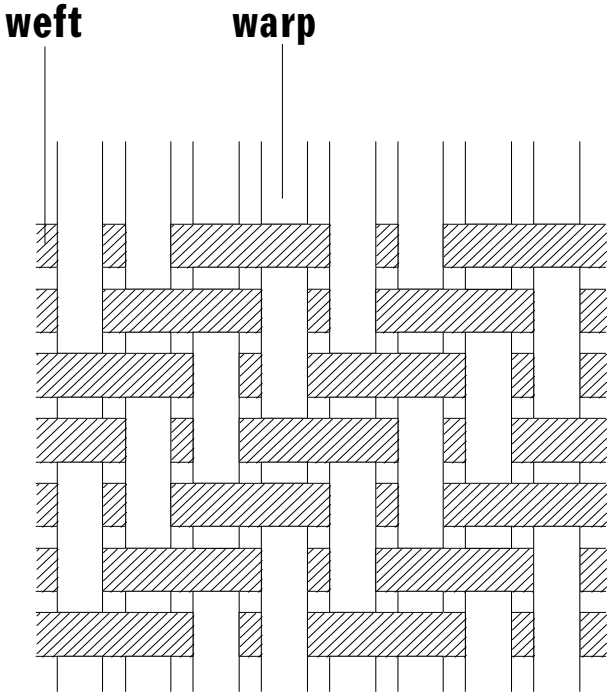


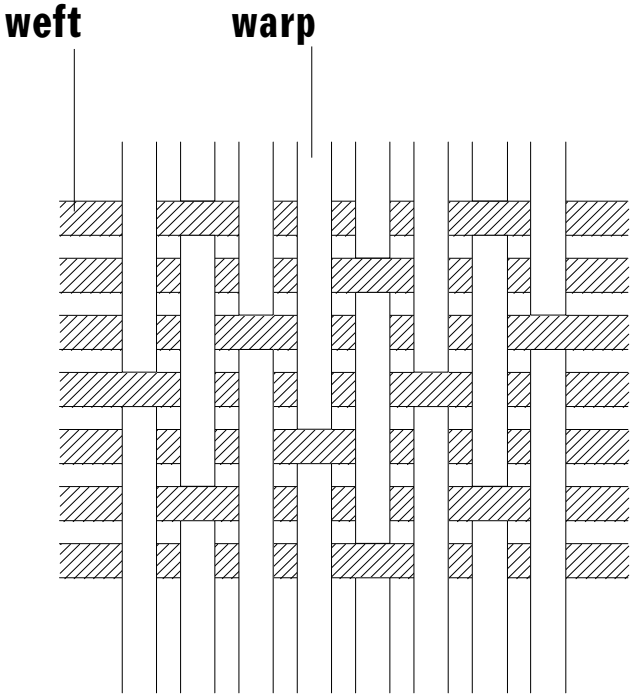
Leno Weave, Spun Thread and Filament Thread



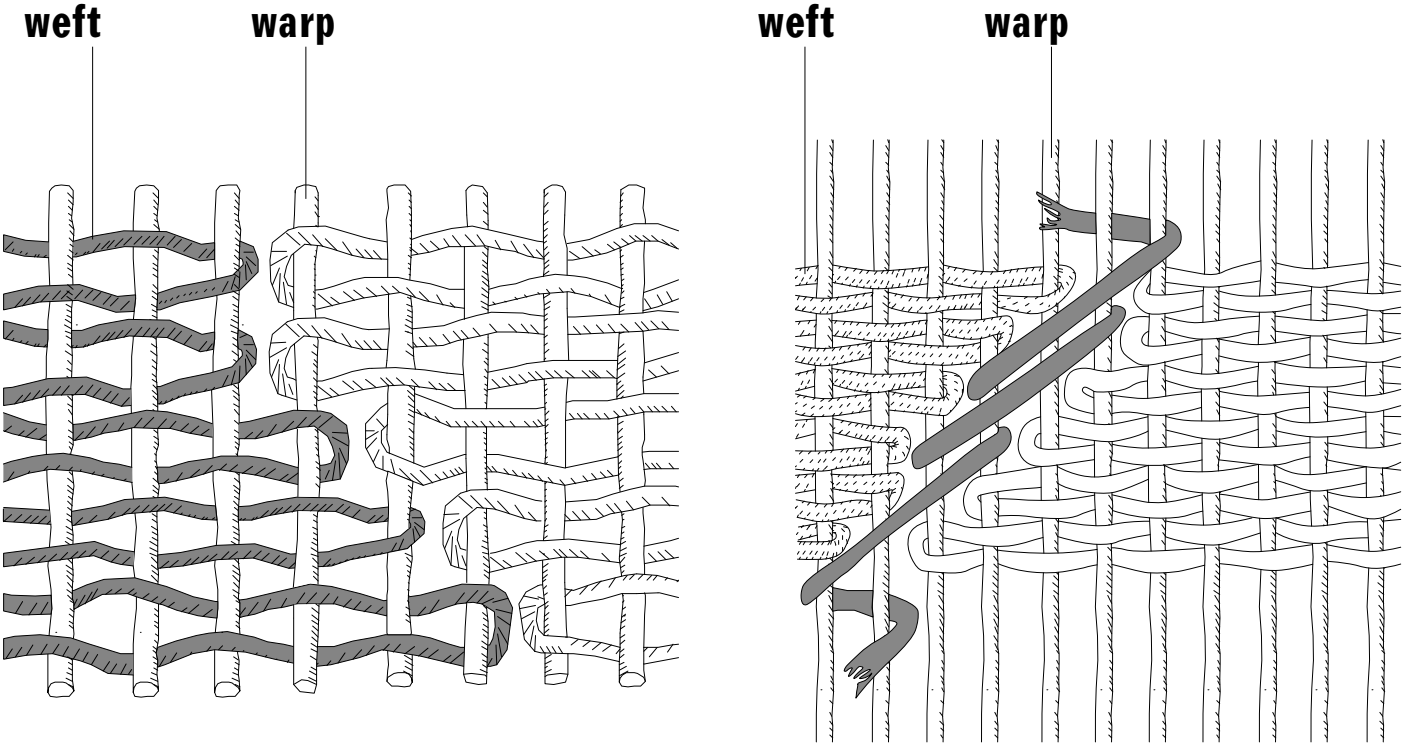


Brocade Diagram, Warp Rib Weave Diagram

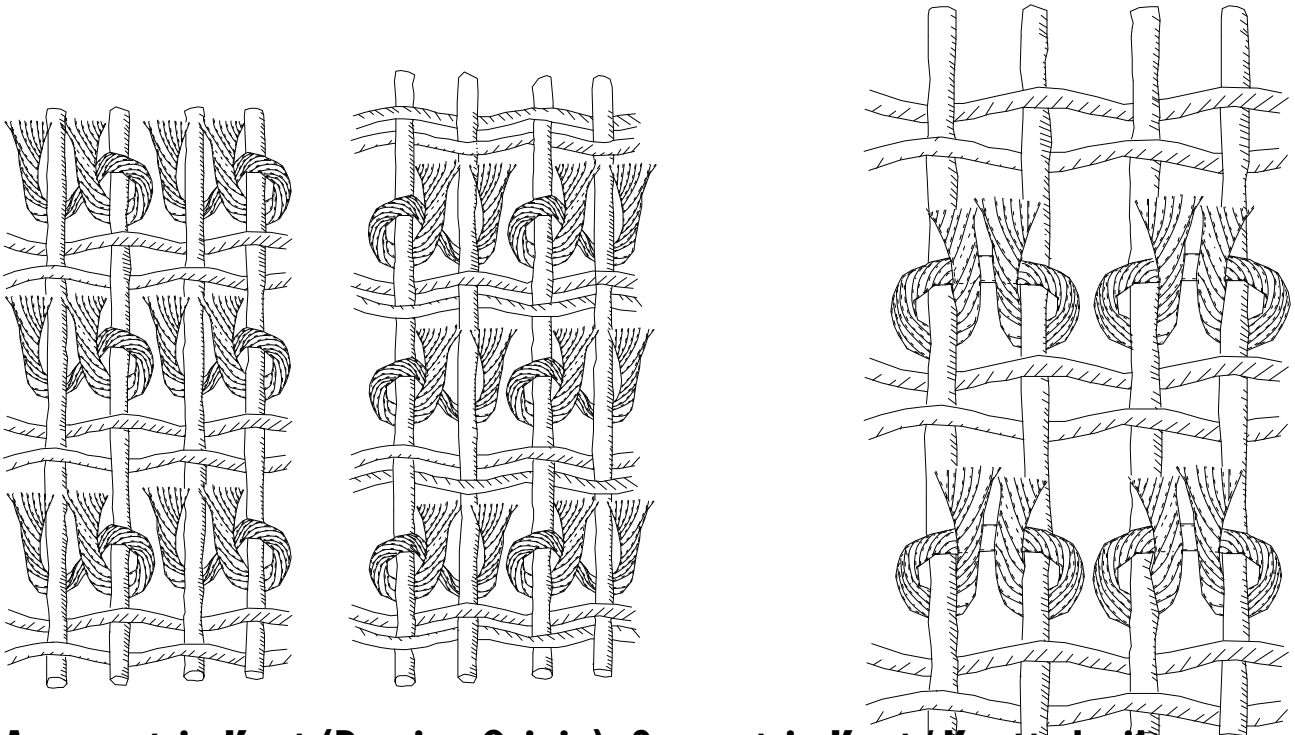




Twill Weave Diagram, Satin Weave Diagram

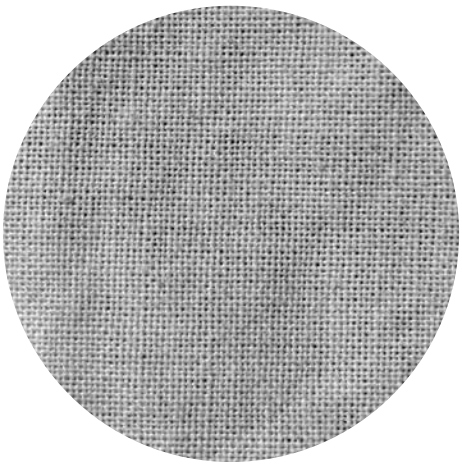
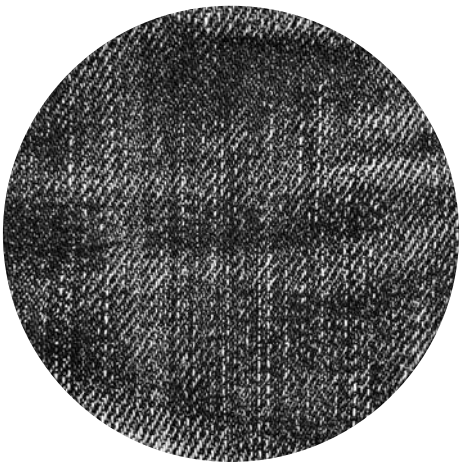


Tapestry Weave, Diagram of weft wrapping on a plain weave

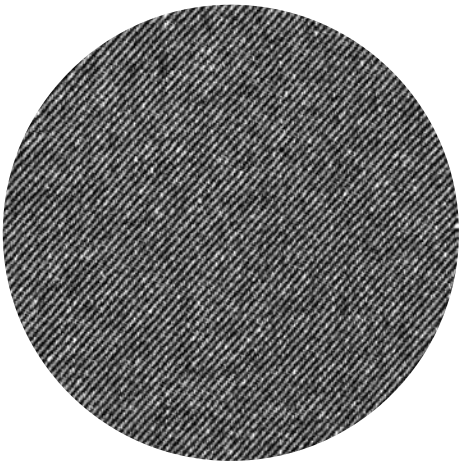


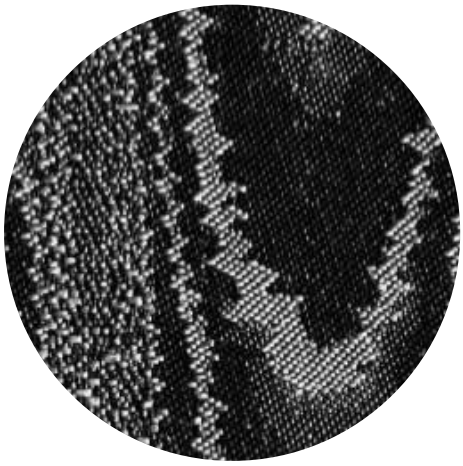
Asymmetric Knot (Persian Origin), Symmetric Knot / Knotted-pile weave

(Turkish Origin)

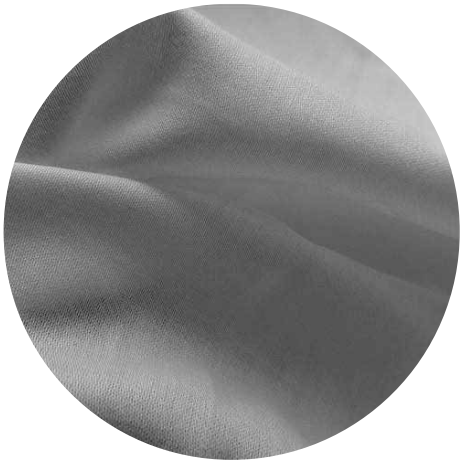




Cotton Plain Weave, Denim Twill Weave, Brocade

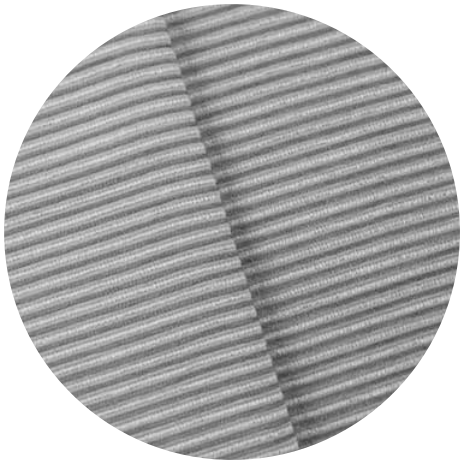




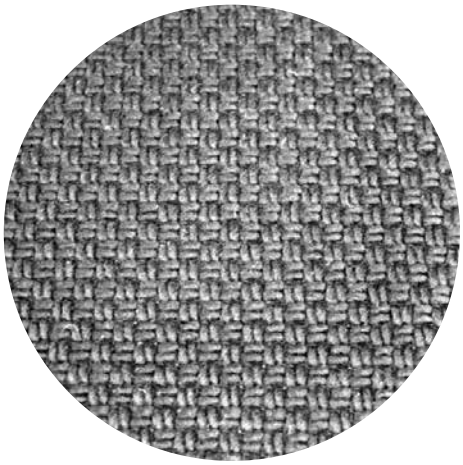
Wool Tweed Twill Weave, Front of Silk Damask, Back of Silk Damask

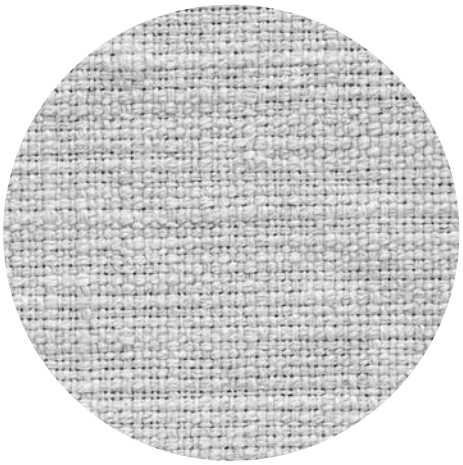



Silk Satin Weave, Cotton Sateen

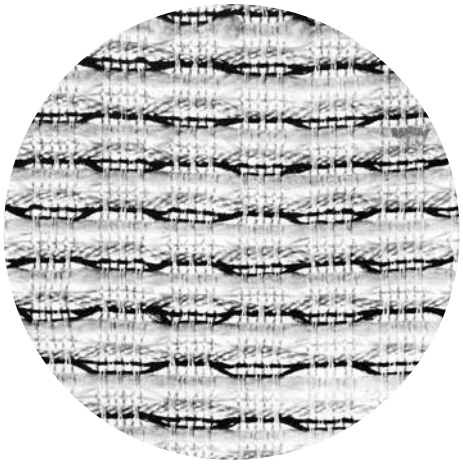


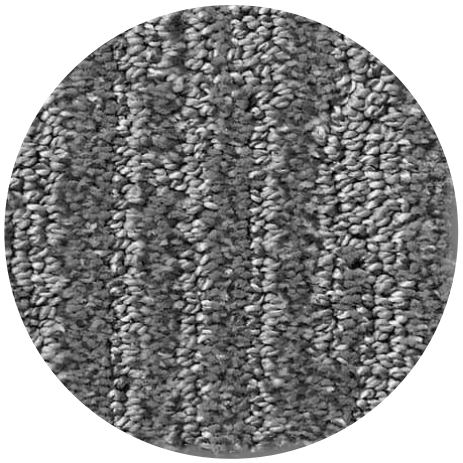
Rib Weave





Wool Basket Weave, Linen Basket Weave





Leno Weave: Anni Albers (Bauhaus period), Cut Pile Weave, Loop Pile Weave

Selection of Traditional Rugs of Nomadic Tribes in Asia

GHALI (main carpet), Türkmen, border of Central Asia and Northern Afghanistan, second half 19th century.

An example of the asymmetric knot pile weave.

NAMAZLIK (prayer rug), Türkmen, Central Asia, last quarter 19th century.

An example of a tapestry weave.

GHALI (main carpet), Türkmen, Central Asia, second half 19th century.
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GHALI (main carpet), Türkmen, Central Asia, c. 1800.
105

RUG, Southern Persia, last quarter 19th century
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Rug 'BALUCH', South-East Persia, second half 19th century.

Notice its irregular shape due to the nomadic tribe transporting the loom

mid weave.

GHALI (main carpet), West-Central Persia, mid-19th century.

An example of tapestry weaving with brocaded details.

SOFFREH-YA-'AQD, North-East Persia, last quarter 19th century.

An example of a pile weave finished off in plain weave and brocading.

KHORJIN (saddle-bag), Kurdistan, mid-19th century.

Most probably started by a learner and finished by a professional.

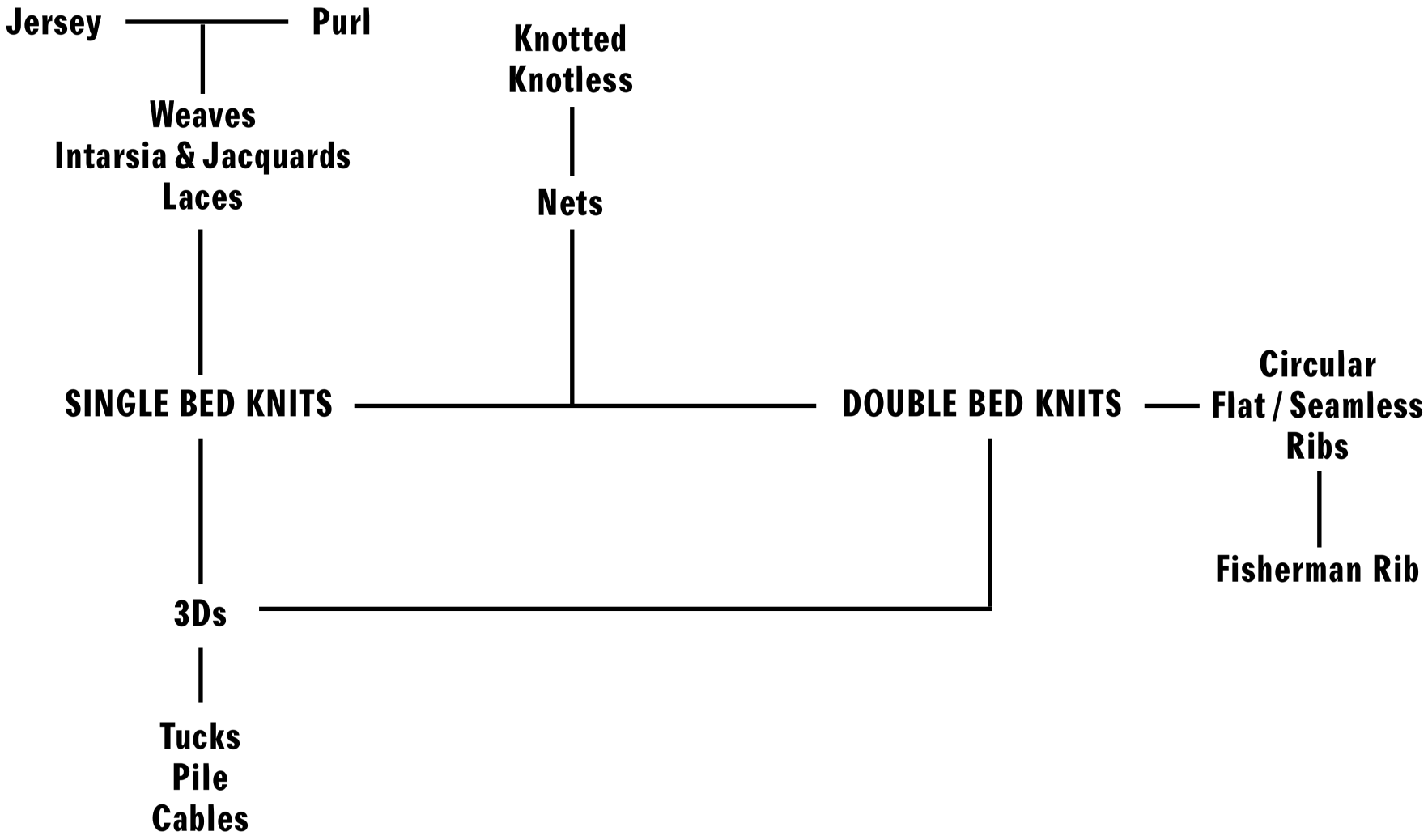
MOJ, South-West Persia, second half 19th century.

Example of a balanced twill weave.

FELT

The most common natural non-woven textile is felt, and we choose to focus on this material in reference to its creation and use in nomadic tribes in Asia.
Nomadic tribes will traditionally make felt twice a year, in the spring and autumn, when the sheep are shorn, after which the fleece is beaten with sticks in order to separate the fibres. The felting process starts by laying a 'mother felt' (an older felt) onto the ground and dampening it with water, onto which several layers of evenly separated wool fibres are then spread. Following this, hot water is sprinkled over the fleece, weighing down the fibres, thus aiding the fusing process. The wet fleece is then tightly rolled around a wooden beam, wrapped in canvas or animal skin and secured with ropes. The beam is tied at both ends to a camel, yak or horse which drags the prepared fleece across flat terrain, slowly increasing in pace, the beam rolls as it is dragged, felting the fibres together. The fleece is rolled open occasionally to check for any holes or uneven sections, to which more fibres are added. The fleece will also occasionally be re-rolled in the opposite direction to ensure even felting. When ready, the piece of felt is hung to dry and often finished by embroidering decorative patterns and motifs sewn using camel, goat or yak hair threads.

Türkmen Oy is a traditional nomadic dwelling found in areas of Central Asia. The circular tent is built using trellises and struts and covered with felts. Türkmen tribes have a history of being highly skilled rug weavers, also producing felt rugs named Namads.
A Türkmen Oy offers good protection against the cold, sometimes the walls might consist of as many as eight layers of felt piled on top of each other. Felt is an extremely thermal textile whilst being breathable and water repellent, due to natural oils coating the wool fibres. It is an incredibly resilient textile that can be folded and bounce back to shape without warping, making it an ideal textile for a nomadic lifestyle.


Jersey
Purl
Weaves
Intarsia & Jacquards
Laces
Knotted
Knotless
Nets
SINGLE BED KNITS
DOUBLE BED KNITS
Circular
Flat / Seamless
Ribs
Fisherman Rib
3Ds
Tucks
Pile
Cables

KNITTED TEXTILES

Fundamental knitting techniques stem from two processes, knits completed on a single bed machine or a double bed machine. There is also the possibility to cross over, for example, although lace knit is most commonly created on a single bed machine, it can also be built on a double bed machine, producing a more intricate lace. In this way, knitting possibilities are vast. All single bed and most double bed knits can be produced through hand knitting but in these next paragraphs we choose to focus on the most common machine techniques.

Knitting machines consist of an even row of needles that, when mobilised, loop yarns together horizontally forming knit stitches of various designs. One row of needles is used to create single bed knit fabrics and two rows of needles are used to create double bed knit fabrics.

SINGLE BED KNIT

The most common single bed knit textiles are:

Jersey and Purl Knit The most basic knitting formation is the knit stitch which builds jersey fabric. It has a uniform plain weft structure which acts as a base design for most other knit types to stem from. A knit and purl stitch are the same stitch producing different outcomes on either side of the fabric, meaning that a purl knit is the reverse side of a jersey knit. Jersey is a workable fabric able to hold its shape better than most other forms of knit, it is most commonly used for loungewear and activewear due to its softness, widthwise elasticity and breathability.

Weave Knits A ground knit can have woven yarn intersections by weaving under and over the machine's needles at various intervals of the knit. As the carriage is drawn across the needles, it builds a line of knitted loops that consequently lock these woven threads into place. This produces a decorative knit that can vary in use depending on what ground stitch and yarn type is used.

Intarsia and Jacquard Knits
Unlike in weaving, where a specific loom is needed to build a jacquard fabric, in knitting, this can be done

on a standard single or double bed machine, but most commonly, a single bed. Jacquard knits and intarsia represent techniques where the textile is knitted in blocks of colours producing a decorative patterned or pictorial outcome. The difference being intarsia is reversible with matching patterns and colours on both sides, while a jacquard knit is not reversible as the yarns are left floating on the back of the knit, meaning the face of the fabric is the true pattern. They do not require a specific stitch to be used, although the most common is the knit stitch.

Lace Knits A lace knit is characterised by its perforated holes built into the knit in a patterned formation. Lace stitches produce a highly delicate and expandable lace knit. Because of its fragile nature it is often knitted by hand.

DOUBLE BED KNITS

The most common double bed knit textiles are:

Circular Knits A circular knitting machine builds seamless tubular knits. In recent years, this process has evolved from hosiery manufacturing to ready-to-wear tubular knitted garments, such as swimwear, body-wear and technical activewear. The machine's diameter determines the final sizing and can be engineered to add support or ventilation areas to the knit. In circular knitting there is often no need for additional sewing, meaning this computerised process is fast and efficient, with very little material waste.

Flat Knits A flat knitting machine can stitch, shape and connect pieces within a single process, making it possible to produce ready-to-wear seamless knitted garments in a very short amount of time and with very little material waste. The machine follows a computerised programme of instructions. In this way, it can build much more structurally complex knits, combining different stitches in a range of dimensions and thread types, allowing knits to cross over into being a viable architectural material.

Rib Knits Rib knits are almost exclusively built on a double bed machine. There are many types of rib stitches but the most commonly used is the fisherman rib stitch. It is produced by passing the yarn from one needle bed with a knit stitch to the other needle bed with a purl stitch, thus building a ribbed pattern. The process delivers a thick, heavy knit, that can be stretched widthways to some degree.

NETS

In net textiles, yarns are knitted, knotted or looped at intersections. There are two main categories of net, knotted nets and knotless nets. Knotted nets are produced by hand or machine by knotting yarns on a loom that have already been twisted together via a winding machine. Knotless nets are produced on a Raschel double or single bed machine producing many formations of knotless nets, but the looped knotless net is often built by hand.

3D KNITS

3D knits are knitted textiles which have raised sections building patterns and textures. There are three main types of 3D knits: tuck, pile and cable. These arrangements are commonly built on a single bed knitting machine, but can also be made on a double bed machine depending on the intricacy of the desired outcome.

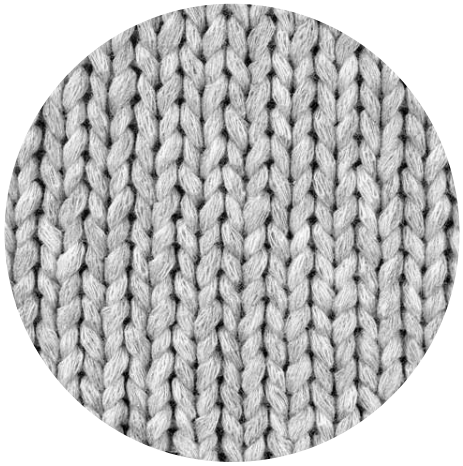
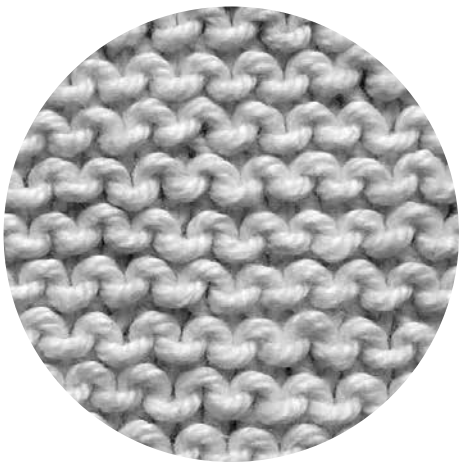
Tuck Stich A tuck stitch is made when a needle already holding a yarn is given an additional yarn. Tuck stitches can offer many decorative 3D possibilities, including openwork effects. A tuck knit often has a reduced lengthwise stretch with an increased widthwise stretch, due to the structure of the stitch.

Pile Stich A pile stitch is when yarns are added into a ground knit, most commonly a jersey. Pile knits are often used for linings for cold weather outerwear and upholstery.

Cable Stich Cable stitches are predominately used to build heavy decorative knits for jumpers, cardigans or blankets. Similarly to the tuck stitch, there is a wide range of cable stitches to choose from, offering many decorative 3D possibilities.

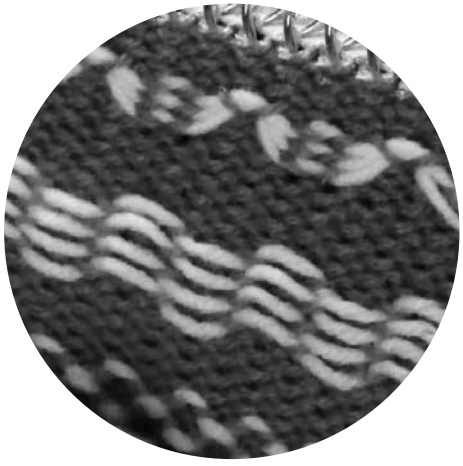
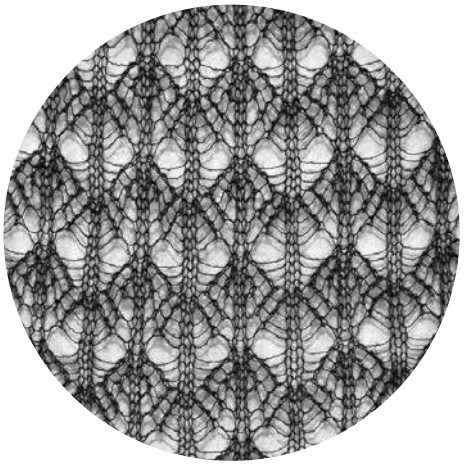
Dr. MARIANA POPESCU AND EQUIPMENT AT ETH ZURICH

Dr Mariana Popescu is a post-doctoral researcher at the Block Research Group at the Institute of Technology in Architecture at ETH Zurich. Her research focuses on the development of KnitCrete, a system for casting doubly curved geometries in concrete using 3D knitting and expanding the dimensionality of knit into architecture.
There is a Brother KH 970 knitting machine available for student use with Dr. Mariana Popescu able to demonstrate how to use it. There is also a Steiger Libra 3.130 flat knitting machine on campus, Dr. Popescu can demonstrate how it works but using this machine is limited to the Block Research Group.

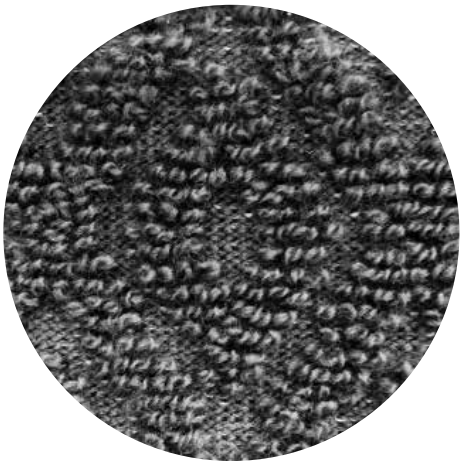



Jersey Knit, Purl Knit

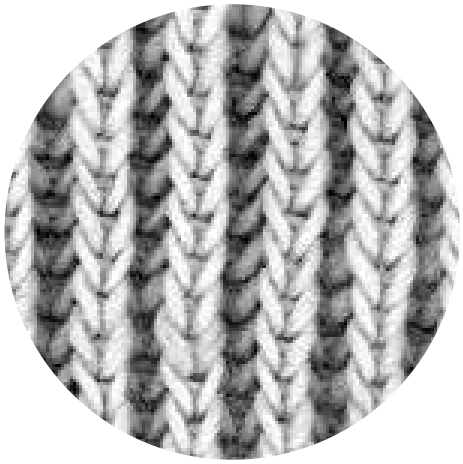
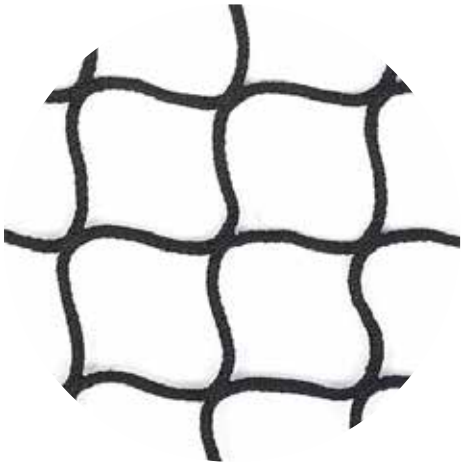

Jacquard Knit, Intarsia

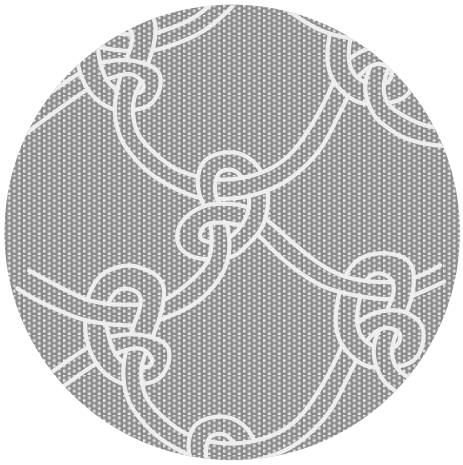
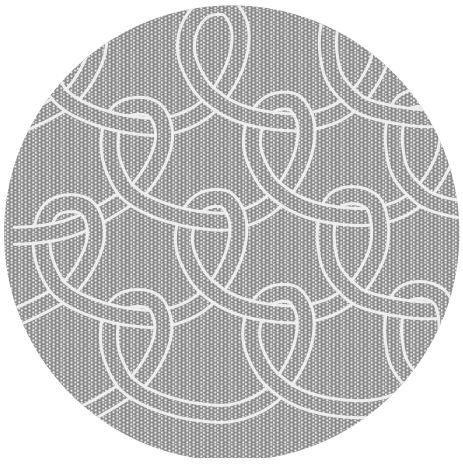
Woven stitch combined with ground purl stitch, Single bed machine lace knit


Tuck Knit, Pile Knit, Cable Knit


Fisherman Rib Knit, Knotless Net, Knotless Mosquito Net

Knotted Net, Looped Knotless Net

DYEING

The first synthetic dye was accidentally discovered by a chemist named William H. Perkin in 1856 from coal tar, but it wasn't until 1860 when chemists produced the first commercially available synthetic azo dyes. Before such point, natural dyes were exclusively used in Asian weaving, and remained the sole method for many of the remote nomadic tribes until as late as the 1940s, as they didn't become aware of synthetic dyes until this time. It is quite easy to distinguish between natural and synthetic dyes, as natural dyes fade much faster over time, especially if exposed to the sun. The downside of synthetic dyes is their negative impact on the environment if not disposed of correctly.

TRADITIONAL NATURAL DYES OF NOMADIC TRIBES IN ASIA

The process of dying wool thread most commonly starts with soaking the thread in a weak mordant bath solution. This is to maximise the wool's capacity to absorb the dye. After approximately an hour, the thread is removed and placed inside another bath containing a mixture of dye, and soaked until the correct colour tone has been achieved. The thread is then removed and washed with water to get rid of any excess colour and debris, and lastly, hung to dry.

Mordant Deriving from the Latin 'to bite', a mordant is a water-based solution most commonly mixed with alum (potassium aluminium sulphate) or iron sulphate which facilitates a faster absorption of the dye. Red or yellow plant dyes need a mordant, whereas indigo does not.

Red To achieve the colour red nomadic tribes in areas of Anatolia and Persia use a plant called Madder. Depending on factors such as the age of the madder-root, the additives and temperature of the dye bath, the type of mordant used and the lime hardness of the water, the consequential shades can range from orange to terracotta to deep purple. Other types of red dyes are Cochineal, Lac and

Kermes, which instead are produced from insects.

Blue To achieve the colour blue, nomadic tribes most commonly use the indigo plant. Indigo belongs to a category of vat dyes, where the dye itself cannot be dissolved in water, so it must instead be mixed with an alkaline solution by chemical reduction. When the yarn is removed from the indigo bath, it turns blue through reoxidisation. The consequential shades can range from sky blue to near black.

Black To achieve the colour black, nomadic tribes use tannic acid colours, from acorn cups, pomegranate skins or oak galls, adding an iron sulphate mordant to facilitate fast and strong absorption. The process is corrosive in nature, and is the reason why many antique tribal rugs can be found with fragile black dyed areas, while the rest of the coloured areas remain firm.

Yellow To achieve the colour yellow, the nomadic tribes have a variety of different plants to choose from, the most common being: Dyer's sumach, Dyer's weed, Saffron, Wild Camomile, Tanner's sumach, Buckthorn, the Pomegranate tree and Isperek.

Green To achieve the colour green, nomadic tribes use walnuts and olive leaves or mix together yellow and blue agents.

Brown The colour of un-dyed wool is naturally brown. If a different shade is desired, nomadic tribes create a dye from fresh or dried pods from walnuts, oak galls or acorn cups.

ADDITIONAL DYEING TECHNIQUES

As an alternative to dying thread before it is woven into fabric, there are methods of dyeing or staining a finished weave, such as:

Shibori An ancient Japanese technique of exposing selected parts of the fabric to the dye, often using tools to fold, wrap, bind or pleat the fabric, in order to dictate the areas where the dye can be absorbed. Traditional Shibori is made with indigo hues.

Ombré Ombré is a dip-dyeing technique, submerging sections of the fabric into a dye bath, whilst suspending the rest of the fabric outside of the bath, letting the textile slowly absorb the dye, leaving a gradient ombré effect.

Batik Batik is a technique which uses wax as a resist. Before dyeing, liquid wax is drawn or stamped onto the fabric in sections where the dye

should not be absorbed. After dyeing the fabric is washed with hot water, melting the wax and leaving the desired pattern.

Staining and Painting There are countless ways to paint and stain a fabric using a range of tools like brushes, sponges or spray bottles. The end result is normally a watercolour effect where the colours blend and merge into each other.

Ice Dye In order to ice dye, the textile must first be dampened. It is then crumpled into a ball and ice is placed on top, covering the fabric completely. Powdered dye is sprinkled on top and as the ice melts it pulls the dye through the fabric creating a mottled patterned outcome.

It is important to note that natural fibres absorb dye vastly better than synthetic fibres, especially cotton and wool, which produce the most vibrant hues after being dyed.

GABBEH, South-Western Persia,

second half 19th century. An example of a colourful rug made using mixed

batches of natural-dyed wool thread.

Auguste Herbin, RUG NO.65, 20th century

A rug made from wool and natural

silk; a good example of the vibrancy of synthetic dyes.

STITCHING AND BONDING SEAMS

There is a wide range of techniques for binding together woven or knitted fabrics to define volume and structure. The first section will touch on selected stitch and seam methods, the second will cover synthetic bonding techniques.

FUNDAMENTAL TYPES OF STITCHING

Lockstitch A lockstitch is the most commonly found stitch type. It has a reversible design and produces a tight bind. A single needle lockstitch is limited to how much strain it can be put under, but by sewing a double needle lockstitch, as seen on most denim outerwear, the stitch becomes more durable and can withstand substantial fabric pull.

Chainstitch Unlike the lockstitch, the chainstitch is not reversible and produces a bulkier seam, but it is better suited to withstand fabric pull and stretch, and even more so if a double needle chainstitch is used. A chainstitch is rarely used to build seams, instead it is best suited for hemming and decorative embroidery.

Zigzag Stitch A zigzag stitch is a variant of the lockstitch, but the needle moves horizontally as the fabric is pulled through the machine. It is often chosen to stitch elasticated fabrics, build a butted seam, reinforce open sections like buttonholes or to hem a raw edge to stop the fabric fraying.

Overlock Machine An overlocker is a specialised sewing machine that is designed for edging, hemming or seaming textiles. The machine has a built-in blade which, when engaged, trims off excess fabric as it sews.

Overlock Stitch An overlock stitch is made on an overlock machine. It is predominately used to build an edge to cut fabric to prevent fraying in preparation for the fabric to be sewn into form. It can also be used for seaming, particularly knitted fabric such as jersey.

Flatlock Stitch A flatlock stitch is made on an overlock machine. It is similar looking to an overlock stitch, used for edging, hemming and seaming, the differences being that a flatlock stitch can be opened flat with no bulk. It can maintain

high elasticity and is often used as a decorative feature.

FUNDAMENTAL TYPES OF SEAMS

The most basic seam formation is the plain seam which can be single or double top stitched to add more rigidity and strength. Welt seams are much stronger than plain seams and are often used for thicker fabrics, such as linen, canvas and denim. A lapped seam is a one of the strongest seam types, most commonly used for thick fabrics, such as denim, leather and felt.
Slot and fagotted seams are primarily decorative seams. Fagotted seams can be made on a sewing machine but are mostly hand sewn due to their delicate nature.
The best seam for lightweight and sheer fabrics is the French seam as it encloses the raw edges inside a fold, making it a very neat and reversible seam.
A butted seam is where two raw fabric edges are butted together, edge to edge, and sewn most commonly with a zigzag stitch on a regular sewing machine, by hand or by using a flatlock stitch on an overlock machine. Butted seams work well with felt, as these textiles do not fray when cut.
An overlock machine is used to build an overlocked or flatlocked seam. A flatlocked seam is a form of butted seam and is ideal for joining activewear fabrics like fleece as it produces a smooth flat seam that can sustain a high amount of stretch.
An overlocking seam is an ideal way to join knitwear as it fixes the seam in place at the same time as it cuts, leaving no time for the knit to unravel.
Knitted fabrics can also be bound by hand using techniques such as the invisible flat seam, mattress stitch seam, swiss darned seam and backstitch seam.

SEALING AND BONDING

There are two main methods for waterproofing a stitched seam: seam sealing and seam taping.
A seam seal is a layer of glue that is painted over the stitched seam, creating a waterproof barrier.
A seam tape is a one-sided adhesive polyurethane tape that is bonded over the stitched seam using an iron, or for high quality results, a specialist high pressure taping machine, which customises the temperature depending on the textile.
Seam taping is a more widely used method, especially in fashion, as it is often a decorative feature as well as reinforcing the seam's structural strength. It is possible to bond seams together without the need of a stitch, by the use of a joining machine or an ultrasonic bonding machine.

MACHINES

Joining Machine A joining machine requires a two-staged technique. First, a two-sided adhesive tape is applied to one seam edge by passing it through the joining machine. The tape's protective layer is removed and the other seam edge is placed on top, overlapping the tape. The joining machine rolls the prepared seam through a heated weal, thus fusing the two fabrics together, building a high-strength bonded seam without the need for stitching. There is a range of bonding tapes to choose from depending on the desired performance of the fabric.

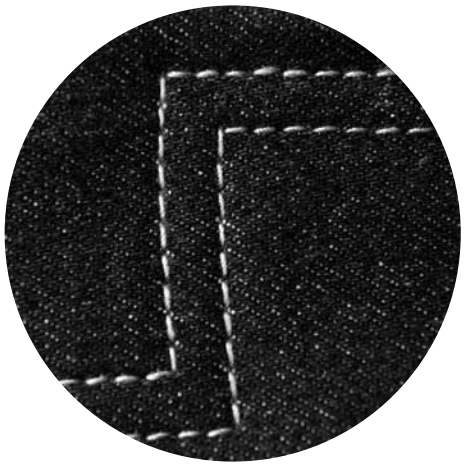
Ultrasonic Bonding Machine
A machine where ultrasonic high frequencies are administered to the fabric via a metal bar called an ultrasonic horn. The frequencies generate heat, not from the horn itself, but inside the fibres at the point of the join, causing the polymers to join and form a bond. Ultrasonic seaming can only be completed on woven, non-woven and knit textiles which have at least 60% synthetic fibres. In this way, a waterproof and windproof seam is created. It is advantageous in the making of sails, sportswear, outdoor clothing and parachutes. Both stitching and bonding are very strong seam-joining techniques, but bonding is a much more reliable technique for sportswear, as it has a stronger seam strength when the fabric has high elasticity.

Producer of polyurethane heat-bonding applications and machines:

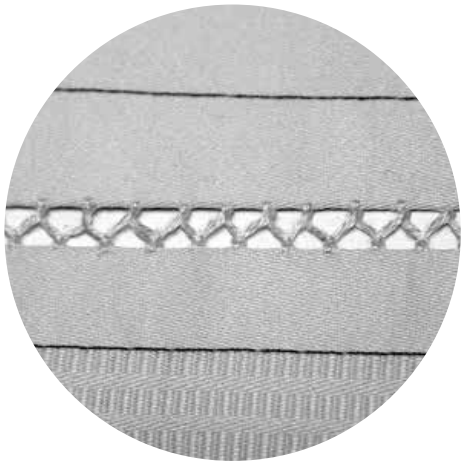
FRAMISITALIA
framis.it

Manufacturer of technologies for textiles:

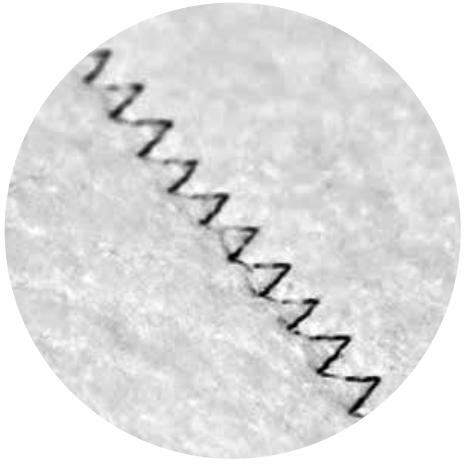
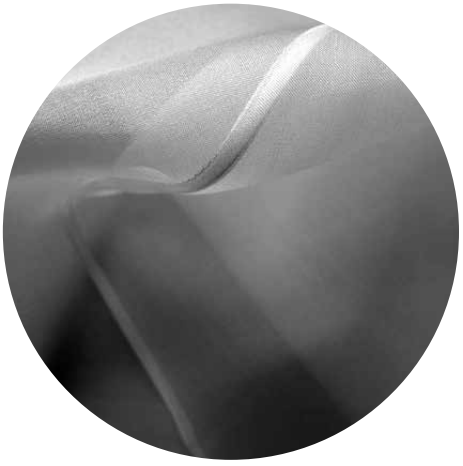
DYLOAN
dyloan.com



Double Needle Lockstitch, Chainstitch (back of fabric), Zigzag stitch

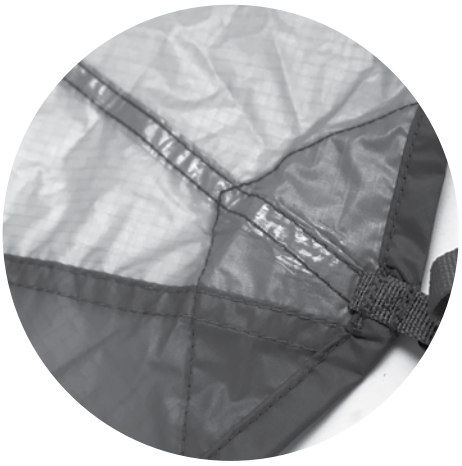



Fagotted Seam, Flatlocked Seam

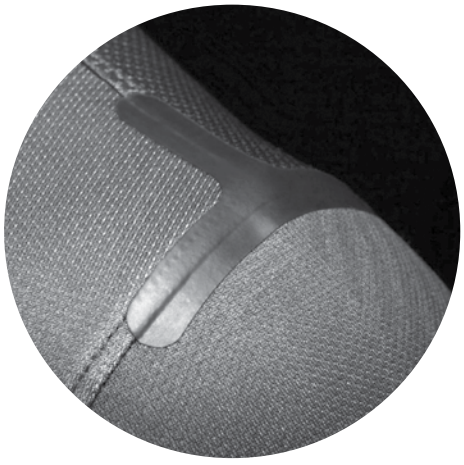



Butted Seam, French Seam

Overlocked Seam



Seam Sealing, Seam Taping



Seam Taping, Bonded Jersey Seam, An Ultrasonic Seam

FINISHINGS, SMART TEXTILES AND PLEATING

FINISHINGS

Once the threads have been woven or knitted into fabric, it is then possible to apply a range of synthetic finishings, the most common agents being: softening, antistatic, water repellent (anti-stain), hydrophilic, anti-wrinkling, flameproofing, anti UV, anti-bacterial, chemical bleaching, anti-static, perfuming, anti-mosquito, anti-slip and a finishing to avoid needle picking. Due to the Covid-19 pandemic, there have been worldwide developments of antiviral textile finishings that can be applied to garments to significantly reduce the spread of viral and bacterial microorganisms.
A natural finishing that works to waterproof textile is to coat the fabric (normally canvas) in wax, thus saturating the fibres and creating a wind- and water-resistant surface, although it is not very breathable and quite heavy.

Selected companies specialising in finishing techniques:
PETRATEX
petratex.com
petratex@petratex.com
(+351) 255 868 000
HEIQ MATERIALS AG
heiq.com
info@heiq.com
+41 56 250 68 50
Ruetistrasse 12
8952 Schlieren (Zurich)
Switzerland

ADAPTIVE SMART TEXTILES AND ADVANCED MATERIALS

Recent developments in textile research have led to smart textiles, which can adapt to environmental changes. The double-woven asymmetric wetting Janus textile is a good example of this; a fabric with different functions on its two sides. The textile has a responsive polymer network that drives liquid through its membrane in an irreversible direction, meaning the inner fabric side is hydrophobic, whilst the outer fabric side is hydrophilic, intensifying the follicle pull from the inside to the outside of the textile. Another recent development in textiles has been the

incorporation of 'biofabric'. A group of researchers at MIT University designed scale-like ventilating flaps by lining e-coli cells onto sheets of latex that are then sewn into fabric. The live microbial cells shrink and expand in response to humidity, resulting in the flaps opening and closing, allowing excess moisture to be released.

A good example of an outerwear fashion brand dedicated to designing with the latest textile technology is Arc'teryx, which collaborates with materials science company W.L. Gore, the inventor of GORE-TEX Fabric. GORE-TEX fabric is a three-layer laminate combining a thin ePTFE (Teflon) membrane between high-performance face and backer fabrics. The outcome is a strong, wind resistant, breathable and lightweight textile. The microporous membrane structure is water resistant, while still allowing moisture to escape.

GORE fibres (100% ePTFE) can be sewn, knitted or woven into fabrics to maximise the textile's ability and longevity, by making it resistant to chemicals, water and extreme temperatures.

EMPA is a materials science and technology laboratory researching advanced materials and surfaces. Such developments include liquid-core fibres and plasma coating. Liquid-core fibres are hollowed fibres which fluid is injected into. These fluids can restrict noise and friction, be flame retardant, enable adaptive stiffness, have flexibility sensors or be perfuming. Plasma coating is a process of metallisation of thread fibres before weaving, whilst maintaining the fibre's original textile characteristics. Plasma coating works to protect against bacteria, UV radiation and electrosmog.

Outerwear brand:
ARC'TERYX
arcteryx.com

Materials science company:
W. L. GORE
gore.com

Research Institute:
EMPA
empa.ch
+41 58 765 11 11
Ueberlandstrasse 129
8600 Dübendorf / Switzerland

Technical Textiles:
SWISS TEXTILES
swisstextiles.ch
info@swisstextiles.ch
+41 44 289 79 79
Beethovenstrasse 20
CH – 8022 Zürich

PLEATING

It is possible to pleat most woven fabrics but polyester and silk are best suited to hold the pleated form over time. There is a wide range of pleated patterns to choose from, the most common being concertina and knife pleats.

Larger pleats are usually made by hand using cardboard moulds, whereas smaller, more delicate pleats are made by a pleating machine. The handmade method starts by stretching out a double layered pre-pleated cardboard mould, using weights and clamps to stop any bounce back. The fabric is placed in-between the layers, and as the weights/clamps are slowly released, the mould contracts, trapping the fabric in the folds; a process guided by the artisan's hand. The closed structure is tied to add pressure and placed in a steam cabinet in order to permanently transfer the folds into the fabric. A pleating machine uses rolls of paper that are not pre-pleated. The fabric is fed in-between two paper rolls and the machine folds the three layers into the desired pleat before being baked in an oven.

Issey Miyake is a good example of a fashion brand dedicated to researching and developing modern pleating techniques. (See reader, p.81)

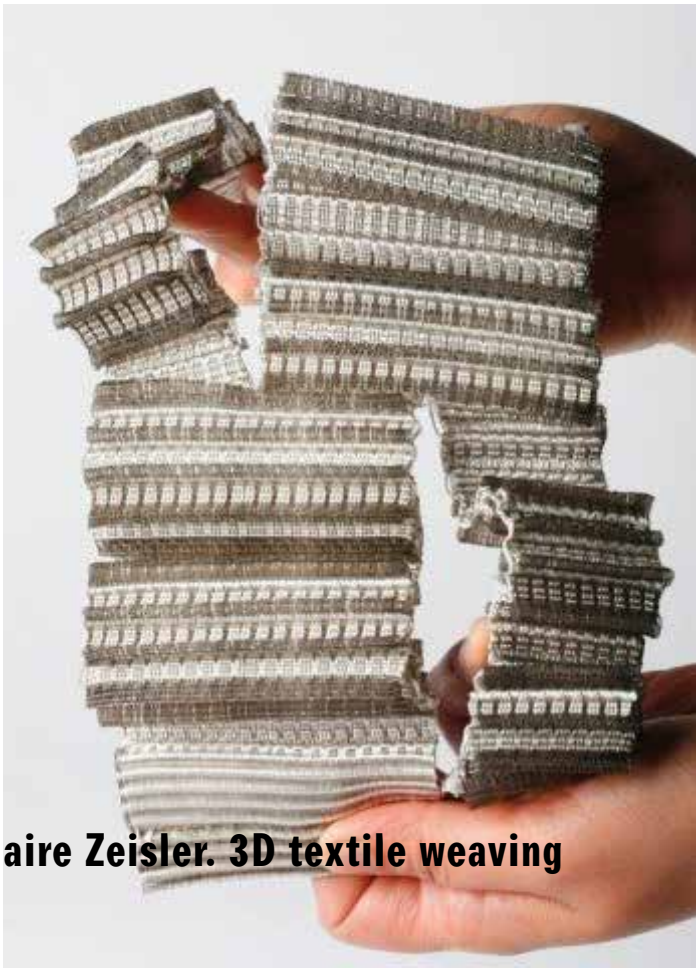
Recent research includes weaving the folds directly into fabric, then using steam to contract the woven pleats, shrinking the fabric's surface area; a second method of pleating. A third method is to sew pleats into place. These are called tucks.

Traditional pleating atelier:
PLISSEEBRENNEREI
floesserplissee.com
info@plisseebrennerei.ch
+41 (0) 61 641 22 48
Innere Margarethenstrasse 19
CH 4051 Basel

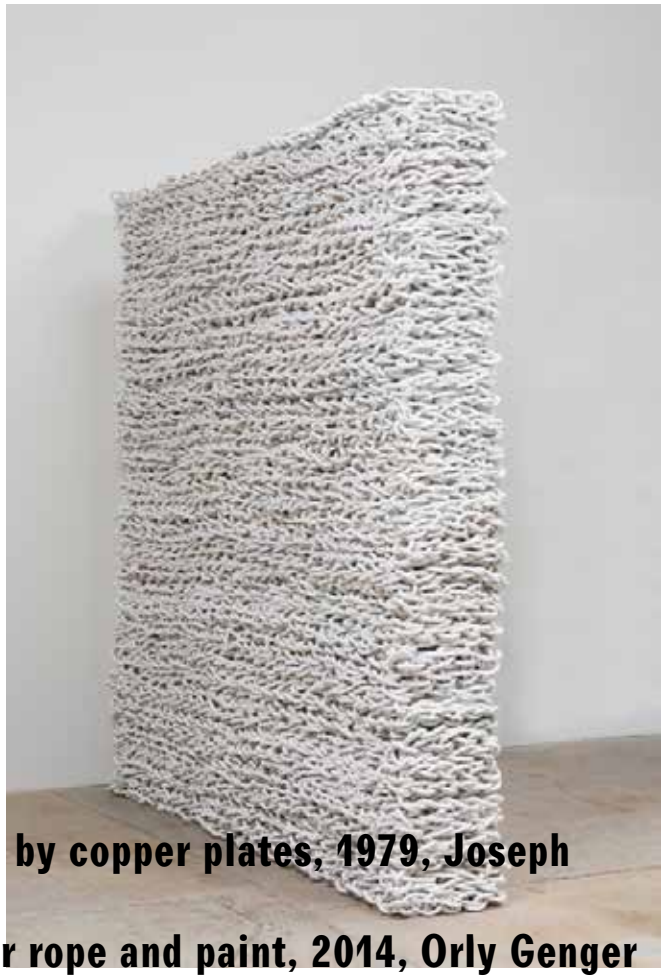
TEXTILE MATERIALITY

Selected Works

ORDEN CIRCULAR II, yarn embroidered on fabric, 2013, Josefina Concha. W0934A, jacquard fabric, 2018, Margherita Raso



PRIVATE AFFAIR, knotted hemp, 1986, Claire Zeisler. 3D textile weaving sample, 2011, Priyal Garg



BRASILIENFOND, stacked felts supported by copper plates, 1979, Joseph Beuys. LINEMAN, knitted recycled lobster rope and paint, 2014, Orly Genger

MA Collection, gathered silk on elastic with zig-zag stitching, 2018, Rebecca Jeffs. LOOSELY SPEAKING, loosely woven threads, 1998, Shiela Hicks

WOVEN SHEER FABRIC SAMPLE WITH PLEATS, 2010, Juliana Sissons. EARLY FELTS, layered cut felts, 1994, Robert Morris

COSMIC SERIES COMO, knotted threads, 1989, modified 2017, Yvonne Palmer Pacanovsky Bobrowicz. TUMSAE 3, sewn industrial felt, natural indigo dye, hand stitching, 2018, Chung-Im Kim

GLOSSARY OF TEXTILE TERMINOLOGY

THREAD COUNT
Referencing the number of threads woven together in a square inch of fabric. If there are 100 weft and 100 warp threads in a square inch, then the thread count is 200.

WALE
In weaving, a wale is a woven ridge that run lengthwise with the warp. Corduroy is a textile with a distinct wale pattern. The more wales per area, the less textured the fabric is. In knitting, a wale is a column of loops that run along the length of the knit.

DENIER
A unit of measurement indicating the mass density of fibres in threads used to build a fabric. This is measured from referencing one single strand of silk, which is one denier, where nine thousand meters equals one gram. Ultralight fabrics are usually made with 20 denier threads, whereas heavy duty fabrics are generally made with 400 denier threads.

PLY
Plied threads are composed of two or more single threads twisted together. Fabrics built with plied threads are smoother and more luxurious, as they produce a tighter weave.

THREAD ELONGATION
Thread Elongation refers to the amount of pull a thread can withstand before breaking. Measured as a percentage, the higher the number, the more stretch a thread can withstand.

WEFT
The widthwise threads that are pulled under and over the still warp threads in weaving.

WARP
The lengthwise threads that are held under tension on a weaving loom.

SELVEDGE / SELVAGE
Referencing the uncut edges formed

on the left and right side of the fabric as it is built. It is woven differently to prevent the weave from unravelling.

KNITTING STITCH

In knitting, multiple loops of threads are called stitches, which build to form a knitted fabric.

KNIT CARRIAGE

On a knitting machine, a carriage is a tool that carries out a pre-positioned knit stitch, either manually or electronically, by sliding it left and right. The carriage feeds the threads to the needles as they knit.

RIBBER

A ribber is a separate bed of needles that can be attached to a single bed knit machine in order to build a rib stitch (a double bed knit).

CASTING ON / BINDING OFF

Casting on refers to the technique of looping threads around knitting needles in order to begin building the knitted textile. Binding off refers to the technique of removing the finished knitted textile from the needles in a way that prevents fraying and defines the final edge. There is a vast number of ways to cast on and bind off in knitting.

LIST OF BASIC EQUIPMENT IN A FASHION ATELIER

EQUIPMENT

Sewing machine with attachments, overlock machine, iron and ironing board, cutting table and a mannequin / structure for draping fabric.

MATERIALS

Pattern-cutting paper, fabric and threads.

TOOLS

Pattern-cutting ruler, large and small cutting scissors, stitch unpicker, needles, pins, tape measure, tailor's chalk and a tracing wheel.

APPENDIX

Nomadic Tribe weaving with a Horizontal Loom

Felt drying. Plain weave textile roofs of the western Arab black tent.

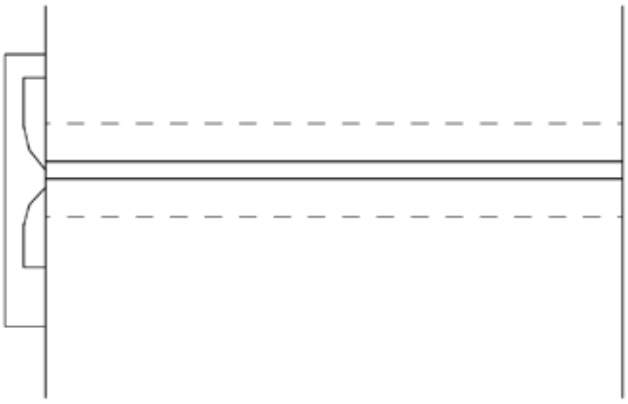
DOUBLE WEAVE WALL HANGING, Anni Albers, Woven in 1964 under Albers' supervision from the original design made in 1927

Concrete pavilion with 3D-knitted formwork by Zaha Hadid Architects and ETH Zurich

Jacquard Loom. Flat Knitting Machine. Circular Knitting Machine.

Single top stiched plain seam, double top stiched plain seam

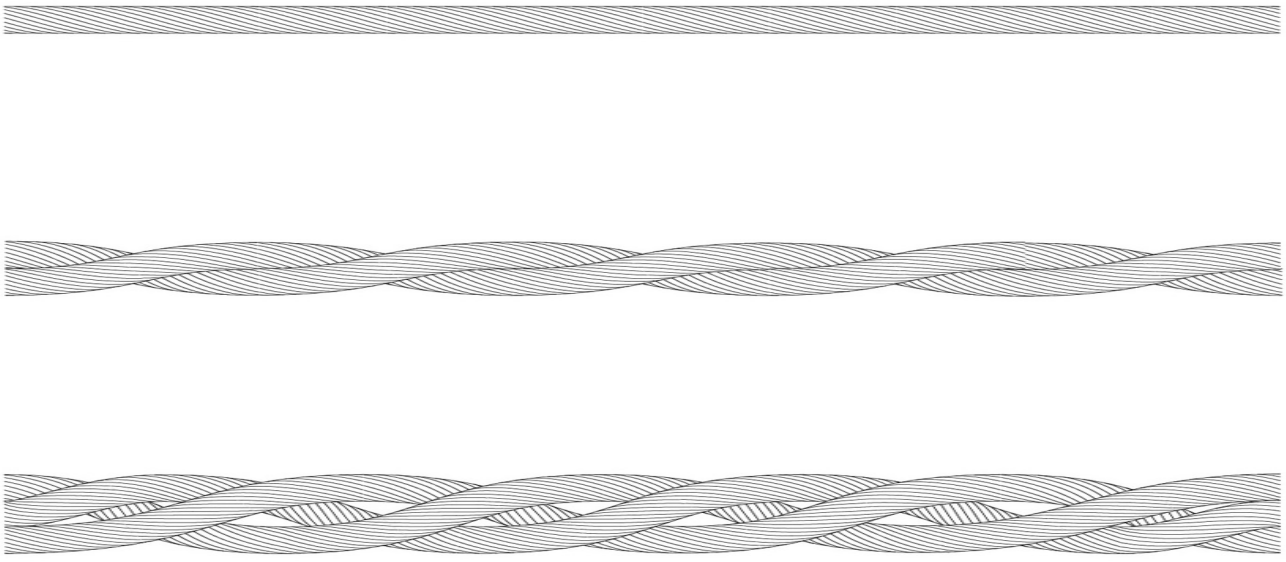
Welt seam, lapped Seam



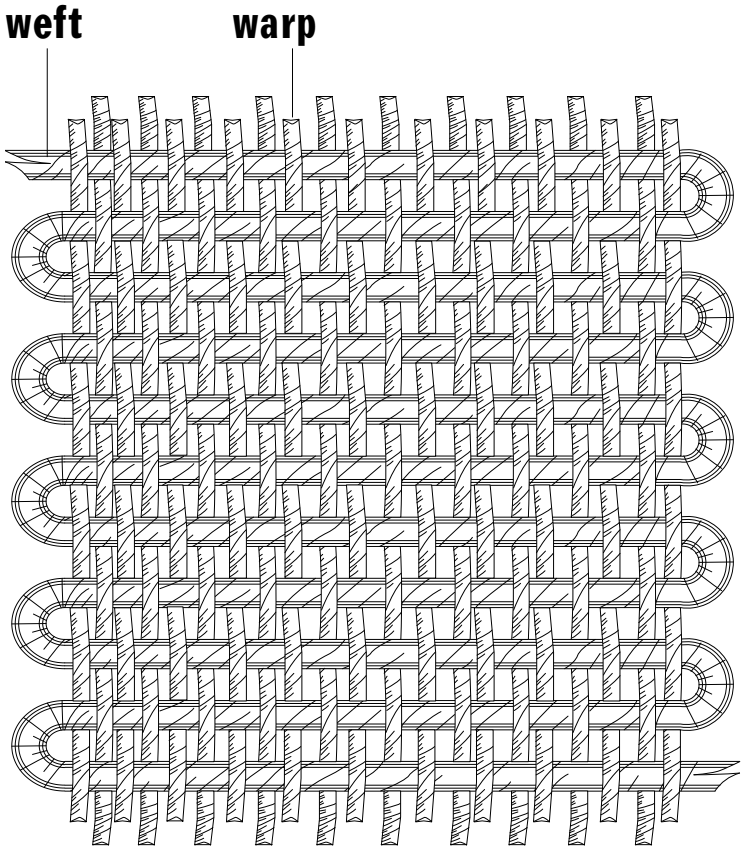
Slot Seam

THREAD SUBSTRATE	Elongation (%) at break (min–max)
Staple Spun Cotton	5–9
Staple Spun Polyester	12–22
Poly-Poly Corespun	13–24
Continuous Filament Nylon	16–17
Continuous Filament Polyester	17–18
Viscose Rayon	18–19
Texturised Polyester	24–31
Polybutylene Terepthalate	40–50

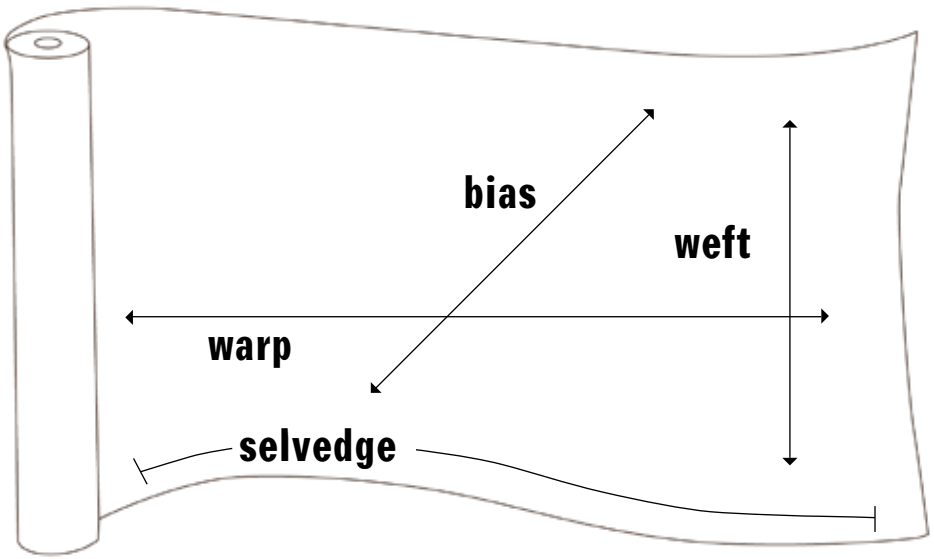
Elongation diagram Citation: “Thread Elongation – Industrial Thread – Seam” Stretch: coats.com/en/information-hub/thread-elongation



Top — Bottom: Single thread, 2-ply, 3-ply



Weft and warp diagram



Selvedge diagram

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In this exceptional situation, with travel restrictions and social distancing regulations due to Covid 19, this semester will start in online mode with teaching to be held via Zoom, the only exceptions are for experimental work, workshops or other activities requiring on-site presence. University buildings will mostly be closed, with a few exceptions. The physical presence of Professor Holtrop and assistants will be adjusted according to the developments in the coronavirus pandemic.

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