Ikat from Timor and its outer islands: insular and interwoven

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2. YARN AND WEAVE TYPES

Fig. 19 A market vendor on Alor spindle spinning cotton while waiting for customers. A touch of irony: a yarn spool for machine-made thread machine-made yarn is put into service for the creation of hand-spun yarn. Photograph by the present author, 1981.

The most fundamental skill required to produce high-quality ikat is spinning. While spinning wheels were used on a majority of the larger islands – Jasper & Pirngadie (1912:5) mention Sumatra, Java, Bali, Lombok, Sumbawa, Borneo and Sulawesi – spindle spinning was common until recently on all the eastern and more remote islands such as Alor. In this respect not much has changed since 1932, when Vatter (1932:219) observed: "in those areas where there still is much weaving, you rarely see women or older girls without their 'handiwork', the spindle, which they diligently spin during every pause that their other work allows". Travelling in Vatter's footsteps half a century later, I could still see spinning women, but only occasionally.

The yarn produced by means of a gravity or drop-weight spindle, in Indonesian called *benang putar* or *benang pintal*, was generally held in higher esteem than commercial thread. In the early 20th century, cloths made of hand-spun cotton were regarded as more durable and commanded a higher price (Jasper & Pirngadie 1912:16). In most regions this difference of appreciation proved long-lasting. On Tanimbar, where commercial thread arrived at least a century ago, weavers preferred to keep using hand-spun cotton for cloth intended as *pusaka*, heirlooms. During her in-depth fieldwork on Tanimbar conducted between 1994 and 2002 van Vuuren (2009:37) observed that elder Tanimbarese women were still able to hand-spin regular yarn as fine and strong as factory-made thread.

Industrial production of cotton thread in the Netherlands East Indies took off rather late compared to for instance India. Substantial production on Java began only in 1936 with the founding of the NV Java Textiel Maatschappij, which integrated spinning and weaving (van der Eng 2007:17). Early machine-made yarn, *kapas biasa*, 'common cotton', or *benang belanda*, 'Dutch thread' (even when actually imported from England or India), was often a little slubby, and to the touch can be misleadingly similar to hand-spun. Yet under a microscope hand-spun yarn is noticeably more uneven than slubby machine-made thread.

Notably on Sumatra, Savu, Timor and Sumba – in the latter under the auspices of the Dutch *assistent-resident* A. J. L. Couvreur – ikat began to be commercialised around 1915 (Adams 1969:96-98). Many weavers started using factory-spun thread rather than spending an entire year growing their own cotton and going through the process of cleaning, ginning and spinning. Labour-saving benefits aside, the weavers also liked the fine commercial thread because it allowed patterning with a high degree of precision and gave the finished product a luxuriously soft feel, particularly when top-quality English thread was used.

In the early period of adoption of machine-made thread – which could differ substantially from island to island – there usually was a time span during which machine-made thread was a luxury item, hence useful for the display of wealth. In this early period we now and again (see Figs. 23, 24) see all the ikat work done on machine-made thread while the plain areas were done in hand-spun. On most Timorese ikat made with mixed materials, we see exactly the opposite: ikat work in hand-spun yarn, borders and accent stripes in pre-dyed commercial thread. Even on islands where machine-made thread became popular early, many weavers continued to use hand-spun cotton for ikat textiles made for their own family which served, not solely as attire for festive occasions, but also as portable status symbols. This appears to have applied even on Sumba, where commercial weaving of ikat was scaled up earlier than anywhere else. Although machine-made thread became readily available here in the first quarter of the 20th century, all the high class Sumba ikat textiles in Group A of the Physical Database woven up until the end of the colonial period were found to have been made, not – as is often assumed of such cloths on the basis of look-and-feel or inspection with a magnifier – with such commercial thread, but with fine hand-spun yarn.

In a few Sumbanese specimens the yarn was extremely fine, producing noblemen's wraps that emanated gravitas but were uncommonly light on the shoulders. An economic disadvantage is that more warp yarns, hence more work, are needed to achieve a given width. But economy may have been the last quality nobles wished to emanate. Apart from the common Veblinian display of pecuniary emulation, a collateral advantage of ikating in very fine yarn, is that it yields patterning in high definition. This is observable, for instance, in PC 351 (see Fig. 252), PC 350 (see Fig. 251), PC 361, PC 228 (see Figs. 210, 234) and PC 299 (see Fig. 241), specimens with a specific weight of respectively 194 g/m^2, 196 g/m^2, 199 g/m^2, 200 g/m^2 and 222 g/m^2 – among the lightest encountered. Given its chiselled definition, the spectacularly detailed *hinggi* in the Museum der Kulturen, Basel, N° IIc 8696 (see Fig. 240) appears to have been made in very fine yarn as well.

It is unfortunate that specific weight was available only for the specimens in Group A of the Reference Set and a small number in Group C. A broader investigation into the specific weight of ikat textiles, particularly those held in museums would be a fruitful undertaking, even if initially limited to, for instance, Sumbanese *hinggi* – of which there are relatively many – particularly if this investigation would correlate weight with objective markers of design-technical excellence, such as thread-counts, replication factors, seepage rates, and the presence or absence of deceitful visual devices. On the basis of the findings of this research, the present author would expect to see most such markers at the extremes of the specific weight scale.

With only a few known exceptions dating from a transitional period and to be dealt with below, adherence to the labour-intensive traditional methods was and still is considered meritorious and leads to a product that is highly valued both in the weaver's own community and in the global community of curators and collectors. Predictably, among the latter this has caused occasionally heated exchanges about the merits or demerits of certain cloths and accusations of wishful thinking: "You call this hand-spun, but do you not know that on island X commercial thread had already arrived before 1900?" It is easy to see how such exchanges can seize upon differences of opinion. The evenness an experienced spinner can achieve with a spindle is of a high order, although one can often feel the difference with factory-made thread by passing it through the fingers and paying attention to the minute differences in thickness that betray the handiwork.

Unfortunately, one does not always have loose lengths of yarn, especially in the absence of fringes. Marie Jeanne Adams, who researched early Sumba ikat in European, mostly Dutch museums, wrote on spindle spinning: ". . . yarn of amazing fineness and smoothness can be made in this way; in some cases, analysis under a microscope is needed to determine whether the yarn was spun by hand or by machine" (Adams 1969:71).

2.1 FIBRES UNDER THE MICROSCOPE

Acting on Adam's (1969:71) cue, but feeling that "some cases" would not suffice for a reliable study, the present author decided to turn to microscopic observation and apply it to a substantial selection of the specimens to which he had access, to wit the ikats in Group A of the Physical Database. Because the microscopy revealed a greater than expected variety of yarn appearance and weave types, and distinct preferences for certain weave types varying from island to island, it was to decided to widen the microscopic study to the entire archipelago. This modus operandi would contextualize the findings in the region under study, allowing us to see ('no island is an island') if and to what extent technical aspects of ikat on Timor and its neighbouring islands differed from more outlying parts of the Indonesian archipelago, adding relief to the findings and enriching our knowledge base regarding the technical aspects of ikat from the region under study, while providing a broader, more intriguing foundation for future research of this nature.

The decision implied investigating examples from 41 distinct ikat weaving regions on

29 islands; a vast undertaking, even after it was narrrowed down to a subset defined by selection on yarn type. Included were only ikat cloths made solely with hand-spun cotton yarn; excluding those done in silk, rayon or commercial cotton, either in whole or in part – with a few very rare exceptions deemed too interesting to be left out; in such cases only the ikat work done in hand-spun was considered. As was to be expected from their average estimated period of manufacture, nearly all the specimens inspected turned out to fall into this 'hand-spun only' subset (n = 219). These were digitally photographed at 800x or 1000x magnification, most of them 20 or 30 times, yielding an image bank containing thousands of images. We shall refer to this subset as the Microscopic Database.

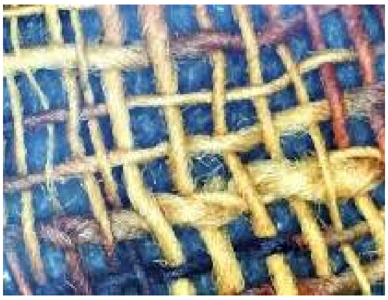
The following three aspects were investigated: (a) regularity versus irregularity of yarn gauge; (b) weave types; and (c) yarn degradation over time. Measurement of yarn gauge was done on-screen, using a digital measurement tool.[1]

Analysis of the 5000+ photographs in the Microscopic Database revealed a great variety of yarn. As was to be expected from the average estimated time of manufacture of the sample (circa 1930), the yarns all showed the irregularities typical of hand-spun material, but one specific class, surprisingly, was found to be far more irregular than others: nearly all ikat of the early 20th century and before was done in what one might be tempted to classify as 'wildly irregular' yarns. During this period, gauge differences (variations in the thickness of the yarn) of a factor four and five were not uncommon – this in sampled areas measuring just 3 x 4 mm. One cloth, a 19th-century men's blanket from Manulea on Timor (PC 224), even showed a factor ten variation.

Over time, hand-spun yarn, perhaps in imitation of machine-made yarn, gradually became more even. The transition point lies roughly around 1925. From this moment on women, more or less across the archipelago, with only a few exceptions, began to produce hand-spun cotton far smoother than their mothers and grandmothers had done. Given the spirit of competition prevailing in numerous ikat-weaving regions – not just among the brawny men with their headhunting mindset, but equally among the ikating women – it is not at all unlikely that the archipelago's women saw the qualities of machine-made thread as a personal challenge, and simply did not want to be outspun by machines.

[1] The JR Screen Ruler Pro by Spadix Software (www.spadixbd.com) is an instrument capable of taking on-screen measurements in pixels in any direction. While the actual pixel count is meaningless as it is a function of the screen resolution, the proportions of width over length are resolution independent, and true under all conditions.

OVERVIEW ILLUSTRATING THE SHIFTING CHARACTER OF HAND-SPUN YARN OVER TIME



Highly irregular hand-spun cotton in a 19^{th}-century ceremonial shawl, *geringsing*, from Tenganan (Bali). Gauge variation factor ~9. Specific weight: 121 g/m^2 (PC 060).

Highly irregular hand-spun cotton in a 19^{th}- to early 20^{th}-century sarong from an unidentified island in the Babar Archipelago. Gauge variation factor ~4. Specific weight: 289 g/m^2 (PC 301).

Highly irregular hand-spun cotton in an early 20^{th}-century *adat* sarong from Adonara (Solor & Alor Archipelago). Gauge variation factor ~6. Specific weight: 297 g/m^2 (PC 130).

Highly irregular hand-spun cotton in a 19^{th}-century men's blanket from Manulea (West Timor). Gauge variation factor ~10. Specific weight 435 g/m^2 (PC 224).

Highly irregular hand-spun cotton in a 19^{th}-century *tuka dulang,* sarong, from Lembata (Solor & Alor Archipelago). Gauge variation factor ~5. Specific weight: 348 g/m^2 (PC 068).

Regular hand-spun cotton, twined, in a late colonial sarong from Kisar. Gauge variation factor ~1.5. Specific weight: 451 g/m^2 (PC 276).

Extremely fine hand-spun cotton, on a circa 1900 East Sumbanese *hinggi* of the highest class, pairing the complications of longitudinal and axial asymmetry. Gauge variation factor ~6.5. Specific weight: a mere 194 g/m^2 (PC 351).

Regular hand-spun cotton, twined, in a pre-1950 sarong from Savu. Gauge variation factor ~2. Specific weight: 294 g/m^2 (PC 185).

Rather regular hand-spun cotton, twined, in a circa 1950 sarong from Kisar. Gauge variation factor ~2. Specific weight: 371 g/m^2 (PC 274).

Fig. 20 The development of hand-spun yarn over time: from very fine and highly irregular to quite smooth, approaching the regularity of machine-made thread, and generally coarser. In several island regions the highest-class cloths were all made of the finest hand-spun yarn, with a very low specific weight.

Specific weight as indicator of yarn gauge

Again using specimens from across the archipelago, a substantial set (n = 240) was both measured and weighed, the resulting data entered into a database. By taking into account the type of cloth (a wrap for waist or shoulder is a single-layer textile whereas a sarong, a tubeskirt, when laid flat has two layers of cloth) the specific weight in grams per m^2 could be calculated. The estimated age of the cloths in the sample was also entered into a database. Differences in density of weaving may account for part of the specific weight differential over time, but generally speaking such differences appear to be small within regions – with the exception of only a few textiles which were woven far more loosely than common, e.g. PC 105 and PC 204 (see Fig. 203), probably to attain a soft tactile experience.

By correlating estimated age and weight per m^2 it was established that weavers active during the 19th and early 20th centuries produced much finer yarn than those active in later years. Given the general decline of refinement in the traditional material culture over this period, this conclusion seems an open door. But the diverging grades of refinement at the level of yarn quality have technical consequences and status-related aspects which warrant investigation. Fine yarn has always been highly esteemed for the result it produces. "The finer the yarn, the more supple the weaving: a much desired result, the obtainment of which however seriously slows down the work (Loebèr 1903:1)".[1] Hence the merit derived from the laborious process.

DATA SORTED BY SPECIFIC WEIGHT

When the Microscopic Database (n = 219) was sorted by ascending specific weight (expressed in g/m^2), a clear correlation between high age and low weight was found:

- The 20 textiles in the sample with the lowest specific weight, averaging 184 g/m^2, had an average age of 102.8 years.
- The 20 textiles in the sample with the highest specific weight, averaging 879 g/m^2, had an average age of 84.8 years.

DATA SORTED BY AGE

When the database was sorted according to descending age, the same correlation between high age and low weight was found:

- The 20 earliest specimens, with an average estimated age of 132.8 years, had an average specific weight of 328.8 g/m^2.
- The 20 most recent specimens, with an average estimated age of 57.8 years, had an average specific weight of 471.4 g/m^2.

Evidently, weavers over time lost either the interest or the ability to spin very fine yarn.[2]

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[1] The present author's translation of the original Dutch text: "Hoe fijner de draad is, hoe soepeler het weefsel zal worden: een zeer gewenscht resultaat, maar welks verkrijgen de arbeid belangrijk vertraagt."

[2] Data available on the present author's website.

Weavers' gain is their loss

Fig. 21 Detail of a shawl or breast-cloth made on Tanimbar (see Fig. 203), probably in the first quarter of the 20th century. The size is substantial, 101 x 137 cm, but it weighs only 310 g (specific weight 224 g/m^2). The finely detailed weaving is at the apex of the Tanimbar Islands' quality range. Even the tiniest details can be significant, such as the four dots in the central motif of the bottom band of this Tanimbar shawl, which symbolise a male headdress, rather than a female comb, which would be represented by two dots.[1] *Source:* PC 204.

What the weavers from the transition period gained by switching from fine irregular to more regular but coarser yarns, is what they lost: the ability to create almost gossamer textiles from hand-spun cotton, with intricate motifs drawn in high resolution. The finest specimens extant are invariably of advanced age. The most extreme examples encountered, likely to be near the bottom of the specific weight-range archipelago-wide, are two late 19th- to early 20th-century Kalimantan *kain kebat*, skirts, measuring 0.67 m^2 and 0.65 m^2 respectivelty. The first weighs just 80 grams, the weight of four standard letters. The other merely 55 grams. These were made in the Ketungau river region – outside the studied area, but referred to here as it helps reveal the trend in the wider area. Their specific weights of 119 g/m^2, respectively 84 g/m^2, are just twice that of a Buginese silk. Note that this was achieved, not in a sophisticated city, or even a market town at a confluence of major rivers, but in some longhouse up along a minor tributary in West Kalimantan, an inland jungle region close to the Sarawak border, where living conditions are challenging. Yet the women from this region managed to spin extremely fine yarn; in this particular case paired with almost unimaginably complex design (see PC 300, PC 362) .

An early 20th-century example from the eastern extreme of the area under study, a

[1] Marianne van Vuuren, pers. comm., 2017.

rather loosely woven Tanimbar shawl (PC 204, see Fig. 21), comes to 224 g/m^2. Again, it is difficult to imagine how a woman on a remote island with few amenities could produce an intricately ikated shawl with such a lush, luxury feel, so lightweight – something that apparently her daughters and grand-daughters either chose, or (resigning themselves to their technical limitations), accepted not to emulate.

In East Sumba we encounter a marked correlation between high class design and lightweight construction. A correlation which was not general, and coeval with high class ikat in especially heavy yarn. As there are just a few surviving examples manifesting this combination of ingenious design and exceptionally low weight, and there is no record of their existence, we can only speculate what they represent. Were these examples of a few courts' unique technical refinement? Or representatives of an archaic technique that in the given period still survived, but merely at a few courts? All that is archaic in peoples' minds can readily turn into antiquated – and cause it to be abandoned, which our analysis indicates happened roughly a hundred years ago.

While the average specific weight of the investigated East Sumbanese *hinggi*, men's wraps, in Groups A and C of the Physical Database is 296 g/m^2, three early specimens of the highest order have a specific weight <= 200 g/m^2, to wit PC 228 (see Figs. 210, 234) with 200 g/m^2, PC 350 (see Fig. 251) with 196 g/m^2 and PC 351 (see Fig. 252) with 194 g/m^2. PC 160, an example of 4-fold replication with a specific weight of 207 g/m^2 (see Fig. 229), while less extreme, clearly belongs to the same select group of intricate, lightweight *hinggi.* It should be taken into account that the Reference Set is skewed towards high quality, so that the difference in specific weight between the highest class and truly average *hinggi*, which may weigh in at circa 325 g/m^2 is greater still.

The present author's conclusion that a number of early East Sumbanese noblemen's wraps were made of uncommonly fine material, initially was not universally accepted by his Sumbanese informal sources. Some stated that kings and noblemen would never condescend to wearing flimsy cloths, that they required heavy, rugged material as a confirmation of their status, that I should not forget that these men often leaned their backs against rough wooden planking which could tear fragile cloth, etc. Some concluded that such superfine cloths must have been made for the nascent Dutch market. This opinion was sustained by the encounter in Group A of the Reference Set of a few noble cloths weighing close to or well over 1 kg, such as PC 188 (an early 20th-century *hinggi* of the highest order with zero replications, see Fig. 250) which comes to 1100 grams and has a specific weight of 252 g/m^2; and PC 171 (ten Hoopen 2018:290), made in 1960 by Tamu Rambu (Princess) Mirinai Danga from Kanatang, which tips the scales at 1240 grams, arriving at a specific weight of 342 g/m^2. The Sumbanese independent researcher Joseph Lamont alone confirmed this study's findings – to wit a preference among at least some of the island's nobles for lightweight wraps, and explained it by pointing to the high average temperatures on the island.[1]

Because of the lack of historical records, it was hard to transcend an exchange of opinions. Felicitously, doubts could finally be resolved by thinking through the technical consequences of using very fine yarn. If the specific weight of a particular *hinggi* was circa 35 per cent lower than that of a cloth made by and for commoners, generally this resulted from working in 20 percent finer yarn.[2] This implied that the weaver must ikat on 25 percent more yarns to achieve the same width of cloth – and (assuming drawing in strokes with the established yarn count for the various elements of traditional motifs), place 25 per cent more bindings. Commitment to such a vast increase in the workload was conceivable only at the highest courts, which have the creative talent in house required for intricate design, and hands around for the drudge work of tying all the extra bindings. The upside was, that the drawing was done in much finer strokes, which allowed greater precision, and perfect execution of patterns as complex as *patola ratu.*

Another matter (which could not be settled), was how the very fine yarn of the late 19th and early 20th century was spun – with a spinning wheel or a spindle. Umbu Makambombu, a Sumbanese nobleman and textile expert from the Rindi region, pointed out that nearly all early Sumbanese spinning equipment on the island was sold to foreigners long ago, e.g. the spinning wheel, *ndatar*, now held in the Singapore Asian Cultures Museum (Breguet 2019) and the yarn skeiner in the Geneva Musée Barbier-Mueller (Breguet 2017), and speculated that the finest Sumbanese yarn may have been made by support spinning. This (not-exclusively) Savunese technique may have been adopted at some Sumbanese courts for its simplicity and technical excellence.[3] The weaver in one raised hand holds a wad of carded cotton, and lets its linked fibres pass through her fingers to shape the yarn with finger pression. With the other she tensions the yarn and twists it onto a tiny spindle called *kindi* which she rotates in a small bowl, typically a half shell or coconut shell (*ibid.,* 142).

Savunese have settled on Sumba for centuries, and Sumbanese women no doubt noticed and respected the quality of their ikat. Umbu Makambombu's suggestion is worth further exploration. Apparently, around 1900 (and perhaps a long time before) a select group of East Sumbanese weavers, all high class, not known from the literature, worked in exceedingly fine yarn. It is indeed very likely that this elite group had a special spinning technique in common; and given the substantial difference with common Sumbanese yarn, support spinning is a likely candidate.

The preference for lightweight *hinggi* at select courts[4] appears to have evaporated, or sacrificed on the altar of fashion, around 1925. No examples of exceptionally lightweight specimens were encountered beyond that point in time – perhaps because from then on

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[1] Joseph Lamont, pers. comm., 2020.

[2] The relative diameter D of the yarns is calculated (see below) by the formula: $D = 2 \times \sqrt{SW / \pi}$.

[3] Umbu Makambombu, pers. comm., 2020.

[4] Noblemen's wraps from West Sumba, *hanggi*¸ are heavy without exception. Sturdy cloth is here associated with python skin and optimal protection, particularly with reference to its use as shroud.

those weavers who still practiced hand-spinning began imitating smoother, but heavier gauge machine-made thread.

Overall, the result of this analysis is surprising. Each and every early 20th-century and older cloth in the database turned out to have been done in hand-spun cotton, including all those so fine and smooth that in the database they had provisionally – while awaiting microscopic inspection and weight analysis – been marked as ‘probably *benang belanda*’, Dutch factory thread.

While a certain increase in specific weight over time had been expected based on handling cloths from various periods and microscopic study of their yarn, the rate of increase over a relatively short period of time was wholly unexpected. As we have no opportunity to query the motives of weavers from the period when the transition to heavier, more regular yarn occurred, all we can venture is an educated guess.

Perhaps the weavers in the region under study, confronted with machine yarn around the turn of the century – some quite early, say 1880, most perhaps around 1925 – were impressed with what they saw, and particularly with what they felt as they let the factory-made, store-bought *benang toko* aka *benang belanda* run through their hands ever so smoothly, without lumps and bumps. Being reflexively competitive as a result of the environment they grew up in[1], they decided not to be outdone by new-fangled machinery, and taught themselves to spin a more regularly spun yarn. It appears that they attained this at a cost: greater evenness could be achieved only by making the yarn a little heavier. Rather than reducing the thickness of slubs, from around 1900 they made the thinner parts thicker to achieve a more even gauge overall, thus increasing the specific weight of their textiles. Starting at 275 g/m^2 in the 19th century, the graph representing the measurement data (see Table 1, below) shows a trend of gradual weight increases over time which continued until the 1950s, when the specific weight reached a plateau of circa 450 g/m^2.

From a designer’s point of view, the principal consequence of the trend towards heavier gauge yarn, is loss of definition. Certifiably royal as Princess Mirinai Danga’s 1960 PC 171 may be, in terms of definition it is not in the same category as, for instance, PC 319 (see Figs. 195, 219, 249) or PC 350 (see Fig. 251), both made some 75 years earlier. The average specific weight of the specimens older than 100 years (represented by the leftmost eight bars in the graph below, see Table 1), to wit, 326 g/m^2, is merely 72 per cent of the circa 450 g/m^2 plateau reached in later years. Assuming roughly equal material density (similar specific weight of the cotton fibres and spinning at like tension) and a few other factors that influence weight, we can calculate the approximate relative diameters from cloths’ specific weight, accurate enough for the purpose of comparitive juxtaposition.

Yarn being tubular, its specific weight (SW) is a function of its cross-sectional area

[1] “Although women did not normally take part in raiding [read: headhunting] expeditions, they played a critical role in motivating men for combat, in the rituals that greeted them on their return, and in the ceremonies that brought each expedition to a closure (Watson Andaya, n.d.)”.

(the result of πr^2). The relative diameter D of the yarn used (2 x r) is arrived at by the formula: $D = 2 \times \sqrt{SW / \pi}$. The relative diameter of the older yarns, $D(a) = 2 \times (\sqrt{326 / \pi}) = 20.37$. That of the younger yarns, $D(b) = 2 \times (\sqrt{450 / \pi}) = 23.94$. Dividing D(a) by D(b) we find that D(a) is a factor 0.85 thinner than D(b). If no other factors came into the equation, to give cloth A the same width as cloth B, a weaver would have to use 1 / 0.85 = 1.18 times as many yarns.

But other factors do come into the equation and preclude exact calculation. Humidity could be a factor because cotton is hydrophilic; but all weighing was done in the same environment with a fairly stable humidity, rarely outside the 55-65 per cent range. Tightness of spin could be a factor, and no doubt variation would be found if there were a way to measure it, but the size of the sample (n = 215) averages out variation to a degree considered sufficient for approximate comparison. Intensity of use and laundering could also be a factor, as both would cause degradation and loss of fibre, but because most specimens in the sample are ceremonial cloths that were rarely if ever washed, this is not likely to affect their weight more than fractionally.[1] Spot checks on microscopic photographs of ikat cloths from different age groups validated the above calculations. (See also Fig. 20). To leave a margin for error, the calculated 18 per cent was corrected downward to 15 per cent.

This still substantial percentage implies a) that the weavers in that earlier period before circa 1920, needed circa 15 per cent more warp yarns to achieve the same width of cloth; (b) when drawing in strokes of the same x-yarn width had to place circa 15 per cent more bindings; and (c) could create proportionally more intricate drawings in cloths of the same size. Inversely, it entails that the weavers of the last 100 years had to settle for drawing in substantially lower definition than their grandmothers and great-grandmothers – and provides overdue empirical substantiation for the subjective sense of a steep decline of ikat in the region under study.

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[1] Owners of an heirloom textile may proudly state that "…it has never been washed". Meaning that it was cherished and very well taken care of. "Those that had never been washed were considered more valuable." Marianne van Vuuren, pers. comm., 2017, cited in ten Hoopen (2018:485).

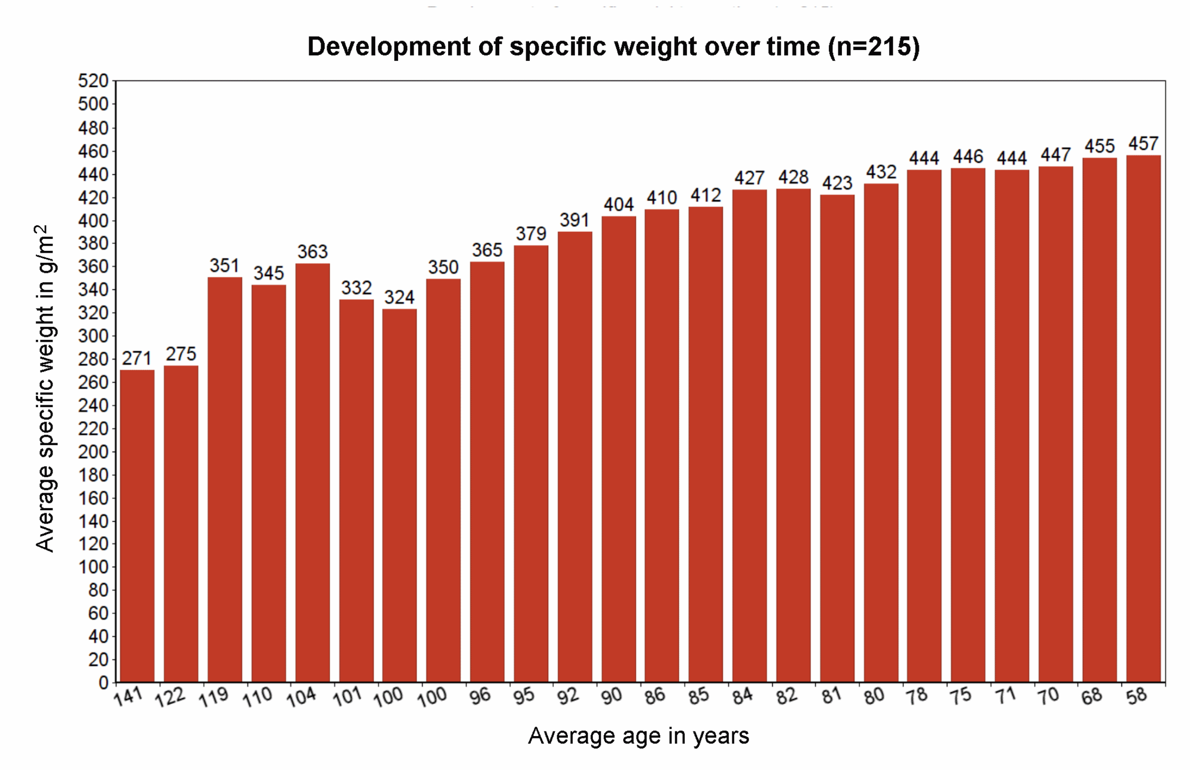

Table 1 The development over time of the specific weight of ikat textiles in Group A of the Reference Set. Clearly discernible is the long-range trend towards higher specific weight; or in other words, towards less finely made cloths, with drawing in lower resolution. A sudden increase of circa 30 per cent appears to have taken place around 1900, when machine-made yarn began to become available, followed by a brief correction circa 1920. 'Appears' is the operative word here, as the number of representatives in the high end of the age spectrum is too low to carry the weight of conclusions. However, when we average the earliest seven age categories to compensate for the low number of specimens, yielding a base of 323 g/m^2 around 1910, we do see specific weight steadily increasing over the next four decades until it plateaus at the end of the colonial period at a little over 450 g/m^2, representing an increase of circa 40 per cent.

2.2 VARIETIES OF PLYING

Microscopic observation revealed that the vast majority of the ikat textiles from the region under study were made of single yarn. Twining, most common on Sumba and Savu, and occasionally seen elsewhere, e.g. on Timor and in the Moluccas, is of two kinds, called S-type or Z-type depending on the direction in which the yarns were twisted together. If we hold the twined yarn vertical and the spiralling yarns slant from bottom left to top right, we speak of Z-type ply; if they slant from bottom right to top left, of S-type ply (Jager Gerlings 1952:153.) On the only island where the warp was twined without exception, Sumba, we encounter both types, though S-type is predominant. Across the other regions under study where twining was practiced, we encounter double-ply, triple-ply, and quadruple-ply; the latter mostly on Timor, but only with commercial yarn, presumably to give it more body, but also on four specimens from the Moluccas made from hand-spun yarn. As single yarn was found far more common than twined, and the investigation's focus was on weave types and changes of yarn gauge over time, no attempt was made to link ply-counts to specific regions beyond the observations made above.

Why would women go through the trouble of creating double-ply from very thin yarn if they could just as well spin it a little thicker to begin with? Double-ply yarn is qualitatively better than single-ply yarn made twice as thick. Plying produces a smoother yarn, as it evens out inequalities, be they differences in thickness or variations in tension (ten Hoopen 2018:34) and, when noticed, may have the additional advantage of showing off effort, investment of time – a form of pecuniary emulation *sensu* Veblen. During the plying process, a length of yarn, spun by twisting together strands of cotton fibre, is twined with another length of yarn, typically (with the odd exception) in a direction opposite to that in which they were originally twisted. This procedure settles the fibre, counteracts the tension created by the spinning process and protects parts of the fibre from abrasion – the more plies, the more significant the effect.

Several oddities were observed. The most intriguing is a probably 19th-century skirt from the Mualang in West Kalimantan (PC 230, see Fig. 22). It shows homodirectional quadruple-ply made by twining two threads, not counter-twisted, but in the same direction; then twining together two strands of this double yarn, again not counter-twisted but in the same direction. While Kalimantan is outside the studied area, it is brought up here in order to illustrate the occasional occurrence, across the archipelago, of gross deviations from the regional standards, even with regard to a technique as basic as twining. The Mualang weaver of this *kain kebat* lived over a century ago in an extremely remote place, given the simple designs almost certainly far up-river. In all her life she may never have come to the Mualang heartland, nor have had more than a few occasions to study evolved designs. All indications are that she was living on the extremities of the Mualang realm, in the thinnest veins of the tribe's cultural bloodstream. This gives us a reasonable assumption of her physical place in the world, but who was she?

Not only was she a contrarian in terms of spinning, her weave is also what the Dutch call *tegendraads* ('counter-yarnish', *i.e.* deviant): hers is the only one found in all of the Borneo sample (n = 29) not woven with twin warp. The vast majority (72 per cent) was done in 'two over, two under' as Kreifeldt, one of very few sources on Kalimantan ikat calls it, [1] the rest in twin warp and double or triple weft– except this particular Mualang skirt, in which everything was done differently.

An early, probably 19th-century Mualang skirt identified as Mualang.[2] It was dyed in the chocolaty colour of *enkerbai* that is typical for Mualang - not the redder *engkudu,* morinda, used by most other Ibanic weavers. Ex-collection Baron Frederic Rolin. *Source:* PC 230.

The yarn of this old Mualang skirt is unusual: the weaver span a very fine yarn, then twined it for strength, although not countered, but winding in the same direction and then twined it with another length of the same two-ply yarn - again not countered, but winding in the same direction. This was done both for warp and weft, giving the cloth a finely ribbed surface. *Source:* PC 230.

Fig. 22 Highly unusual homodirectional twining in an antique Mualang tubeskirt.

2.3 INTRODUCTION OF MACHINE-MADE THREAD

Microscopic analysis of the yarn yielded a few anomalies suggesting that around the *fin-de-siècle* in most regions a reversal of values took place: machine-made yarn was given a higher appreciation than hand-spun. It appears that this reversal took place at the introduction of machine-made thread, which, because a cash outlay was required to obtain

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[1] John Kreifeldt, pers. comm., 2017.
[2] Iban Chandra Kantuk, pers. comm., 2016.

A microscopic detail of hand-spun yarn used in all plain indigo bands.

A microscopic detail of double-ply machine-made thread used in all ikated areas.

Fig. 23 Mixed use of hand-spun yarn and machine-made thread on a 1925-1950 Savu sarong. *Source:* PC 012 (shown in full on Fig. 220).

it, must have been seen as a luxury. During this transitional period a few weavers chose to do their ikat work in machine-made yarn, which temporarily was seen as status-enhancing, while using hand-spun yarn for all the plain bands.

A typical example is the Savu sarong PC 012, described in detail in the caption of Fig. 220, which is estimated to have been made between 1925 and 1940. Remarkably, the ikat work (the 'posh' part) was all executed on commercial thread, whereas the plain areas were done in very fine hand-spun. This suggests that on Savu at that particular time commercial thread – which allowed exceedingly precise ikat – was considered a luxury, something one would not waste on plain sections.

Another, more complex, example is the antique Palu'e *tama,* sarong PC 305 – one of very few intact survivors of the type (see Fig. 211). The striking irregularity of the hand-spun yarn used in the plain bands, with its wild gauge swings (see Figs. 24, 25), points to an early date of manufacture: probably mid to late 19th century. Microscopic inspection showed that, as on the Savu sarong described above, the ikat work, the part used to flaunt your skills, was all done on commercial thread, whereas the plain areas were done in very fine hand-spun. This again places manufacture in a time when machine-made thread had more cachet than hand-spun. It could not be established when commercial thread became a commodity on Palu'e, but there are reasons to believe that, while exceptionally orthodox in their traditions compared to the weavers in Sikka across the strait, paradoxically, Palu'e weavers were also early adopters. It may never be known when exactly the mass switch-over to commercial thread was made on Palu'e, but in the late colonial period we already see more machine-made than hand-spun yarn and a rapid influx of chemical dyes.

Regrettably, there are few similar *tama* to compare it with. Early examples in are extremely scarce, because the 1928 explosion of the volcanic cone that constitutes Palu'e caused a tsunami that destroyed many *adat* houses, which all lay on the coast – the only habitable region part of this tiny yet 875 m high island. The island's complex ikat culture was studied assiduously by Stefan and Magnus Danerek, who created an inventory of the its motifs (Danerek 2019) and investigated its nomenclature and iconography (Danerek & Danerek 2020). This and another Palu'e *tama*, PC 209, caught their attention as they may be the only examples extant of particular styles. The latter came with no provenance and no known cognates. A design-technical analysis showed up a combination of features found only on Palu'e: a preference for angularity, drawing in stippling, and the use of vertical division bars to separate indivividual motifs. The Danereks took photographs of PC 209 to Palu'e and queried elder weavers if they recognized the motifs, and if so, if they could name them and describe their connotations (Danerek & Danerek 2020:22). Part of the Danereks' efforts to document the ikat of Palu'e consisted of attempts to let local weavers recreate the few antique cloths known from publications and public collections accessible online (sets which largely overlap). While certain simpler designs could indeed be recreated, it remains an open question if the current generation of weavers will be able to reach the level of technical accomplishment of their grandmothers leave alone great-grandmothers. First reports disclose that they find the patterns of PC 305 "very difficult".[1]

From a curatorial point of view this speaks to the heart of the matter. It underscores the urgent need to undertake field work while there is still a field to work in. If we want to have a more fine-grained record of the Indonesian archipelago's ikat culture, we need more people to research remote small islands and record every bit of information they can elicit; and beyond that, to try to restore the local weavers' technical ability to work to their grandmothers' standards. The ikat culture is disappearing so fast – except in a few pockets where ikat has not been commodified – that, as Danerek's experience demonstrates, in one or two more generations it will not be possible to replicate even its basic elements.

The Palu'e weaver who produced PC 305 was clearly experimenting with commercial thread, as we can distinguish four types of yarn used in the same cloth:

1. Machine-made thread, double-ply, used in all ikated parts;
2. Hand-spun cotton, used in all plain indigo bands;
3. Combination – never observed elsewhere – of handspun yarn and double-ply machine-made thread running in parallel, used for all the plain red stripes;
4. Quadruple-ply machine-made thread, used only for yellow pinstripes.

[1] Stefan Danerek, pers. comm, 2019.

Double-ply machine-made thread, used in ikated areas (PC 305).

Hand-spun yarn, used in plain indigo bands (PC 305).

Fig. 24 The mixed use of hand-spun yarn and machine-made thread found on an antique Palu'e sarong. *Source*: PC 305 (see Fig. 211).

Hand-spun yarn and double-ply machine-made thread running in parallel, the latter in the white stripes.

On a background of indigo hand-spun yarn, deeply saturated, a single thread of quadruple-ply *benang belanda* (or other *benang toko*) creates a narrow yellow pinstripe.

Fig. 25 The mixed use of hand-spun yarn and machine-made thread found on an antique Palu'e sarong. *Source:* PC 305 (see Fig. 211).

2.4 WEAVE VARIETIES PER REGION

Microscopic inspection of the textiles in the Microscopic Database (n = 219) yielded a substantial variety of weaves, enough to warrant a separate study. While a thorough inventory of the repertoire of weaves falls outside the scope of the present study, an analysis was made of the occurrences of weave types in each of the 41 regions. In total 21 distinct weave types could be identified – a surprisingly large figure for such a limited number of regions. Several of the simpler weave types are found all over the world and go by a variety of popular names, some of them applied to more than a single way to interlace warp with weft. To create clarity it seemed imperative to develop a nomenclature based on unique technical qualities, and use it exclusively. The coding convention applied here is xWpyWf, whereby Wp stands for warp and Wf for weft, x for the number of warp threads and y for the number of weft threads. Whenever double or multi-ply yarn was used, the code is preceded by zply-, whereby z stands for the number of plies. For a summary of the findings, see the Appendix.[1]

The more common weave types are described in the illustrated list below. Excluded from the subset defined in the beginning of this chapter were all specimens where, because of the density of the textile, even after studying multiple microscopic images the nature of the weave remained ambiguous (except one, shown below, because it is so unusual), leaving a sample size of 219 textiles. Whenever a cloth was encountered in which the weaver had combined hand-spun cotton with commercial thread, only weave types in the hand-spun part of the cloth were accounted for. In several cases (e.g. PC 314 from Pantar) disparate weaves were used to create the patterned and the plain parts of the cloth. In these cases only the ikated part was ranked.

Sumba presents a special case. Nearly all Sumbanese ikat is done in single double-ply warp with twin weft (2ply-1Wp2Wf), but for commercial production weavers occasionally opt for labour-saving 2ply-1Wp3Wf or 2ply-1Wp4Wf. As this weave type shows more of the warp, such cloths are a fraction more colourful. On rare occasions, for cloths of the highest order, single double-ply warp with single weft (2ply-1Wp1Wf) is used. Such warp ikat with single weft, *pakan tunggal*, produces finer, crisper drawing than the common *pakan kambar*, twin weft, but requires more work. Nearly all of the small number of known Sumbanese examples of 2ply-1Wp1Wf are narrow shawls, *tiara haringgi*, measuring just circa 0.25 m^2. For *hinggi,* which on average are 12 times as large, this weave type is used even more sparingly. In Group A of the Physical Database only two examples were found, both early 20th-century: one in West Sumba (PC 163), the other in East Sumba (PC 299, Fig. 241). The most common weave types and a few rare ones are described in detail below.

The weaves type found in the studied region are:

1Wp1Wf	2Wp3Wf	2ply-2Wp2Wf
2Wp1Wf	2Wp3&4Wf	2ply-1Wp4Wf
1Wp2Wf	3Wp1Wf	4ply-1Wp1Wf
2Wp2Wf	3Wp4Wf	4ply-1Wp4Wf
2Wp3Wf	2ply-1Wp1Wf	hybrid weaves
1&2Wp1Wf	2ply-1Wp2Wf	
1&2Wp2Wf	2ply-1Wp3Wf	
2&3Wp2Wf	2ply-2Wp1Wf	

[1] For the complete set of data, see URL: https://www.ikat.us/leiden/ikat_weave_types.pdf.

OVERVIEW OF WEAVE TYPES FOUND IN IKAT FROM THE INDONESIAN ARCHIPELAGO.
Note: the acronyms were designed to fit a table analysing the distribution of the no less than 21 weave types encountered in the course of this investigation. For a compact version of this table, see the Appendix.

SINGLE WARP, SINGLE WEFT
Code: 1Wp1Wf

Fig. 26 A single warp thread interlaces with a single weft thread. This weave type is very common, except on Borneo (Sarawak and Kalimantan) and Timor where only a single instance was found. It is here shown in a Rotinese *lafa ina*, horse blanket, from the second quarter of the 20th century.

Source: PC 107.

TWIN WARP, SINGLE WEFT
Code: 2Wp1Wf

Fig. 27 This weave type is illustrated here on an *mau*, men's wrap, from Amanuban (West Timor) skull trees as its main ikated motif. Two warp threads in parallel interlace with a single weft thread. This is the most common weave type in both West and East Timor, with 23 occurrences. Only 18 occurrences have been found across the other 40 ikat regions.

Source: PC 013.

SINGLE WARP, TWIN WEFT
Code: 1Wp2Wf

Fig. 28 A single warp yarn interlaces with two weft yarns in parallel in this *lawo*, sarong, from Lio (Flores), made in the second quarter of the 20th century

Source: PC 022.

TWIN WARP, TWIN WEFT
Code: 2Wp2Wf

Fig. 29 In this early 20th-century *sapu jara,* sarong, from Ngada (Flores), two warp threads in parallel interlace with two weft threads in parallel. This ‘two over, two under’ weave is used in three regions on Flores: to wit Ngada (exclusively), Sikka (occasionally) and Ende (a single specimen); in West Sumba (idem); and it is the default weave on Borneo (both Kalimantan and Sarawak). This weave type shows much weft, so colour and degree of saturation of the weft have substantial import.

Source: PC 076.

SINGLE DOUBLE-PLY WARP, SINGLE WEFT
Code: 2ply-1Wp1Wf

Fig. 30 Moderately popular, with 10 occurrences found. It is here shown on a shawl, *lafa*, from Roti, created circa 1930

Source: PC 003.

SINGLE DOUBLE-PLY WARP, TWIN WEFT
Code: 2ply-1Wp2Wf

Fig. 31 A double-ply warp interlaces with two weft threads in parallel. This weave was found only on Flores, and there only in Ndona and Lio – the origin of this sample, a 1920-1940 *lawo,* sarong – and in East Sumba, where it is used for all but a small number of exceptional cloths. The only specimen from East Sumba in Group A of the Physical Database to have single weft is PC 299 (see Fig. 241), which also in other respects – *hondu kihhil walla*, extremely low specific weight – is extraordinary.

Source: PC 099.

TWIN DOUBLE-PLY WARP, TWIN WEFT
Code: 2ply-2Wp2Wf

Fig. 32 Twin double-ply warps running in parallel, interlacing with twin wefts. A single example of this weave type was found in Subun, Western Insana (West Timor) on a rare type of noblemen's wrap. The thread appears to be machine made, but the results of microscopic inspection remained ambiguous.

Source: PC 081.

SINGLE DOUBLE-PLY WARP, QUADRUPLE WEFT
Code: 2ply-1Wp4Wf

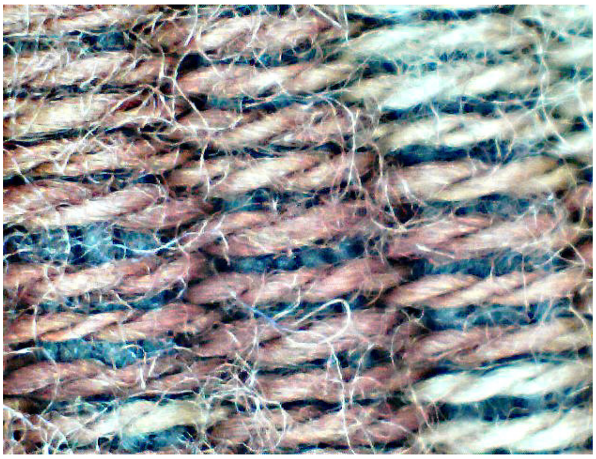

Fig. 33 Only found in East Sumba, in an early 20th-century *hinggi* (PC 015). This weave gives the cloth a sturdy, ribbed feel. It represents a short-cut to producing more yardage in less time. The weave type suggests that this cloth, while almost certainly early, was made for the trade. Perhaps the Dutch wanted their cloths heavy, with that extra dose of gravitas that only physical weight can provide, and wanted them quickly.

Source: PC 015.

TRIPLE WARP, QUADRUPLE WEFT
Code: 3Wp4Wf

Fig. 34 Encountered only in a Toraja (Sulawesi) 'revival' *sekomandi*, probably made in the 1970s. This production-oriented weave was not observed anywhere in the region under study. It produces a coarse cloth in record time, good enough for the tourist trade, but not conducive to fine detailing.

Source: Private collection, Amsterdam. Photograph by the present author.

In conclusion, in the sample of 219 cloths three weave types stood out as most popular, with 136 examples accounting for 70 per cent of the sample:

- (a) single warp interlacing with single weft (1Wp1Wf, 75 occurrences, 34 per cent). This type was found across the Indonesian archipelago, except on Borneo (Sarawak and Kalimantan) and Sumba. On Timor only a single example was found;
- (b) twin warp interlacing with single weft (2Wp1Wf, 41 occurrences, 19 per cent). This type was found across the region under study, although not on Bali and neighbouring Nusa Penida and Lombok, and only once in the Solor & Alor Archipelago, to wit on tiny Pantar, in many respects an outlier. It is the dominant type in both West and East Timor, found on 23 out of 39, or 59 per cent of all specimens;
- (c) twin warp interlacing with twin weft (2Wp2Wf, 28 occurrences, 13 per cent). Notably 21 of the 28 in this category were found on Borneo, where only eight specimens deviated from what is clearly the dominant weave type on this island; of the remaining seven specimens five were found on Flores, one in West Sumba, one on Pantar.

Also rather widely used were:

- (a) double-ply, single warp interlacing with twin weft (2ply-1Wp2Wf, 21 occurrences, 9.5 per cent). The type was found mostly in East Sumba, where it is the dominant weave (16 out of 21 specimens), and on Flores in the Lio and Ndona regions of Ende District where it is also dominant – in contrast to all other regions on Flores, including the rest of the Ende District where single warp interlacing with single weft is used exclusively. It was encountered nowhere else;
- (b) double-ply, single warp interlacing with single weft (2ply-1Wp1Wf, 12 occurrences, 5.5 per cent). The type was found on Sumba, Savu, Roti, Kisar, in the Batak region (Sumatra) and in the Toraja region (Sulawesi), where it is the dominant type.

2.5 IRREGULAR WEAVES POSE QUESTIONS ABOUT MOTIVATION

A small but not insignificant number of specimens (9 occurrences, 4 per cent) were found to have been made in a mixture of weaves that resisted categorization. If we pass over clumsiness as a possible factor – as we certainly should in the case of technically accomplished textiles like PC 199, shown below – we can only speculate why a weaver would choose such an extraordinary, labour-intensive technique. Was it a means to show off virtuosity (see Section 4.4 'Ikat as Performance'), or sheer pleasure in her own mastery *sensu* Csikszentmihalyi who stated *re* intrinsic motivation:

> [Any] activity can become rewarding if it provides information about a person's ability to meet a set of challenges. This implies that the activity is one with rules of performance that can be evaluated at least by the actor. [..] The activity should be structured so that the actor can increase or decrease the level of challenges being faced in order to match exactly his or her skills with the requirements for action (1978:213).

Irregular, complex weaves such as those shown below certainly meet Csikszentmihalyi's criteria. It is striking that, with only two exceptions – one from West Timor, and one from West Timor or the offshore island of Semau – such unusual and technically demanding combinations were found exclusively on ikat textiles that were either antique (19^{th}-century to very early 20^{th}-century) or made on tiny, isolated islands such as Lakor (Leti Islands) and an unidentified island in the Babar Archipelago, probably one of the smaller in the group.

As complex weave types require a conscious decision to produce them – and additional effort – it appears that in the earlier part of the period investigated (1850-1950), complex weaves carried more prestige, and in terms of costly signalling *sensu* Smith & Bliege Bird (2005)[1] were more effective than in the later part of the period. The examples of complex weaves found on tiny remote islands are probably relics from such a past, changes typically coming late to out-of-the-way places.

The remarkable parallel with sought complexity in design, particularly with regard to Sumba, is revealed and discussed in Section 4.2 'Sought complexity: asymmetry as proof of mastery'. Shared is the conscious commitment to do something in an 'unnecessarily' complex manner – a textbook example of costly signalling, a behaviour that McAndrew characterised as "truth in advertising (2019:2)". Drawing an evolutionary parallel to Veblen's economic concept of conspicuous consumption he states that for costly signalling to be effective

> [first,] the behavior must be easily observable by others. Second, it must be costly to the actor in resources, energy, or some other significant domain. Third, the signal must be a reliable indicator of some trait or characteristic of the signaler, such as health, intelligence, or access to resources. Finally, the behavior in question must lead to some advantage for the signaler (McAndrew 2018:n.p.).

The final sentence raises an alert: in the case of complex weave types and most of the sought design complexity encountered during this investigation, the cost is either barely visible with the naked eye, or intentionally hidden. This finding is intriguing – particularly as no living human can provide an explanation, forcing us to venture into heuristics, with incidental but often vital assistance from a network of local sources. While the following insight, provided by one of the present author's Sumbanese sources, was written in the present tense (presumably because *bahasa* Indonesia does not conjugate verbs) it needs to be read as applying to the past:

> Most of the time the weavers want to show off what complicated ikat techniques they master by putting in more and more color… But sometimes a family chooses to focus on the quality of the thread, and tightness of the weaving.[2]

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[1] Zahavi (1975, 1977) is frequently cited as the originator of costly signalling as a concept, although he does not mention it and strictly focusses on sexual selection. Smith & Bliege Bird (2005a and particularly 2005b) developed a costly signalling theory with broader application which serves as a useful adjunct to Veblen's (1899) research. In Heppell (2014) the phenomenon is lucidly described in a dedicated chapter, enriched with numerous field observations.

[2] Koesbandy Liong, pers. comm., 2020.

This contemporary explanation of ikat weavers' artistic choices illustrates an observation made more than a century earlier:

> The method of advertisement undergoes a refinement when a sufficiently large wealthy class has developed, who have the leisure for acquiring skill in interpreting the subtler signs of expenditure. "Loud" dress becomes offensive to people of taste, as evincing an undue desire to reach and impress the untrained sensibilities of the vulgar. To the individual of high breeding it is only the more honorific esteem accorded by the cultivated sense of the members of his own high class that is of material consequence. Since the wealthy leisure class has grown so large, or the contact of the leisure-class individual with members of his own class has grown so wide, as to constitute a human environment sufficient for the honorific purpose, there arises a tendency to exclude the baser elements of the population from the scheme even as spectators whose applause or mortification should be sought. The result of all this is a refinement of methods, a resort to subtler contrivances, and a spiritualisation of the scheme of symbolism in dress (Veblen [1899] 1931:187).

There is no better wording than the above to introduce specific findings of this investigation. In the region under study a small group of weavers strives for excellence in areas where it is not easily noticed. It is hard to explain this other than through a sense of superiority, an excellence that does not seek the approval of the masses. While investing extra energy in technical subtleties most people will overlook does not do much to raise one's precedence among the *hoi polloi*, it is by that same token the more effective with the elite. Elites the world over appreciate performances they alone can properly value, as these confirm their sense of superiority.[1] This sense, as well as its expression in behaviour and ikat design, will be further dealt with in Ch. 4, under the heading 'Ikat as performance'.

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[1] Tom Wolfe's *The Painted Word* (1975) and the present author's interview with Wolfe (Haagse Post, 1976, issue number could not be retrieved) elucidated this need of elites for objects or performances, by preference costly, that the general public either does not understand or rejects. This leads to competition on intellectual levels *sensu* Miller (2000). In the ikat-weaving of the Indonesian archipelago this kind of costly competition clearly was more vital than previously assumed.

IRREGULAR OR HYBRID WEAVE

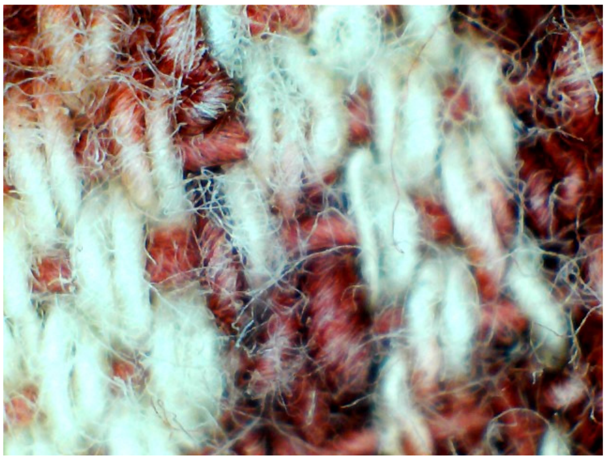
Fig. 35 A circa 1940 sarong from the tiny, isolated Lakor (Leti Islands) has single warp interlaced with single weft (1Wp1Wf), twin warp with single weft (2Wp1Wf), both handspun, and quadruple warp in commercial thread with single weft (4ply-1Wp1Wf), running in parallel to each other.

Source: PC 110.

IRREGULAR OR HYBRID WEAVE

Fig. 36 On this circa 1950 men's wrap presumably made by Helong people from the island of Semau (off West Timor) or the part of the Kupang region (West Timor) inhabited by Helong, we observe both single warp, single weft weave (1Wp1Wf) and twin warp, single weft (2Wp1Wf). Such a hybrid weave complicates setting up the loom. The same weave was seen on PC 120 (also from West Timor) and on PC 163, a late 19th-century *hanggi* from West Sumba.

Source: PC 162 (see also Fig. 51).



IRREGULAR OR HYBRID WEAVE

Fig. 37 On this late 19th- to early 20th-century sarong from the Babar Islands, part of the Southwesterly Islands to the east of Timor, the weaver used both single warp (1Wp1Wf) and double-ply warp interlacing with single weft (2ply-1Wp1Wf).

Source: PC 109.

IRREGULAR OR HYBRID WEAVE

Fig. 38 On this late 19th-to early 20th-sarong from Lembata (Solor & Alor Archipelago), the weaver used both single warp and twin warp cotton as well as triple-ply store-bought silk, all interlacing with single weft (1Wp1Wf, 2Wp1Wf and 3ply-1Wp1Wf).

Source: PC 178.

IRREGULAR OR HYBRID WEAVE

Fig. 39 In this 1940-1950 church altar cloth, *tais altar*, from Suai-Loro in Covalima (East Timor), the weaver alternated twin warp interlacing with triple weft (2Wp3Wf) and twin warp with quadruple weft (2Wp4Wf). This weave type has not been encountered elsewhere. Most weavers in the region under study would regard it beneath their dignity. By contrast, Covalima ikat textiles for *adat* use are very finely made. If the comparative quality of cult objects is any guide, in Suai-Loro, around 1950, Christianity was patently secondary to *adat*.

Source: PC 331.

HYBRID WEAVE TYPE, TRANSITION

Fig. 40 Antique ikat textiles – such as this 19th- to early 20th-century *hoba,* ceremonial sarong, from Nagé Keo (Flores) – are the class most likely to surprise us: they confront us with techniques or patterns that fell into disuse, hence are rarely if ever seen in younger specimens. This 3 x 4 mm sample shows a transition from one weave type to another. It was taken at the verge where the plain red field, executed in single weft interlaced with single warp (1Wp1Wf), weds a section ikated in indigo that was executed in twin warp, single weft (2Wp1Wf).

Source: PC 052.

WEAVE SHOWING OFF VIRTUOSITY

Fig. 41 A minute number of specimens in the Microscopic Database, such as this 19th-century *semba,* men's wrap, from the Ende District (Flores), revealed an irregular combination of weaves. In this sample we see twin warp interlaced with twin weft (2Wp2Wf), found on only one other specimen from the Ende region, but also single warp interlaced with twin weft (1Wp2Wf) not found on any other specimen from the region.

Source: PC 199.

WEAVE SHOWING OFF VIRTUOSITY (CNTD.)

Fig. 42 Any aberration from regularity adds complexity, additional manipulation of the yarns. In the same Ende *semba* studied above (see Fig. 41), we also observe twin warp floating over six weft threads before passing under twin weft treads, a weave type *hors catégorie.*

Source: PC 199.

ALTERNATING SINGLE AND TWIN WEFT
Code: 2Wp1&2Wf

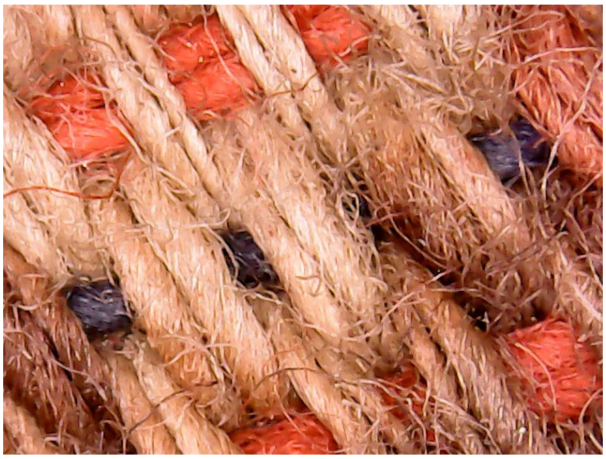


Fig. 43 On this early 20th-century *kain kebat*, skirt from the Ketungau river basin (Kalimantan) [a late encounter, not accounted for in the appendix], the weaver alternated single and twin weft. This type of weave was not encountered anywhere else. The alternation was accentuated by also alternating the colour of the weft: the single weft is indigo, the twin weft is red. In the plain indigo bands along the selvedges this produces a slightly purplish, ribbed effect.

Source: PC 362.

Yarn degradation and plying for protection

The physical degradation of the cotton yarn investigated was quite striking. All old cotton yarn becomes brittle over time, although to different degrees. It is no longer smooth, but under the microscope appears shredded, with bits of fibre breaking away at odd angles. It is not clear why the yarn of certain antique ikat textiles is less degraded than that of others. Such variation may be partly caused by unequal quality of the cotton used. Healthier plants, grown in naturally lush environments are likely to produce stronger fibre than plants that had to struggle for life in a region plagued by prolonged droughts. However, most differences in deterioration are probably caused by disparate levels of usage. In some regions, for instance, women are loath to wash ceremonial cloths and beat any dirt out of them, so as to prevent dye bleeding.

To give one example: most Timorese and Savunese yarns from the late colonial era to circa 1950 show unexpectedly high levels of degradation, whereas the yarn of Batak cloths on the older side of the range (late 19th to early 20th century) typically shows little signs of wear. This is likely to result from a difference in intensity of usage: most Batak *ulos* were used only once or twice a year, on the specific occasions for which the type was suitable, whereas Savunese and Timorese cloths were more likely to be used for all occasions of a more or less ceremonial nature including churchgoing and visits to the nearby market town when a certain level of decorum was called for.

In the past ikat for ceremonial purposes was often enriched with accent stripes in chemical dyes which were not colourfast, and natural dyes that could be colourfast were on occasion used improperly. Linda S. McIntosh, during field work in 2019, observed that weavers in the Lerek region of southern Lembata did not properly mordant their cloths before dying with morinda, so that on washing them the red bled out profusely.[1] But handling does not need to be so extreme as beating to do serious damage to cotton cloths. Yarn also suffers from frequent folding, unfolding and refolding, which causes fibres to rub onto one another. This effect is more marked in single- and double-ply yarn than in triple- and quadruple-ply, where outer strands protect the inner – next to increased strength and regularity the main reason why plying is undertaken. Quadruple-ply yarn was encountered only on ikat sarongs from the tiny islands of Leti and Buaya, and one men's wrap from the Niki-Niki area of Western Timor.

[1] Linda S. McIntosh, pers. comm., 2019. When querying Lerek weavers, she learned that they used only morinda, lime, and water, did not oil the threads with candlenut oil prior to dyeing but just rubbed them with copra, and used no alum – although a tiny amount of alum may have been given off by the dye vats made of clay with an admixture of volcanic soil (see also Barnes 1984:71).

Fig. 44 The most heavily degraded yarn in Group A of the Physical Database. This advanced degradation was found in a 1930-1940 *tais sela*, horse blanket, that before its addition to Group A of the Physical Database belonged to the Tamukung (petty raja) of Suai-Loro (East Timor). While to the naked eye the cloth shows few signs of use, clearly the type of use put much stress on the yarn as the microscope reveals extreme degradation (PC 330).

Fig. 45 The second most heavily degraded yarn in the Physical Database. This example of advanced degradation was found in a 19th- to early 20th-century *beti*, men's wrap, from Amanuban (West Timor). The cloth shows signs of intensive use; the yarn is heavily degraded (PC 326).

Fig. 46 Hand-spun cotton in a ceremonial shawl of the highest rank, Ndao, 1900-1925. Rather heavily degraded yarn, but the cloth shows no signs of intensive use and given its rank was probably used sparingly (PC 290, see Figs. 82, 198).

Fig. 47 Yarn of an early, but only sparingly used East Timorese ikat. Even though it is 80-90 years old, the yarn of this *tais feto*, ceremonial sarong, from the ruler's family in Suai-Loro, Covalima (East Timor), the hand-spun cotton is only moderately degraded. This no doubt results from the fact that such sarongs were worn only a few times a year and rarely, if ever, washed (PC 328).

Yarn destabilization resulting from photodegradation

Another explanation for the observed variation in yarn degradation among cloths of similar estimated age is disparity in photodegradation, the level of exposure to ultra-violet light, known to accelerate the aging of organic materials. While the deleterious effect of sunlight on cotton was known since the mid-19th century, concerted efforts to determine its cause only began about a century later, mainly stimulated by the US military which wished to extend the life of its uniforms. A report forwarded to the United States Department of Agriculture states:

> […] the most important effect of light is an activation of the cotton cellulose. It accelerates enormously the reaction of cotton cellulose with oxygen of the atmosphere. […] Cellulose is a polymer substance: Its chemical structure consists of a simple molecular pattern that is repeated many times. The patterns are joined like links of a chain into long, threadlike molecules. The chainlike structure gives cotton its fibrous qualities. Light attacks the cellulose at the points of linkage and thus shortens the average chain length. Although photochemical degradation, until it is well advanced, does not alter the feel or appearance of the cellulose, it reduces the strength and finally causes the loss of all fibrous properties (Fynn & Dean 1950-1951:436)

The above assessment perfectly matches the present author's experience that handling and feeling cloths in the Physical Database only occasionally brought a correct estimation of the degree of fibre degradation that microscopic inspection would show. This underscores the need for further follow-up to Adams's call for microscopic inspection. The only cases where brittleness of yarn could be predicted accurately were cloths that felt extraordinarily soft, almost tender to the touch. These fabrics were without exception among the earliest handled in public (with gloves) and in private collections; their yarn invariably looked ravaged by time; each had what may be referred to as a 'tactile patina'.

For an overview of the distribution of weave types encountered, see the Appendix.