Knots, Loops & Braids: an examination of fibre craft techniques in the Upper Sepik and Central New Guinea

Jill Bolton
Spinners and Weavers Guild, Adelaide

Andrew Fyfe
University of Adelaide

Photographs by Bolton and Fyfe unless stated otherwise.

Introduction

The USCNG Project's preliminary analyses focused on two ubiquitous functional/operational classes from the study area (Fyfe 2009a and b). One class comprised arrows made by men, the other the range of string bags made by women. There were several reasons these were chosen. Firstly, across the study area they were, and to some degree still are, crucial to the most important activities undertaken by men and women: hunting, fighting, gathering and gardening. Their importance in these activities meant that they were also used to some degree as both social and cultural markers (Gell 1975: 142-43; Jorgensen 1981: 68; MacKenzie 1991: 39, 142). Secondly, string bags and arrows are technologically sophisticated and complex artefacts, their manufacture is labour intensive and time consuming and a single example may have a number of features, each of which requires different skills to complete and therefore they offer a significant range of formal qualities to be used for comparisons. Thirdly, as these classes are exclusively products of either gender their attribute distributions are considered likely to reflect any differences that existed between each gender's social patterns at the time the collections were made.

As discussed by Fyfe (2009b), the analyses indicated that the range of formal and technical features determined for these classes distributed in a manner that by and large reflected the language groups' spatial positions, regardless of the linguistic relationships between these groups previously determined by linguists. Consequently, it was argued that that this indicated that the distribution of technical knowledge throughout the study region was more a product of recent social interaction rather than one resulting from a process of inheritance following genetic lines. Importantly however, the association with geographic position was particularly evident in the manner in which string bag attributes clustered reflecting the fact that women, by and large, had more restrictive spheres of social interaction than men.

Most of the technological attributes used in these analyses, indeed all of those associated with string bags, are associated with fibre crafts. These have been particularly useful because the identification of techniques associated with these attributes has provided unambiguous analytical units. The assessment of string bag techniques was to a significant degree made possible by the ground-breaking study of Telefolmin string bags by Mouli MacKenzie (1990; 1991);[1] as part of his thesis Fyfe (2009a) provided descriptions of some of these and others associated with arrow binding identified in the sample from the study area. This paper provides further detail concerning these fibre craft techniques including additional categories according to which string bag and arrow attributes are better explicated and positioned. In doing so, the paper also includes a more thorough examination of the relationships between the technical characteristics belonging to these classes.

[1] Mouli MacKenzie has given the Project access to her personal archive of photographs and some of these will soon be posted on the website. Additional photographs by Barry Craig will also be posted to provide the reader with images of both women making bags and people using them in daily activities.

String bags: functional subclasses

Throughout the study area, the creation of string bags[2] is the primary objective of the craft of looping. It provides a flexible and portable container for which there is no comparable substitute resulting in a wide variety of bags needed to carry all of the objects, produce and resources transported by both men and women.

By and large four classes of bags are determined for the sample according to their functional and operational properties. The largest class includes bags specifically made to carry garden produce, firewood and babies (Figure 1a).[3] The predominant features of this class, which is most commonly used and owned by women, is that they were designed to stretch considerably to accommodate large heavy loads and have a strap designed to be worn on the forehead enabling a better spread of the weight over the back When flattened the faces of the bodies of these bags have areas generally greater than 2,500 cm² in size.

Figure 1a. Large domestic bag (Kubrenmin, Telefol, AM E88439, MacKenzie).[4]

The second class is a general purpose personal bag designed to be worn on the shoulder (Figure1b). Such bags usually carry several items at a time from small personal objects, resources collected in the bush, food taken for consumption on a journey or, in the case of men, trade goods. Personal bags exhibit the greatest range in size – from a small size 'large pocket' style which is worn over the shoulder and diagonally across the body, through those of medium size, often embellished with feathers and worn across the shoulders like a cape, to a larger general purpose type which may sometimes be made with coloured dyes. The bodies of such bags have areas generally between 300 and 2500 cm² when measured flat.

[2] Commonly termed *bilum* across New Guinea (Tok Pisin)

[3] Attributions for artifacts shown in photograph follow the sequence: collection point (settlement), language, museum and accession number, collector. Acronyms for museums are given in Fyfe (2009a: 77, Tables 8.2 and 8.3).

Figure 1b. ‘General purpose’ personal bag (Bifrou, Abau, PM E7490, Craig).

A third class, often termed as a ‘pocket’ or ‘neck’ bag, is designed to hold smaller, more personal possessions such as tools, smoking tubes and, in the lowlands, betel nut chewing paraphernalia (Figure 1c). Such bags are worn with the strap around the neck and the body of the bag lying flat against the chest. Bags belonging to this class have bodies between 30 and 300 cm² in size

Figure 1c. Pocket bag (Mukudami, Namie, Leid. 4477-325, Craig).

The fourth and smallest class of bag acts as a form of amulet, worn usually at the base of the neck or chest, again with the strap around the neck (Figure 1d). They are sometimes used to carry small tools by men, such as possum teeth chisels, but are more specifically made to contain magic charms believed to provide success in hunting and gardening, cure illness or even to assist one to secure a sexual partner.

Commonly fossils, animal and human bones or particular types of bark or seeds were placed or looped into the bag's body. Such bags are generally below 30 cm² in size.

Figure 1d. Amulet bag (Brolemavip, Tifal, BM1964.Oc.3.428, Cranstone).

String bag materials and their preparation

All string bags within the study area were constructed with hand-spun string made from the treated inner bark (bast) of saplings. In the lowlands, fibre from the bark of the tu-lip (*Gnetum gnemon*) is reported most commonly as that being used (Kelm & Kelm 1980: 178; Kooijman 1962: 21), On the other hand, *Phaleria* sp. has been reported being used the Border Mountains (Juillerat n.d.), although it is likely that *Gnetum gnemon* is also used there. In the highlands, the fibre largely comes from the bark of species belonging to the *Ficus* genus (Hyndman n.d.; MacKenzie 1991: 69-70). MacKenzie, however, observed that by the 1980s, the Mountain Ok had come to use tu-lip fibre which had to be sourced from the lowlands; its elasticity and softness means that it is stronger, easier to spin and loop, and provides a more pleasant texture (MacKenzie 1991:71). A comparison of bags in the study sample whose fibre source was identified, revealed that bags made from tu-lip fibre were significantly different in texture to those made of *Ficus* sp. fibre, a difference that was generally apparent between bags from Central New Guinea and the Upper Sepik Basin, suggesting sourcing of tu-lip by women in the highlands was relatively insignificant in the time when the majority of the collections from the study area were made.

Before the spinning process the bast was either treated by smoking or soaking it in water for a period of time. In the lowlands the bast is often beaten and prepared by men but in the highlands the women, by and large, treat and shred the bark (Kelm & Kelm 1980: 178; MacKenzie 1991: 73-74). After treatment a woman then chooses an appropriate length of fibre which she twists with the flat of the hand on the upper thigh. She first rolls and twists each strand singly in an S-direction (down the thigh)

and then twists them around each other in a Z-direction (up the thigh) to create a strong two-ply thread (Kelm & Kelm 1980: 178; MacKenzie 1991: 78-79).

There is no evidence that the Mountain Ok traditionally used any form of dye to decorate their bags. Often stripes resulting from alternating shade and colour are found in the bag's fabric but this feature was unintentional and resulted from variation between the different batches of prepared fibre. In the lowlands and Border Mountains, however, there was an extensive use of natural dyes; multi-coloured patterns are common for string bags intended for personal use.

The range of styles used in the adornment and embellishment of string bags throughout Central New Guinea have also been described by MacKenzie (1991: 111ff). There has been a great tendency there for men to decorate string bags, and not only their own bags, but also the bag of a son or nephew about to go through one of the earlier stages of initiation. These decorations used feathers of particular birds with symbolic attributes that differentiated the various stages of male initiation (Barth 1975: 161; MacKenzie 1991: 170). Feathers that have been identified as being used for such a purpose included Pesquet's Parrot, Great and Sulphur-Crested Cockatoos, various species of bird of paradise, cassowaries, hornbills, great or brown cuckoo doves and eagle feathers (Figure 2a). The four latter species provide feathers most significant to initiation. Feathers usually are prepared for attachment by slicing off a section of the quill lengthways, then folding the remaining section over the selected string after which the end of the quill was fastened to the stem (MacKenzie 1991: 117, Figure 20). Cassowary feathers have either been attached as part of a section of the birds' pelt or as individual feathers grouped as clusters, their unmodified quills again forming hoops in the same method for other feathers (MacKenzie 1991: 119, Figure 21).

Figure 2a. Bag with feathers (Balantavip, Telefol, Bas. Vb 26826, Schuster).

Few bags in the sample from the lowlands had been given feathers and such adornments appear not to have been particularly significant in any ritual sense. Also, such bags were more commonly owned by women, although particular bags adorned with pigtails, sometimes in combination with cassowary feathers, were the most

socially important bag possessed by men in the lowlands, as these signified a man's hunting prowess (Figure 2b). The hoops that were used to attach these to the bags were made from strips of cane or bamboo. In other cases personal bags were adorned with nuts, shells or seeds and these were threaded on with string (Figure 2c).

Figure 2b. Bag with pig tails (Norambalip, Namie, Berl. 50687, Kelm).

Figure 2c. Bag with conus shells, bag: 8 x 4.5 cm (Abrau, Awun Berl. 50807, Kelm).

String bags: construction

Unlike some parts of New Guinea by far most of the bodies belonging to string bags collected in the study area were looped as spirals (c.f. Sillitoe 1988: 249ff). Nevertheless, throughout the study area there were a number of different steps and techniques for both the way they were started and finished and this also resulted in differences between bags in terms of their form. There were also different choices in looping techniques, which resulted in some variance concerning the texture and tightness of the material. Finally, there also existed different methods to co-join the bodies, straps and mouthbands.

The mode of string bag construction followed four basic patterns:

1) The body of the bag was spirally looped as an open cylinder and this could be done from scratch or from a previously looped mouthband (Figure 3a). The cylinder end chosen for the base was then sealed with a row of looping;
2) the body was looped up from a looped chain or support cord with half-hitches after which the mouth was usually finished with *chain-looping* (Figure 3b);
3) a panel was looped, folded and secured along the two side edges (Figure 3c).;[5]
4) the body of the bag was looped up from an initial row/s (panel) of *figure-eight* looping and finished with an edge—or more rarely a mouthband (Figure 3d).

Figure 3a. Personal bag looped as an open cylinder with the base sealed with a row of *chain-looping* (Tumolbil, Tifal, Attenborough personal collection).

[5] There were also three examples (PM E11625, AM EE88863 and Berl. VI 50700) of a baby sling essentially made from panels—an additional two were collected just east of the study area in the settlement of Magleri in East Sepik Province by Mackenzie (AM 88864-5). These were constructed by applying two separately constructed side panels onto a central panel that extended to form the base and strap of the sling. These slings will be discussed in future articles.

Figure 3b. Amulet bag made with *stacked half-hitches* forming the body from a looped chain. Note that the *half-hitches* are pointing up indicating the direction the bag is being worked (Kwermin, Bimin, BM 1982.Oc.6.112, Wronska-Friend).

Figure 3c. Small Pocket bag made from a panel of *figure-eight* looping that was folded length-wise and secured along the two side edges (Fongwinam, Yuri, GUM 3643, Peter).

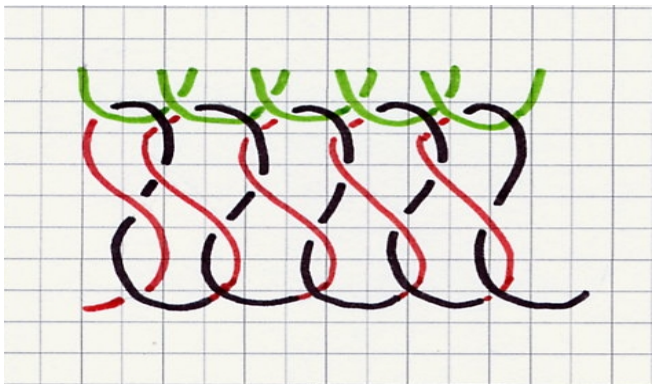
Figure 3d. Large domestic bag looped up from initial rows of *figure-eight* looping and finished with an edge (Betiana, Oksapmin, Perey personal collection).

Techniques associated with Construction Method One were ubiquitous although uncommon in eastern Central New Guinea. As will be discussed below, this first method tended to result in a shape that more often flared towards its base as in a trapezoid. The second method, which was most commonly used for very small bags, was most commonly in eastern and southern Central New Guinea and was almost absent outside the highlands. This and the third method, which was almost exclusive to the Border Mountains, mostly resulted in a rectangular-shaped bag. All of these three methods resulted in relative flat bases prior to any stretching from use. The fourth method, found throughout Central New Guinea, but predominantly used in the east, resulted in all such shapes, however, sometimes provided a more rounded base resulting from the looping spiraling out from the initial row or panel.

String bags: looping methods and bag bodies

The looping of bag bodies, straps, mouthbands and edgings all involved one of nine techniques corresponding with those identified by MacKenzie (1991: 215-217), Appendix 2a). Four looping techniques were used for bag bodies. The most common of these was the *figure-eight* method which has been reported as a preferred technique throughout New Guinea (Figure 4a). It is popular because it is simple, makes it easy to judge the working of the bag and enabled various degrees of flexibility as determined by the measure of openness of the loop. Essentially, it was good for making any kind of bag both small and large.

Two methods of achieving openness with the *figure-eight* method have been identified for the study area. These involve either the use of spacers, particularly in the form of pandanus leaf strips which was common in the some parts of Central New Guinea (Figure 4b; MacKenzie 1991: 94: Figure 14); or, the use of tension, most commonly achieved by looping the bag around the legs or feet and using the thumb to control the looping size, a method common in the lowlands (Figure 4c, see also MacKenzie 1991: 93, Plate 57).Where this latter method was used, it is likely that the height of the bag was controlled by the distance between ankle and knee and the mouthband, if used, correlates to the distance around both knees.



Key:
green : *foundation or previous row*
red: *upward track of loop*
black: *downward track of loop*

Figure 4a. *Figure-eight* looping

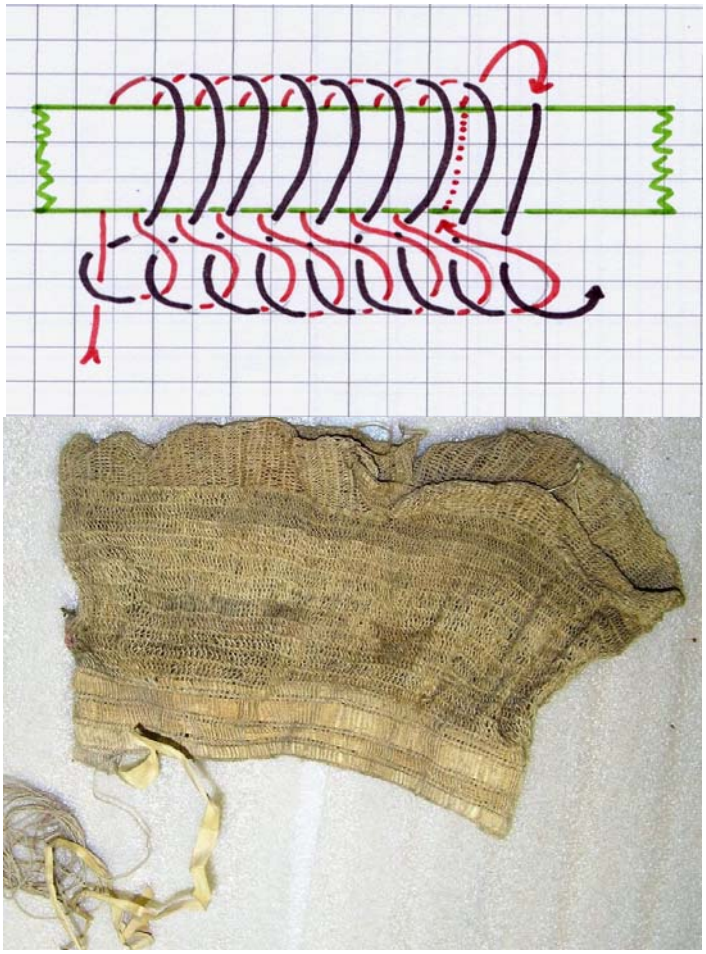


Figure 4b. *Figure-eight* looping with spacer (Bolbil, Telef, Bas. Vb 23061, Schuster).

Figure 4c. Amto[-Musian] woman using legs to create tension (Photo B. Craig).

Two looping methods are more commonly used for tighter bags although a few larger bags involve these techniques. One is visually related to the stocking stitch used in knitting which uses repeated rows of *half-hitch* looping in a *stacked* form. In this technique each hitch worked round the crossing point of the half-hitch of the previous row (Figure 5a).[6]

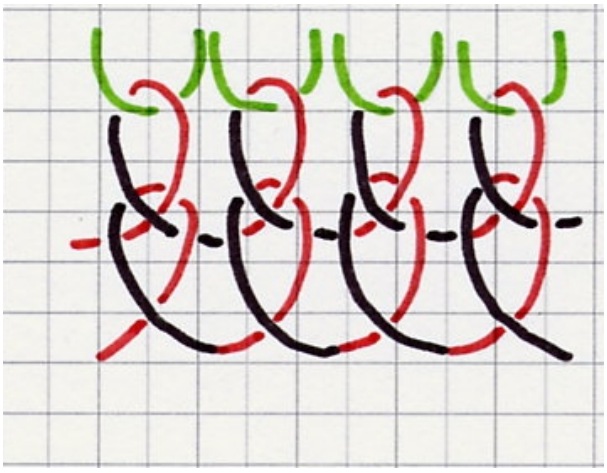


Figure 5a. *Half-hitch*: *stacked* form

This *stacked half-hitch* requires the use of a needle made of bone. It is non-reversible and has very little stretch. It is particularly useful for making very tightly looped small string bags and was especially popular in the east-southeast region of Central New Guinea where small pocket and amulet bags were a specialty (Figure 5b). However, it has been sometimes used for larger personal bags, especially in conjunction with *figure-eight* looping (Figure 5c). In the lowland sample, bags that involved this technique were found only in significant numbers in the Yellow River region.

Figure 5b. Small pocket bag made with *stacked half-hitch* (Baktaman, Faiwol, Berg. no number, Barth).

[6] Known to the Telefolmin as *dam kaal men* (MacKenzie 1991: 216).

Figure 5c. Personal bag made with *stacked half-hitch* and then a series of *figure-eight* rows before the edging (Bimin, Bimin, BM 1982.Oc.6.94 , Wronska-Friend).

The other half-hitch form also consists of repeated rows of half-hitches. In this case, however, each loop is formed by working over the string between the half-hitches in the row above in a 'staggered' form (Figure 6a). This *staggered half-hitch* is slightly more flexible and is reversible. Again, this second form is more easily worked using a needle when making tightly looped bags (Figures 6b), but when worked in a more open style with looser tension it may be achieved without (Figures 6c). This method is most common for the sample from the Sepik Family languages Abau and Namie.

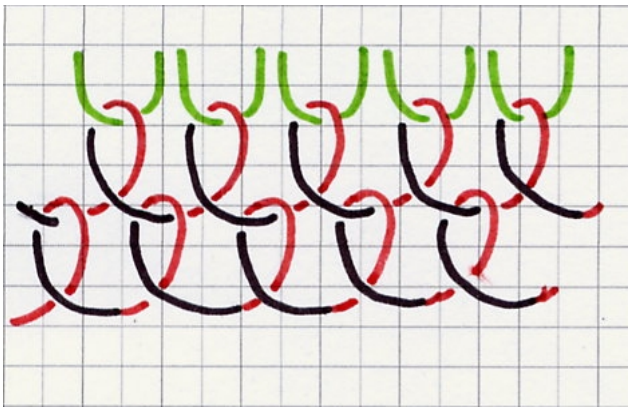


Figure 6a. *Half-hitch: staggered* form

Figure 6b. *Staggered half-hitch* used in the tighter style (Yiwani, Namie, Bas Vb 26403, Schuster).

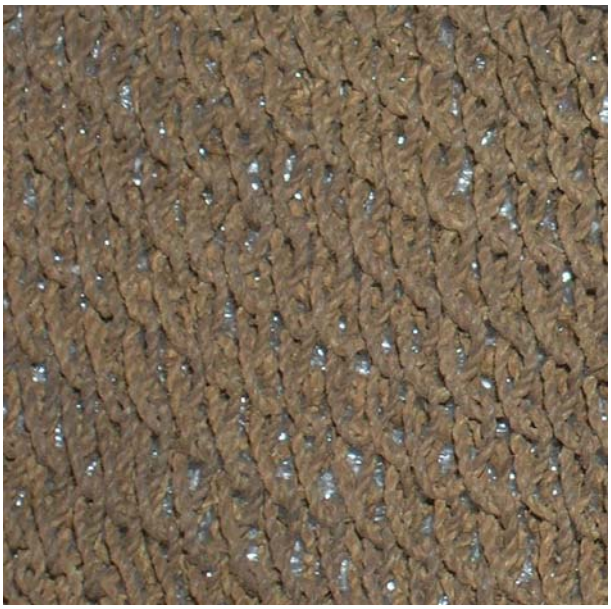


Figure 6c. *Staggered half-hitch* used in the open style (Yiwani, Namie, Bas. Vb 26405, Schuster).

Both *half-hitch* methods, whether worked tightly or loosely, are impossible to work without some form of foundation (and will unravel without): viz. a mouthband or circle of string when working down, or a length of *chain-looping* such as in the case using Construction Method 2.

The fourth looping technique used in the study area for the construction of bag bodies had been previously described by MacKenzie (e.g. 1991: 92)[7] in the context of its use by Central New Guinea groups as the distinctive joining technique used to connect the bodies of string bags to the mouthband (see below). Its use in the formation of string bag bodies was almost exclusively identified for bags collected in Namie settlements.

This technique is essentially a *twisted half-hitch* made by reversing the linkage of the half-hitches into the previous round. By leaving a longer shank to pass the string

[7] It was termed *muuk/kang Sagaal kali dagam* by the Telefolmin.

around, right to left as many times as required it becomes the multiple twist variation classically used for mouthband joins (Figures 7a and b)—by adding a side linkage the classic *figure-eight* loop which needs no foundation is formed.

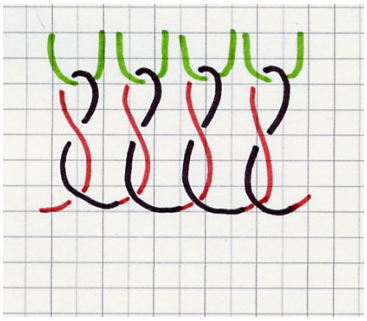


Figure 7a. *Twisted half-hitch*

:

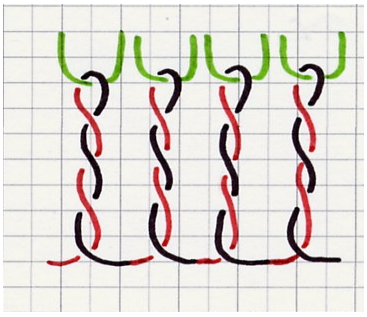


Figure 7b: Multiple twist *twisted half-hitch*

In the lowland sample the use of the *twisted half-hitch* with multiple twists was found for both plain bags and those with dyed patterns. In the former it was used to achieve openness and was often interspersed with rows of *figure-eight* (Figure 7c), while in the latter it was used to preserve a distinction between colours (see below). This style of looping also requires a foundation but in this case the foundation was typically provided by a mouthband and rows of *figure-eight* looping particularly at the bottom and top of the bag.

Figure 7c. *Twisted Half-hitch* used to create open looped bag (Yaru, Namie. Berl. VI 50219, Craig)

String bags: mouthbands
Mouthbands were either constructed according to a sequence of *short interrupted rows of figure-eight* looping running perpendicular to the length of the mouthband panel(s) or as a *single band of uninterrupted looping*.

The former followed two different methods. It could either be constructed as two panels, one for each face of the bag or as a *long single narrow panel*. When constructed as two panels two different tendencies were used. Either the two panels were looped and then secured at each edge with a length of *chain-looping* (described below), providing the foundation from which to loop the cylinder and attach the strap (Figure 8a; see also MacKenzie 1991: 84). This method was used extensively in Central New Guinea where mouthbands were involved, and was particularly common for Telefolmin bags.

Figure 8a. Mouthband constructed using two panels reinforced with chain-looping at the ends (Balantevip, Telefol, Bas. Vb 23055, Schuster).

The alternative manner of using two separate panels is to join them by merging the *figure-eight* looping into one panel simultaneously forming the strap (see below). This method was common in samples from western Central New Guinea particularly Tifal and Ngalum speakers who used these to loop the bags' bodies with long *twisted half-hitches* (Figure 8b). It was also a method used by the Abau in the lowlands, but in their case each panel was looped directly into the top edge of either side of the body cylinder (see Figure 13d).

The other method of creating a mouthband involving panels of short interrupted horizontal rows of *figure-eight* looping, one that resulted in a *long single narrow panel,* is essentially completed when the two ends of an a panel of appropriate length are joined to form a circle. From this the body could then be looped and strap attached (Figure 8c). This was the more common form of the *figure-eight* looped mouthband in the sample from the lowlands, west of the Yellow River and south of the Kwomtari family of languages, and in the Border Mountains.

Figure 8b. Mouthband constructed using two panels that merge to form strap (Namindumavip Tifal, BM1964.Oc.3.232, Cranstone)

Figure 8c. Mouthband looped as *long single narrow panel* using *figure-eight* looping (Kambriap, Yuri, Vien. 148893, Peter).

The other mouthband construction technique, looping a mouthband as a *single band of uninterrupted looping*, involves either of three looping methods. The most basic form of these three uses a single or two corded *double interconnecting braiding* technique (see mouth of bag, Figure 7c).[8] The single cord *double interconnecting braid* was common for bags throughout the lowlands and the northern Border Mountains, particularly for pocket bags. The use of the two corded technique in the construction of mouthbands was almost exclusively found for samples coming from settlements attributed to Awun and Namie speakers in the Yellow River. In this case this technique was used for large bags.

[8] The single corded version was termed *kaang sel* by the Telefolmin (MacKenzie 1991: 217). As a single corded version it was also used as an applied edging covering the tops of the body's last row of *figure-eight* looping, although this use is only evident for some lowland bags made in more recent times.

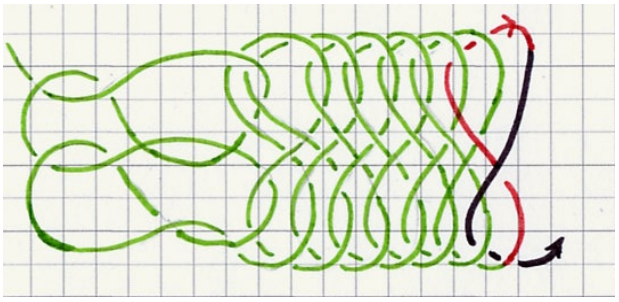


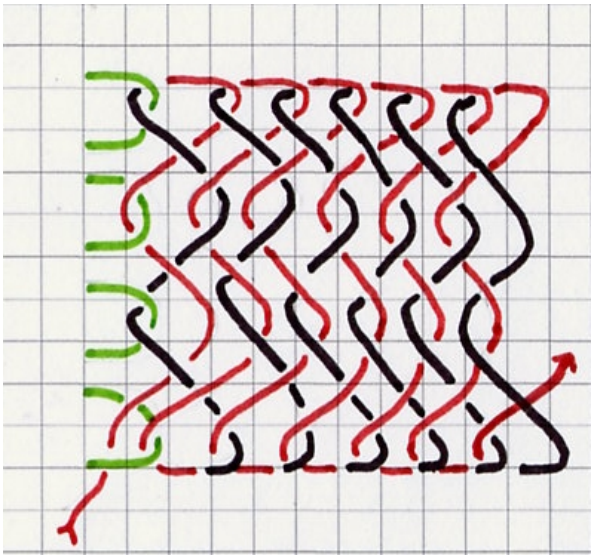
Figure 8d: Double Interconnected braid

The *double interconnected braid* commences with two *figure-eight* loops being made and turned sideways so that further looping can take place from their top edges (Figure 8d). Firstly, the string is taken through the lower loop as if making a third *figure-eight* loop. Then it is taken from left to right into the upper loop. The string is then brought downwards, and the needle inserted into the lower foundation *figure-eight* loop from above – this has two strands now to the right of the needle. Next the string is taken on the upwards track, and the needle inserted from above (left to right again) also with two strands to the right of the needle. This completes the starting sequence. From this point on, the needle is inserted from above (left to right) alternately taking it to the top and then to the bottom of the strip, always inserting the needle so that there are two strands to the right of it. Sillitoe (1988: 383) shows this same construction, as used by the Wola of the Central Highlands of Papua New Guinea, but with the string inserted from below – either method produces the same result – a narrow strip of figure-eight-like loops which are connected 'two back' rather than 'one back'. The strip has a pattern resembling a plait down its centre with a row of eyelets along each edge. The eyelets are more apparent when the braid is stretched, or when it is worked in very fine string (as for use as arrow binds). Either the upper or lower row of eyelets can be used when the joining row is constructed between the mouthband and the body of the bag.

The second method of looping a mouthband as a *single band of uninterrupted looping*, here termed an *extended double interconnected braid,* was more commonly used for making chest straps and armbands by several groups across the study area. Indeed, it was not reported as being used for mouthbands by MacKenzie so may have fallen into disuse for that purpose by the time she arrived in the region.[9] In the study area sample it was only found for bags belonging to Telefolmin living in the Eliptamin Valley (Figure 8e). It is worked essentially as described for the double interconnected braid above, but with extra extensions top and/or bottom, or several units of the braid worked simultaneously. The string passes from edge to edge across the width of the braid, forming characteristic "V" patterns along the centre of the units (Figure 8f).

[9] The technique was termed *tiit* by the Telefolmin (MacKenzie 1991: 217),

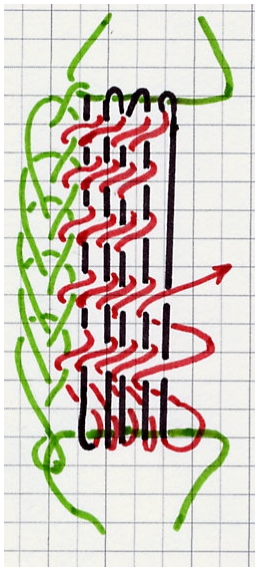
Figure 8e. Mouthband constructed as a *single band of uninterrupted looping* using the *extended double interconnected braid* (Awungkaman, Telefol, Bas. Vb 23050, Schuster).



Key:
Green: Foundation Loops
Red: Upward track of string
Black: Downward track of string

Figure 8f: *Extended double Interconnected Braid*

There is a third method to make *bands of uninterrupted looping* for mouthbands. It is a *weaving-looping hybrid* technique; previously identified by MacKenzie (1991: 87-9) as a method used by the Telefolmin who called it *tumin men*. Again this method seems to have been most commonly used to make chest straps and other bands worn as body ornamentation, and many of such items made with this technique have been identified in the sample, particularly for the Telefolmin of the Ifitamin Valley. The method, which is well illustrated by MacKenzie (1991: 89, Figure 10), requires two fixed points (usually supplied by a bow loom) and is worked in three distinct stages (Figure 8g).



Key:
Green: chain loop foundation and holding strings
Black: downwards track of string
Red: upwards track of string

Figure 8g. *Weaving-looping hybrid*

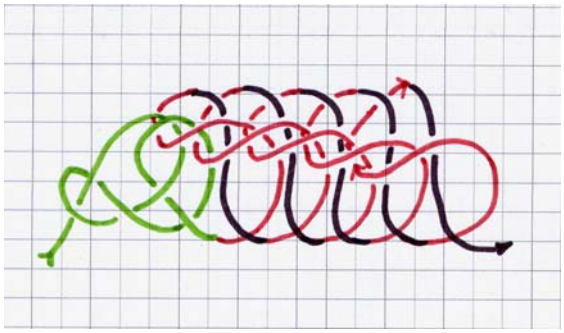
Firstly, a length of *chain-looping* (see below) is constructed and attached at the two fixed points (usually into a separate loop of string), second, a length of string is run alongside the chained length, (top to bottom) then thirdly, using an under then over motion (no crossing of the working string to form hitches) the working string passes under the previously run string and under a loop from the chained length, then, turning to the right, goes over the run string. These last two actions are repeated until all the loops from the chain have been worked. The run string and under/over actions are then repeated, taking the 'looping' strand under and over the currently run length and the previous one, mimicking the path of the first linkage. The finished band has distinct ridges running across its width where all the turning points of the weaving strand align, separated by the parallel strands of the run string. The band has width-wise stretch and when stretched, a visual similarity to *figure-eight* looping. Only one example of a mouthband constructed with this technique was found in the sample and in this case it was a two panel construction. It was collected by Bryan Cranstone in the Tifal speaking community of Blemtalevip (Figure 8h) where, surprisingly, other techniques, such as the *extended double interconnected braid* and a conventional warp faced weaving technique, utilizing a different kind of weaving frame, were more commonly used for making straps and bands.[10] To some degree this technique is similar to an arrow bind knotting technique (Knot 1, see below) in its use of the two working ends and exaggerated turns.

[10] MacKenzie's (1991: 216) had suggested that there had been decline in the use of the *tumin men* technique prior to the time she carried out her fieldwork, however, it also appears that the use for making mouthbands had been relatively uncommon in the decades prior to her research in the area

Figure 8h. Mouthband constructed as a *single band of uninterrupted looping* using the *weaving-looping hybrid* (Blemtalavip, Tifal, BM 1964.Oc.3.227, Cranstone).

String bags: edging

In parts of Central New Guinea where mouthbands are not traditionally used, edging was often worked directly into the rim of the bag's mouth. This was done using one of two methods. Both of these utilize a *chain-looping* technique, called *tiim* by the Telefolmin (MacKenzie 1991: 217). It involves working a tight row of modified *figure-eight* looping which is otherwise used in a spaced looping technique.[11] For the *chain-looping* technique no spacer is used and on the upward path of the needle it is inserted into the previously formed loop, rather than behind the downward strand – hence MacKenzie's (1991: 217) use of 'chain of mesh' as a term for this technique (Figure 9a).[12]



Key:
Green: Spacer and/or foundation loops
Red: Upward track of string
Black: Downward track of string

Figure 9a. *Chain-looping*

[11] Also well illustrated in MacKenzie (1991, 215). This is another way of producing the *figure-eight* linkage where the side linkages are performed below the spacer, rather than alternately above and below as normal. This has a slight textural difference when the spacer is removed. It is postulated that this textural difference disappears once the bag is in use, since it has not been observed in the sample

[12] When itself worked over a spacer, this produces a style of looping referred to as "bemdule men" (MacKenzie 1991 : 215). where *chain-looping* is made simultaneously with the *figure-eight* loop, however, the central crossing of the *figure-eight* loop becomes obscured behind the portion of *chain-looping*.

The second and less common method involves a *double row* of the *chain-looping* whereby the second round was looped into the single strand side of the first round of chain (Figure 9b). Bags that included this feature were somewhat restricted to samples from eastern and northern Central New Guinea particularly for bags originating from Bimin, Mianmin and Oksapmin speaking groups who commonly used it for larger bags (see also MackKenzie 1991: 139, Figure 24).

Figure 9b. Edging using a *double row* of *chain-looping, (*Bimin, Bimin PM E11149, Poole).

The mouthband, and to a lesser extent the edging, not only strengthen the top edge of the bag, but works to control the finished mouth width, giving rise to variation in the shape even in bags of a similar size. Where mouthbands are used to start a bag or to finish a looped cylinder a trapezoidal shape is the norm. The number of loops worked in the joining row also contributes to this phenomenon: a shape with parallel sides has three or four loops worked into each row of the mouthband, or may have the joining row worked in groups which preserve this ratio. Also, by using a shorter mouthband, larger numbers of loops in the joining row and by adding one or more extra *figure-eight* loops into the string separating the groups enhances the trapezoid shape. To a great extent, the width of mouth opening corresponds with the depth of the bag, especially for those used as personal bags; the depth being measured by the length of the forearm. As edging is usually applied to bags spiralled from a row or panel that has less length than the maximum width, edged bags have more of a 'U' shape — although a 'U' shape can be relatively pronounced for larger bags with mouthbands as a result of an increased width to depth of the bag body paired with a shorter strap (see below). Additionally, all larger bags gain a more rounded base with increased use.

String bags: cojoining mouthbands and bodies

Aside from the looping of components there are also different techniques used to cojoin the mouthband and body. Where bags are looped up and finished with an edging these are always looped directly from the edge of the top of the bag cylinder. However, where a mouthband is used, either looped on or initially constructed to provide the frame from which the body of the bag was looped, it is connected to the bag in a number of ways.[13]

The simplest method used, which is necessarily reversed where mouthbands are looped onto the bags, is one where the top row of body looping is worked directly into the bottom row of mouthband loops with each loop from the body carried once through a respective row of the mouthband (Figure 10a). This method is associated with bags that have either been started or finished with the mouthband.

Figure 10a. Cojoin of mouthband where top row of body looping is worked directly into the bottom row of mouthband loops (Bamblediam, Abau, PM 79.1.319, Craig).

Three further methods involve the use of a series of groups of three to six loops, extending down from a number of rows into the mouthband, to link the mouthband with the first row of the body. These involve either:

2) extended *figure-eight* loops with a single twist between body and mouthband (Figure 10b);

3) longer extended groups of *twisted half-hitches* with two or three twists (Figure 10c);

4) very long extended groups of *twisted half-hitches* involving six or more twists (Figure 10d).

[13] Some of these have been previously illustrated by MacKenzie (1991: 139: Figure 24).

Figure 10b. Cojoin of mouthband with the use of extended *figure-eight* loops involving a single twist between body and mouthband (Moiyokabip, Tifal, QUM 20017, Hyndman).

Figure 10c. Cojoin of mouthband with the use of longer extended groups of *twisted half-hitches* with two or three twists (Kometen, Mianmin, Morren personal collection).

Figure 10d. Cojoin of mouthband with the use of very long extended groups of *twisted half hitches* involving six or more twists (Moiyokabip, Tifal, QUM 20022, Hyndman).

A less common method to attach mouthbands to bodies involves a row of *chain-looping* being directly looped into the bottom row of the mouthband, thus providing loops into which each loop of the first row of the body could be interlocked. This method was found for samples from two Mountain Ok speaking groups, the Mianmin

and Bimin, in northern and eastern Central New Guinea, who traditionally loop string bags from the base and finish them with edging. Therefore it appears to have been a more recent innovation designed to join a prefabricated two panel mouthband, described above, onto an already prefabricated body, usually looped from the bottom (Figure 10e).

Figure 10e. Join of body and mouthband using a row of chain looping being directly worked into the bottom row of the mouthband (Kometen, Mianmin, Morren personal collection)

String bags: straps

Throughout the available sample of string bags, it has been noted that the width of the straps are in keeping with the size of the bag and its perceived function. Approximate ranges of lengths have been established for the various classes although there is some overlap.

Amulet bags and chest-worn pocket bags have fine straps (see below) that are between 70 to 75cm long – i.e. sufficient that the bag hangs in a position directly above the breast bone.

As personal bags intended to be carried with the strap over the shoulder exhibit the greatest range in size the range of widths also varies along with this increase in size. In general the length of the straps is around 100-120cm, so that the bag itself rests on or just below the hip.

The large domestic bags generally have much shorter straps as they are carried with the strap across the forehead with the loaded bag hanging down the back. A strap of between 75 to 80cm long (often commensurate with the width of the mouth of the bag) is common for bags where the bag mouth is wider and a strap attached to the edging. The other style is a much shorter strap on a correspondingly wider bag or an almost non-existent strap joining the two opposite end of the mouth (mouthband) (Figure 11). Because the bag bodies are so much wider, these are still able to be carried with the weight borne by the forehead, in this latter style, the bag assumes a very deep "U" shape with use.

Figure 11. Large domestic bag with mouthband acting as strap (Namindumavip, Tifal, BM 1964.Oc.3.228, Cranstone).

The looping methods for straps have to some degree been determined by the size of the bags. There were four methods used for looping straps: The *figure-eight* method was commonly used for large bags (Figure 12a), while three others were most often used for pocket style and smaller bags. The most common of these latter three was one that involved a single width of *double interconnected braid* (Figure 12b). One other was the use of an *extended double interconnected braid* of two or three widths (Figure 12c). The final method was one that resulted in a simple *single-crochet* chain (Figure 12d). This last style was used for very small bags such as those designed for use as amulets.[14]

Figure 12a. Strap on personal bag made with *figure-eight looping* (Fongwinam, Yuri, Rott. 60904, Craig).

[14] In addition to these, plain unspun bast fibre strips were sometimes used for straps in the lowlands.

Figure 12b, Strap on small amulet bag made with *double interconnected braid* (Betiana. Oksapmin, PM 2416.1, Perey).

Figure 12c. Strap on small pocket bag made with *extended double interconnected braid.* (Telefolip, Telefol, AM E61393, Craig).

Figure 12d. Small pocket bag with a simple *single-crochet* chain strap (Tipas, Namie, Bas. Vb 15850, Bühler).

The ways in which straps are attached to the bag varied quite significantly over the study area and to some degree co-vary with bag structure and mouth characteristics. Straps are either 'picked up', that is, following the course and extending from the edge row of looping of either the mouthband, body or edging; or they can include extended loops penetrating into the rows of the mouthband/body looping. Straps can also be independently constructed with their ends looped or threaded through the gap between the mouthband and bag.

In all, strap attachment follows either of six tendencies:

1) doubled over and passed between mouthband and body (Figure 13a);
2) attached via a group of extended loops at the end of the strap being passed through the space between mouthband/edging and body (Figure 13b);
3) picked up using extended loops from rows in the body/mouthband perpendicular to the course of body/mouthband looping (Figure 13c);
4) continued on from ends of each of the two mouthband sections in line with the course of their *figure-eight* looping (Figure 13d);
5) picked up (or continued) from join of mouthband panel but then attached at other end with extended loops inserted several rows into mouthband (Figure 13e);
6) picked up from top loops of edging (Figure 13f.);

Figure 13a. Strap doubled over and passed between mouthband and body (Kambriap, Yuri, Vien, 148892, Peter).

Figure 13b. Strap attached via a group of extended loops at the end of strap being passed through space between mouthband and body (Tipas. Namie, AM E88872, MacKenzie).

Figure 13c. Strap picked up using extended loops inserted into rows in the body/mouthband perpendicular to the course of body/mouthband looping (Rawei, Busa, Leid. 4477-320, Craig).

Figure 13d. Strap continued on from ends of each of the two mouthband sections in line with the course of their *figure-eight* looping (Hogru, Abau, Berl. VI 49929, Craig).

As stated above, much of this has to do with the way that the mouth of the bag has been finished. For example, Methods 1 to 3 usually are associated with mouthbands that were either looped as a *long narrow panel of short interrupted rows of figure-eight looping*. Method 1, for example, is most common for Border Mountains groups such as the Yuri who appear to have exclusively made mouthbands of the former type (Figure 13a). Method 2, on the other hand, is common to all groups who used such mouthbands and therefore widespread throughout the lowlands and Border Mountains (Figures 13b). Method 3 was used in conjunction with the *long narrow panels of short interrupted rows of figure-eight looping* or small bags where edging or mouthbands were not used such as those associated with Construction Method 3 (Figure 13c). As far as the former is concerned, this was found for bags attributed to the Busa in the plains to the north of the Sepik. For the latter, it was mostly found for bags from the southern Border Mountains.

Method 4, on the other hand, has been used when mouthbands were looped as two panels. As discussed above, this 'picking up' technique is sometimes preceded by a row of *chain-looping*, a practice common for Telefolmin speaking groups and mouthband forms in eastern Central New Guinea (Figure 8a). Otherwise, as stated

above, the ‘picking up’ is essentially a product of the merging of mouthband panels associated with the second method of constructing mouthbands, described above, which is common to western Central New Guinea groups and Abau speakers in the lowlands (Figure 13d). In both cases the strap was usually completed in the middle.

Method 5 is also a method of strap attachment where mouthbands are *long narrow panels of short interrupted rows of figure-eight looping*. In this case the loops extending from the strap connecting it to the mouthband perform the additional function of joining the two mouthband ends (Figure 13e).

Figure 13e. Strap picked up from join of mouthband panel after which it is attached at other end with extended loops (Tipas, Namie, Bas. Vb 15844, Bühler).

Method 6 essentially involves two interrupted rows of *figure-eight* looping, each at opposite edges of the mouth, being continued on from the final spiral of edge or body looping — in the latter an edging can be done after the strap was made. As with method 4 the strap is completed by meeting both ends in the middle in the middle however in this case, other than being joined with a row of looping, they are also made to be tied, the latter enabling the length of the strap to be adjusted (Figure 13f). In such cases more often the width of the strap rows tapered, narrowing towards the middle.

Figure 13f. Strap piked up from continued on from the final spiral of edge looping (Betiana, Oksapmin, Tarrow personal collection).

String bag: decoration

The most important differences between the methods of string bag decoration are whether they involve appliqué or pigmentation or a combination of both. As pointed out earlier, across the study area the use of appliqué to decorate string bags involves a limited range of materials and they can be sorted according to whether they are feathers, pigtails, string, shells or seeds.

The use of pigmentation traditionally involves dying the string prior to looping. This practice is common throughout the Upper Sepik Basin and the Border Mountains and is done usually by steeping, a method particularly suited to bast fibres (e.g. Dean 1999: 50).[15] Less commonly, mineral pigments were painted onto bags, a practice only evident for bags belonging to Telefol and Mianmin speakers. In such cases only two pigments were used, white and red, and are always applied as vertical stripes around the mouth.[16] These were likely painted on the bags by their male owners because such pigments are commonly used for arrow and shield designs and the stripes reflect those painted onto some arrow binds (Figure 14a).

Figure 14a. String bag with mineral pigments painted around mouth (Balantavip, Telefol, Bas. Vb 23055, Schuster)

The dying method involves alternating various colours of string while looping the bag. The kinds of effects that were achieved had very much to do with either the choice and sequences of looping patterns used or the way the pigment was applied to the string during the looping process. These patterns ranged from a simple arrangement of horizontal stripes involving one or more colours, stripes arranged in a staggered or step-like arrangement, horizontal arrangements of large rectangular shapes, or a 'check-like' pattern of smaller rectangles or squares.

[15] Some of the pigments that have been recorded for the lowlands include: the juice from the seed capsules of a small yellow-flowering plant *Cypholophus latifolius* (Awun: yi yeman), which produces a dark blue-green pigment (Kelm & Kelm 1980: 180; Juillerat undated); the fruit of the arnatto bush (*Bixa orellana*) is used for red dye (Kelm & Kelm 1980: 180); and *Melastoma polyanthum* has reported as being used for red/mauve dye (Craig 1973: supplementary notes).

[16] White was derived from decomposed limestone and the red is a type of ochre or ferrous compound (e.g. Craig 1988: 33).

Figure 14b, String bag with horizontal stripes looped with dyed string (Fongwinam, Yuri, Berl. VI 49887, Craig).

Horizontal stripes are achieved by splicing in a colour and looping until it runs out, then splicing in more of either colour (Figure 14b). The more sophisticated method involves working in a double spiral arrangement where two colours are worked simultaneously and alternately. This latter method leads on to the 'check-like' patterns, mentioned above, where one colour is worked to the point where the colour change is needed, the second colour on the row below is then worked to a similar position, at which point the lower row colour is linked into the row above, and the top row colour drops down into the lower position. A block is worked on the top row, followed by its counterpart on the lower row; the exchange is then performed again. The blocks may be as short or long as the maker desires (Figure 14c).

Large blocks of colour, on the other hand, are worked by looping in a discontinuous fashion backwards and forwards, by flipping the work as is done when looping a mouthband or a strap using the *figure-eight* method (Figure 14d). The next colour is done similarly following on from the previous block.

Figure 14c. String bag with checks of colour looped with dyed string (Bisiaburu, Abau, AM E64305, Craig).

Figure 14d. String bag with large blocks of colour looped with dyed string (Fongwinam, Yuri, PM E2652, Craig).

The stepped or staggered patterns are also worked in narrow, discontinuous blocks, similarly linking to the next colour as the looping progresses (Figure 14e). Stepped stripes (three to four loops wide in their vertical expression and visually equivalent to the height of the looping) are found to be an odd number of rows high, in order that

the longer horizontal stripe can be worked from left to right as normal. The *twisted half-hitch* is most commonly used for such staggered techniques because it preserves the distinction between the colours best.

Figure 14e. String bag with stepped pattern looped with dyed string (Yegelapi. Namie, AM E64595, Craig).

Arrows: functional subclasses and structures

Unfortunately, there has been no account in the study area of the manufacture of arrows that is comparable to MacKenzie's study of Telefolmin string bag technology. Nevertheless, it is clear the degree of attention and effort that men dedicate to the creation of arrows is as intensive as string bag manufacture and that fine examples are acknowledged as works of great craftsmanship (Craig 1988: 47; Jorgensen 1981: 68; Morren 1986: 272-3). High quality arrows confer prestige on their makers and owners and are readily sought out by men, being frequently traded and gifted between men from different communities (Bush 1985: 257; Cranstone 1990: 38; Jorgensen 1981: 69).

There is considerable morphological diversity for arrows across the study area and some of this can be accounted for through the subdivision of the sample into a number of functional classes, all of which are more or less ubiquitous.[17] Arrows that are designed for pigs, cassowaries and humans differ from those made for lesser prey in that they are larger, they are usually decorated and they have more complex heads or blades (e.g. the pattern of barbs of fight arrows). Arrowheads for these and smaller arrows were made of bamboo or a heavy hard wood, typically one of the many varieties of palm wood that are grown in the lowlands and lower slopes.[18] Bamboo blade arrows were most commonly used for humans and larger animals such as pigs while palm wood head arrows were reserved for humans and smaller animals such as marsupials.

Palm wood heads can comprise a simple tapering length of round or oval cross-section, but are often carved with a range of barb forms and cross-sections. Bamboo blade arrows are less likely to have barbs but when they do these can be cut into one or both edges of the blade. Both classes of arrows, however, are often embellished with intricately carved and painted designs when intended for human victims. Designs on palm wood heads are usually structured a little differently to those on the foreshafts of bamboo blade arrows, as the barbs often form part of the design (compare Craig 1995, Fig. 65 A and B to C, D, and E).

Another significant class comprises palm wood-headed arrows with a detachable bone tip. These were exclusively intended for human targets and the tips were intended to stay in the body once the arrow has been removed, to cause infection in the wound of the victim. This device is used in many parts of New Guinea; in some areas the tips were made from sections of human fibulae but more commonly cassowary spurs, or a long thin section of the fibulae bone of a cassowary, wallaby or tree kangaroo (Sillitoe 1988: 145-151). In the study area, only tips made from fibulae are evident and inspection as well as available data suggests these are usually from the marsupials (e.g. Kelm & Kelm 1980: 69).

A fourth class of arrow comprises multi-pronged forms used to kill small game, such as lizards, fish and birds. The prongs are commonly made of palm wood or bamboo, although local hardwoods are sometimes substituted for palm wood in parts of the highlands where palm wood is relatively scarce and has to be traded in.

[17] Fyfe (2009a) provides images for these arrow classes and the various arrowhead forms each class includes.

[18] Hyndman (1979: 216) provides the most comprehensive list for species of palm wood used by communities within the study region (e.g. *Hydriastele*, *Nengella*, *Caryota*).

The last distinct class of arrow is used to stun or kill small game, such as lizards or birds, without causing damage to the skin or pelt of the prey. These may consist of a carved conical wooden head, a more gnarled form made from a sapling root, or less often a section of animal bone, such as a pig vertebra (Cranstone 1964c).

The arrow shafts are made with a cane from reeds or sword grass[19] and the arrowheads are usually attached to the bottom end of the reeds where the diameter is greatest (Kelm and Kelm 1980: 67). The shafts are not equipped with fletching. Instead, being designed to shoot at short range the arrows are long and weighted towards the head.

Arrows have two or three structural components:

- the 'head' or 'blade' that varies in size and shape according to the prey and the type of wound intended;
- a foreshaft or other means of additional weighting for arrows with bamboo blades;
- a shaft.

The most commonly used methods of weighting bamboo blade arrows involved either:

- using a foreshaft made from palm wood;
- binding a small stone to the base of the arrow blade;
- applying a paste made from marl or lime and various plant resins to the bind that joins the shaft to the head (Juillerat n.d.; Kelm and Kelm 1980: 67).

Arrows: binds

The most important technical features used to unite and hold the various arrow components in place are the binds.[20] These are composed of strips of plant material that are braided, wound (whipped), or knotted over the joins of arrow components. Bush (1985) and Woolnough (1998) previously investigated some of the links between arrow binds and linguistic affiliations among highland communities of New Guinea, including some arrows from CNG. While they were successful in demonstrating some correlation between arrow bind techniques and language, their work was hindered by the small numbers of arrows in their samples and an incomplete grasp of the different binding techniques.

The number and position of binds are determined by the structure of the arrows. The largest range of bind positions, and also techniques, are found on bamboo blade arrows with foreshafts. These usually have at least two, and sometimes up to five, independent binds that vary according to their function and their position on the arrow. There are also a range of possible bind types for each position and it is apparent that while variation in braiding, whipping or knotting technique is somewhat determined by cultural choice, the nature of the head, and the structure of the arrow in some way determine the method of bind. For example, wide blades are more likely to

[19] The most commonly identified are *Miscanthus floridulus* and *Saccharum sp*. (Cranstone 1964b; 1990: 37; Kelm & Kelm 1980: 67; Hyndman 1979: 216)

[20] This discussion on binds does not include those exclusive to pronged arrows.

be fastened with whippings of straight winds or alternating winding techniques. On the other hand, where narrower points and foreshafts are inserted into shafts, this juncture may be reinforced with the addition of a small braided ring that acts as a ferrule.

The material used for binding is to some extent determined by the bind technique. For example, whipping techniques are always used when the bind material is bast strips or string while pandanus leaf and, more commonly, rattan is used for braiding, although rattan is also often used for basic whips. Unfortunately, it has not been possible to undertake material analyses of binds but it is apparent that both commonalities and differences in material preference are found between groups across the highlands and lowlands. Highland groups were reported to use strips of pandanus leaves (Barth 1987: 70), orchid fibre (Bush 1985: 266), strips of rattan (*Calamus sp*., Cranstone 1964a; Hyndman 1979: 216; Kooijman 1962: 26), and bast fibre string made by women (MacKenzie 1991, Plate 110). In the lowlands, rattan was also commonly used; varieties such as *Stephania zippeliana* or *Cayratia sp*. have been reported being used in the Border Mountains (Juillerat n.d.). String was also in common usage in the lowlands and Border Mountains but, unlike the highlands, plain strips of bast, which men rather than women prepare, were sometimes used. These bast fibres are often used in combination with mineral and resin pastes to add weight and security (Juillerat n.d.; Kelm &Kelm 1980: 67).

Arrows: bind positions

The first bind position discussed here, Bind Position A, corresponds with the requirement of attaching the shaft to the rest of the arrow construction (Figure 15a.). The most common method of attaching the shaft is one where a palm wood head, foreshaft or variety of prongs is inserted into its culm pith cavity—the method of attaching prongs or blades that are fastened onto the outside of the shaft corresponds with the way that they were attached to foreshafts, so these belong another position which is discussed together below.

Figure 15a. Bind Position A (Afogavip, Telefol, Bas. Vb 23292 Schuster).

Bind Position A requires the bind to tighten the reed shaft socket onto the thin cylinder of palm wood inserted into the culm pith cavity, while at the same time preventing the splitting of the shaft. Braids have been commonly used for this purpose because they provide the tight and secure ferrules appropriate for this position's cylindrical juncture. Sometimes the braids are preceded by a plain wind in the same

material, such as rattan, to prevent the braid slipping down the shaft. For some arrows, however, only a simple whipping is used and these are either applied with a series of knots—each of which secured a wind to the previous one—or with the ends of the cord fastened underneath the wind proper. In other cases, a series of alternating winds, often of a relatively fine strip of fibre, are wrapped around the juncture and it is sometimes apparent, through comparison with other binds on the arrows, that such binds were often not used in the original construction but rather to attach a new shaft or re-attach one that had come loose with use. The rudimentary nature of such binds suggests that they are often either used in this provisional manner or created by men who are not as proficient in bind techniques.

Figure 15b. Bind Position B (Angkevip, Telefol, AM E61607, Craig).

A second bind position (Bind position B) exists for heads and foreshafts inserted into the culm cavity of reed shafts (Figure 15b). This position's ideational foundation likely involves some conflation of two related but not fully analogous binds. The position lies between the base of the palm wood head, at its juncture with the shaft, and the point at which the base of the palm wood head or foreshaft starts to reach its maximum width, typically before its midpoint. In most cases it is clear that binds here were intended to provide an additional buffer to prevent the impact of the arrow from causing the head or foreshaft to further penetrate and split the shaft as the binds touch or almost touched the end of the shaft. It is also important to note here that examples for this bind position were very uncommon for foreshafted bamboo blade arrows: presumably because a considerable amount of the impact sustained by these arrows would have been buffered by the bind at the juncture of the blade and foreshaft; indeed investigation of foreshafts that sported this braid revealed that they were, in almost every case, recycled palm wood arrowheads. In some cases those determined as belonging to Bind Position B were clearly intentionally placed some way up from the juncture, and therefore could not have provided buffering so that function was clearly not always the intention. The reason that it is believed that the two are related is that they are never found on the same arrow and that they appear almost exclusively on palm wood heads. We believe therefore that the second variant is a derivation of the first and has been adapted as a decorative feature.

Figure 15c. Bind Position C (Yapsie, Mianmin, Gardner personal collection).

A third bind position (Bind Position C) is associated with the function of securing the end of the bamboo blade stem to the end of foreshaft or shaft, or tightens the socket where a bamboo blade has been inserted into the notch cut into the foreshaft. The cross-section of this juncture is circular so again a braid is commonly used (Figure 15c). This bind is also found on palm wood heads, but for palm wood heads it is a decorative device that mimics the use of such binds on bamboo blade arrows. This notion of derivation is supported *firstly* by the fact that throughout the lowlands and Border Mountains this bind position is almost exclusive to palm wood head arrows with long heads carrying blade-like ends or barbs that project along the distal part of the head; in Central New Guinea, similar decorative binds are also a feature on thick heavily barbed tapering points, but are positioned a little further down the head. *Secondly*, the binds used at this position on both palm wood heads and bamboo blade arrows are of the same type.

Figure 15d. Bind position D (Isu, Abau, SAM 43619, Womersley).

The next position in the sequence, Bind Position D, secures the blade from the point where the shaft and foreshaft start their juncture with the blade (Figure 15d). The bind begins either on the foreshaft or shaft below the blade stem or, if a braid is present, at the upper section of the stem, and usually concludes one or two centimetres along the blade proper, usually well before the point at which the blade reaches its maximum width. The binding material used for this join is usually relatively supple and fine so as to be able to ensure a secure wrap around this difficult tapering juncture which progressively becomes meniscoid in cross-section. The most commonly used materials include bast strips, string, or the narrow string bands that have been looped by women. The binding methods include a variety of winding techniques that range from simple sequences of plain concentric or alternating winds to those that consist of a layer of plain winds that are overlain with alternating or interwoven winds. Each

particular variety of wind used at this juncture is usually given an adhesive coating to prevent unravelling. The coating was usually tree resin and sometimes lime or clay was added to produce a cement-like paste. As stated above, the latter also provided additional weight to the distal end of the arrow.

Figure 15e. Bind Position E (Yiwani, Namie, SAM 58105, Wills).

A final bind position (Bind Position E) functions to provide additional security at the end of the juncture between shaft/foreshaft and blade, while also securing feathers or pig bristles which are often set decoratively to fan across the frontal or rear plane of the blade (Figure 15e). Bast fibres, string or looped string bands were commonly used, however, in the Border Mountains and Yellow River area, traded European cloth, largely brought by the Dutch (Gell 1975: 2), was also used and there was a strong preference for red cloth.

Arrows: bind types

There were fourteen bind types identified in the sample. Five of these involved a whipping technique; five involved braiding; two involved a knotting technique; and another two either involved the use of prefabricated looped bands or rags. The whips were fairly simple and involved either: a plain tight wind sometimes reinforced with a knot after each circuit (Whip 1, Figure 16a); a wide returning spiral wind which was then often coated with a paste (as previously described) because it lacked the security of more complex winds (Whip 2, Figure 16b), a wide returning wind over a plain wind; less often found coated (Whip 3, Figure 16c), a close alternating wind (Whip 4, Figure 16d), or sections of close alternating interlacing winds over a underlay of plain winds (Whip 5) (Figure 16e). As stated above, the looped bands, which were commonly made by the women, in most cases involved the *double interconnecting braiding* or a simple *chain-looping* technique and these were applied with a straight wind (Figure 16f).

As far as distribution is concerned, Whips 2 to 4 are largely restricted to the lowlands and Border Mountain sample, although the Abau sample did not include arrows with Whips 2 and 3. Whips 1 to 4 could be though of as general purpose and were often used for Bind Position A. Whip 2 was also commonly used for Bind Position D where a foreshaft was absent as it added weight and sometimes encapsulated a short wooden plug that provided security to the juncture. Whip 5, on the other hand, was almost exclusive reserved for Bind Position D and was used most commonly when a foreshaft without a notch was used.

Figure 16a. Whip 1 (Samanai, Anggor, Berl. VI 49759, Craig).

Figure 16b. Whip 2 (Kwieftim, Ak, Berl. VI 50641, Kelm).

Figure 16c. Whip 3 (Iafar, Amanab, PM E14048-2, Juillerat).

Figure 16d. Whip 4 (Abrau, Awun, Berl. VI 50617, Kelm).

Figure 16e. Whip 5 (Isu, Abau, SAM 43619, Womersley).

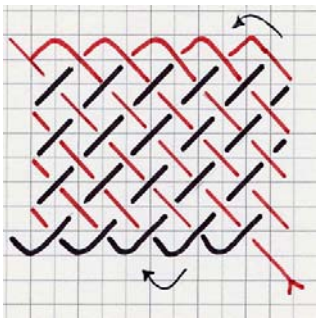
Figure 16f. Whip at Bind Position E using looped band, in this case one made with *double interconnecting braid* (Isu, Abau, SAM 43654, Womersley).

Arrows: braids

Forms of braiding used for arrows binds across the study area were found to be various interpretations of the 'Turk's Head' Knot, used by leather workers for similar purposes. Such braids may be tied in any length and interlacement. The basic Turk's Head' form, which for the study area is termed as Braid 1, is distinguished by the regular over and under pattern formed at the edges as the working strand exits and re-enters the braid (Figure 17a). It is particularly evident for arrows from the western region of Central New Guinea

Three variations on this braid represent all but one of the braiding techniques identified and these involve infill to the Turk's Head pattern. The first of these, Braid 2, utilises an infill where the strand never exits the edge of the foundation and provides an over two/under two braid that runs perpendicular to the length of the arrow (Figures 17b and c).[21] Having infill this is a more secure braid than Braid 1 and is commonly chosen braid for Bind Positions A and B. It also works best with more oval cross-sections due to the perpendicular course of the infill and therefore is also popular for Bind Position C where a bamboo blade is attached against rather than inserted into the foreshaft. Indeed, it is the most commonly occurring braid in the sample and is relatively ubiquitous, although more common for arrows collected in the eastern and northern regions of Central New Guinea and amongst the neighbouring Abau to the north in the lowlands.

[21] Braid 2 was reported as being used by the Wola by Sillitoe who provided a description of the technique ─ termed *birril* (1988: 130, Fig. 40).



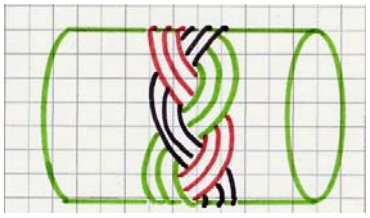
Key:
Black: downward track of the working strand
Red: upward track of the working strand.

Figure 17 a: Braid 1 - over1/under 1 body (Turks Head) (Right: Demavip, Tifal, BM, 1964.Oc.3.140, Cranstone).

Figure 17b. Rollout of recreated Braid 2.

Figure 17c. Braid 2 (Afogavip, Telefol, Bas. Vb 23279, Schuster)

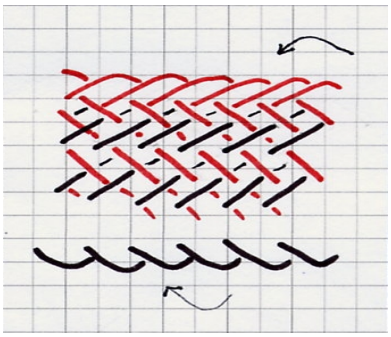
Another infill variation, Braid 3, simply involves an infill of the Turk's Head that makes one path following that of the first pass of the strand (Figure 17d). This braid was only found on one arrow and it was collected in an Oksapmin community.[22]

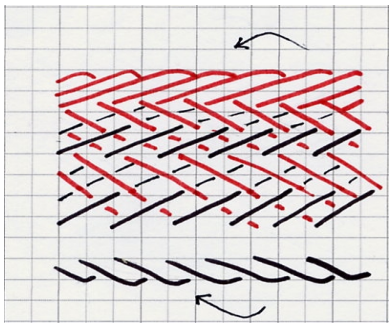


Key
Green: first circuit of working strand
Red: second circuit of working strand
Black: third circuit of working strand, completing the knot.

Figure 17d. Braid 3 (Right: Betiana, Oksapmin, PM E2190.4. Perey).

Braid 4, the last braid involving infill, utilises an infill that regularly exits the edge of the foundation and usually provides either an over two/under two or over three/under three braid that runs horizontal to the length of the arrow (Figures 17e-g). The distribution of this braid is particularly clustered in an area that encompassed territory belonging to three neighbouring language groups, the Mountain Ok languages Mianmin and Telefol and the Sepik language Abau. It was a braid that the former two particularly favoured, along with Knot 2, for Bind Position C because it could provide an especially tight and compact ferrule useful for notched foreshaft bamboo blade arrows (see Figure 15c). For the Abau, who did not use such foreshafts, it was more commonly found at Bind Position A.





Key:
Black: downward track of the working strand
Red: upward track of the working strand

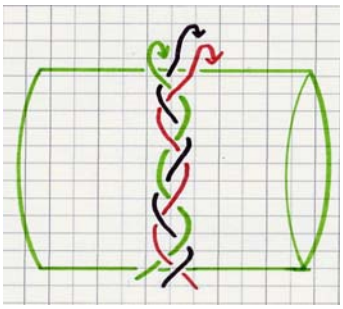
Figures 17e. Left: Braid 4: over 2/under 2 body; Right: Braid 4: ver 3/under 3 body

[22] Braid 3 and Braid 4's numbering were reversed in Fyfe (2009a)

Figure 17f. Braid 4: over 3/under 3 body (Bamblediam, Abau, Berl. VI 49803, Craig).

Figure 17g. Recreated Braid 4: over 2/under 2 body

The final braid, 'Braid 5' (Figure 17h) is a simple 'Spanish Knot', essentially a 3-end plait working in the round. This was not a particularly common braid and its occurrence was almost confined to Central New Guinea. Its use was also mostly confined to Bind Position A probably because, along with a simple whip, it provided a simple but reasonably effective way of securing a shaft to the head/foreshaft whereas it would have not been overly sufficient for other bind functions.



Key
Green: first circuit of working strand
Red: second circuit of working strand
Black: third circuit of working strand, completing the knot.

Figure 17h. Braid 5, the "Spanish Knot" (Right: Kasanmin, Bimin, BM 1982.Oc.6.82, Wronska-Friend),

Arrows: knots

The final set of techniques comprises binding methods that are here described as knots. In the context of this essay a 'knot' involves a process whereby two working ends (as opposed to a single working end in the braiding) are used and involve interlacements of the two strands whereby there is a regular twist between them. These twists are formed as the ends link together, after which they turn back. For such knotting techniques the two ends are worked alternately.

Two knotting techniques were identified in the sample and each is started in the same fashion (Figure 18a.). Knot 1 involves a process where the downward working end goes over one row, then under two before twisting under to return. On its return it then maintains this sequence but reverses the manner in which it goes under or over the existing rows (Figures 18b and c).[23] For Knot 2 the downward end is only threaded over/under one each time before the twist but the reverse in the manner in which the thread goes under or over in the return is maintained (Figure 18d and e). The widths of the strands affect the appearance of these knots, as does the tightness with which they are worked. Increasing tightness induces a spiral effect, and exaggerates the height of the twist. This is especially so for Knot 2.

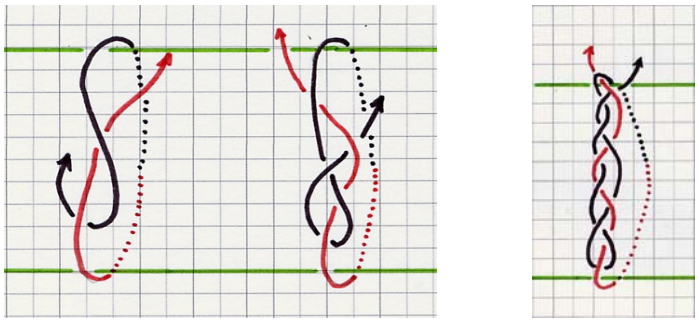


Figure 18a. Special start required so that two working ends are available.

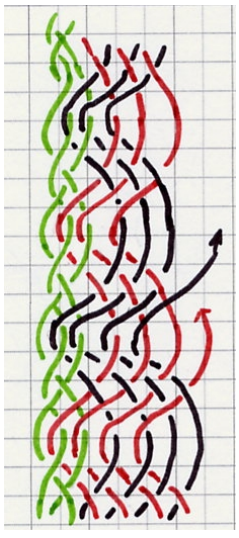


Figure 18b. Knot 1: Over 1 /Under 2 and twist
(Right: Tipas, Namie Bas. Vb 19420, Bühler).

* Foundation shown in green

[23] This technique, termed *portport* by the Wola, is also described by Sillitoe (1988: 131, Fig. 41)

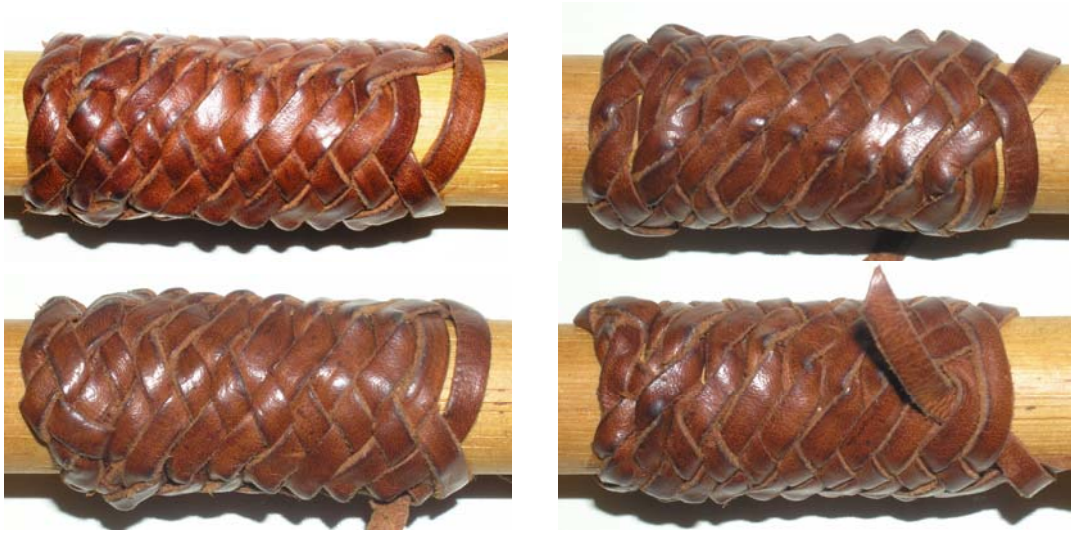


Figure 18c. Rollout of recreated Knot 1. Note the twist from which the strands then pass under two then over one before they turn back.

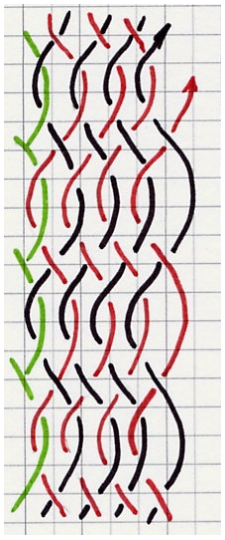


Figure 18d. Knot 2: Over 1/Under 1 and twist.
(Right: Angkevip, Telefol, AM E61587, Craig).

Figure 18e. Photo of recreated Knot 2.

The distributions of Knots 1 and 2 are largely uncorrelated and to some extent they were used for different functions. The sample suggests that Knot 1 was more commonly used north of the Sepik into the northern plains and Border Mountains. It was also used more commonly to the east by the Namie. The Abau sample had smaller proportions of arrows with this braid. Knot 1 is most certainly used as an alternative to Braid 2 as it was similarly used for Bind Position A and B as well as Bind Position C where a bamboo blade is attached positioned lengthwise against rather than inserted into the foreshaft. Knot 2, on the other hand, was not used for Bind Positions A and B. It strongly correlated with the distribution of the notched foreshaft in Central New Guinea and was used for such bamboo blade arrows at Bind Position C as it was a good bind with which to wrap this juncture. Curiously, it was also sometimes used at Bind Position C on palm wood head arrows as a decorative device that mimicked it use on the bamboo blade arrow.

Discussion

This appraisal of fibre crafts of the Upper Sepik region, inclusive of the Border Mountains and Central New Guinea, is comprehensive but by no means exhaustive. The task of investigating such crafts is very much a work in progress and many classes of artefacts produced using these have yet to be analysed in a systemised fashion. Importantly, there is much information contained in the records of fieldworkers such as Mouli MacKenzie and Barry Craig that has yet to be scrutinised and assimilated into the dataset. In the coming year increasing attention will be turned towards such sources.

Nevertheless, the investigation so far has shed light, not only on the scope of these fibre crafts, which provide a significant range of technical alternatives to the craftspeople of the study regions, but has also to some degree identified where and how the resulting technological components are interrelated and determined by the functional and operational concerns of the artefact classes for which they are used. Accordingly, this approach has the potential to provide a robust dataset, inclusive of a wide range of analytical units, with which to best undertake an exploration of relationships between material culture and other variables such as language, ecology and geographic distance.

Bibliography

Barth, F. 1975. *Ritual and Knowledge among the Baktaman of New Guinea*. New Haven: Yale University Press.

Barth, F. 1987. *Cosmologies in the Making*. Cambridge: Cambridge University Press.

Bush, T. 1985. 'Form and decoration of arrows from the highlands of Papua New Guinea'.*Australian Museum Records* 37: 255-93.

Craig, B. 1973. *Upper Sepik Field Diary. 1972-3.* Unpublished Manuscript in possession of author.

Craig, B. 1988. *Art and Decoration of Central New Guinea*. Shire Ethnography publication Nr. 5. Aylesbury, Bucks.: Shire.

Craig, B. 1995. Arrow designs in northern and central New Guinea and the Lapita Connection, in D. Smidt, P. ter Keurs and A. Trouwborst (eds), *Pacific Material Culture, Essays in Honour of dr. Simon Kooijman on the Occasion of his 80th Birthday*. Leiden: Mededelingen van het Rijksmuseum voor Volkenkunde, pp. 237-59.

Cranstone, B. A. L. 1964a. *Tifalmin collection*. Archives of the National Museum of Papua New Guinea, Port Moresby. Unpublished Manuscript.

Cranstone, B. A. L. 1964b. *Field Notes of the British Museum Ethnographical Expedition to New Guinea*. Archives of the British Museum, London. Unpublished Manuscript.

Cranstone, B. A. L. 1964c. *Collection notes in the British Museum Register*. Unpublished Manuscript.

Cranstone, B. A. L. 1990. The Tifalmin and their Environment: Material Culture of a Mountain-Ok People, in B. Craig and D. Hyndman (eds), *Children of Afek: Tradition and Change Among the Mountain-Ok of Central New Guinea*. Sydney: Oceania Monographs No.40, pp. 35-53.

Dean, J. 1999. *Wild Colour*. New York: Watson Guptil,

Fyfe, A. 2009a. *Gender, mobility and population history: exploring material culture distributions in the Upper Sepik and Central New Guinea.* PhD Thesis, Geographical and Environmental Studies, University of Adelaide.

Fyfe, A, 2009b 'Exploring spatial relationships between material culture and language in the Upper Sepik and Central New Guinea', *Oceania*: in press.

Gell, A. 1975. *Metamorphis of the Cassowaries: Umeda Society, Language and Ritual.* London: The Athlone Press, University of London.

Hyndman, D. 1979. 'Wopkaimin Subsistence: Cultural Ecology in the New Guinea Highland Fringe'. PhD Thesis, Anthropology and Sociology. University of Queensland**.**

Hyndman, D. C. (undated). *Untitled documents:* collection notes held at the Papua New Guinea National Museum & Art Gallery. Unpublished Manuscript.

Jorgensen, D. 1981. 'Taro and Arrows: Order, Entropy and Religion among the Telefolmin'**.** PhD Thesis, Anthropology, University of British Columbia.

Juillerat, B. (undated). *Notice de la base de gestion des collections:* Collection Bernard Juillerat, Musée du quai Branly

Kelm, A. and H. Kelm. 1980. *Sago und Schwein. Ethnologie von Kwieftim und Abrau in Nordost-Neuguinea*. Wiesbaden: Franz Steiner Verlag.

Kooijman, S. 1962. 'Material Aspects of the Star Mountains Culture', *Nova Guinea* 10(2): 15-44.

MacKenzie, M. 1990. The Telefol string bag: a cultural object with androgynous forms, in B. Craig and D. Hyndman (eds), *Children of Afek: Tradition and*

Change Among the Mountain-Ok of Central New Guinea. Sydney: Oceania Monographs No.40, pp. 88-108.

MacKenzie, M. 1991. *Androgynous Objects: String bags and gender in central New Guinea.* Chur, Switzerland: Harwood Academic Publishers.

Morren, G. E. B. 1986. *The Miyanmin: Human Ecology of a Papua New Guinea Society.* Ann Arbor: UMI Research Press.

Sillitoe, P. 1988. *Made in Niugini: Technology in the Highlands of Papua New Guinea.* London: British Museum.

Woolnough, R. 1998. *Decoration and Binding Methods on Arrows in the Papua New Guinea Highlands*. Honours Thesis, Department of Anthropology and Sociology, University of Queensland.