IRANIAN FELT TENTS: AN ARCHITECTURAL HERITAGE OF THE TURKMEN NOMADS

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ABSTRACT

For the last thousand years at least the Turkic and Mongolian nomads have been using a prefabricated and portable, yet rigid dwelling. It is by nature light, well insulated, streamlined, and regulable for changes of weather. However, until very recently almost no one has made a serious attempt to describe tents as a form of architecture. Though, the scope of the present article is not to discuss the history of these tents; but the authors hope that by describing the structure, its handling, manufacture and transport to provide a general basis for understanding the nature of one type and its place in the Turkmen economy, which may to some extent be typical of the others. The contents of this article rely heavily on the information provided during several interviews with *Yomut* and *Goklen* Turkmen in Iran at various times in addition to historical documents and travel accounts concerning the traditional buildings techniques of the Iranian region. The results suggest that nomads have developed a rigid structure which answers to their needs by means of a principle of repeating small parts, in which mass-production, prefabrication, and consequent standardization are implicit.

Key words: Felt Tents; Iran; Turkmen; Nomads; Architectural Heritage

1. INTRODUCTION

In the early years of this century, when nomadic life was still general in Central Asia, they were to be found from Anatolia in the west to the furthest frontiers of Mongolia in the east, a quarter of the way round the world, in a belt some thousand miles from north to south. Throughout this vast area the form and details of the tent vary only a little; it is built on the same structural principles, made by the same techniques, and used in much the same way by all the races familiar with it. (Rona-Tas, 1961)

The word *yurt* is something of a misnomer where tents are concerned, as none of the major nomadic groups use it in this sense. Its general meaning is in fact camping place, camp, or native country: it is understood as such by Anatolian Turkish, *Qazaq*, *Qirzig*, the *Shahsavan* of Azerbaijan, and the Turkmen of *Khurasan*. It appears to have had the same meaning in Old Turkic. Yet ironically its misuse has even become current among ethnographers in Turkey, where its proper sense is well known. The real common Turkic name is *ev* and its cognates *oy*, *uy*, and Old Turkic db, all with the connotation of home (mud and masonry structures are distinguished by the word tam). The Mongol names however are quite different, and to avoid confusion we shall simply refer to tents as tents, the context being limited here to the Central Asian kind. There are or were a variety of felt tents in Iran and the nearer east, but wherever they appeared, it was as the homes of Turkmen nomads all descended from the *Oguz* tribes which crossed the Amu Darya (Oxus) in the eleventh century. In certain cases it seems that groups which originally used felt tents later took over the use of black goat-hair tents more suitable to a particular climate: among these are the *Qasqay*, and *Avsar* and the Anatolian *Yoruk*. Of the felt tents which still remain, there are two principal types in Iran: the *alacix* of the *Sahsavan* and their neighbors the *Qaradagi*, and the *oy* of the Turkmen. (Ferrier, 1989) A further type just survives in Anatolia: the *topag ev* of the Turkmen there. Although the *Sahsavan* tent has been described in some detail, the Turkmen tent of *Khurasan*, which is in most respects the most elaborate of all the nomad tents to be found in Iran, has not. Like the alacix and the *topag ev*, the *oy* shows the signs of independent development over a considerable time; but it bears an important relationship to the domed tents of Iran, Turkey, Iraq and Syria both by virtue of the diffusion of the Turkmen from the area where it is found, and because *Khurasan* lies midway between the types of Central Asia and those of the Middle East.(Mirnia, 1995) The Turkmen in north-eastern Iran, northern Afghanistan and Russian Turkmenistan now number about one-and-a-half million. They are divided into tribes known as *halq*, of which the most important are the *Teke*, *Yomut*, *Salor*, *Sariq*, *Qavdir*, *Ersari* and *Goklen*. Of these, the *Yomut* and *Goklen* are the principal groups in Iran, with small numbers of *Teke* refugees. (Iri, 2001) Much of the flat grazing land has now been turned to the plough, since it is ideal for combine harvesting, and much of the population has now settled, but there are still some ten thousand *Yomut* shepherds in the north-eastern part of traditional *Yomut* territory. The *Goklen* have been mainly concerned with agriculture since the beginning of the nineteenth century at least, but they still use tents as well as houses. (Noroozpour and Mousavi nejad, 2003)

The contents of this article rely heavily on three bases: 1) the information provided during several interviews with *Yomut* and *Goklen* Turkmen in Iran at various times (as a part of the authors` field work) 2) The consultancy of leading experts on vernacular constructions and Iranian architectural heritage specialists from the University of

Tarbiat Modares in Tehran. 3) Historical documents and travel accounts concerning the traditional buildings techniques and the architectural heritage of the Iranian region.

2. GENERAL DESCRIPTION

The Turkmen use two kinds of tent, the *oy* and the *gotikme*. The Persians use a third name, *alachuq* (pl. *alachiq*), for both of them, but this, though of Turkic origin, is not used by the nomads themselves. (Herbert, 1928) The *gotikme* is today regarded as an inferior version of the *oy*. (Fig.1) The full name for the latter is *uq Oy*, white house, or *qara Oy*, black house, a description which corresponds to the change of color in the felts as they grow old and darken in the smoke. A tall tipi-like structure *kume* is also put together from timber, reeds and brushwood, but this, though interesting, is not strictly a tent. (Shahbazi, 1990) The felt tent is characterized as possessing a rigid, domed wooden frame which, when erected, stands on its own and is not dependent on the covering for support. In this respect it differs radically from the black tent types used elsewhere by Arabs and others, the cloths and poles of which are interdependent. (Asgari-Khanghah and Sharif-Kamali, 1995) Table 1 divides the felt tents into 10 groups. (Table 1) Except for very poor examples, domed tents are invariably covered with felt, which has no great tensile strength. The whole weight of this covering, which amounts to more than two hundredweight (130 kg.), is carried by the frame in compression A flat site is chosen and cleared, and the frame is erected without any adaptation to the terrain It consists of four groups of elements: the wall frame, which is formed of curved trellises into a cylinder about five and a half meters in diameter and one and a half high (these are the sizes of an average tent of 62 struts); the door frame which is set in one side of it; the roof wheel, about two meters in diameter and slightly dished; and a set of struts about two and a half meters long, and bowed, spanning between the top of the wall and the rim of the wheel, which they support some three meters above the ground. The upper part of the wall is encircled by several broad girths, woven from wool, which prevent its collapse under the outward thrust of the roof; while the struts are held firmly at the correct spacing by a much narrower girth which is wrapped around each in turn. The dome and the upper part of the wall is covered by two large semicircular felts, one over the door and another at the rear, cut so as to leave the roof wheel exposed. This is then covered with a circular felt (square in the case of the *Teke*), the forward part of which is usually folded back to leave a smoke hole. (Burnes, 1834) The walls are hung with four rectangular felts which reach nearly to the ground, and outside them, from either jamb of the door, are bound two screens of cane work two meters high, which almost meet over a third and smaller piece at the rear.

Table 1. Different kinds of the felt tents with their current location. [Authors]

Scheme	Type	Current Location
	Tajik	Afghanistan
	Turkmen	Afghanistan
	Turkmen	Anatolia
	Turkmen	Iran
	Turkmen	Iran
	Firuzkuhi	Afghanistan
	Firuzkuhi	Afghanistan
	Hezare	Afghanistan
	Uzbek	Afghanistan
	Shahs van	Iran

Fig.1. *Aq oy, from the back, showing felt junctions. [Image archive of Tarbiat Modares University]*

3. CONSTRUCTION ELEMENTS

1- The Frame of the Wall: *Terim* or the complete wall frame is made up of four separate trellises called *qanat* (wing). These are composed simply of an upper and a lower layer of lightly curved laths placed across one another and pinned at their individual crossing points with knotted strips of camel-leather, *kok*. The complete trellis may be closed up for transport or storage so that all the laths in each layer he close alongside one another in a nearly solid bundle, or pulled open to form a section of wall which, because of the curvature of the laths, is arc-shaped in plan. The laths themselves are 2-2.5 cm. thick and 2.5-3 cm. wide, and fastened together rather loosely, the full thickness of the wall being almost 5 cm. Though the length and number of the laths differ according to the size of the tent, in the sets most widely used the full laths (also called *terim*) in the central section of the trellis measure 220 cm. and each is set across eleven others at a regular spacing. Shorter laths, *kelte terim*, make up the corners. Each lath projects beyond the first

and last of those crossing it, so that when the trellis is opened a series of vee shaped intersections is to be found all along the top and bottom edges: these are called bas (heads) and *ayaq* (feet), and measure 10 cm. and 15 cm. respectively. They are of the greatest importance in the one case for fastening the lower ends of the roof struts, and in the other for providing some friction where they rest against the ground. So far the construction is simple, but it is in the smaller details that a surprising subtlety and ingenuity are visible. Firstly, not all the crossings are pinned, but some are left free, *tarhan*, so as to impart the necessary flexibility to the trellis: each lath is set 20 cm. from the preceding one, and the sequence of crossings is always the same, with, from the top, three pinned joints, one free, two pinned, one free, and four pinned at the base. The centre and edges are thus held firm. The rhomboid spaces between the laths are called *gozenek*: those surrounded by pinned joints are called *dar gozenek*, and those with joints left free, *iri gozenek.* Secondly, the ends of each section of trellis are contrived to interlock neatly and tightly with the succeeding one, the laths of both inner and outer layers being so arranged that every one overlaps its equivalent across the joint. Progressively shorter laths are placed across two diagonally opposite corners in each layer, making the trellis up to the rectangle, and all their joints are pinned. The ends of these laths are left to project 10 cm. as vee shaped heads at the ends of the trellis, as they are along the long sides, and it is the interlock of these upon one another which holds the joint, *qabsit*, firmly in place. Though at first it seems to be complicated, this interlock is controlled by a simple principle: the inner layer of laths in all cases runs, as seen from the inside, from top left to bottom right, and the corners of each section of trellis are closed by a short lath which crosses either two, *civit*, or three, *tek*, of the longer laths. When a joint is made a two-crossing lath must always be paired with a three-crossing lath in the other layer of the next trellis, and the distribution of these short laths across the corners is arranged accordingly on all four trellises. (Amirkhani and Okhovat, 2009) The trellises for a tent are therefore a set, and a broken section cannot be replaced by any section which comes to hand. Thirdly, the trellis is modified in two respects where it meets the doorposts on either side. The top corner of each of the trellises at the door is always closed by a three-crossing lath, and the long lath which crosses its centre is prolonged 35 cm. beyond the pin to form a horn which rests against the outside of the doorpost: this is called the *sah terim* or *qaraqus* (eagle), and it is used not only to steady the trellis when it is lashed to the door post, but to control the manufacture of the whole trellis at the right spacing. The bottom corner of the trellises next to the door, are always closed by two-crossing laths, which leave room for the ends of the threshold. The short laths which cross the long ones are referred to by the number of joints in them: thus the first short lath on a *sah terim* is *uc kok*, the next *bes kok*, and so on. Finally, the ends of the trellises which abut the door-posts do not have prolonged tips like the others, but instead the laths are cut off short with only 2.5 cm. left beyond the pin. The curvature of the laths gives a maximum depth of 12- 15 cm. on a full lath. It results in an inside diameter of 560-70 cm. when the full trellis is erected, with a height of about 155 cm. overall, in a 62 strut tent. (Lansdell, 1927) (Fig. 2).

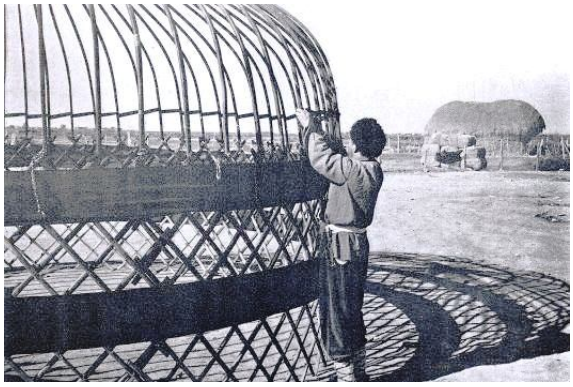
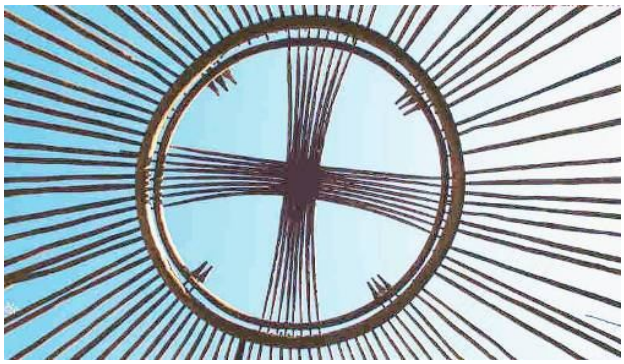


Fig. 2. *The tent frame during erection, the shepherd is fastening the struts with a duz yup. Atabay Yomut. [Image archive of Tarbiat Modares University]*

2- Tuynuk or the Roof Wheel: *Tuynuk*, is made up of three elements: the rim, the spokes, and the trimmer. The rim, *tegek*, is built from two or three felloes roughly semicircular in section, and about 7 cm. deep by 4 cm. thick, which are tapered at the ends so as to overlap smoothly for 20 cm. or so/The flat side is usually placed inwards, though there are exceptions, and the joints are bound with several turns of camel leather in thongs 1cm. wide. This rim is pierced with two sets of holes, *desik*, the lower set being square in section, about 2 × 2 cm. and bored straight through the timber with its upper edge on or near the centre line: these are the slots, at 9 cm. centers, for the struts to engage in. The second set of holes are round, 2 cm. in diameter, and usually set close to the upper edge of the rim (in some cases they are on the centre line); they are bored only half way through from the inside, and at a slant so as to dish the spokes whose ends are fitted into them. They occur only where the spokes are required, and then at 9 cm. centers: the two sets of holes are staggered. The spokes, *cagaraq* or *canaraq*, are always set in three groups, each of which spans the wheel from side to side. (Amin-Allahi Baharvand, 1981) These groups contain eight spokes each as a rule, and occasionally nine, the spokes themselves being round, oval or a rounded triangle in section, and about 2 cm. thick. The three groups overlap one another at the centre, each with its members packed as close together as possible, but as they radiate outwards the spokes diverge from one another in a fan shape, and end all in the same plane at the rim. They are nailed together at the central crossing, and bound together with a pair of 5 mm. thongs, ham *tikisi*, which describe a circle around the centre 45 cm. across. One of the thongs lies on top of all the spokes, while the other passes in a spiral over it and under each spoke in turn. The splay of the spokes creates a pattern, and this is controlled by the spacing at the rim. The most common arrangement is for the two central spokes of each group to continue close together to the rim, with the three spokes on either side set a little apart from them. Each set of two or three is spaced alternately with the strut holes, but sets of two and three are separated by two strut holes, and the complete groups of eight spokes are separated by three strut holes. The spokes are curved enough to give a depth of 20-25 cm inside the centre of the wheel. They are held in place by a rounded, flexible lath 2 cm. in diameter, (*canaq halqasi*, which is

nailed above them around the rim. The whole wheel is 202-10 cm. in diameter. (Figs. 3 and 4) Table 2 divides different kinds of roof wheels into 7 groups. (Table 2)

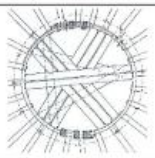


***Figs. 3-4**. Tuynuk or The roof wheel [Authors]*

3- The Struts: The struts are of two kinds: those of full length, *uq*, which comprise the greater number, and five shorter ones, the *alin uq* or *manlay uq* (six in *Goklen* tents), which accommodate the additional height of the door frame above the surrounding wall trellis. All are made from straight-grained timber with a section measuring 2.5 × 2.5 cm, or in other cases 2×3 cm wide. The corners are shaved off, and the upper end is chiseled to a taper for 20 cm. of its length, to measure 1cm square at the tip: it then fits easily into a slot in the roof ring, protruding 4 cm. or more on the inside of the rim. At 2-5 cm. from the other end is bored a 5 mm. hole, and through this are threaded the tails of a plaited woolen tie, fig bag, with which the strut can be lashed to the top of the trellis. The lower tip of the strut is chiseled to a blunt vee shape. The curvature of these struts is always much greater at the lower end than at the upper: so much so that the upper half of the length is almost straight. For a sixty-two strut tent the length along the strut is 270-280 cm., and the maximum depth of the curve 35-45 cm. at 70 cm. from the lower end, so that the distance between the tips is 245-55 cm.: the dimensions vary between different frame-makers. (Afshar Sistani, 1987) The struts over the door are similar, only some 20 cm. shorter at their lower ends, which are cut off square and tapered a little, and provided with no tie. The number of full struts corresponds to the number of heads on the trellis. (Fig. 5)

4- The Frame of the Door: Two posts, a threshold and a lintel make up the door-frame. The posts are roughly square in section, 5 × 5 cm. and are called *soye*. They retain this thickness for the clear height between threshold and lintel of 150 cm. their bottom ends are chamfered to a taper for 5cm. and the tops are prolonged as tenons 20-25 cm. long and 2cm. thick. A groove is ploughed into the outer side of each post to receive the ends of the wall trellises; it is 1cm. deep and runs along the whole length to within 20 cm. of the lintel. The horizontal members are much heavier, being some 7 × 20 × 120 cm. over-all, though the mass is reduced by fancy carving of various styles, and a cutting-away on the inside edge to leave a door stop. The clear width varies from 80-100 cm. between the door-posts, their heels fitting into sockets in the threshold and their tenons passing through slots in the lintel to project above it, where they form useful belaying pegs. Five sockets or six in *Goklen* tents are made in the upper side of the lintel to receive the short roof struts: these are spaced regularly, with one in front of each tenon slot. The threshold, *bosoga* or *asaki isik* and the lintel, *ustki isik*, are both plain outside, but their inner edges are scalloped out in a series of bold arcs and saw-tooth shapes. Just inside the

Table 2. Different kinds of the roof wheels. [Authors]

Scheme	Type	Current Location
	Firuzkuhi	Afghanistan
	Uzbek	Afghanistan
	Shahs van	Iran
	Turkmen	Afghanistan
	Turkmen	Anatolia
	Turkmen	Iran
	Turkmen	Iran

tenon slots are bored two holes 4 cm. in diameter to receive the door pivots, *dirnaq*, in the lintel, and two corresponding shallow sockets are made in the threshold for their counterparts. Sometimes a single slot is provided on the underside of the lintel for an internal locking bar. There is usually a ringbolt in the centre of the outside face of the lintel for a padlock. The doors themselves, which appear to have come into general use within living memory, are of two equal leaves, *qabsa*, of wood, one which, usually the left hand, is provided with a strip of beading to mask the joint on the outside. They are paneled, with up to five rails, *muntins*, and stiles prolonged into pivots. The outer face of the door framework is usually scored with longitudinal grooves around the edges, the central part and the panels being decorated with a rippling pattern reminiscent of linen-fold work, or else with stamped circles. The inner face is usually plainer. The edges of the panels may be beveled. The fittings are completed with a hasp and chain, *kilik*, of wrought iron, fastened outside on the top rail for use with the padlock, and a similar one inside at waist height, for use with a wooden peg kept on a cord. The whole door is called *qapi*. (Tapper, 1971) (Figs. 6 and 7)

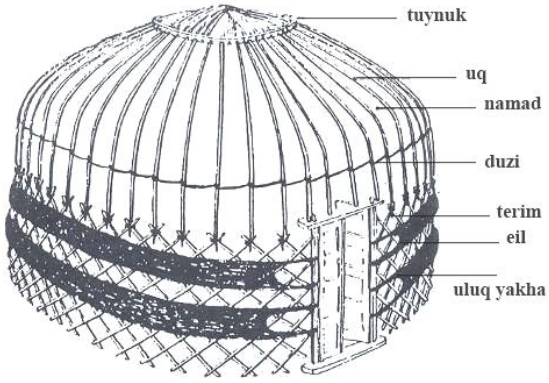


Fig. 5. *The full length struts, uq [Image archive of Tarbiat Modares University]*

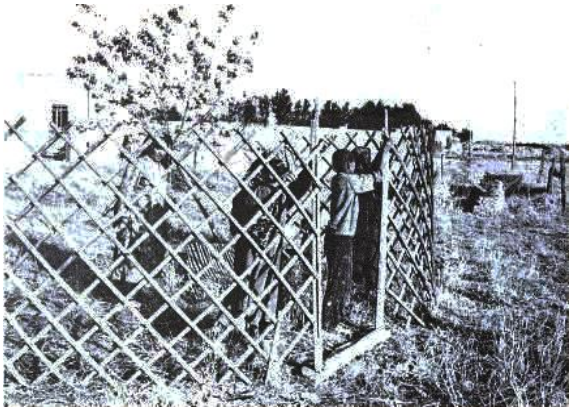


Fig. 7. *Fitting the first trellises to the door frame. [Image archive of Tarbiat Modares University]*

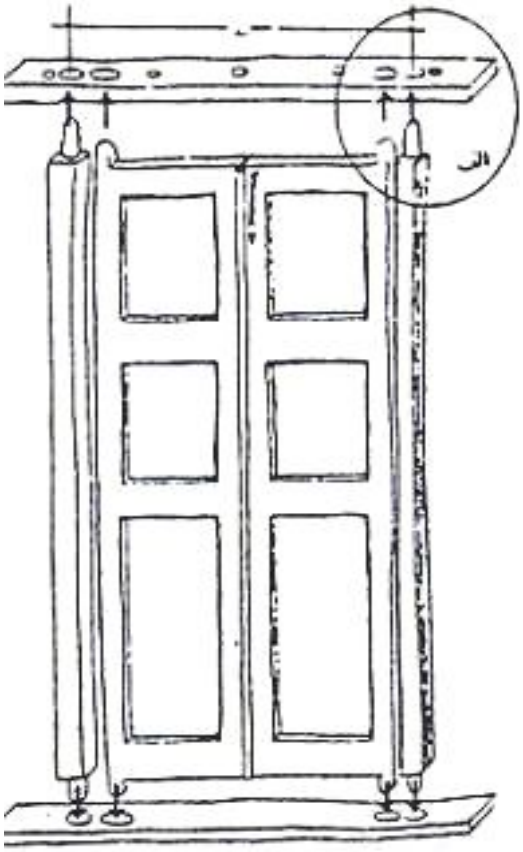


Fig. 6. *Paneled doors in place, with the long horns of the trellis projecting either side. The screen wands are decorated. [Image archive of Tarbiat Modares University]*

4. MANUFACTURE OF THE FRAME

The basic piece of equipment is a chimney, *koruk*, over a hearth, in which the timber could be heated. This was at least 150 cm. high, and about 50 cm. across: it might be built in wood above a fire pit or it might be hollowed out of the ground in a bank where the fire could be lit at the side with a communicating tunnel. The timber is cut to size, and put to soak for long enough to draw in water perhaps overnight. The pieces are then placed in the chimney, and the fire is stoked with wood or dung. They are kept in the heat for at least half an hour, until they have softened; it is important that only good quality timber free from knots is used. The work is arranged so that batches of one structural element are heated and bent at a time, either trellis laths, or roof struts, or felloes for the wheel. When the timber is ready it is taken out and carried immediately to a work bench, *esek*, with a shallow slot cut across its upper surface and a stout peg or two driven in next to it. This serves as a fulcrum for bending the pieces while they are still warm .When roof wheels are being made, the craftsman works on one end of the felloe at a time, holding the timber on the fulcrum with a lever, *yan agac*, or *qaptan agac* or *yantov*, which has a slight concavity in one face near the end. He bends the timber by leaning on it with his side, working that part of it back and forth between lever and peg. When he has achieved an appreciable curve, he holds it by tying a rope around the two ends of the timber, which he continues to tighten until he has bent it into a quadrant. He then sets the half-finished felloe on a form made of three stout stakes driven into the ground, *teble* or *tevle*. He does the same for the

six or more pieces in the chimney, and stacks them all one above the other. He leaves them like this only for a quarter of an hour or so before taking them off to work on the other end in the same way as before, still using the rope. Meanwhile his assistant has re-set one of the stakes, and the complete semicircular felloes can be put back on them to set for five or six days. They can later be taken off, finished, and the ends tapered so that pairs of felloes can be bound together with rawhide. The holes are then bored out with a drill, and the strut slots are given the right section by plunging a red-hot, four-cornered iron into each one in turn. The spokes are heated, bent by hand, and inserted with the centre of the wheel supported by a short stake with a cross-bar which holds them 20 cm. above the ground. The trimming lath is fixed, and the centre nailed and bound together with camel-hide. The struts are treated in much the same way, but the timber is more carefully divided, cut, and trimmed with a draw-knife before soaking and steaming. Batches of twenty struts or more may be steamed at once. They are taken singly from the steam-box and bent as before to the correct curve (a rope is unnecessary) before being set alternately one, one way, one another, on a template, *teble,* of six stakes which hold them with their ends crossed over one another. Eight or nine pairs can be put on the same set of stakes, and the two stakes at the head of the template, which control the critical part of the curve, may be repeated up to six times so that, still using the same stakes at the base, the craftsman can with a slight adjustment dry a complete set of *uq* at one time. The curve of the struts and the setting out of the template is controlled with a pattern strut, *misan uq*. They are left to set for a week, or longer in cold weather. The trellis laths too are trimmed and rounded before being put to steam. When they are bent on the workbench, the curvature of the long laths is controlled with an old *sah terim* used as a pattern, *endaze terim,* the curve of the shorter pieces is relatively unimportant. As the curvature of even the long laths is slight, they are not put on stakes to set, but when cold are laid aside ready for pinning. They are then marked off for the pins with the aid of the pattern strut, and drilled. The drill, *parmi, parma, parmuta* is a simple affair mounted in a wooden axle between two uprights: while one man winds this to and fro with a cord, another holds the laths against the bit. A gang of fifteen or sixteen men and boys work together on the job of assembly, and using the long *sah terim* as their guide they fasten the other laths adjacent to it with the softened strips of hide. They work from the top left hand corner, as seen from the inside, to the bottom right, beginning with a three-crossing lath, then the longer laths fastened to its ends, then a five-crossing lath, and the longer laths attached to its ends, and so on. At two points in the full length (three in some *Goklen* trellises) they leave the crossings unpinned. (Tapper, 1966) The master-craftsman controls the setting out of all four trellises, making sure that corners with three crossings are matched with those with two, *sakna.* The leather for the pins and bindings is camel-hide, *duyenin hami,* preferably from the neck. It is scraped clean of all traces of meat, pegged out on the ground, and treated with salt or ash before being left to dry for a day or two in the sun. It can then be stored. Before use it must be soaked, cleaned of hair, and cut into strips, *tasma* or *tirse.* These are wound on two pegs, then divided into thongs, *tike* or *dilim* about 5 mm. wide; these must be used at once before the hide dries, though it may be oiled, usually with milk. The knots are made by bending the end back and passing it through a slit in the body of the strip. (Fig. 8)

Fig. 8. *Manufacture: bending a felloe for the roof ring. Ceperbay Yomut [Image archive of Tarbiat Modares University]*

5. PITCHING THE TENT AND THE CAMP

Four or five women can pitch a tent with some small help from the men, and whatever children there may be around: many households can carry out the operation, which takes about an hour, without calling for their neighbors' help. As some of the women carry the trellises into position and begin to open them, two others erect the complete door-frame. Together they fit each adjacent trellis into it, one manipulating the end crossings into the groove in the door-post and the horn of the *sah terim* over the outer face of the post at the top; while the other lashes it in place with a long and narrow woolen *sennit*, the *soye danar*, starting with the horn and working downward spirally. By the time that the two door-trellises have been fastened, the others have been extended and interlocked; and the assembly is made stable by passing a broad woven girth, *bil yup*, around the perimeter half way up the wall, with its end tails passing around the door-posts and made fast to the trellis inside. One or two more girths may be fitted in the same way at the top and bottom .The roof wheel is then lifted onto the lintel, and one of the women takes two of the short struts which she fits into the front, *manlay*, of the rim (this may be specially marked). Three women then fit three struts each into three groups of adjacent slots in the back and two sides of the rim, and by careful balance all four of them lift the wheel into its position more than three meters above the ground. The woman at the front fits her struts into the corresponding sockets of the lintel, while her helpers tie their bundles of struts to the top of the trellis for temporary scaffolding. The other struts are then placed evenly around the rim of the wheel, and lashed to the wall heads with their gaily plaited ties, cleat-fashion in a figure of eight. When this is completed, the bundles of struts are untied, and each one is lashed individually in its place. The diameter and set of the trellises is adjusted, and if there are wooden doors, they are set on their pivots by lifting the lintel slightly. (Clauson, 1968) The remaining short struts are set in their sockets. The whole assembly of struts is then held firmly

in place with a special slender girth, the *duzu* or *duz* yup, 16m. long and 4 cm. wide. A woman first winds one of these onto a stick, or around a fold of itself, to make a spool. She fastens one end to the trellis, just to the rear of one of the side junctions; and then, raising the spool to the level of her head, she proceeds to wrap it tightly around each strut in turn, moving towards the doorway where she passes it around the horn of each jamb with its associated short strut; and continuing to the trellis junction on the other side where she knots it to the rear as before. Another woman meanwhile wraps a second of these girths in the rearward direction, fastening the ends similarly, but this time in the corresponding position on the foreside of the trellis joint; while at the back, opposite the door, she brings the spool down, wraps it around the two trellis heads on either side of the rear joint, and then up to the struts again. In this way the two wrapping girths are made to hold the trellises, the struts, and the door frame tightly together. Another broad girth may then be passed around the perimeter over the base of the struts, and made fast to the jamb horns. At this stage the structure is complete; and to settle it in place a heavy plaited rope adorned with red and blue tassels, the *tuynuk yup*, which is attached permanently to either side of the centre of the roof wheel and hangs down in a loop, may be tugged or used as a swing .The felts may now be put on. First the side felts are fastened on either side of the door, their ties passed in a turn around the nearest roof-strut and then down to the opposite door-horn, or at the other end to the trellis. The rear felts are hung in the same way, and their ties at the sides and rear cross each other in pairs on their way to the trellis heads. In summer these wall felts are rigged so that their upper edges are as high as a man can reach, leaving a space uncovered next to the ground. The edges of the four rectangles are arranged to overlap one another. The roof felts, which are always folded in a special way, are lifted into position with the help of a pole, *siyriq* the front one first. As some of the women hold up what they can of the lower part of the bundle, the top is unrolled upwards with the pole; as the sides are unfolded from the centre outwards, two women run with the long ropes from either side round to the back, relying on their speed to prevent the heavy unfurled felt from slipping down to the ground. With some dragging and prodding with the pole, they work it into its exact position, and lash it, passing the line from the top corner of each side a quarter of the way across the roof wheel and down over the struts in a great circle. There it is joined by the middle rope from the other side in a half hitch at head-height before the ends are brought down vertically and fastened at the foot of the trellis, near the back. The rear felt is then lifted and fastened in a similar fashion, with the paired ropes brought forwards and downwards to meet just above the corner of door-post and lintel, before being tied to the trellis: they make a characteristic pattern above the door. The top felt is lifted last, and six of its eight ties are brought down vertically and tied to the foot of the wall. The remaining two, for the control of the smoke flap, are then tied loosely on either side of the door. Thus the top felt overlaps the roof felts which in turn overlap the wall felts .The knots used throughout in fastening the frame and felts are clove hitches, sometimes with a bight caught in the last turn, to help in casting them off .The cane screens are unrolled from either door-post backwards, where they are lapped over the smaller one at the rear, and tightened with goat-hair lines from one side passing through a wooden fastening from the other as though it were a pulley. (Fig. 9)

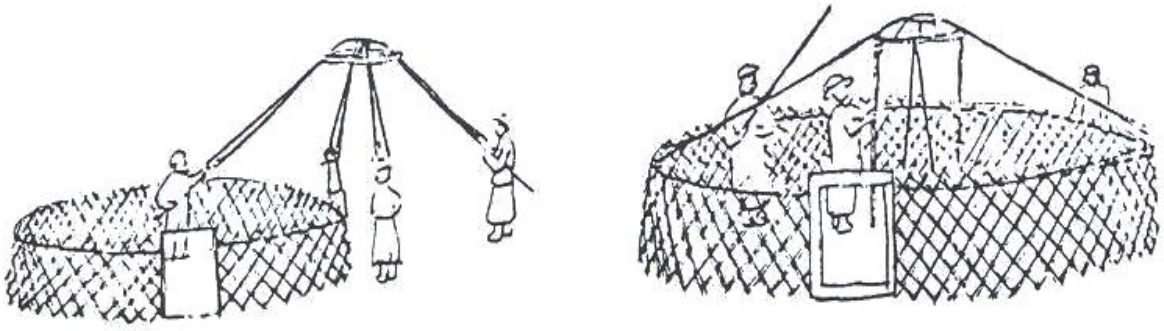


Fig. 9. *Women lifting the roof wheel with help at the center. [Authors]*

A camp is pitched without any very noticeable sense of planning, and is likely to consist of six to ten tents set out in a straggling line, all with their doors facing south. Most of the tents are usually *aq oy*, with a *gotikme* or two inhabited by the poorer individuals. According to information we were given at *Gomishan*, the *Ceperbay Yomut* formerly used *gotikme* as kitchens, setting them somewhat to the right in front of (i.e. to the south of) the *oy*, with the doorways facing one another. *Gomishan* (*Kumustepe*), however, was a particularly large settled community numbering six to eight hundred tents in the nineteenth century. The Khan's tent, flanked by those of his brothers and sons, was pitched in the rear, so that anyone approaching him had to pass before all the other tents of the camp.

- Transportation: When moving from place to place, the Turkmen use camels to carry their tents. The trellises are folded and nested two by two, then loaded in pairs in either side of the animal, where they are seen to be just so long as to fit neatly over the curve of its flanks, but not so long as to impede the movement of its neck. The struts are packed in two bundles on top of the trellises, and the roof wheel, cushioned on the top felt, is lashed down in a horizontal position above them. The camel could hardly carry the wheel safely if it were much larger than the usual. The whole of this load is 245 kg. Another animal is packed with the roof and side felts, cane screens, doors and door frame, weighing 220 kg. The total weight of the tent may once have been important, for the Turkmen relied upon their ability to strike camp and avoid their enemies for survival. Though, a camel may be

loaded with as much as 360 kg. Under ideal conditions, it can only be made to carry half that amount for 16 hours a day over any distance. The tent load therefore represents a medium burden (Fig. 10)

- Technical Issues:

- Flexibility and Tolerance:

A certain amount of play is inherent in the design of the trellis, as explained, and the provision of free joints at regular intervals gives it some internal flexibility. The way in which the roof struts are fastened to the heads allows some change in their angle, and the insertion of their tapering square tips into the roof ring not only allows adjustment but ensures that there is some support even if the fit is loose. The design of the door-frame also allows some vertical movement of the trellis. All the felts are made to overlap one another by generous margins, giving not only tight, weatherproof joints, but scope for shrinkage and variations in size which may occur during the erection of the frame.

Fig. 10. *Transport of a single tent. The wool-comb and a goatskin churn are stowed on top of the roof wheel. [Image archive of Tarbiat Modares University]*

- Durability and Maintenance:

A well made tent frame may last for fifty years if properly cared for, but it is certain to require maintenance, such as the replacement of the leather pins as they wear or pull out, the renewal of broken trellis laths or roof struts, the binding of a cracked or warped roof wheel, or the repair of a door panel. The feet at the bottom of the trellis are made a little longer than the heads on top to allow for wear, but they may rot or break in the end, and it is not unusual to see trellises which have been cut down by a joint at the bottom. The roof wheel seems to be particularly prone to damage. There is also the problem of beetles, and their grubs, *qurt*, which gnaw the interior of timber into a powder. Felts remain in a usable state for five to ten years, depending on the amount of smoke and weather they are exposed to, and the fastidiousness of the owner. As they age they may be passed on to poorer dependants, or used for a *gotikme*. They are generally replaced part by part, rather than all at once, and one often sees parti-colored tents as a result, though this is more noticeable from the inside. Turkmen never dress their felts to preserve them, nor can felt be washed. The cane screens require replacement after four or five years. (Irons, 1974)

- Adaptation to the Climate: A tent can be adapted to the weather in a variety of ways. In summer the side felts are raised as described, so that there is a gap of half a meter between their lower edges and the ground. The front third of the top felt being permanently folded back to form an opening, *ebsit*, a current of air is able to enter the sides and flow out at the top by stack effect: this is adequate to maintain the same air temperature inside as out. The felts provide good insulation against the sun's rays, but even so the temperature may rise to100° or 110° Fahrenheit in August, and on such occasions the small cane screen at the back is removed, and the door left open, to encourage a draught in a lateral direction. The cane screens not only protect the felts from the attention of goats and exclude chickens, but filter the air from at least the larger particles of wind-blown dust. (Kasmaie, 1984) No fire is lit in the tent during the summer, but instead a cooking pit, *ocaq*, is prepared outside in a convenient place near the door. Bread is also cooked out of doors in a domed mud oven, *tamdir*, at a little distance. In winter the side felts are lowered to the ground, the door is closed, and the screens are tightly bound against the wind. A mud rampart may be built against the bottom of the canes outside, and felts may be hung like a skirt around the inside of the wall trellis from one door post round to the other. The smoke hole too can be closed in extremely bad weather, though for short periods only. Even while it is open the curling of the smoke around the sealed interior can cause a stranger considerable discomfort, though some have found that it compensates for this in keeping away flies. If the tent is to be made more permanent, especially in winter, certain additions are made. Stakes, *paya*, may be placed at strategic points around the inside of the trellis; and four pegs, *celci qaziq*, are driven firmly into the ground, two each side, around the perimeter of the tent outside, so that if need be wind ropes, *urugan*, may be thrown across the dome diagonally and made fast to them. Another rope, *cektirem yup*, may be rigged inside from the roof wheel to the foot of the wall to counter any distortion the wind might otherwise cause. The interlocking joints between the trellis sections may be lashed with a length of plaited cord, *qabsit* yup, which is wrapped around each of the inner laths where they overlap their successors. The unpinned joints, *tarhan*, may be confined loosely with a little loop of cord in a horizontal direction. The *Yomut* also line the floors of their tents with a sort of sedge, *qildirgan*, before spreading out their felt floor mats. The roof opening, *ebsit*, provides a window during the day, and because the tent always faces the south, the sun throws a semicircle of light into the interior which describes an arc over walls and floor like a sundial, and warns a housewife when to prepare meals. An ordinary Turkmen tent is brown, for as the fire burns inside during successive winters the creosote in its smoke turns the felts first fawn, then peat colored, and finally black; at which stage they become brittle and useless. The darkening has its advantages, for the smoke renders the covering more waterproof. The upper part of the dome is most affected, and it is not unusual to see festoons of soot around the roof-ring. Ultimately even the trellis is made black. Nevertheless, to a tribesman the archetype of tents remains white, and he obstinately calls his dwelling *aq oy* even when it is anything but white .

- Rigidity and Airflow resistance: The tent is a self-supporting structure; the frame holds its shape with no help from guy ropes or a stretched cover. In all but the strongest winds the tent will stand with nothing but gravity attaching it to the ground. This rigidity is maintained by opposing forces exerted by different parts of the frame. The

walls are firmly tied to the doorframe to form a complete circle. The conical or domed roof, with its heavy crown exerts a force on top of the walls. This force is kept in check and put to advantage by strong bands tied tightly around top of the wall. These opposing forces give the frame great rigidity, which is further reinforced with the addition of downward pressure from a heavy roof cover and the inward pressure from tight wall covers. (Fig.11) In addition, the tent has an aerodynamic shape, the wind slips over the structure with minimal resistance. There are no flat or concave surfaces to catch the wind. However, the tent will not blow down but can, in exceptional circumstances, be lifted by a strong gust of wind through the door. (Fig.12) The shape of the tent is very thermally efficient. A large tent can be easily kept warm using a small wood burning stove down to -5°C without any additional insulation. In Central Asia layers of thick felt keep the interior warm as the outside temperature drops well below -40°C. (Qobadian, 2006) In hot weather the sides can be lifted: warm air rises and exits through the open tono drawing cool air in at the bottom. (Fig.13)

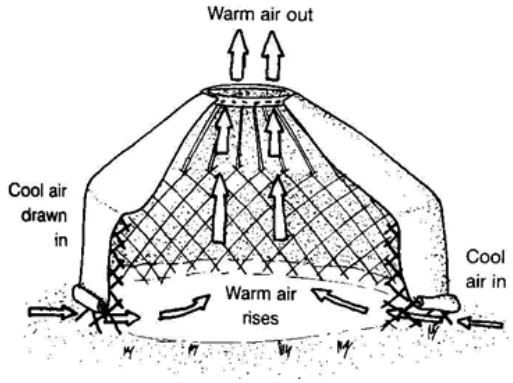


Fig. 11. *Opposing pressures which give the tent its inherent rigidity. [Authors]*

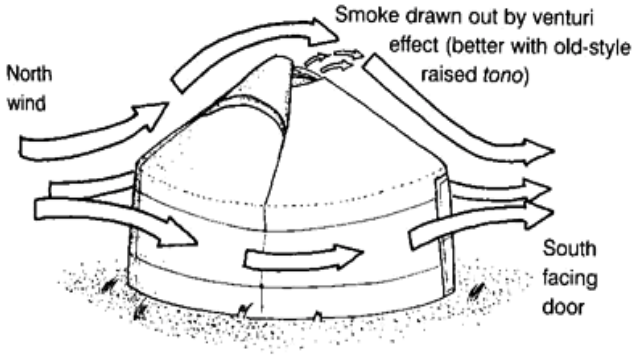


Fig. 12. *Airflow over the tent. [Authors]*

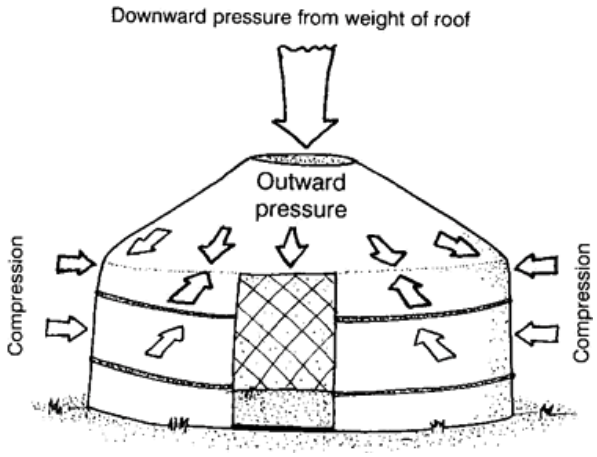


Fig. 13. *Airflow inside the tent during hot weather. [Authors]*

7. CONCLUSION

Turkmen, like most Middle-Eastern nomads, conform to a common sense of order to a remarkable degree; everything has its right place, and every task an established routine. (Irons, 1969) What is surprising however, is the extent to which a relatively complicated structure should have become standardized, and the subsequent realization that had it not been so, it could not have become part of the nomads' life. By conforming, they were able to pass their culture and skills from one generation to another, despite their illiteracy; women in particular, knowing exactly what to do, were able to accomplish complicated but often-repeated tasks as smartly and as quickly as possible, so as to begin the next part of their unending work. The development of the form itself appears to have been dominated by the way in which it must be taken to pieces, transported, and put together again. The nomads have developed a rigid structure which answers to these needs by means of a principle of repeating small parts, in which mass-production, prefabrication, and consequent standardization are implicit. A minimum of apparatus is required. The method has the advantage that it allows the easy replacement of damaged pieces, though the frame as a whole can be expected to last a reasonably long time. The felt covering, which is less durable, is very much simpler than the frame, and subservient to it. The girths, which are protected and therefore long-lasting, may be

woven with much care and skill to decorate the tent. The circular form of a felt tent, with parts arranged radially or concentrically, and requiring no differentiation except at the entrance, is ideally suited to such a development. It also allows the framework exceptional stability for its weight, and is able to accommodate variations in the size of felts, cane screens, and even the wall itself by movement and overlaps around the circumference. Besides this, the nearly hemispherical shape is highly efficient in the amount of space it encloses for a minimum surface area; covering material is saved, and the least possible surface is exposed to heat loss or heat gain. There is, however, little scope for individual variety, other than ornament; the principle of construction has been elaborated so far that it is not longer in the nomads' interest to change.

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