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Yggdrasil as Map: precedents for a large-scale Eliadian cross structure in prehistoric Scandinavia and probabilities of integration with locations of largest mounds

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Abstract

Ethnographic precedents exist for the ritual use of large-scale Eliadian cross structures in the landscapes of the New World. Historical evidence of related ritual processes and settings exists in the old farm culture of Norway as well indications of such from Norse myth and archaeological artifacts. Evidence also exists of the technical abilities of pre-modern people to understand and create accurate geometric patterns among natural and built points through simple surveying processes. Spiritual power from natural sites like sacred mountain peaks is channeled to built sites where subordinate social groups conduct ceremony. As a probabilistic simulation of such a cross construct in Scandinavia, the ten most singular natural features of the landscape are selected. Two are in each of the NW, SE, NE, SW and North directions. Combinations of two intercardinal axes and one *axis mundi* (North) create 16 different possible cross structures with unifying common points. A list of the locations of the 35 largest memorial mounds in Scandinavia then produces three areas in Denmark, Norway and Sweden where most in those countries cluster. The computer then replaces these areas with test boxes to determine the frequency in which equal numbers of random points accurately align with possible large-scale axes. The ultimate probability of a great mound in each of the three areas aligning and thus creating a unified cross structure of three axes can be calculated. One such case occurs among the existing mound locations, and is shown to have an extremely high probability of not being a random occurrence.

New World spatial layouts, and their associated often larger scale ritual processes, are very much thought of in Eliadian terms, i.e. structures of cross axes, thresholds, orientations, oppositions, and homologues effective in making sacred contact with the gods (Marshall 1997, Stein et. al. 1997, Ortiz 1969, Doxtater 1978, Wilbert 1993). One of the best ethnographic examples of intersecting lines surveyed on the larger natural landscape exists in the Warao region of Venezuela. Wilbert's (1993:11) diagram of figure 1 describes north and south points of the Warao world marked by two petrified world trees in the form of mountains and abodes of two gods (1993:13). These are actual topographical features, Naparima Hill on Trinidad Island to the north and 212 kilometers to the south, Cerro Caroshimo. The two points deviate only about nine arc minutes of longitude of being an exact meridian. Other axes of the cross are derived from the vertical.

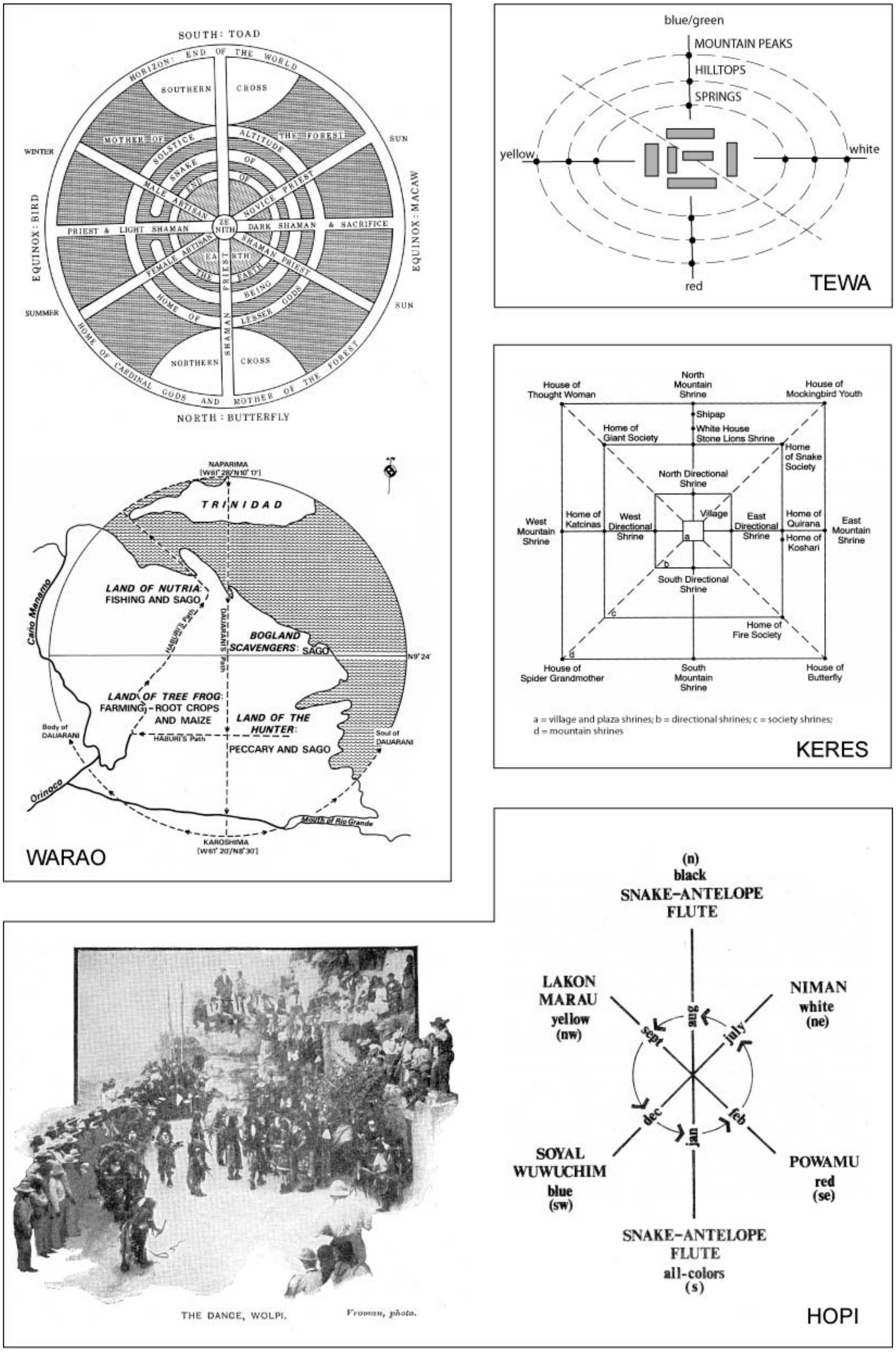


Figure 1. Symbolic and ritual cross structures associated with larger scale landscapes in the New World: Warao in Venezuela (Wilbert 1993); Tewa (Ortiz 1969), Keres (Snead & Preucel 1999) and Hopi (Doxtater 1978) in the US Southwest.

A related, more complex social and religious phenomenon occurred among the Pueblo people of the Southwest US. Ortiz' (1969) account of journeys that Tewa religious societies take out to three scales of sites in the natural landscape--springs, smaller hill tops, and highest mountain peaks--provides the best evidence of how actual features in the landscape were used ritually. Each of the twelve sacred points was a point of opening to the world below and above, or of contact with the ancestors. A similar pattern may well have existed among the Hopi. A paper derived from Ortiz's seminal work describes the linkage between spatial structure, ritual societies and the timing of the major yearly ceremonies (Doxtater 1978). Social groups appeared to have been integrated by a spatial cross concept; paired societies "owned" axes intersecting at a center and conducted major rituals associated with those directions.

Southwest archaeologists such as Graves (1990) maintain, however, that the spatial areas of the Historical Pueblos such as the Tewa, Hopi, Zuni and several others represent separate territories, much smaller than the earlier scale of Pueblo Ancestor (Anasazi) organization focused at Chaco Canyon (850 to 1250 A.D.). The substance of this "Chacoan World", stretching several hundred kilometers out from the center in northwest New Mexico, remains a very active archaeological topic. One possibility here is that large scale surveying connected important ceremonial sites, facilitating social and religious integration. Doxtater (1991) first explored the idea of adapting Tewa or Hopi-like landscape frameworks to Chaco Canyon organization. More recent work on Chaco continues this alternative explanation, i.e. that the center was created by an accurately surveyed cross structure from peripheral mountains (Doxtater 2002, 2003, 2007). This center, was likely not a place of elite residence, *per se*, but the location of a dozen or so large ceremonial structures, each built and used more cooperatively by ritually integrated tribal entities from the various regions of the larger Chacoan sphere. This was primarily a place of pilgrimage and alliance (Malville & Malville 2001, Kantner 2003:220, Renfrew 2001).

The old farm culture of Norway

One of the best kept secrets about Middle-Ages, agrarian societies in Scandinavia--particularly in folk museums--is their incredible dependence upon highly structured Eliadian ritual frameworks. This cultural expression is not associated with today's integrated societies in Scandinavia with their balance between competition and cooperation. Social anthropologist/ethnographers such as Daun (1991) and Stromberg (1991) have described this unique political process, but the origins of the ethic are felt to derive less from elaborate symbolic systems at the level of culture, than from common ecological experiences of a relatively dispersed rural people living in a hard climate. It is not clear how far back in time this experience goes. The best and earliest evidence of a ritually founded social balance, however, is in the old farm culture of Norway.

The family, intimately tied to the possession of land, was the primary hierarchical entity. The "odelsrett", or "asetesrett" maintained the right to dwell or to inherent the family farm (Frimannslund 1964-70:32). Its hierarchical nature was exemplified by the position of the "*husbond*", or master of the farm, together with his "*husfru*". These were the "individual" statuses vis-à-vis the community of farmers, the valley "*bygde*" or the mountain "*grend*". These spatial entities were generally synonymous with the "*belag*" or "invited group", consisting in most recent folk times of about eight to twelve farms. The *belag's* primary function was the maintenance of social relationships between the family farms through invitations to collective rites (ibid:19). Ritual occasions were numerous, especially Jul, Jonsok (midwinter and midsummer), rites of passage for birth, marriage and death. Evidence of formal ritual structure can be found in both Norse folklore/mythology and the actual farm layout and ritual practice.

North was the land of the dead; the god Loki went north to Jotunheimen (land of the dead) to get the goddess Idunn (Birkeli 1943:209). In Snorri's Edda fear usually is associated with the north and a more positive meaning with the south (ibid). Spiritual and spatial oppositions abound between the gods and between Asir/Vanir axes. Thor, without an opposite in Dumezil's description (see diagram of figure 2) is placed in the center (1973:61). In the Grimnismal, Thor goes to the Ting meeting at the location of the world tree Yggdrasill (Birkeli 1943:223). The Eliadian center axis is most evident in the position of Heimdall; Dumezil calls Heimdall the "frame" god (ibid); his residence is interpreted by Jan De Vries as a:

> "Palace above the skies in Himinbjorg….The rainbow is the path that joins the limit of the horizon to the center of the sky; it is from above the sky at the top of the central axis, that the watch-god watches the whole circumference of the world (from Dumezil 1973:130).

Norse time as well had an Eliadian cross structure. On Saga Iceland, the day was clearly organized according to a spatial concept composed of eight directions (Gordon 1927:211). Storaker's exhaustive collection of later folklore reveals much opposition between Day and Night and Summer and Winter (1921:6), both sets expressed as north-south halves of the clock-like spatial structure. An early representation of "spatialized" time can be found in Olaus Worm's 17th century reproduction of a Swedish *runestave* from the 1300's (Byrnjulf 1970:40). Figure 2 illustrates positions of the seven days of the week (Norse gods) around the inner circle of the calendar. Their sequence, beginning with Friday (Freya), the first day after the old "center" day of Thursday (Thor), crisscrosses back and forth across the circle, ultimately ending up with the vertical or *axis mundi* of Thursday. This pattern creates a symmetrical cross structure with a clear focus at the center.

In the ritual layout of farms, many appear to have had an expression of Yggdrasil, the mythic world tree, embodied as a real tree usually associated with a prehistoric grave mound, *haug*. Though not extensively documented, several sources place this most powerful center image to the north of the group

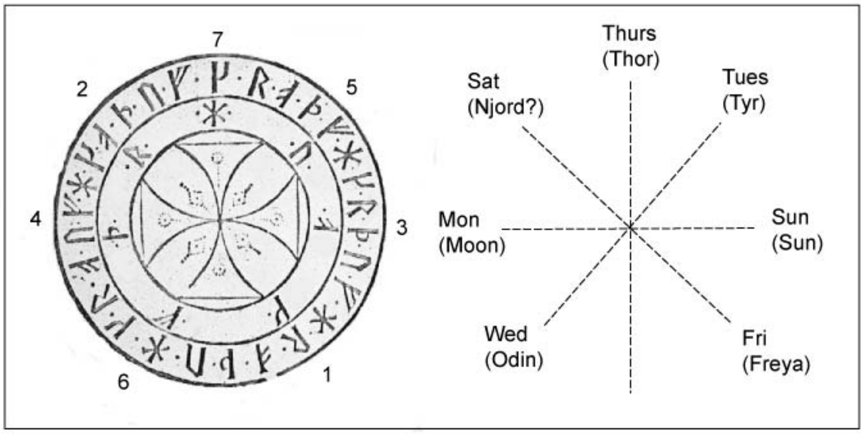


Figure 2. Olaus Worms' 17th century reproduction of a Swedish *runestave* from the 1300's (Byrnjulf 1970). Seven runes on inner circle designate days of the week. Their sequence creates a spatialized cross structure of time with Thor's day as the vertical *axis mundi* or center axis.

of farm buildings or *tun*. At the farm of Konnismo, the old *haug* tree as offering site reportedly was situated in the middle of the farm (Storaker 1928:33) or near the house (ibid:35). Saga sources, however, indicate the direction of the farm burial mound but nothing is said about a tree; a ship buried in a mound lies north of the farm in Landnamabok (1972:52). An actual Setesdal site is described by Bø & Hodne (1974:104) where the holy trees and mound lie directly north of the farm. They further describe an 11^{th} century account of a *haug* which, again, lies just north of a Telemark farm *tun* (ibid:106). If one didn't give the farm spirit, *Nisse*, his ale on Thursday (old day of center) at his mound, the logs of the *stue* would suddenly begin to separate and the humans inside would see the bloody eyes and hands of the spirit (Christiansen 1911:185). The *Nisse* was the most powerful spiritual being associated with the farm. This spirit is at times referred to as the *haugbonde*, or "farm master of the mound" (Birkeli 1943:207).

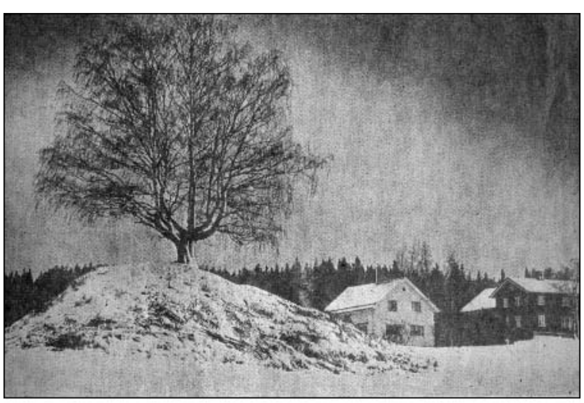


Figure 3. "Tun" tree and prehistoric burial mound from Hammar, Norway (Aftenposten Dec. 8 1976)

The most grievous of sins among farmers was to strike with an ax or otherwise injure the *tuntre* (Storaker 1928:32).

One sees then, in effect, a spatial opposition between a spiritual being associated with a natural looking mound and tree or trees (North) and the architectural settings used most actively by humans (South). The *tun* is subordinate to the *haug*. This same spatial and semantic relationship is reproduced within the *tun* as the next smaller scale of the farm (homologue). Human buildings (North) are now opposed and dominant over animal buildings (South), as evident in the layout of Søre Rauland in figure 4. This is the original site of the oldest *stue* in the Bygdøy Folkmusuem in Oslo. The idealized "cosmology" of the *tun*, also figure 4, is extensively documented by folk literature in Doxtater (1981: chapter V). Characteristically the "female" north-south *loft* lies to the East and represents the competitive and fertility aspects of the farm society, connecting back perhaps to Middle Ages guilds and prehistoric *hov* (special farm buildings associated with warriors and wealth). To the West is the east-west domestic *stue*, with its emphasis on collective male relationships between farmers, particularly at the *fest* table along the west end. In terms of orientation Rousell states that on the Nordic farms of the Scottish Islands, an almost "mathematical" e-w plan of the *stue* is the rule (1934:100). This orientation can be traced back to prehistoric longhouses (Randsborg & Nybo 1984).

As in the larger scale axis between *tun* and *haug*, entrances to both *stue* and *loft* lie on north-south axes and are guarded by symbolic threshold features that help articulate relationships between spirits (North) and humans (South). And just as the *haug*-*tun* axis was also a vertical conception between above (heaven) and below (earth), within the *tun*, the vertical *axis mundi* occurred at the central *stue* hearth with its smoke opening, *ljore*, directly above, see figure 5. Traditionally, the pole (*ljorestang*) that opened the smoke vent had to be cut from a specific mountain ridge (Sundt 1863-65:101). Here at the vertical axis we find as well the association of natural places with above (North) in opposition to hearth and *stue* below (South).

A multitude of folk beliefs make reference to *axis mundi* at several scales of farm layout, both horizontal and vertical, as *the* means of controlling contact between humans and spirits. Activities involving the turning of axels, such as churning butter or spinning wool (Storaker 1921:11,23), were rife with associated lore that served to protect the user from inadvertent contact with spirits. Often the structure of time is clearly linked to spatial direction and center *axis mundi*. If a woman of the farm, for example, dared to spin wool at midnight (vertical, North), the bloody hand of a deceased female relative would likely appear in a threatening gesture to the spinner (Storaker 1923:34). To get the most butter one should churn just before midday or midnight (Storaker 1921 tid: 11). More butter could be produced by placing the churn midway under the cross-beam (center element in the West Coast smoke *stue*) (ibid: 40).

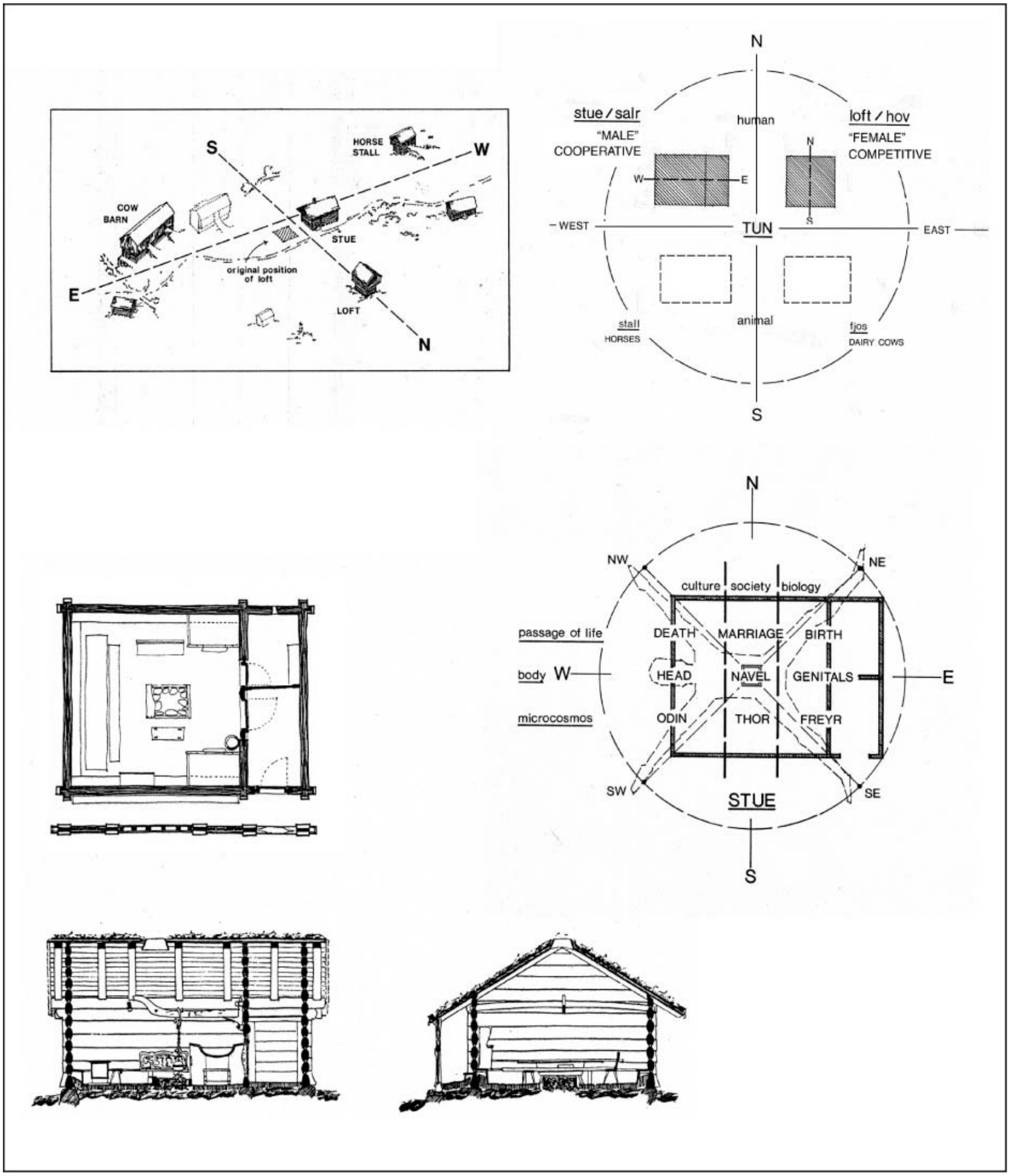


Figure 4. Rygnestad, Setesdal *stue* in Norway (now at the Bygdoy Folk Museum) and its original position in the farm *tun* (left). Idealised ritual *tun* and *stue* layouts (right). From Doxtater 1981. Drawing of *tun* layout from Berg (1969); stue plans and sections from Bugge & Norberg-Schulz 1969.

These symbolic frameworks also created a powerful setting for ritual, whether calendrical, in the case of Midsommer and Jul, or rites of passage for birth, marriage, and death. When a person died in the *stue*, the smoke vent over the central open hearth was cracked open to let the spirit of the deceased pass to the other world (Christiansen 1956:17). This vertical act was soon followed by a perhaps more important horizontal, ritual sequence involving the symbolic equivalent of the *ljore*, the farm mound and tree. The body was first washed on a bed of straw in preparation for the funeral. Stigum describes the burning of the straw after the washing:

> …then out came he who carried the straw followed by a procession in loud song. The direction of the procession was to a small mound, north of the *stue*. They stood in a ring around the straw while it burned. The red glow of the fire told all that there was a death; the fire burned quickly then died. The procession then returned to the *stue*. (Stigum 1971:339-342).

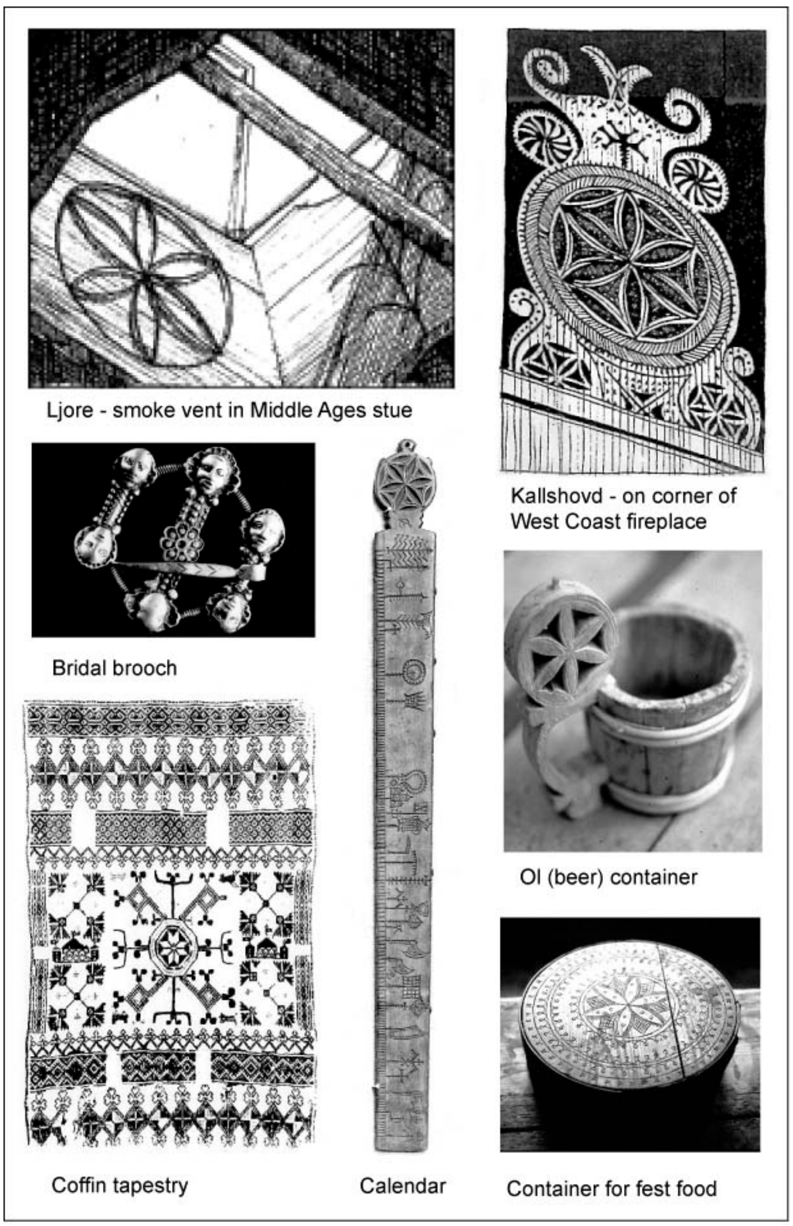


Figure 5. Cross imagry from the Norwegian Folk Culture

In wedding ritual, after the bride was “freed” from the center position of her family *stue*, and passed through the north-south *stue* threshold, the community wedding party was symbolically transported into the other world. With guns in hand to protect from potentially dangerous spirits, the party traveled, often by boat, to the collective natural site of the community (early church sites played this role) (Stigum 1971 vol I:422). Here, after passing through another threshold with the approbation of the gods or priest (whether or not one was available) they would be transported back into the world of humans. Ale would flow and the mood was now joyful. Note that here the spatial scale of the wedding journey now involves the most important collective site that could in prehistoric times have been wholly natural as a *horg* (natural site distinct to farm associated *hov* as in Olsen 1966:59).

While contact with the all powerful north-south axis does the affective work in rites of passage, the two calendrical rites of Jul and Midsommer speak to the broader relationship between individual farm families and the community. More importantly they were structured Eliadian opposites in Norse conceptions of symbolic space and time. Olsen (1966:88) suggests a possible Jul ritual to Odin existed on each farm. In folk periods, Storaker (1924:112) is explicit describing the fire on the heights (natural site) at Jonsok that related to the community or *bygde*, while the hearth, with its emphasis at Jul, was the holy altar for house and home. At Jul (midwinter), Odin and his entourage would rise up out of the mountainous north and swoop down on the individual farm and its principal dwelling the *stue* (Birkeli 1943:174). Its human inhabitants would have vacated the dwelling after setting a table for the occupying spirits. The collective gods were clearly dominant over the individual farm and family. The opposite calendrical ritual and social effect occurred at *Midsommer* when the community would journey to the collective natural site. Bourdieu speaks of these kinds of ritual as “union” to which their opposite of “occupation” may be added (see fuller discussion in Doxtater 1991).

While it is easier to document the Eliadian center structure of the old *stue*, the imagry of Jonsok, perhaps as the successor to the prehistoric *horg*, also carries comparable meaning. The midsummer fire was built with a pillar in the center with a cross arm attached near the top (Bø & Noss 1967:124). Wood, piled all around the pillar was set afire at midnight (Storaker 1921:216). A fiddler provided tempo, as the *grend* or *bygd* danced around the flaming pole. In the early hours of the morning, a special *graut* (*gomme*), cooked over the coals, provided the typical communal finale to the rite (Bø & Noss ibid). Symbolically this was a communion where the spiritual essence of the transformational fire and natural place reintegrated into the bodies of the community. In more contemporary Sweden the Jonsok fire has been replaced by the “mid-summer pole” (*midsommerstangen*), or “maypole” (*maistangen*) (Storaker 1924:116). Both are icons of center structure.

Towards the end of the traditional farm dwelling plan and *tun* layout (settlement) in the late 1700’s and early 1800’s, the *stue*, still keeping its same plan, began to rotate about 90° so that the ridge of the roof ran north-south (Doxtater 1990). This may not have occurred because of the advent of windows and solar orientation. Rather, the *stue* for the first time became symbolically integrated with the Christian Church structure that had finally displaced the domestic dwelling as principal ritual locus. What is most remarkable about the possible symbolic change is the way it worked across larger distances in Norwegian landscapes. If farmers felt compelled to reorient their *stues* some kilometers away from the church, with its new pews and reasserted Christian east-west orientation, this suggests a still effective cosmology that connected family farms with central religious sites.

The orientations of churches and churchyard layout in early Christian times in Scandinavia provide additional information at least about smaller scale "cosmologies" and their relation to religion and ritual. Orientations of church naves or main room are nominally east-west as per Christian orthodoxy (Eide 1986 for Norway, and Abrahamsen 1985 for Denmark). Thus they follow the ancient custom of long-house orientation. But most interesting is the location of entrances, or ritual thresholds into church naves. Many early churches did not follow the Christian convention of entering from the west (humans) and progressing to the altar in the east (spirits). Rather, they maintained the north-south axis evident in the layout of symbolic axes on the farm. One of the best examples of the meaning of this reproduction of *axes mundis*, especially that between the architectural *stue* and the farm *haug*, is found in the parish church of Alstahaug along the northern Trondheimsfjord. One of the largest Iron-Age burial mounds of the region stands immediately to the north of the church. It serves as the axial climax of the two north-south thresholds, the southern as the main entrance leading from the graveyard through the nave.

Ritual landscapes in Scandinavia

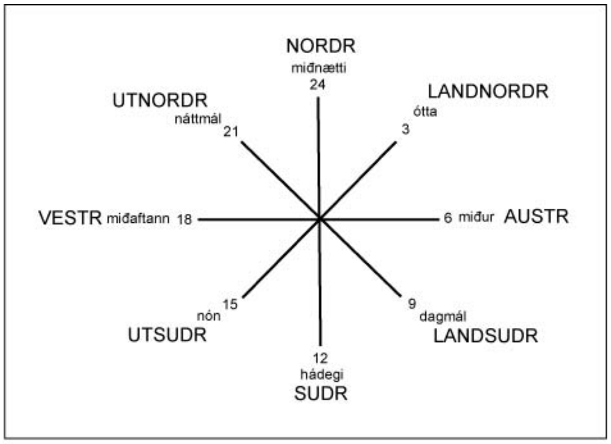
While there is as yet no published evidence of large-scale cross structures in Scandinavia comparable to those in the New World, good ethnographic evidence of ritual and mythic use of landscapes, *per se*, comes from studies of Sami and other arctic practices, particularly from early ethnographers like Ernst Manker (1957). Recent work furthers this understanding (e.g. Bradley 2000, Mulk & Bayliss-Smith 2006). Unlike Manker, however, this evidence now considers landscape related spatial structures, or cosmologies, that help achieve liminal ritual effects (Mulk & Bayliss Smith 2007:98). An opposition exists between the warm upper world of life and the cold lower world of death, with the middle or human world in between. Holy mountains, springs and rivers form a landscape context in which rituals, particularly of life, death and the movements of the souls take place. Similarities exist between Sámi cosmology and that derived from Bronze Age rock art (Bradley 2006).

On Viking Iceland one found as well a generalized, mythically based conception of a vertical opposition and a horizontal, concentric one, as described by Meletinskij (1973) and Hastrup (1981). In his piece on Old Norse cosmology, however, Wellendorf (2006) evaluates the mythic evidence and doubts that there ever was a more or less systematic spatial location for the gods; he says that Brink (2004:297) agrees. Wellendorf begins his discussion of Old Norse cosmology with the familiar illustration of Finnur Magnusson's Yggdrasill or world tree (1824), apparently a purely mythic structure. Andrén (2004), however, describes more of a continuum between tree as "idea" and as "reality". Mythologically, the great tree has three roots spreading at its base. Its verticality, in a clear Eliadean sense is associated with the principal gods of Odin, Tor and Heimdall, who most connect with the myth of "world pillar" (ibid:394). Parallels exist with cosmological tree concepts of Sami culture.

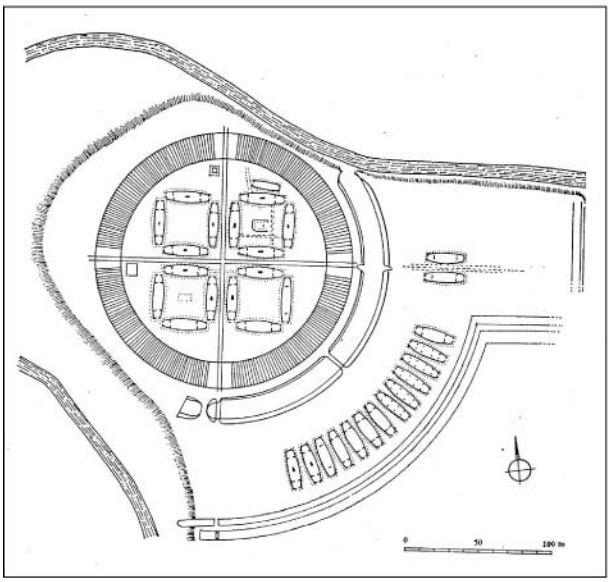
But then Andrén describes the ritual use of actual live trees such at the "temple" of Old Uppsala (via Adam of Bremen), and those as "*vardträd*" and their expression in later folk cultures (ibid:397). The ritual importance of the farm tree and mound in the old farm culture of Norway has been discussed. Additionally one can recount the way sacred power of the central fireplace in the *stue* was reconsecrated during the Black Death. A burning piece of a great oak in nature (collective gods) was brought to the closed door of the *stue*. A small ember was passed through the keyhole as threshold at the center of a cross shaped iron adornment; the *stue* (family) fire was rekindled from the ember of the great oak (Storaker 1924:104). Oak was the material of pillars in houses and masts on boats, all symbolic of the power of the world tree. Andrén also mentions the archaeologically verified burials of Bronze Age people in oak tree trunks, then buried in earthen or stone mounds (2004:400).

Whether from myth or ritual, the structure of the Scandinavian world tree is synonymous with cross structures or *axis mundi* centers, both vertical and horizontal, as graphically seen in the Icelandic and prehistoric artifacts of figure 6.

Landscape archaeologists, while not suggesting formal, ritual layouts, increasingly discuss how people actively used their larger physical settings. Rudebeck (2002) makes comparisons between the cultural significance of walking on roads in the Mediterranean, including Crete, and roads in prehistoric Scandinavia. While roads were less permanent in the North, they still organized grave monuments and other cultural venues into actively used cognitive, symbolic experiences. Johansen, et. al. (2004) describe the ideas of early Danish archaeologists who suggested that important pathways were created in part by the placement of some 80,000 smaller grave mounds during the Early Bronze Age. They use computer mapping to illustrate these possibilities in one region of Denmark. In Sweden's Bjärre peninsula, Nord suggests how people experienced its dense cultural landscape, including rocks with cup marks, smaller and larger mounds, and viewsheds (2007). Farther north in the Trondheimsfjord region, Sognnes describes the way Bronze Age mounds were intentionally placed to be seen from active waterways (2000).



Icelandic Day as directions



Viking site pattern at Trelleborg

Figure 6. Cross structures as Icelandic time, pre-historic Viking *borgs*, and pendants.

Though based primarily on deposits, rather than any kind of measured spatial practice, Fabech (2006) distinguishes between an earlier period ending at the middle of the first millennium A.D. when ritual deposits of wealth items focused on natural features like bogs and lakes and later periods when the focus became the elite residences, assembly halls and cult buildings. In this regard how does one consider suggestions of cosmological foundations of later Scandinavian central places, such as at Gudme in Denmark (Hedeager 2001). Not unlike the Norwegian traditional *stue*, these buildings and perhaps larger settlement layouts are described in full Eliadian symbolism; i.e. as places with ceremonial liminality used to make contact with the gods, though again without any specific ritual map. But unlike the Norwegian *stue*, there is no mention of more naturally related ceremonial sites that constrain or integrate the places of obvious wealth and power. Is this an omission because of the difficulty of investigating larger-scale nature based structures (Darvill 19990), or like Fabech suggests, had the sacred collective places been replaced or co-opted by the competitive side of the equation? One must recall that much of what Eliade described came from an understanding of temples and churches, as part of more historical, hegemonic social organization where the sacred landscape had long ago lost its religious and perhaps integrative power. Smith (1972) comments on the direction of power flow in the classic Eliadian layout: from the sacred in the center to the profane in the periphery, and how in more traditional ("primitive") societies the most sacred places were in the periphery. One wonders how Munch's (1947) classic diagram of a Norse cosmology radiating out from the farm at center reflects a literary Eliadian bias, rather than the true "on the ground" prehistory of the Scandinavian landscape.

Technical processes of large-scale surveying

While present text space does not permit a precise computer simulation of large-scale prehistoric surveying in Scandinavia, as would be necessary in a landscape cross structure, some evidence can be cited. Romans in Germany placed twelve watchtowers along a straight 80km line over very diverse terrain in Germany (Söderman 1989). The greatest deviation of any particular tower from this line along the Neckar River was two meters (deviation of about 0.016° at an average distance between towers of about 7,000m; limit of unaided visual acuity is 0.017°). The question here is not whether the Celts borrowed this technology from the Romans, but whether such surveying ability existed much earlier in the Mediterranean world, and perhaps made its way north in Bronze or Neolithic periods. Bronze Age archaeologists (e.g. Kristiansen & Larsson 2005) describe considerable cultural transmission that occurred between the Mediterranean and the North. While these archaeological comparisons do not include examples of large scale surveying, the positioning of the four most recognized "palaces" in a framework of natural sites on Minoan Crete provides a clear example of technological ability in the period around 1700 B.C. (Doxtater 2009). Much more is known about the remarkable surveying and related mathematical abilities of the Egyptians (Dilke 1971: Chapter 2).

This technology, as remarkable as it may seem, turns out to be quite simple. The actual "instrument" used by the Romans might have been threesomes of "range poles" aligned across the landscape (Gallo 2004:14). In prolonging a line, one of the (exterior) poles is moved to an aligned next position and so on. Given poles of 0.10m in diameter, an accuracy of visual acuity or 0.017° can be achieved when the poles are spaced about 300m. Prolonging a long line in Roman Germany or as defined by Lekson (1999:118) for his 700km "Chaco Meridian" in the Puebloan Southwest, requires less work than creating one or more new aligned interim points between two preexistent distant landscape points.

As part of research into prehistoric surveying, the author built two three meter tall tripods, each with a plumb bob (Doxtater 2002). Experiments in the field tested backsighting methods with the tripods about six meters apart. It proved possible for a single surveyor to align an interim point between two visible landscape features 100km or more apart, at accuracies in the range of visual acuity (0.017°). Doxtater (2002) also shows a limited simulation of the trial and error process by which multiple interim points can be aligned with two distant features, such as mountains, *not* visible from each other. Approximate interim points were set up on ridges or high points along the full length of the line, adjacent to a probable travel route between the two end positions. It must be possible to view the two adjacent points from each interim point of the total line. While the technology is still simple backsighting with pairs of tripods at each point or using range poles, multiple iterations of aligning with different threesomes must be done to eventually straighten the line to requisite accuracies.

Considering such possibilities in prehistoric Scandinavia, one logically asks about stretches of open water between land areas. Were winters cold enough, for example, to ice over the Skagerrak Strait between present day Denmark and Norway, thus making the connecting surveying possible? Map data on historical conditions from the SMHI (Swedish Meteorology and Hydrology Institute) illustrates that the strait is mostly covered in a typical hard winter. But what about climate during prehistoric periods? The Holocene pattern is a major warm-up after the last ice age and then a gradual cooling down, at least until very recently. The climatic summary of the Ystad Project, a cultural/ecological study over the past 6000 years in Southern Scandinavia (Skåne), provides evidence that in spite of warmer summers, winters were colder (Berglund 1991:439).

In addition to generally colder winters in the Bronze Age, other cycles of warmer and cooler average temperatures exist along the entire prehistoric period beginning from the time of the earliest human inhabitants. These cycles are documented by pollen and peat evidence that describe shifts between warm/dry and cool/wet periods that occur about every 250 years (Roberts 1998:163). Complicating the issue are recent ice core studies that describe an also well documented cycle of cooling every 1,500 years (D.A.Meese et.al. 1994, Oppo 1997, Bond et. al. 1997). Sunspot activity may be responsible for the 210 year cycles and other solar influence for the 1,470 year swings (Braun et. al. 2005). Thus in the case of the Skaggerak, although precise climatic determinants are difficult for prehistoric periods, it is not at all impossible that ancient surveyors could often count on the freezing to the extent shown for hard winters in historically recorded times.

NATURAL CROSSES AND PROBABILITIES OF MOUND LOCATIONS

In archaeoastronomy, it is increasingly recognized that discovered geometric patterns need to be proven as artifacts. Ruggles admonishes his colleagues to take great care in the selection of variables by which to compare existing patterns involving land features and astronomical bodies with randomly generated ones (1999:161). Ideally, the sets of natural and archaeological features will be selected independently of existing geometric patterns found among them. By replacing either the manmade or natural features with an equal number of random points, one can compare the frequency of randomly generated patterns with existing ones.

While non-astronomical probability studies of prehistoric surveying practices are relatively undeveloped, a small body of literature is forming. The first analyses were simple computer procedures testing claims of Ley Line hunters that various features in the English landscape, usually within a range less than 10 km, were aligned to some degree of accuracy. As detailed twenty years ago by archaeologists Williamson and Bellemy (1983), computer generated random arrays of points produced many coincidental alignments. This did not mean, however, that ancient peoples did not align features in the larger landscape, only that it was difficult to distinguish artifactual patterns from those generated by random processes. The first mainstream archaeological publication to do this was Swanson's GIS based analysis of signal fire alignments at relatively small scales of several kilometers on Cerro Moctezuma, the apparently sacred peak with a kiva-like feature visible to the west of prehistoric Paquime in Northern Mexico (2003). Using ten randomly generated sets of points on the mountain, and the Student's T-Test statistical process, he concluded that the existing pattern of signal locations had a high probability being designed.

Also more recently, but in Scandinavia, Stahlqvist enlisted university faculty in Statistics for his exploratory dissertation at Uppsala which sought to prove that Neolithic peoples in central Sweden used the locations of small burial mounds to create cardinal cross centers associated with "hundreds" boundaries (2000). Given the large number of these small, 5-10 meter, burial mounds in the Scandinavian Landscape, this was a thorny problem to say the least. Yet by creating random variation of points away from existing patterns of cardinally (north-south or east-west) related ones, Stahlqvist was able to state a good probability of some intentional design. There is no consensus, however, on the interpretation of these apparent intentional layouts. Contemporaneously with Swanson's and Stahlqvist's efforts, the author developed ("Geopatterns") software which combines aspects of the two, as described more fully in Doxtater (2007). Its capacity to generate random points in an actual mapped landscape is similar to Swanson's use of GIS, but unlike the raster basis, geometric processing is purely mathematical. Far greater numbers of points can be tested on mapped landscapes.

The independence mandated by Ruggles was achieved in an analysis of the mentioned relationship of Minoan palaces to most prominent natural features on the island of Crete (Doxtater 2009). A wholly coincidental but not cross-like pattern of two west-east parallel lines and a center vertical axis exists between highest mountains and caves on Crete, most of which had been used mythically or ritually. To these points on the island were added the locations of the four palaces that archaeologists frequently discuss in overviews of Minoan culture. This total of twelve points in the landscape was created independently of the geometric patterns that exist between them. The complex existing "georitual" pattern was modeled in Geopatterns and searched for in a very large number of sets of 12 random points each. Results, together with a clear logic of palace orientations to features of the earlier landscape framework, provide good evidence for the intentional positioning of the four palaces.

Most prominent natural features and their coincidental alignments in Scandinavia

If prehistoric people in Scandinavia had been interested in using large scale cross structures in the landscape, they might well have sought most prominent features among eight possible orientations, four cardinal and four inter-cardinal. The emphasis, again, is not on directions *per se*, but on opposed pairs of features that create an Eliadian center at their intersection. The first step is to find a set of logical natural features that are independent of any constructed features such as large mounds.

NW – SE : One logically begins with the selection of Galdhøpiggan (2,469 m) as the highest mountain in Scandinavia. Its position on the larger peninsula is to the NW, and thus might have been considered an intercardinal feature. The highest point in the opposite SE direction in southern Sweden is Tomtabacken (Småland 377m). Tomtabacken, however, while being the highest in its region, is not visually or phenomenologically distinguished. Galdhøpiggan for its part has a nearby twin, Glittertinden, only four meters less in elevation to the east. Galdhøpiggan is, however, listed as Norway's most "topographically prominent" mountain in web sites. The second most prominent mountain listed is up in Troms, actually in the northeast of Scandianvia. Third is Snøhetta (2,286 m), the highest mountain in Norway outside of Jotunheimen where along with Galdhøpiggan, twenty or so of the highest mountains in Norway lie. Snøhetta is only about 90 km from Galdhøpiggan and thus is a logical second feature in the northwest direction. Historically, prior to precise elevation measurement, Snøhetta was considered to be the highest mountain in Norway.

Down in the SE, it is only with difficulty that one can distinguish the rolling top of Tomtabacken from among others in this area of Småland. For a second southeast feature, one would logically add the most recognized natural feature of southern Sweden, Stenshuvud, the large natural mound-shaped massif on the edge of the Baltic, a present day national park in southeast Skåne. Archaeologically well known, it is surrounded by extensive Bronze Age remains, the most noteworthy being the large tomb cairn at Kivik with its impressive stone tablet carvings. One of the two prehistoric *fornborgs* (rock wall enclosures) in Southern Sweden is found on top of Stenshuvud.

SW – NE : The highest point in Denmark, to the SW, is technically Møllehøj, determined in 2005 to be 170.86 m elevation. Most commonly listed as the country's highest point, however, is Yding Skovhøj at 173 meters, which includes a small prehistoric mound, one of thousands in Denmark. Without the mound, the point measures slightly lower, 170.77 m, than Møllehøj. The analysis uses Yding Skovhøj for additional reasons to be described shortly. Not unlike Tomtabacken, Yding Skovhøj, or Møllehøj for that matter, are also hardly distinguishable as notable landscape features. In this regard, one can include a second SW point which is perhaps *the* most phenomenologically recognized high point in Denmark, Himmelbjerg (147m). Himmelbjerg, or “heavenly mountain” was regarded until the middle of the 19th century as the highest point in the country. A historical, commemorative tower sits on the high point of the larger recreational site visited by thousands every year. Data bases list no significant archaeological sites in the immediate vicinity.

In the opposite intercardinal direction, NE, the logical feature is the highest mountain in Sweden, Kebnekaise (2,104 m). This peak is listed as the most topographically prominent in Sweden. While it is not yet demonstrated how prehistoric Scandinavians would have determined the superior elevations of natural features, the Romans had devices called *chorobates* to level aqueducts and other constructions (Gallo 2004:28). Evidence exists for similar devices in Pre-Columbian Peru (Hadingham 1987:50).

A second NE feature is also a good candidate as a potential intercardinal cross feature. The reason Yding Skovhøj was chosen as a SW feature, in addition to its popularity as Denmark’s highest point, is its involvement as the southernmost point in a large-scale coincidental three-point alignment. The interim point is the mountain Helagsfjëllet, and at the northernmost top of this line, northeast of Trondheimsfjord, is perhaps one of the most phenomenologically and culturally powerful natural sites in Scandinavia, Gudfjelløya (God-Mountain-Island), see figure 7. The Sami offering site lies at the boundary between agricultural cultures to the south, and hunting and gathering ones to the north (Skevik 2005:249). The following is a condensation of description and sources about Gudfjelløya from Manker (1957:274-277).

The first recorded source for “*Tunnsjøguden*” is from 1723 (Johan Randulf) as part of an explanation of a carved god figure as the “*Tonsie Gud*”. The cult site is said by several sources to be well known among the Sami, and used for a long time. Linder (1854) speaks of lore about the offer place on a protruding island (812 m high and about 3,000 m in diameter) with a rock cleft in which the remains of reindeer and other sacrifices are found. The Sami left their reindeer alive and tethered near the ravine in the rocks for the gods to eat. The ravine on the top of the island is described by Helland (1909) as possibly penetrating down to the level of the lake. The lake is remarkable in itself; it is so deep that it doesn’t freeze over in the winter (L. Johansson 1946). The well known Sami site does not belong to the more private sacrifice place “*tjekku*”, but was used collectively “*sjielavaja*”. From the Ostersunds-Posten (1953) comes the description of a flat rock wedged in the cleft, on which offerings are left at solstice times (*solverv*). Manker’s own investigation of the island describes the “*spricka*n” or crevasse as running in an east-west direction about 20 m at a width of from 20-50 cm. The depth could not be determined, but the sound of dropped stones reverberated for some time. He concludes that Gudfjelløya gives the highest convincing impression (of a natural sacred place) with its pronounced elevation and its “459m” rock face down into the lake.

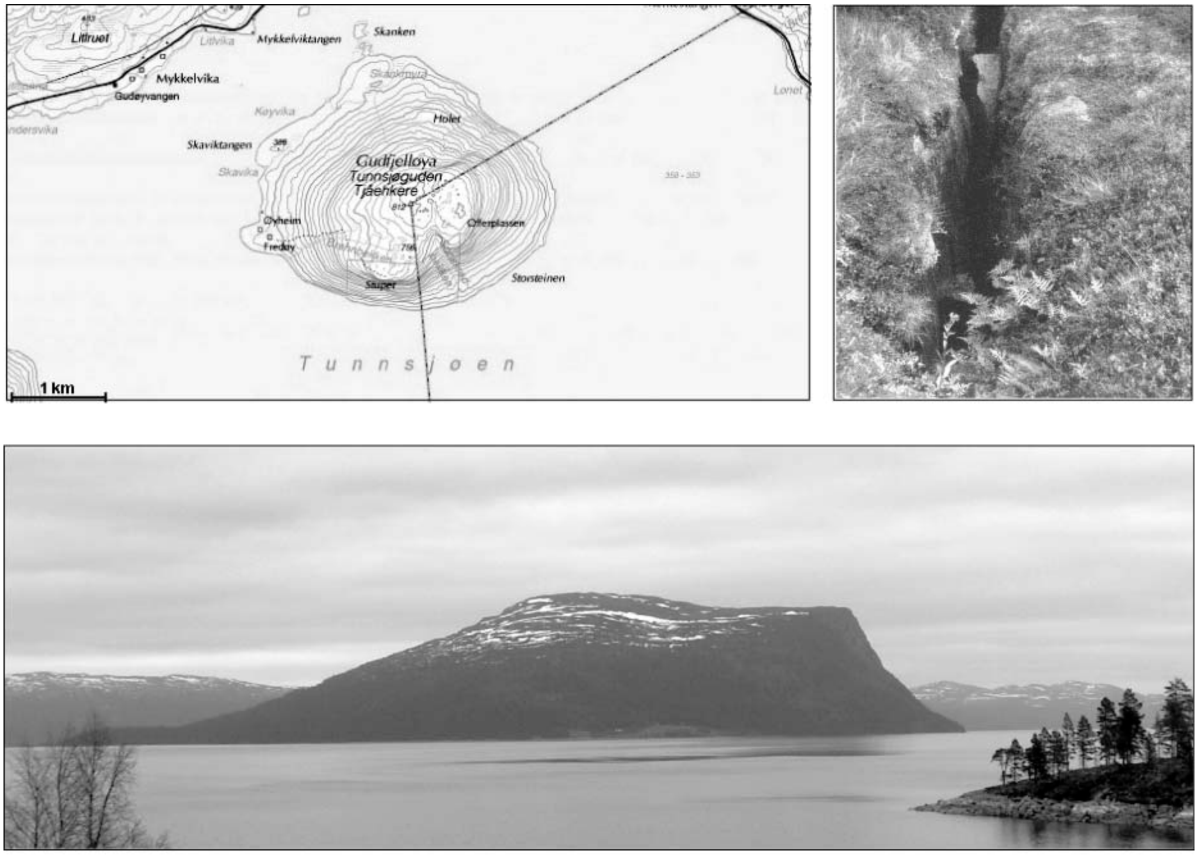


Figure 7. Gudfjelloya (Norway), a Sami sacrifical site as possible prehistoric NE point in a large scale, prehistoric cross structure in the landscape.

In terms of the large-scale three point alignment, the triangle point on the top of Gudfjelløya, through the triangle point on Helagsfjället as interim point, runs down 992.552 km coming about 302 meters from the GPS point (accuracy + or – 3 m) on the high point at Yding Skovhøj. The relation of Helagsfjället to the long line is 0.011° (visual acuity again is 0.017°). Helagsfjället (1797m) is the highest and most prominent peak between Trondheimsfjord in Norway and Storsjön immediately east in Sweden, areas with prehistoric ritual relationships. Visible from higher points in both areas, the peak contains the unique glacier in the central area between most southerly and northerly mountains of the Scandinavian spine. In Swedish, *“Hel”* is defined as “whole”, “entire” or “complete”, and *“lag”*, as a “law”, “social group” or “team”. Even though one can find no recorded folklore history associated with the peak, its name can connote some coming together of a group, perhaps even ritual. Understandable in this vein, perhaps, is the name of its southern flank “Predikstolen”, or “pulpit”.

N – S or *Axis Mundi* : In the SW Native American frameworks, Minoan Crete, and at least ethnographically in Scandinavia, the central, vertical or N-S axis is the most symbolically and ritually powerful. In Scandinavia, however, the geology of the peninsula has placed the highest mountains in the NW and NE. Given the eight possible intercardinal points and sixteen intersection points, there are few candidates for North or South natural features that would create a vertical axis, which in combination with two cross axes, would produce a somewhat coincidental intersection point of all three. The range of the intersection points has an extreme width of 50.925 km. This path hits the sea when prolonged in both South and North directions. In Denmark, one finds few remarkable land features of any height in Sjaelland, but to the north, one possibility can be immediately found. Just before the Namsosfjord and North Sea, the intersections "path" encounters a rather singular mound shaped mountain, Hemnafjellet (685m). This is the highest point in the northernmost part of the path.

Hemnafjellet is also interesting as a potential North point because of its coincidental relationship with one of the 16 intersection points, namely the two pairs: Galdhøpiggan (NW) – Stenshuvud (SE) and Kebnekaise (NE) – Himmelbjerg (SW). There is no sixth feature to the south creating the north – south axis, but a meridian prolonged south from Hemnafjellet comes within 99 meters of the precise intersection point of the intercardinal axes. The three lines are within about 50 meters from a common point. As three point alignments, average angular deviations for the three lines are well within the very accurate range of visual acuity, again 0.017°.

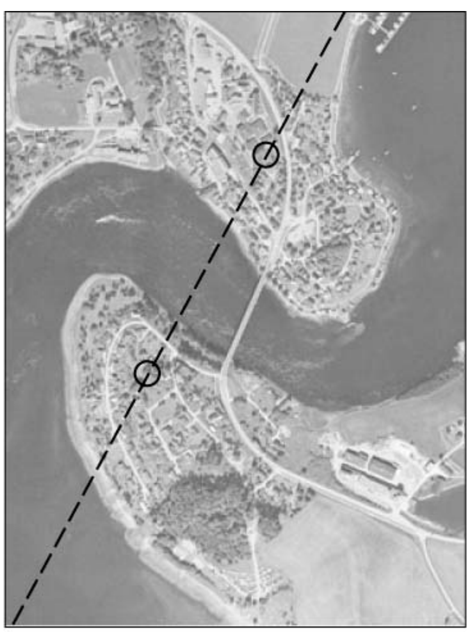


Figure 8. Straumen inlet, Trondheims-fjord, Norway. "Marker" mounds aligned to great circle line between Galdhopiggan and Kebnekaise.

A second feature, the narrow inlet in Trondheimsfjord called “Straumen” also had possible symbolic power in its coincidental geometric relationship to the two highest mountains of the NW (Galdhøpiggan) and NE (Kebnekaise). As seen in figure 8, the narrow, winding inlet to the Borgenfjorden has two larger prehistoric mounds, one on each side, each 35 m in diameter according to the Norwegian archaeological database Askeladdan. The center of the passage is accurately aligned to within 0.058° angular deviation from the precise line between Galdhøpiggan and Kebnekaise. Straumen lies 3’ 09” longitude west of Hemnafjellet (about 2,800 meters at this latitude).

Integrating cross-axis intersection points with vertical *axis mundi* lines

In both the American SW and on Crete, major ceremonial sites were located in partial relationship to wholly coincidental frameworks in the large scale landscape that created “natural” intersection or center points. The best and perhaps most ancient of these in the SW is the three armed cross structure, not unlike the “Hemnafjellet” cross just mentioned, involving the highest mountains and sacred river confluence in the Grand Canyon that creates a focus about 350 meters from a common point at the head of Canyon de Chelly (Doxtater 2005). It’s vertical axis between the highest mountain in its northern region, Abajo Peak, and the highest mountain to the south, Baldy Peak is coincidentally off N – S or 180° by about 178° 46’ 42” (from Abajo).

A more phenomenologically superior and technically precise *axis mundi* subsequently developed to the east and became the basis for much of the ceremonial layout and organizational meaning of Chaco Canyon. The first and possibly initiating phenomenology is the coincidentally precise (only a few arc seconds of difference) location of the northern terminus of the Chaco “meridian”, Mount Wilson, due east of the northern terminus of the western vertical, Abajo Peak. As observed from this location, the equinox sun rises precisely over the pyramidal summit of Mount Wilson, the highest mountain in the Anasazi sphere at over 14,000 feet. A second coincidental aspect of the Mount Wilson meridian, is its azimuth to the most recent volcanic flow of the region, McCarty’s Flow, an angle of 179° 50’ 32”. The two features are 336 km apart and form a very precise *axis mundi* that passes through the northwest edge of Chaco Canyon (Doxtater 2010).

What was missing in the evolving Chaco ceremonial focus were two cross axes and perhaps a cardinal east-west feature as had existed in Canyon de Chelly’s line to the great *sipapu* (creation place of emergence) in the Grand Canyon. The partial solution was to lay out intercardinal lines from four points in the eastern or Chaco realm. The problem, however, lay in the relative non-coincidence of the intersection of the cross axes with the all powerful Mount Wilson meridian; the two are over 2 km apart. As more fully described in Doxtater 2002 and 2005, the major ceremonial layout of the eventual 1050 AD canyon is heavily invested in the symbolic and undoubtedly ritual integration of the spiritual power of all three axes, particularly as it ultimately focuses on the largest great kiva of Rinconada.

In Scandinavia, aside from the coincidentally precise "Hemnafjellet" cross, neither Hemnafjellet nor Straumen comes closer than 1.535 km from any of the other 15 intercardinal intersection points. Seven are within 5.042 km of a meridian, and the rest range up to 41.205 km. Because of the way the Chacoans responded to a somewhat close but non-coincidental convergence, one should logically include in the analysis the less than precise 15 intersection points and their potential linkage to the two meridians. The simplest means of connecting intersection points with meridians, and therefore most logical for the present analysis, is to extend a line from the intersection point either due east or west until it hits the vertical, creating in effect a unified center site. In the analysis, the Hemnafjellet Cross intersection point will be considered as similar to the other 15, i.e. with a unifying point on both Staumen and Hemnafjellet verticals, even though this latter is only 99 meters to the east.

The eight intercardinal features, along with the two north features (omitting anything in the south) thus produce potential five-armed cross structures without east or west natural features or arms. Because all ten points have been shown to be the most prominent and logical features selected from their respective directions, either as most singular natural features or as wholly coincidental alignments among three such features, as a set they can be considered independent of any geometric relationships with built ceremonial sites.

The "great" mounds of Scandinavia as independent analysis sets of landscape features

One independent data set of major ceremonial features to use in an analysis with possible Scandinavian crosses is the list of all the largest memorial mounds, 50 meters and over, in Denmark, Norway and Sweden. Only the diameter of the structure is used, excluding dating, given the very incomplete investigation of most of these features. In Denmark, such a list was available from the Kulturarvsstyrelsen (Culture Heritage Authority). In Sweden and Norway no comparable list exists. The 12 mounds in Norway and 7 in Sweden were discovered by conventional literature searching and are judged to be relatively complete. Several of these sites contain a group of mounds and some estimation was necessary about overall size compared to the singular great mounds. Examples of multiple mound sites, beyond pairs, are Buskehøj in Denmark, Borre and Bertnem in Norway, and Uppsala, Nordians Hög, Högom and Steglarp/Mellan Grevie in Sweden.

While archaeologists may be uncomfortable with such an easily derived data set, considering all the existing and potential research about such features, the real issue here is independence of data, not archaeological interpretation *per se*. The primary issue at present is whether this list was derived independently of any consideration of possible large-scale geometric patterns, as was the list of natural cross features. The issue of interpretation arises only if the two independent sets create a pattern which is highly improbable as a random occurrence.

Figure 9. Examples of "Great Mounds" over 50 meters in diameter within Scandinavia.

The analysis sets up test boxes in Geopatterns that replicate areas in Denmark, Norway and Sweden where the largest mounds cluster. Within these test areas random points are substituted for an equal number of mound locations. Each set is searched for geometric coincidence with possible cross structures. Beginning in Denmark, the entire list of 16 mounds could be included in the test box, but the amount of open sea in the eastern portion of the area, on which it would be impossible to build, suggests focusing on the 12 that exist in Jutland. This reduction of size appears to focus the test area somewhat towards the paths where alignment with possible SW – NE lines can occur, possibly biasing the process. Comparative tests between the total and reduced areas, however, produced minimal effects in ultimate numbers. This is because the 12 mound area is still quite large and the size of mounds and angular accuracy of alignments is very small in comparison.

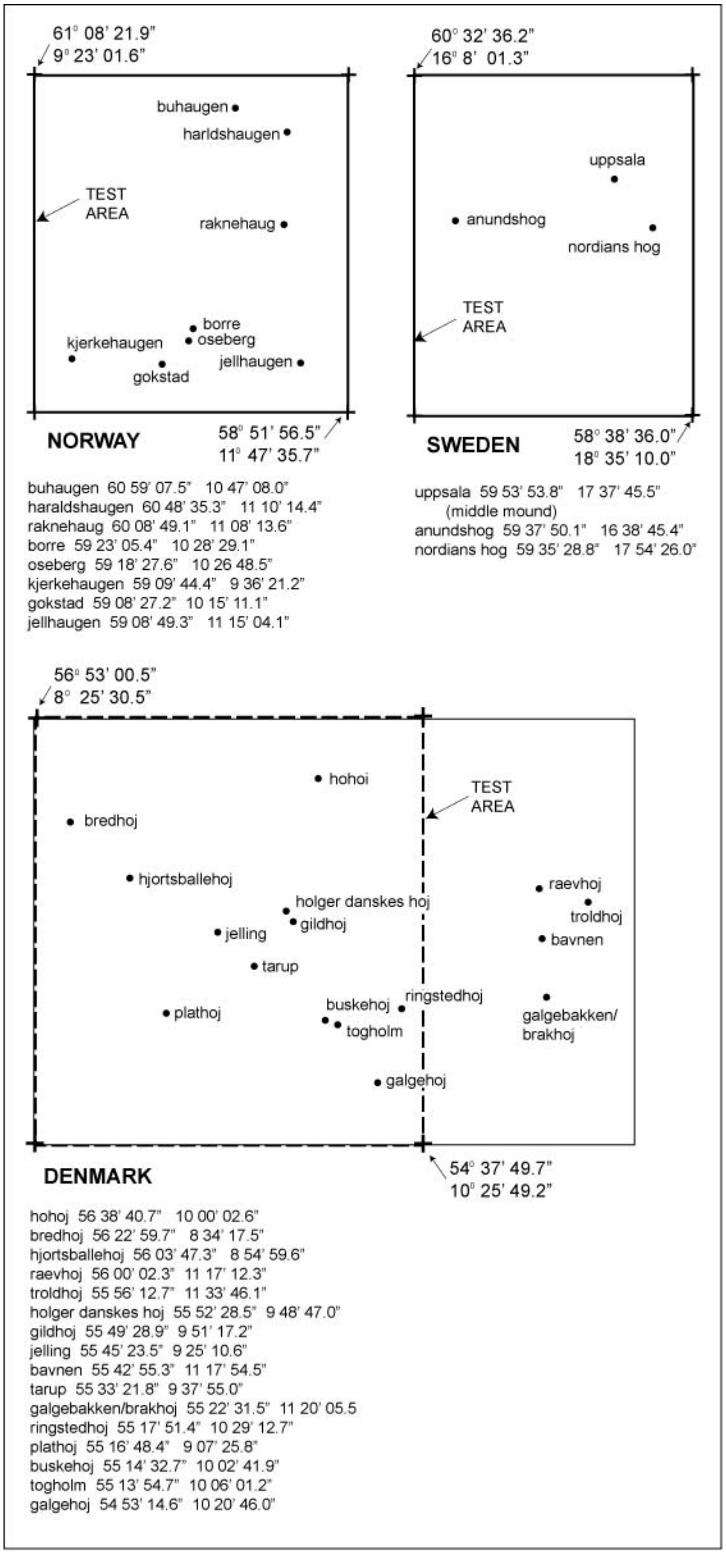


Figure 10. Locations of great mounds in relation to three test areas in Denmark, Norway and Sweden.

In Norway, eight of the twelve largest mounds cluster around the Oslo Fjord region. The other four are considerably north, three in the Trondheimsfjord area (Bertnem, Alstadhaug, and Ørland) and one farther north yet on the island of Leka (Herlaugshaugen). Limitation of the test area to the eight around Oslo, again, does not significantly increase the likelihood of coincidence with NW-SE axes. Sweden, for its part scatters four of its seven sites, but shows a cluster of three in the Uppland plain. Lying outside this test area is Högom, north in Sundsvall, Uggarda Räir out on Gotland, Kivik, as mentioned down at Stenshuvud, and Steglarp/Mellan Grevie near Malmö.

There are two ways sites in the Uppland test area could relate to a cross structure. One is as a continuation of a cardinal west-east line from the unifying point on a meridian, and the second is as an eastern arm of a 90° perpendicular with its vertex at a unifying point and other arm to the involved North point. This second alternative, diagramed as part of figure 14, is the most symbolically logical for several reasons. The most significant perhaps, is that an extended west-east cardinal line does not, unlike the other ends of the cross connect with a significant natural feature, but with the rise location of the sun. Furthermore, the short distance from an intersection point to a unifying point on the vertical creates serious potential for inaccuracy when prolonging a much longer line to non-visible points in the distant east. A perpendicular from a significant natural feature as North, not only involves this probable most powerful location, but allows a much more precise surveyed pattern.

The reader should note that an "east-west" leg as a perpendicular to a meridian is several degrees off being a cardinal point in relation to the vertex (unifying point on the meridian). This is because east-west cardinal relationships are alignments of two points on the earth to a distant sun at equinox. North-south cardinals, to the contrary, are alignments on a meridian, or great circle with its vertex at the center of the earth. Perpendicular alignments to meridians are also great circles with the same vertex, as are all other alignments calculated in Geopatterns. For present purposes, this analysis restricts itself to relationships between great circle patterns, leaving the likely integration of astronomical alignments for future research. This begs the question of the short line from an intersection point to a North meridian. This could have been either a direction observation of the sun at equinox, unlike the much longer lines to the Swedish mound area, or a line laid out perpendicular to a meridian at the intersection point. At this scale the difference between a cardinal east and a meridian perpendicular is negligible in terms of accuracies of resulting large scale patterns.

The three test areas, while none are mountainous, do have their topographic differences, and questions must be asked about where mounds can be built. Most largest mounds are located on flatter agricultural areas. If the test area for Denmark was diminished to eliminate an unbuildable area of open water, what about unbuildable areas in the three land areas being used in the tests? Jutland in Denmark, is probably of least concern. A very large majority of the test area is buildable. The Uppland area of

Sweden has greater variation in topography and a mix of agriculture and forest, but still most is buildable. In the Oslo Fjord, however, according to the map of prehistoric agricultural land (Øye 2004), Figure 11, probably over half of the test area would not be buildable. Certainly it would be ideal to be able to program the computer to place random points in only the buildable areas of a test box, but this is beyond present capabilities.

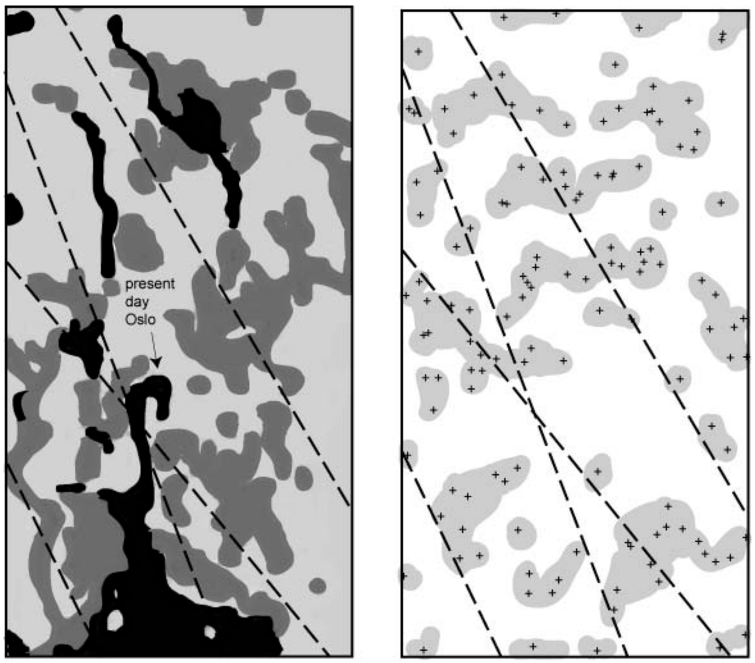


Figure 11. Agricultural areas around Oslo Norway during prehistoric times where great mounds could likely have been built (left); clustering of 132 random points in the test area necessary to produce one NW - SE alignment at the designated accuracy (right).

Still, one wishes to know the effect of scattering random points in a test area in which less than half is buildable. One way to think about this apparent dilemma, though not solving it mathematically, is to compare the distribution of prehistoric agricultural areas around Oslo Fjord with a distribution of random points, see again figure 11. Illustrated is the pattern of 132 random points in relation to the four possible intercardinal cross axes. The number 132 is the number of random points it takes to create one alignment with one of the four axes at a given accuracy. If one considers the graphic clusters of random points, the overall pattern becomes not that dissimilar to the pattern of agricultural land around Oslo Fjord. From the perspective of possible geometric landscape patterns, the prehistoric agricultural areas around Oslo Fjord where great mounds could be built is a random array. So is the pattern created by distributing random points in a computer test area. Given the similarities of visual patterns, one can imagine that if one had the ability to scatter random points within the prehistorically existing buildable areas, then the incidence of particular points aligning with intercardinal axes would not be radically different from using the simple test boxes.

Probabilities of great mounds aligning with possible large-scale cross structures

The series of illustrations, Fig 12, 13 and 14, describe the relationship of the three test areas, representing the three clustering of great mounds, to the ten potential cross axes. Figure 14 provides a detail, again, of how the cross intersection point is logically integrated into a vertical North – South or *axis mundi*. The reader is reminded that the selection of natural cross features and largest mounds were made independently of each other.

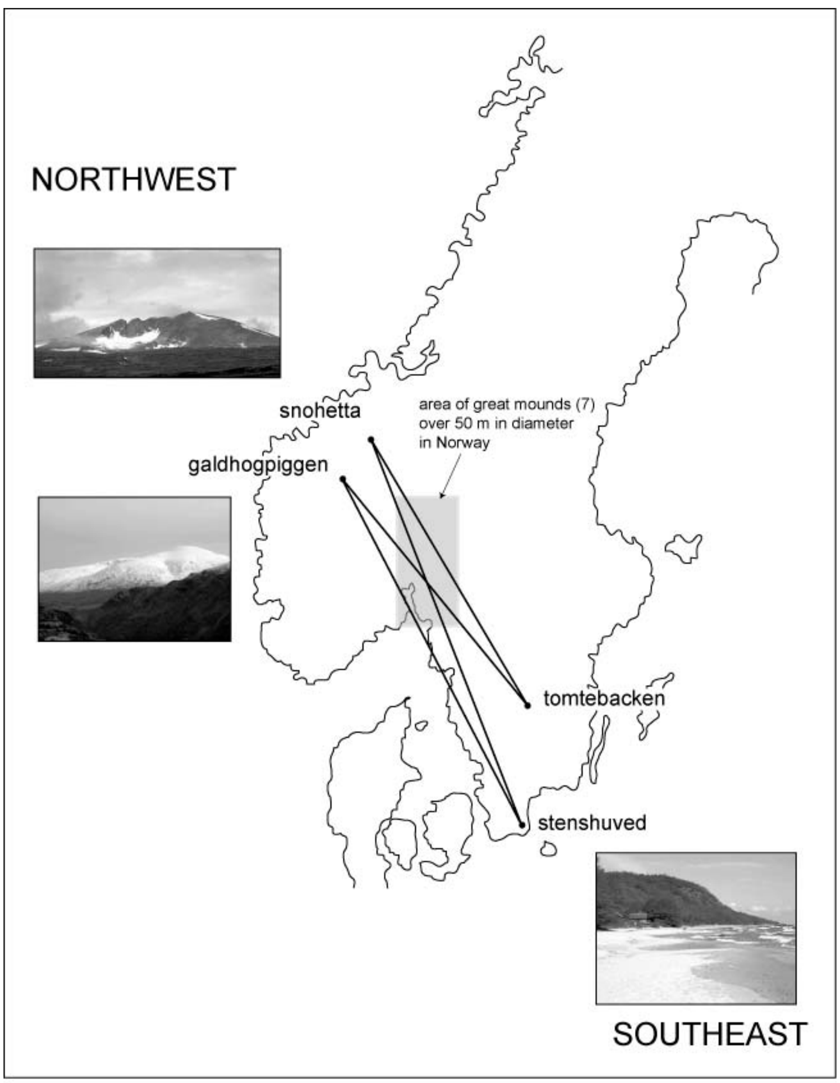


Figure 12. Norwegian test area of great mounds in relation to four most prominent natural features in the Northwest and Southeast directions.

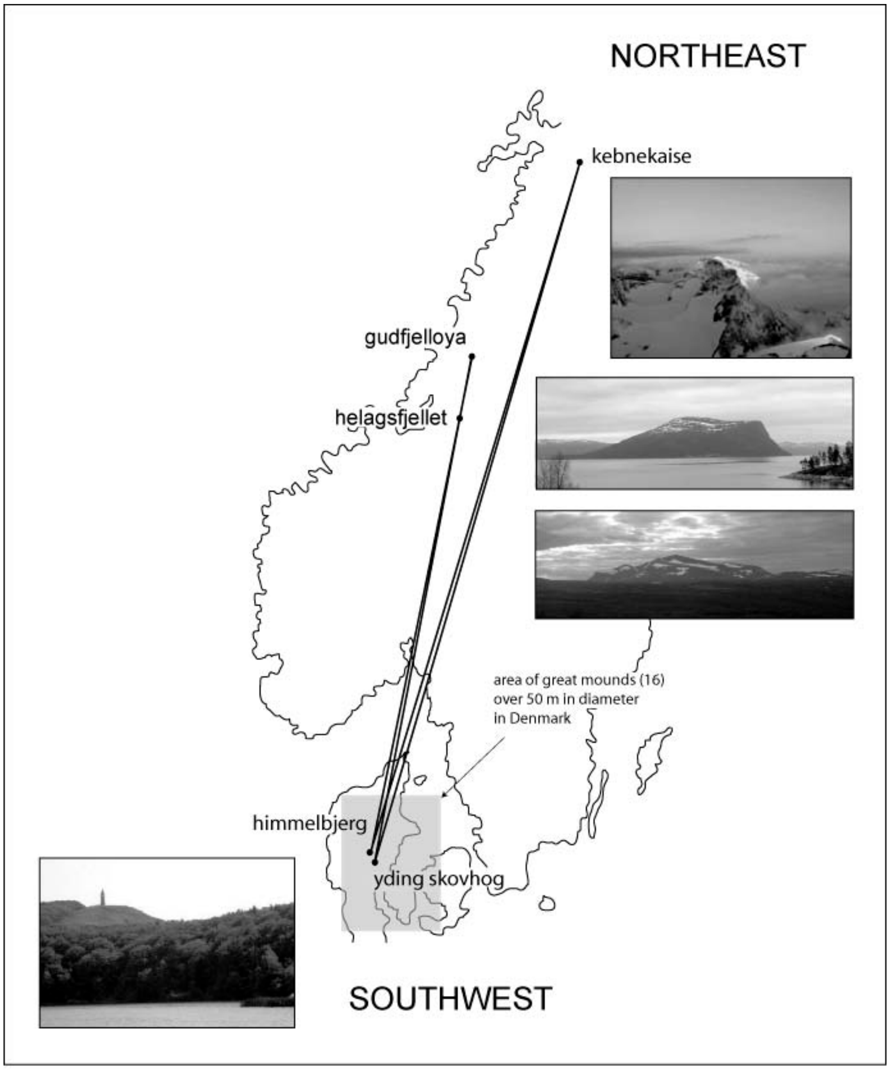


Figure 13. Danish test area of great mounds in relation to four most prominent natural features (and a coincidentally aligned Helagsfjellet) in the Southwest and Northeast directions.

The following probability exercise treats the three test areas as "independent" events as defined in texts on simple or "everyday" probability (e.g. Woolfson 2008:15 or Kotz & Stroup 1983:33). Two of the independent events (test boxes) seek the frequency that a large mound will align with one of four intercardinal axes running through the test area, and the third event looks for the frequency that a mound in the test area will form a perpendicular with a unified intersection point on a meridian and the North point of that meridian. The probability texts on independent events and the "general multiplication rule" (Kotz & Stroup 1983:33) define the widely known means of determining the likelihood that multiple events will happen "at the same time", e.g. that if one tosses a coin and a die, that a "heads" and a "six" will occur with one flip and one roll. To connect two or more independent events, one simply multiplies their respective probabilities.

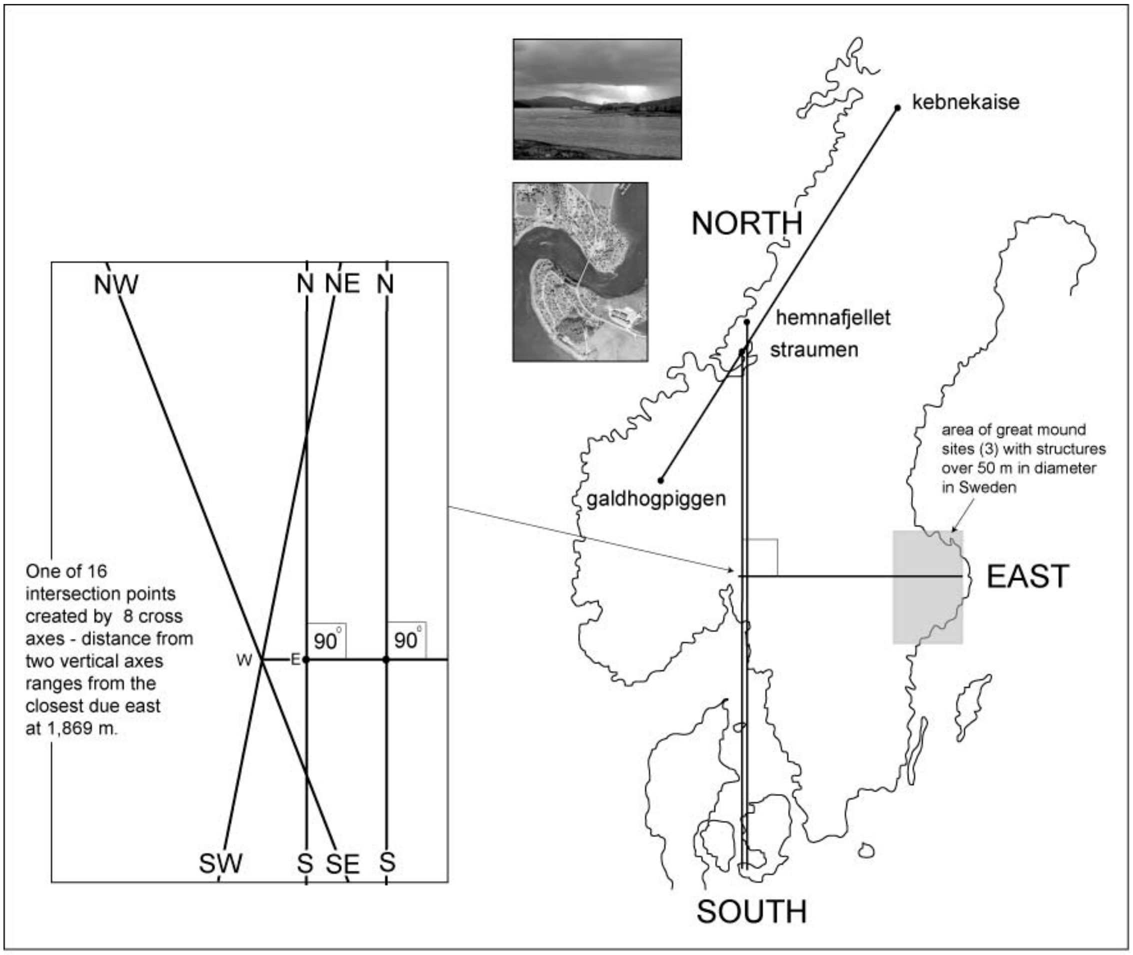


Figure 14. Swedish test area of great mounds in perpendicular relation to two most prominent natural features of the North and the most logical integrating points on these axes with cross axis intersection points.

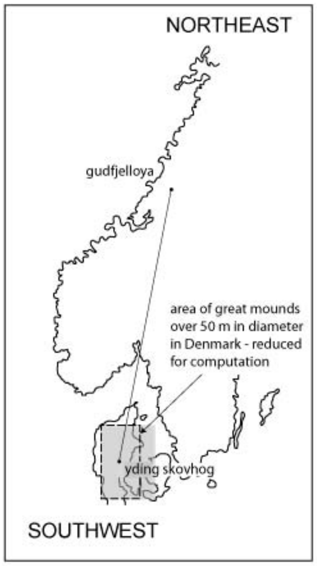
Test areas are drawn just outside of the limits of the existing largest mounds in the area, as previously described. For both the test areas in Denmark and Norway, each is set up with the four respective intercardinal natural features in their respective map locations. The reader will notice that while the Danish area can only connect with a SW – NE axis, mounds in the Norwegian area have the potential to align with both intercardinal axes. Because the test uses SW features in Jutland, it is assumed that if the largest Scandinavian mounds associated with some overall cross structure, at least one would logically be from this SW area, heavily populated and comparatively wealthy as it was. For present purposes, therefore, the Norwegian cluster of mounds is only tested for relationships to the opposite NW – SE axis.

For each test area the computer is instructed to look for a particular geometric pattern; in these two cases a three point alignment. The computer also needs to know the angular tolerance at or below which it will report any three point alignments between any two natural features and any particular random point within the test area. This number is taken from existing alignments understood prior to the probability analysis. In the present case, the range of possible angular deviation for the Denmark group is 0.06°, and that for the Norwegian cluster is 0.03°. Visual acuity, again is 0.017°. To give a sense of how large, or small, this deviation is, we can return to the location of the Straumen inlet on the 848.278 km line between Galdhøpiggan and Kebnekaise. Its average deviation (considering the angles from both ends) is 0.058°, which translates into a distance off of about 295 meters.

Given the possibility that mounds in the first two test areas will align such that a cross intersection point is formed, two particular unifying points on the two meridians (as described in figure 14), along with their respective North points, would ideally be the basis for finding a random point among the Swedish test area that creates an accurate 90° angle. But this ability to connect all three components of the cross is beyond the present capacity of Geopatterns. The three tests must be independent. This apparent indetermination is actually not a problem. Consider again that one Danish and one Norwegian test produces an intersection point, and that this can be reported. What then is the probability that a Swedish point will produce a perpendicular with the related point on one of the two meridians? This could be determined by running a Geopatterns search using random points and the particular two points on the two meridians. But it would be extremely time consuming to find each intersection point and then conduct perpendicular tests for each. What one can do instead is to consider the probability of finding the particular perpendicular the same as finding any chosen perpendicular among the 32 (just picking a number from 1-32). Tests were made to verify that all of the 32 points can create a perpendicular with north points and points in the Swedish test area.

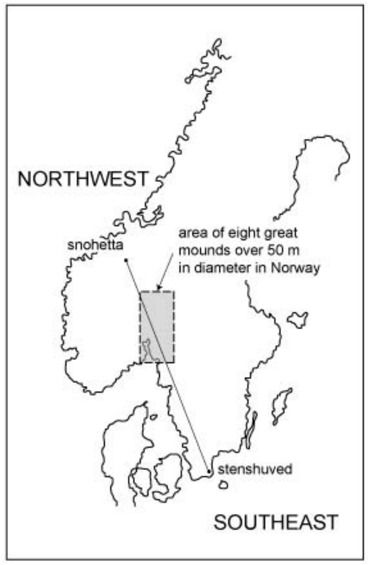
Thus in the computer setup one can enter any two pairs of the 32 points on meridians along with the two North points of Hemnafjellet and Straumen (the two points in the “middle” of the vertical axes are precisely due south of their respective North features). These are the two possible cardinal legs of a potential “ninety” perpendicular with a random point within the Swedish test area. The computer searches for ninety degree angles within an angular tolerance of a very accurate 0.02°.

In the first part of the analysis, graphically detailed in figure 15, 10,000 sets of random points are distributed in each of the three test areas independently. For each area, the number of random points in each test set equals the existing number of great mounds in that area (12, 8 and 3). In the Denmark area, the probability of one of the 12 random points aligning with one of the four intercardinal lines is 0.051 (1 in 19.6 sets or 1 in 235.2 points in total). Up in Norway, the probability of one of the 8 random points aligning with a NW – SE line is about the same at 0.057 (1 in 17.5 sets or 1 in 140 in total). Threesomes



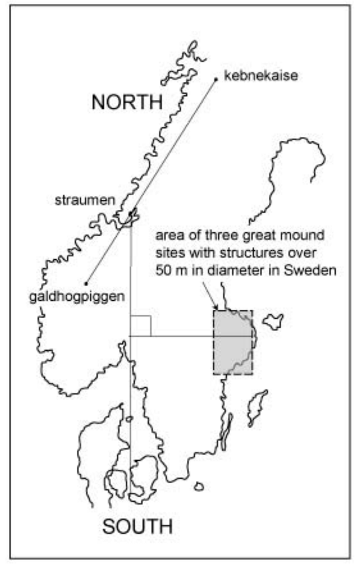
sets of 12 random points produce one alignment with one of four SW-NE lines every 19.6 times =
0.051

single random point aligns every 188.7 times =
0.0053



sets of 8 random points produce one alignment with one of four NW-SE lines every 17.5 times =
0.057

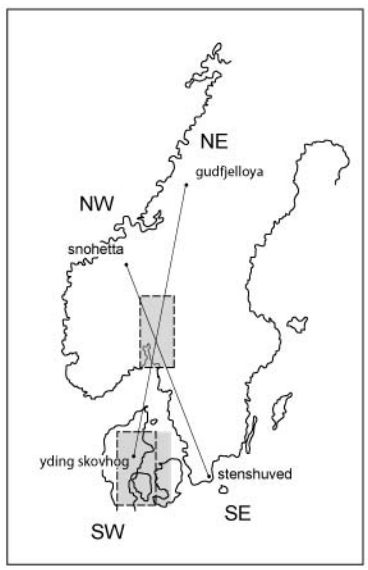
single random point aligns every 132 times =
0.0076



sets of three random points form a ninety with one of two north points with vertex at same longitude as one of 16 possible cross intersection points - occurs every 166.7 times =
0.006

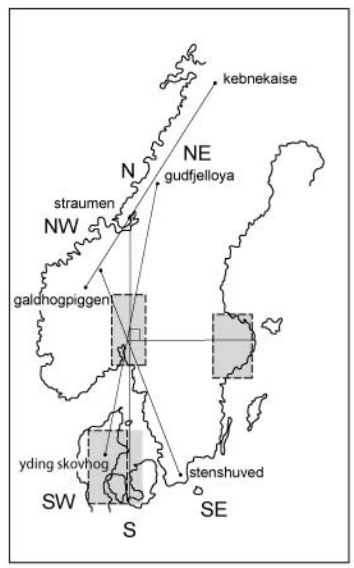
single random point forms a ninety every 526 times =
0.0019

Figure 15. Independent probabilities of any one mound within the multiple mounds of the three test areas aligning or forming a perpendicular at the defined accuracy with any of the ten most singular natural features of the SW, NE, SE, NW, and N; and the independent probabilities of only the largest of the mounds in each of the three test areas (above). Probabilities of one alignment among multiple mounds of each of the Danish and Norwegian areas happening as part of the same cultural "set" to form a cross intersection point and of an added Swedish point forming a complete cross; and the probability of only the three largests mounds of the three test areas forming a complete cross (below).



multiple sets (12 & 8 random pts.) align simultaneously with one SW-NE and one NW-SE line every 344 times -
0.051 x 0.057 =
0.0029

single random points align simultaneously every 25,000 times - 0.0053 x 0.0076
0.00004



multiple sets (16, 8 & 3 random pts.) align simultaneously with one SW-NE, one NW-SE, and the ninety with a north point at its vertex at the same longitude as the cross intersect point every 58,823 times -
0.051 x 0.057 x 0.006 =
0.000017

single random points align simultaneously every 13,157,894 times -
0.0053 x 0.0076 x 0.0019 =
0.000000076

of random points in the Swedish test area create a perpendicular with either meridian pair (each with a North site plus unifying point) at a much less frequent rate of 0.006 (1 in 166.7 sets or 1 in 500.1 random points in total). Following the general multiplication rule, one can multiply these three figures to arrive at the probability of a cross intersection being formed, and then of a perpendicular linking it to a Swedish random point and one of the two North features. The odds of the cross intersection are 0.0029 (1 in 344.8 times the exercise is run with the Danish and Norwegian test areas), and of a ninety connection are 0.000017 (1 in 58,823 times the total three part exercise is run).

A variation of this first exercise can also be conducted by using only one random point in each of the test areas representing the largest diameter mound of each cluster, Hohøj (72m) in Denmark, Raknehaug (77m) in Norway, and Uppsala (70m x 3) in Sweden. This is also a clearly independent group, small as it is, because of preexisting data that establish the greater diameters of Hohøj (Kulturarvsstyrelsen) and Raknehaug (Skre 1997). Certainly a word must be said here about Jelling, the most well known great mound site in Denmark. While its two mounds are listed with diameters of 65m, seven meters less than Hohøj, there are nonetheless two of them. Some agreement might exist, however, that Jelling should not be included in the Danish list because of the very late date of the site, right at the cusp between Viking and Christian cultures in the 900's. The analysis, however, simply uses the largest diameter great mound listed in Denmark. Uppsala's largest diameter mounds, three at about 70m, can be compared to diameters at Anundshög's singular mound, also about 70 m, and Nordienhög (57m) in Google Earth. Uppsala, however, with its three structures is clearly the "largest" mound site in the test area.

When one runs 10,000 sets for each test area, each set consisting of a single random point, an alignment occurs in the Danish test area at a rate of 0.0053 (1 in 189 tests), in the Norwegian area at a rate of 0.0076 (1 in 132 tests), and a perpendicular occurs in the Swedish test area at a rate of 0.0019 (1 in 526 tests). The likelihood that two random points or mounds, one in each of the Danish and Norwegian boxes will create a cross intersection point is 0.00004 (1 in 25,000 tests), and that a *axis mundi* perpendicular will be added in relation to this cross intersection point is 0.000000076 (1 in 13,157,895 tests).

How could one manipulate the analysis process?

If existing points in all three test areas do align to create in effect a unified cross structure, the reader's first reaction may be to accept the very unlikely possibility that it is a random occurrence, at 1 in 13,000,000 million, or even 1 in 58,000, but to still question the possibility of intentional or designed layout. Was the analysis manipulated? Which aspect would be most suspect? Most problematic will undoubtedly be issues of data set independence, perhaps not so much with the lists of largest mounds than with the pattern of the cross structure itself and the selection of natural features.

It is argued, in regard to the cross structure, that introductory portions of this paper have demonstrated that the pattern chosen for the analysis clearly existed in concepts of time, farm layout and graphics of early Icelandic and Norwegian Middle Ages farm societies. Beyond this, similar crosses have been ethnographically described in the New World. Cross structures, in their simplest form as intersections of three or four axes, usually with cardinal and intercardinal components are almost universal in traditional societies. Even the connection of an intercardinal intersection point to a close by vertical has its precedence in the American Southwest, although the connection means were quite symbolically elaborate. The geometric unifying relationship used in the present analysis is the simplest and most precise possible surveying pattern, and therefore leaves little choice among alternatives by which to make the existing data (mound locations) fit.

The second dimension of doubt, the selection of natural features, will probably be the most persistent in the mind of the reader. Both the vertical axes of the cross and the intercardinal cross axes can vary considerably, the latter especially in a range of at least 45° or more. Thus isn't it possible to find unique natural features along these ranges that would align with three great mounds, thus manipulating the analysis? The way to think about this issue is to reverse the analysis. When the ten natural features were fixed and the mounds were replaced by equal numbers of random points, it took 1,352,929 (23 mounds x 58,823) points to create one overall cross structure (the number of mound locations to create a total pattern using only the three largest mounds is 39,473,685). If one leaves the 23 mounds in their fixed position in a reversed analysis, where random points in test areas are substituted for the natural points instead, how many tests, or different locations of natural features, can one imagine would have to be run to create a total cross structure with three of the existing mounds?

Figure 16 illustrates four test areas around the eight natural intercardinal features of the main analysis. Because of the absence of known cross intersection points, this reversed analysis cannot include the perpendicular relationships between north points and Swedish great mounds. One can, however, set up two independent tests in the computer, one for each of the intercardinal axes. Again associating the Danish group of mounds with the SW – NE axis and the Norwegian one with only the opposite NW – SE, each set of each test consists of one of the two existing mound groups and two random "natural" points, one in each test box at the two ends of an intercardinal axis. When all of the mounds are used in each area (rather than just the two largest), an aligned mound occurs 1 in 125 (0.008) for the NW – SE axis, and 1 in 43 (0.023) for the SW – NE axis. The probability of a mound aligning on each axis, creating a cross intersection point, is 0.008 x 0.023 = 0.00018 or 1 in 5,555 sets. Considering 4 natural feature random points necessary for both Danish and Norwegian sets, one would have to consider 22,220 alternative natural features to find four that create an intersection point, not even considering the additional probability of a perpendicular relation of this point to a North and Swedish mound.

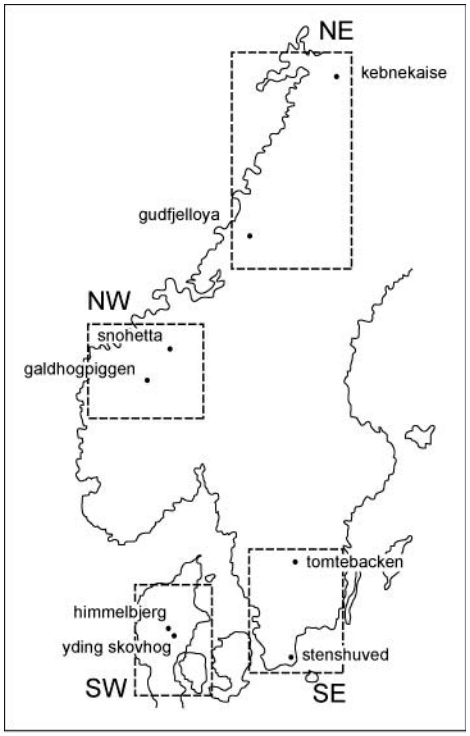


Figure 16. Test areas for reversed probability of forming a cross intersection point with aligned mounds; mounds are fixed and random points are placed in the SW, NE, NW, and SE test areas.

One needs not report the far greater numbers when only the two largest mounds, Raknehaug and Hohøj are used in this reversed exercise. It is obviously impossible to find huge numbers of significant natural features by which to find four that coincidentially create an intersection point using the existing mound locations in Denmark and Norway. One must conclude that if a total cross structure using great mounds is created with the presently selected natural features it is because those features were readily apparent as very most unique in the landscape, and made logical frameworks for positioning the greatest of built memorials.

YGGDRASIL AS MAP

As coincidental as the Hemnafjellet cross is, with cross axes to Galdhøpiggan (NW) – Stenshuvud (SE) and Kebnekaise (NE) – Himmelbjerg (SW), no three great mounds, one from each of the three cluster areas clearly associate with this common cross structure. If we take the entire group of 23 mounds, minus the three largest in their respective areas, there is no single mound that aligns with any of these ten axes used in the study. Both of the very largest great mounds, Hohøj and Raknehaug do align with

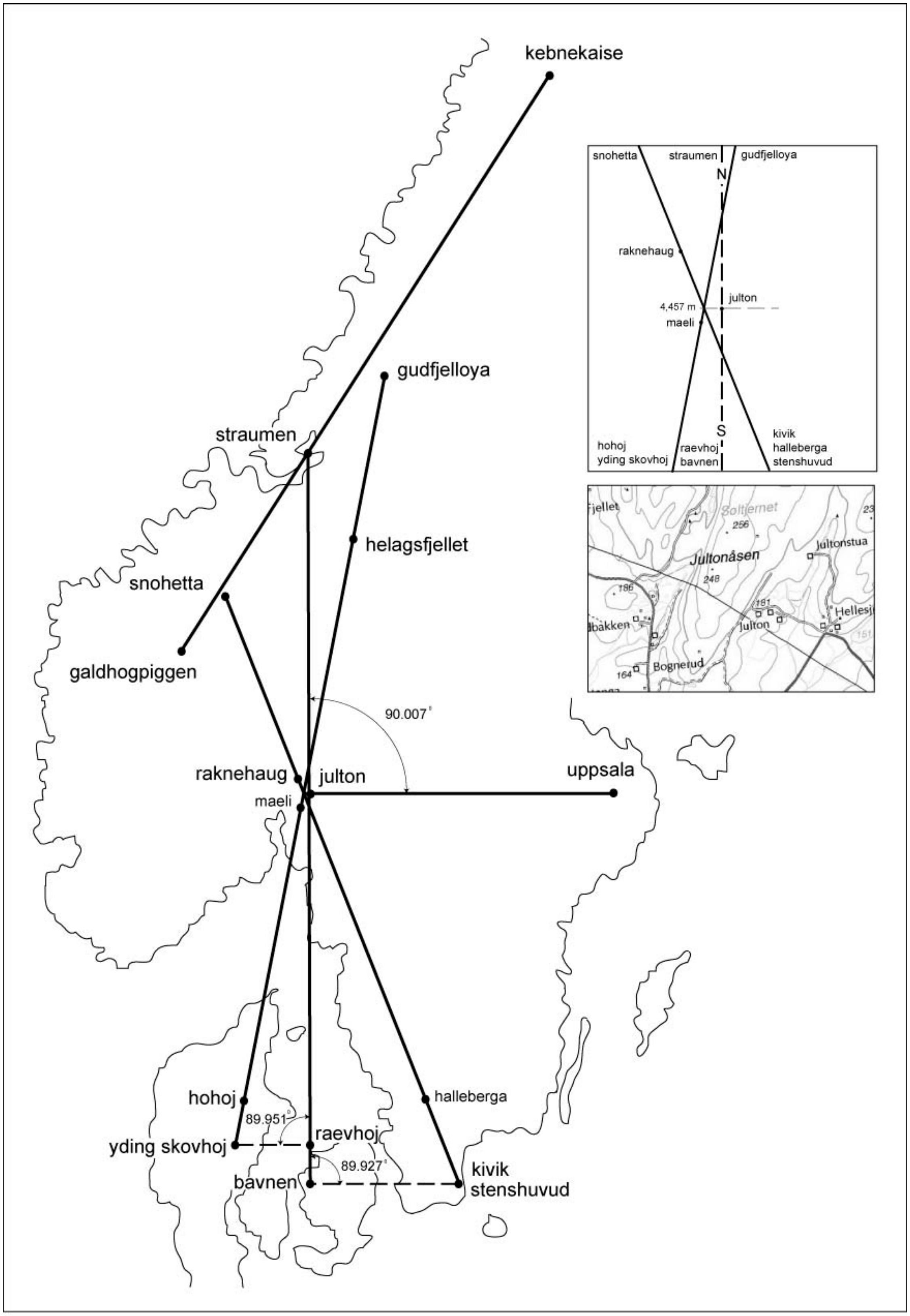


Figure 17. Probable prehistoric Scandinavian cross structure involving the three largest mounds from Denmark, Norway and Sweden, with three additional mounds also possibly related; map and diagram of cross center at the Julton farms area.

intercardinal axes, and Uppsala creates a very accurate perpendicular to their intersection point. The probability again of this happening randomly is 1 in 13,157,895.

North and the vertical *axis mundi*: This total cross structure is illustrated in figure 17. The North feature that forms a very accurate (90.007°) perpendicular with a unifying point on its meridian and the center mound at Uppsala is Straumen, the Trondheimfjord inlet. While analysis proves that the three largest mounds in their areas do form an intentional cross structure with Straumen, it does not prove that the surveyors knew about the inlet's alignment to Galdhøpiggan and Kebnekaise. One indication that that line between the two highest mountains in the NW and NE was known, however, is the location and orientation of the two "marker" mounds on either side of the Straumen inlet, see again figure 8. The azimuth of the south mound looking to the north mound is 329° 26' 45.3", and from the north looking to the south mound is 149° 26' 30.4". These azimuths are within about two degrees of accurately paralleling the line from Galdhøpiggenn to Kebnekaise. From the south mound looking to Kebnekaise is 327° 02' 02.5", and from the north mound looking to Galdhøpiggan is 147° 10' 18.2". If the southern mound were in better condition, it would be possible with precision surveying equipment to get more accurate points for their tops and thus refine the figures above. The mounds are not dated but might be Bronze Age, given the large number of burial mounds specifically located to be seen along the Borgenfjord (Sognnes 2000:100). One consideration of this site is the water level of that period (Grønnesby 1998). Were the mound locations under water due to the depression of land after the last ice age? The channel would have been somewhat more open as seen in Grønnsby's map, though still a good perceptual threshold.

If an understanding of Straumen's coincidental alignment with Galdhøpiggan and Kebnekaise had been part of the selection of the inlet as the North feature for the cross structure, then the spiritual power of the *axis mundi* would have flowed, via the Straumen passage, from these two great mountains. The image might have been that of a tree's canopy, a most sacred cover of the vertical axis and trunk below. In this respect the tree might well have had a base. While no significant mountain exists at the southern end of the vertical, two of the four 50 meter mounds on Sjælland, excluded from the Danish test, do align with the Straumen meridian (11° 17' 49.8" longitude). Rævhøj's longitude is 11° 17' 12.3" (0.017° deviation) and Bavnen's is 11° 17 54.4" (0.004° deviation). As will be detailed below, the Straumen meridian at these two locations forms perpendicular relationships to the two base points of the intercardinal axes of the "Yggdrasil" structure. The lower portions of the three axes of the cross structure, the vertical and two intercardinal, might have thusly been considered as the three "roots" of the world tree.

NW – SE : On this axis of the "world tree" lies Raknehaug the purported largest of all Scandinavian mounds (Skre 1997, Grieg 1940). Its center point is about 176 m from the line between the precise high points of Snøhetta (NW) and Stenshuvud (SE), an average angular deviation of 0.029°. The line is 794.721 km long. There is a second great mound, not part of the analysis but mentioned above, associated with this axis. The purportedly largest Bronze Age mound in Sweden, Kivik, lies 3.185 km north of Stenshuvud. It is Kivik that forms an accurate ninety degree base (89.927°) for the cross structure with the mound Bavnen, and Straumen. This is a better relationship than with Stenshuvud (90.522°). Bavnen is 187.127 km from Stenhuvud.

Two additional archaeological sites have relationships to the Snøhetta-Stenshuvud axis. While Sweden has hundreds of *fornborgs*, there are only two, possibly three in the southern flatlands of Skåne and Blekinge according to Alebo (1998:8), who is most certain about the "*borg*" on Stenhuvud and on the prominence called Hälleberga. This latter 180m x 200m enclosure forms a very accurate line with Snøhetta and Raknehaug (deviation 0.017°). Hälleberga's position with respect to the Snohetta-Stenshuved line is much less accurate, 0.402° or about 774 meters off the line (using Kivik produces almost identical numbers). Wall's (2003) general analysis of *fornborgs*, or *inhagned* (enclosed) places opens the door for further research on ritual rather than defensive purposes for some of these natural sites.

SW – NE: The largest and most northerly of the great mounds in Denmark, Hohøj, was constructed about 118 meters (mound center) from the precise (0.011°) naturally coincidental three-point alignment from Gudfjelløya through Helagsfjället to Yding Skovhøj, a length again of 992.552 km. As the interim point between Yding Skovhøj and Gudfjelløya, Hohøj's accuracy is 0.050°. As a prolonged point from Gudfjelløya and Helagsfjället, this three point alignment has an average deviation of 0.016°. Apparently this axis of the cross was chosen because of its coincidental relationship between three significant natural features. The great mound Rævhøj may have been positioned on the Straumen vertical to create a perpendicular base to the west. The angle at Rævhøj to Straumen and the base of the SW-NE axis, Yding Skovhøj, is 89.951°, a deviation of 0.049°.

Surveying both north and SW–NE axes could have been prolonged from an accurately determined southern point on the horizon from Straumen and from an alignment between the relatively near Gudfjelløya and Helagsfjellet, a much easier surveying process especially over considerable expanses of sea compared to locating Raknehaug on the Snøhetta-Stenshuvud line.

Integrated Center and Cardinal East:

The intersection point of the two cross axes, as shown in figure 17, occurs about 4.457 km west of the Straumen meridian. Raknehaug, a Migration Period (400-550 A.D.) structure (Skre 1997) is located about 11.601km further to the northwest on the Snøhetta-Stenshuved line. Thinking dualistically, as fundamental to most integrative georitual, one would expect a partner to Raknehaug in a similar position on the Gudfjelløya-Yding Skovhøj line. Prospecting in the data base for such a point suggests at least one possibility, an unusual uncompleted mound or "platform" (given description of site) about 76 m in length by 40 meters wide on the Mæli farm. On this raised, seemingly constructed platform were eventually built 5-6 grave mounds ranging in size from 20m-6m in diameter (Askeladdan # 42319). The Mæli feature is 3.284km from the cross axes intersection point, much closer and asymmetrical compared to Raknehaug's 11.601 distance. Topographically, however, the line from Gudfjelløya to Yding Skovhøj misses the center point of the platform by about 272m, a deviation of 0.032°. If the line was much older than the building of these mounds on them, the position of "Mæli" could have been prolonged from Gudfjelløya through Helagsfjället. Helagsfjället has a more precise 0.009° relationship to Gudfjelløya-Mæli.

Most importantly in this central complex, however, is the reconciliation of the intersection point of the two cross axes with the meridian. The latitude of the cross axis point is projected the 4,457 meters east to its intersection point on the meridian which lies right at the small farm called Jultonstua in Sørum. Nothing in the archaeological record speaks of any central ceremonial place around Jultonstua or the other related Julton farms. Most interesting as a still coincidental, natural, central focus is the pronounced adjacent ridge called Jultonåsen (åsen = ridge). Local history describes a Jotun or mythical giant residing in this peninsular feature projecting from the north (Horgen 2003:503). Stories also exist without confirmation about a cloister of monks in the Julton farm(s) area. The farm name, according to Oluf Rygh (ibid 505) derives from the plantname "*jol*", combined with "*ton*" or flat place. Rygh also states that the derivation of the winter solstice "*Jul*" from the plant name is not dissimilar to the linkage with the Julton name. "Julton" could have had significance as a winter ritual setting, the same as that at Uppsala (Henriksson 2003).

The most analytically critical aspect of the Jultonstua point, however, is the geometric relationship it creates between the Straumen meridian and the largest great mound(s) of the Swedish test area. Jultonstua forms an overly accurate 90.007° relationship between Straumen and the central mound at Uppsala, figure 17. If one uses a location on Jultonåsen ridge between its two high points (248 m & 252 m elevation), then the perpendicular relationship with Straumen and Uppsala is 89.935° (0.065°). This point on the ridge is actually on the projected line from the cross intersection point.

RITUAL IMPLICATIONS OF YGGDRASIL AS MAP

This analysis has proven that the three largest mounds in Denmark, Norway and Sweden were located in relation to a cross structure founded on five natural features. Answers to the questions of whether the cross was in fact envisioned as a world tree, what the symbolic and ritual relationships were between the three memorial sites, and what was the nature of social organization necessary for this integration are clearly beyond the capacity of the present paper. One can at least attempt however, in conclusion, to begin a discourse in this direction.

Most important, perhaps, is the fact that the three mound sites can be interpreted socially and politically from two usually separate perspectives. They were apparently hierarchical in their relationship to other large mounds in their region--mound sizes ranked sites--while at the same time, they were integrated with the other mounds sites via cross (tree) symbolism. Because spiritual power flowed from the crosses' natural features to a united center focus which was not built upon, the position of the built mounds with respect to the (natural) cross structure would likely have been subordinate. It is true that Raknehaug, and possibly Mæli, are closer to the Julton center, but are nevertheless dedicated each to only one of the intercardinal axes. Even on the axes, there could have been an integrating paring between Raknehaug and Kivik, and Hohøj and Mæli, even though the two southern mound sites are reportedly much earlier. While Uppsala's three mounds are largely contemporaneous (Ljundkvist 2005) with Raknehaug, there are possible Bronze Age components at the site (Ljundkvist 2000:148), which could mean considerable antiquity to Uppsala's cross role.

This presence of both hierarchy and integration, with an ultimate deference to nature and the latter, is characteristic of Scandinavian culture. Whether in recent modern periods, especially in white collar work settings in Sweden (Doxtater 1994), or in the essentially medieval folk culture of the Norwegian farm (Doxtater 1981), Scandinavians exhibit an unusual means of effectively organizing necessary contributions of both "individual" and "group". As described in the two first chapters of Doxtater 1994, the ritual space in folk and undoubtedly prehistoric cross "systems" was Eliadian in essence, a means of making contact with spiritual power, while traditional farm villages in the southern parts of Scandinavia and "informal" Swedish offices from the 1970's to 90's at least were fueled by highly frequent and structured daily practices, ritualistic at their base, but not sacred. It is only in some office site layouts, as well as other contemporary cultural settings like libraries (the Black Diamond) and museums (Louisiana) or new opera houses (Oslo) that a dominant landscape component remerges.

As in the history of archaeology in the American Southwest, and elsewhere, the most evident remains of ancient cultures are architecture. Logically, much of this evidence is interpreted as the result of power, authority and hierarchy. In Scandinavia, great mounds are unquestionably the most expensive symbols of those societies, and tend to be seen more from an individual status perspective than as collective meaning (Goldhan 2005, 1999). Spatially, even though expanding the scale to include journeys of some distance by important people to participate in a chieftain's burial, Oestigaard & Goldhan's (2006) concept continues to regard the landscape of the great mound as far less symbolically constituted then territorial. Great chieftains control larger territories through political and military manipulation, and then erect great mounds to signify this power.

Conceptually, however, all graves or memorial mounds, and particularly the greatest of them, are not just signs of individual power, but also thresholds to the world of ancestors and other spiritual beings. The reason ships and carts were prominently buried in some of these great mounds was not only that it expressed wealth, but that there was another component involved, the deceased were *going somewhere*. In many other prehistoric landscapes, e.g. in the New World and even Minoan Crete, important gods are associated with most significant features of the landscape. In the old farm culture of middle-ages Norway one finds meanings of "vertical spiritually", things associated with the *axes mundi* or "above" isomorphic with the horizontal plane (Doxtater 1981). By translating the "above" to "north", these meanings became accessible for a variety of ritual processes, and particularly for an effective means of making contact with the spirits.

Even without considering the possibility of prehistoric mound location in sacred Scandinavian frameworks, one can see the recent archaeological reinterpretations of the overall funeral process in a more Norse socio-spatial context. If we look closer at the ritual sequence at Lusehøj near Voldtofte outlined by Svanberg (2005), one sees a strong symbolic statement about the relationship between hierarchies, whether of chiefs or ordinary "*husbonder*", and collectivities. He describes the funerary sequence as initially focusing on the cremation of the deceased and the "viewing" of the urn over a period of time in a specially constructed longhouse at the site of the future burial mound. If we recall in the Old Norwegian farm culture the opposition between (competitive) architectural dwelling and (cooperative) grave mound, and other natural sites for calendrical rites, then one has again the expressive core of the Scandinavian cultural equation. At the end of the viewing, visitation and alliance negotiating period, the remains are moved from the longhouse to the crypt at the core of the great mound. The dwelling, built at some expense, is torn down or perhaps ritually "consumed" in preparation for the construction of the mound. There is a transfer of the authoritarian (familial) symbol to its base position on the Eliadian *axis mundi* or world tree about to be raised. The crypt symbolizes the authority of dwelling and of warrior objects. What may have been symbolically important here is both the radical reduction in size of the "dwelling" and its new location at the base of the mound as tree, now the dominant collective symbol.

Goldhahn's excavation of a 20 meter "*storhog*" at Sagaholm, south of lake Vättern, Sweden (1999), describes a related tripartite horizontal structure of concentric rings interpreted as organizing a ritually used, liminal sequence. Initially the center circle was a small mound surrounded by two concentric rings of rocks towards the outside edge of the eventual mound. Passage through the two outer rings constituted, according to Goldhahn, a sequence of separation, liminal state, and contact with the other world in the center. Not unlike many traditional ritual settings, this horizontal sequence of actual ritual has its symbolic parallel in the progression of the spirit through the three layers of the mound on its vertical, central (Eliadian) *axis mundi*, not at all unlike that of the Norwegian *stue*.

The climax of the ritual occurs as the competitive or authoritarian element (dwelling) is covered up by its symbolic opposite, a large mountain of earth that may have required cooperative labor to construct. Grave or memorial mounds look like natural mountain features when they are finished, remaining so forever; symbolically they express natural landscape. If one adds the possible symbolism of mound positioning in a cross structure founded on major natural features, and if the mountains were still seen as the abodes of the gods, then mound ritual might well deliver a significant and socially effective balance to the authority at any scale, whether of chieftains or ordinary farmers. Large scale political alliances, and relative stability, could have been the incentives for such a georitual "system".

One of the most interesting aspects of recent discussion of funerary rites at mound sites is the emphasis on the participatory journeys of important people from afar. If large-scale cross structures were also involved in these and other rituals, it might also have been essential to take pilgrimages to distant sacred sites of the gods. We recall Bordieu's "union" rituals, as modified with the addition of "occupation" rites (Doxtater 1991). Funerary rites at mounds, perhaps not unlike winter solstice meanings where the gods displace humans in their dwellings in Norse folk traditions, may have been essentially "occupation" rituals where collectivities, and gods, come to make their final statement about the authority of the chieftain. Structurally, opposite rituals should occur where humans traveled to significant sacred natural sites and experience communitas with the gods, or "union". With this in mind, one can take a closer look at what went on at Bertnem, lying precisely on an axis from the triangle points of Gudfjelløya and an interim point of Heimdalshaugen, one of the most folkloric natural features in Norway and another major Sami sacred site. This 69.729 km line from Gudfjelløya and Heimdalshaugen misses the middle of the center mound at Bertnem by less than one meter; angular deviation is an overly accurate 0.0003°.

While this impressive Uppsala-like site of three 40-50 meter mounds is also from the Migration Iron Age period about 400-700 AD (Farbregd 1980:20), it shares several features in common with Lusehøy, well over a thousand years earlier. Together with the three mounds, archaeolgists found the remains of an unusually large longhouse 50 x 80 meters as part of the complex. Unlike the dwelling at Lusehøj, the Bertnem structure co-existed with the mounds. This and the lack of clear funerary evidence may suggest a structurally related, but opposite function of Bertnem, i.e. as a pilgrimage destination. The site is not simply the seat of a powerful "king" of Namdalen because the longhouse is built unlike any other in the Trondheim region. It has Danish or English components, as would be understandable if it was built as a threshold for pilgrims from great distances worshiping at a sacred Heimdalshaugen and Gudfjelloya.

Figure 18. World tree or Yggdrasil as motif in folk weaving from Norway (Norwegian Folkmuseum).

The alignment Bertnem – Heimdalshaugen – Gudfjelloya has not yet been integrated into any probability analysis pattern, though it does connect interestingly to the Julton cross structure via Gudfjelløya. Also largely circumstantial as yet are a number of other large scale geometric relationships--not reported in this article--between great mound sites, natural features, and each other. Much work remains to be done to ascertain their intentionality. What we do know, however, is that the three largest mound sites in Denmark, Norway and Sweden were positioned in relation to an Eliadian cross structure at the scale of the entire Scandinavian landscape, a world tree, or Yggdrasil perhaps.

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