The Spatial Order of the Scanian Runestones

Analysing Runestone Clustering and Pathways through GIS

BY GABRIEL B. N. NORBURG

Abstract

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This article presents and discusses the test results of GIS-based spatial quantitative analysis conducted on the Scanian runestones. The analysis was conducted as part of a Master's thesis at Lund University (Norburg 2013). The primary goal was to test one of the current theories on the motives behind regularities in the surrounding contexts of runestones, which suggests that runestones generally were raised along common frames of reference in the landscape, such as roads, rivers, grave fields and regional boundaries. In this article the results are re-examined and discussed further, with the purpose of highlighting the potential of using predictive modelling in Scandinavian archaeology. Spatial statistics and least-cost path analysis, used together, can be useful tools when discussing prehistoric infrastructure. The analysis is divided into two parts. The first tests whether the Scanian runestones were randomly clustered (through Ripley K & nearest neighbour analysis), the second whether they were situated on a path of high energy conservatism. The results show that the Scanian runestones were not only placed in an orderly fashion, but probably also placed along very few routes of low energy consumption. I argue that the Scanian runestones were most likely placed along one common frame of reference, probably the largest piece of infrastructure in the area. I also argue for a connection between the sudden and ordered appearance of the Scanian runestones and the higher echelons of the Danish province of Scania, which was newly formed at the time. By discussing statistical results from a historical context in this manner, I hope to highlight the very broad usefulness of quantitative and predictive methods when studying prehistoric Scandinavian landscapes.

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Introduction

Runestones have for a longer time been viewed as territorial markers. Extensive surveys have been performed, most of them concluding that the location of most runestones either relates to infrastructure directly or to larger structures such as churches and grave fields, which in turn are related to contemporary infrastructure and local boundaries (e.g. Sawyer 2000; Selinge 2010, 67). In the Mälar valley area they are often placed along natural transportation paths such as esker pathways, but even in terrain without an obvious topological symmetry between the stones, runestones have been portrayed as part of ancient pathways. In Jönköping County, for example, the County Museum has released a book, complete with maps for those who might wish to follow these ancient runestone paths by car (Agertz & Varenius 2002, 389 ff.). With this in mind it is safe to say that the theories surrounding runestones as boundary and infrastructural markers are the ruling ones, but have these theories really been properly put to the test? And furthermore are they applicable to flat areas like Scania where runestones are not situated on ridgeways? Are the runestone paths local or trans-provincial, perhaps even national? These were the questions that in 2013 caused me to choose runestones as the subject of my Master's thesis.

Larger surveys of the Scanian runestones have of course already been carried out, though none of them to my knowledge with a GIS-based methodology, at least none that has a primary focus on Scanian runestones. Birgit Sawyer has produced one of the cornerstones of the area, with her large survey of trends in both location and inscriptions in Scandinavia as a whole (Sawyer 2000). This survey also covers Scania, but though Sawyer's survey is an excellent anthropological study of the runestones, it does not really study the runestones as a part of the space that was the Viking Age and early medieval landscape. On a local level Svanberg and Söderberg published a minor geographical survey of the Scanian runestones in their book *Porten till Skåne: Löddeköpinge under järnålder och medeltid*, categorizing them by the theme of the inscription and their relation to previously known roads (Svanberg & Söderberg 2000). There is also a contextual survey of the Scanian runestones presented as a thesis by Caroline Hulting Lindgren (2003) and a GIS analysis of the roads around Uppåkra by Maria Åkesson (2012, 2013) that also marks out the runestones in the region. While the research that has been done covers both a local and a pan-regional level, what seems to be lacking are larger studies that not only define the relationships of the Scanian runestones to the local infrastructure but also in relation to larger bodies of infrastructure. The infrastructure may have connected the different locations, thus placing the runestones in a wider cultural network.

The goal of the study was thus to analyse whether the runestones appeared to be placed only according to local conditions or if they in fact may have been organized to fit into a larger network, in relation to a common frame of reference. A second goal was to simultaneously evaluate predictive modelling as a means to study such networks. The predictive tools chosen were two statistical tests, and one slope-based cost-path analysis. The statistical tests were run to determine whether the null hypothesis (i.e., that the runestones are randomly distributed) could be rejected for the Scanian runestones, or if they were organized on a local level only. For this ArcMap's Ripley K & nearest neighbour tests were employed. The purpose of the cost path analysis was to test whether the Scanian runestones seemed to align to a path of higher energy conservatism. This was to test whether the runestones may be ordered along a natural path of transportation, while simultaneously simulating hypothetical locations for the above-mentioned larger bodies of infrastructure (see Norburg 2013).

Theoretical background

In many respects the method is based on predictive modelling and digital archaeology. Predictive modelling in archaeology started during the Processual Archaeology of the 1950s, largely through the work of Gordon Willey (e.g. 1953). Today's digital predictive modelling, with its testable models, has been said to adhere to the principles of cognitive archaeology, that is to say, the idea that archaeological theories can be tested in a controlled environment; cost path analysis has even been called a cognitive method (Chapman 2009). But then again, Neo-Darwinian perspectives as a whole are becoming more and more popular in modern archaeology (e.g. Hodder 2012), so one could argue that it is becoming increasingly difficult to place testable digital models in an ideological pigeonhole. What can be said is that predictive modelling is increasingly being used in cultural heritage management, primarily in the United States, but since the 1990s it has also gained significant traction in the Netherlands after several studies highlighted the usefulness of predictive modelling (Kamermans 2000; Verhagen 2007b, 13 ff.). In countries where predictive modelling is used by officials and landowners in charge of heritage management (e.g. the Netherlands and the United States), archaeological predictive modelling is now a rather large research area with a wide and ongoing methodological and theoretical debate. Here we find large and complex models, many of them used to predict the location of settlements prior to large land development projects, obviously with a variety of success, reliability and academic approval (Verhagen 2007a).

The tests presented in this article were not inspired by these kinds of settlement tracking models, but rather by smaller models used to study past infrastructure, and guided mainly by academic motives. The testing presented in this article builds to a large extent upon least-cost path testing performed by Bell & Lock (2000) and Verhagen & Jeneson (2012). This is because the aim of this study is not to advocate large-scale predictive modelling in Scandinavian commercial archaeology, but rather to encourage Scandinavian archaeologists not to ignore the usefulness of certain tools within predictive modelling.

Method and material

The empirical material of this study was the Scanian runestones, while the rest of the material is either comparative or used to build the environment of the model. My runestone material was created by exporting all posts in Scania for runestones from *FMIS Fornsök* (to my knowledge no new posts for runestones have been added since I was allowed to access the shapefiles in 2012). After the shapefiles were exported, the antiquarian commentary for each post was read, and through this the posts were categorized in a table (Table I). The table is divided into four categories according to assumed relevance to the Viking Age landscape. *Out of Context* means runestone shapefiles that are irrelevant, either because the stone is not Viking age or because the stone in question has two posts, one for its previous location and one for its modern location. *Historical source* refers to posts for stones that are now missing. *Locally moved* is used for stones judged to have been moved within the original parish. *Original position* denotes runestones judged to be more or less in their original position. A visual representation of this categorization (excluding the FMIS runestone posts judged as irrelevant) can be seen in fig. 1. Besides the runestones, milestones were used as a comparative material. In the statistical testing they were used as a benchmark for the statistical level of organization among historic infrastructural road signs (for this Gotlandic runestones and milestones were also used). During the least-cost path analysis, they were instead used as a visual representation of what the Scanian road system looked like in the 17th and 18th centuries (Söderpalm 1967, 24 ff.).

For the cost path analysis, geographical data were of course also required. This geodata mainly consisted of LIDAR data and satellite images, both acquired from the National Land Survey of Sweden (Lantmäteriet) through the SLU:GET tool. The data is delivered in tiles of 2.5 × 2.5 km, the LIDAR tiles have an average point density of 1–2 points per square metre in open terrain and an average error of 40 centimetres in distance, 10 cm vertically. The orthographic satellite tiles have a resolution of 25 centimetres per pixel (see Norburg 2013, 21 ff., for more detailed information).

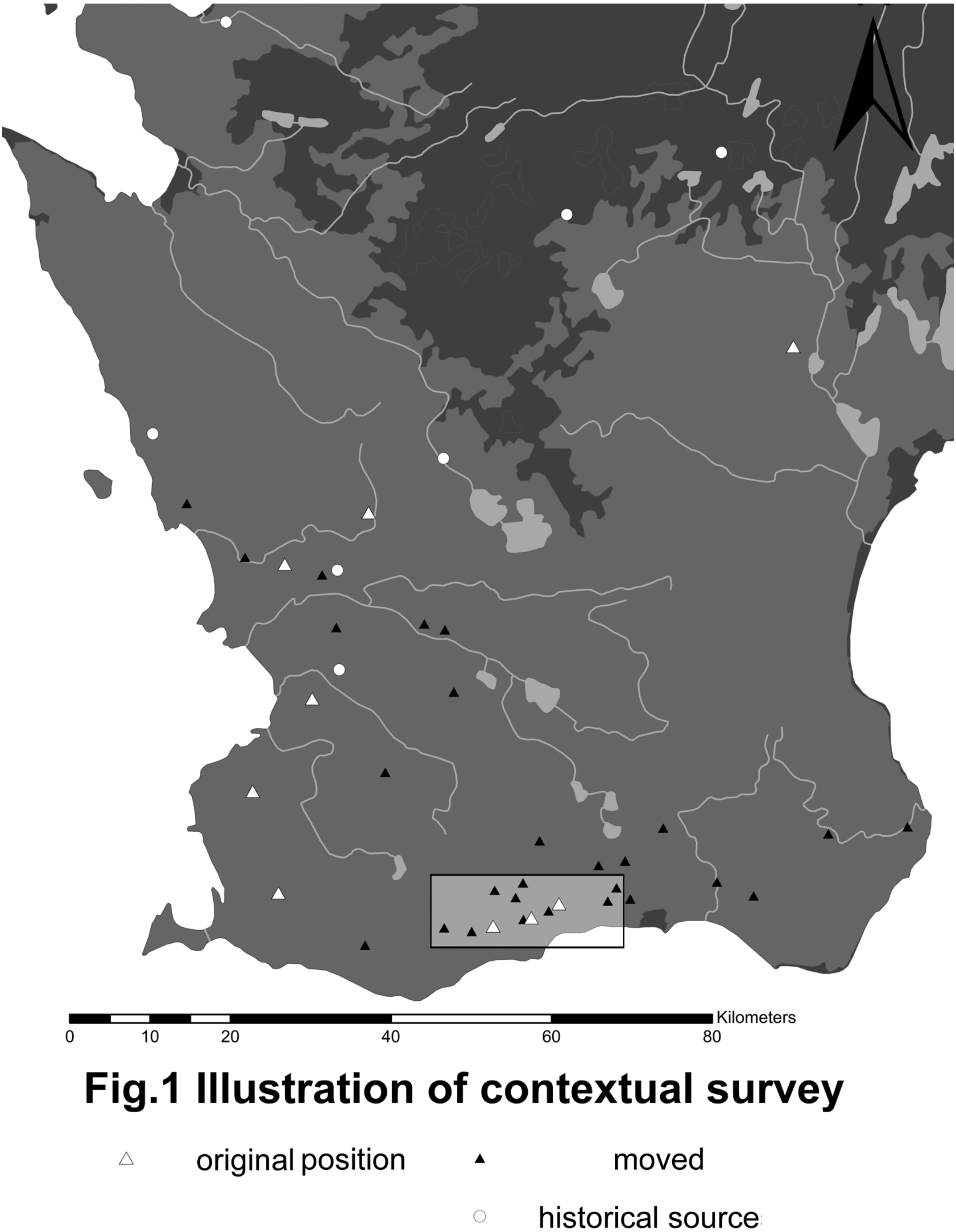

Fig. 1. Visual illustration of the contextual survey summarized in Table I. The category "out of context / post-Viking age, has been removed to better highlight the linear shape of the in context runestone cluster. The least cost path study area has been marked by a lighter color and a black square. @Lantmäteriet, Dnr: i2012/927.

Workflow

As previously mentioned, the study was divided into several parts. The order, input and output of those parts are visualized below in fig. 2. First, all the Scanian runestones were subjected to Ripley K and nearest neighbour analysis. The results were then compared to the results of the Scanian milestones and the Gotlandic runestones and milestones. After this the Scanian runestones were studied, categorized and then exported to their own shapefiles corresponding to the categories in table I. These shapefiles were then tested both individually and in multiple constellations, to be compared again to the benchmark results of the milestones and the Gotland runestones. With the results of the different constellations in mind, two areas were chosen as case studies for the least-cost path analysis, after which LIDAR data for the two areas were converted into digital elevation models in the form of slope raster files. The runestone shapefiles were then placed into the elevation models and the two outermost stones in each of the two areas were used as markers for the least-cost path. The generated paths were then compared to the results of the statistical testing, satellite photography, historical maps, the milestone roads, as well as previous knowledge about the area and their runestones. However, as the results of the second cost path analysis were all but clear-cut, and the complex paths would be hard to visualize here in black and white, the first path calculated on the southern coast will be focused on in this article. For the full results of the western case study see Norburg 2013.

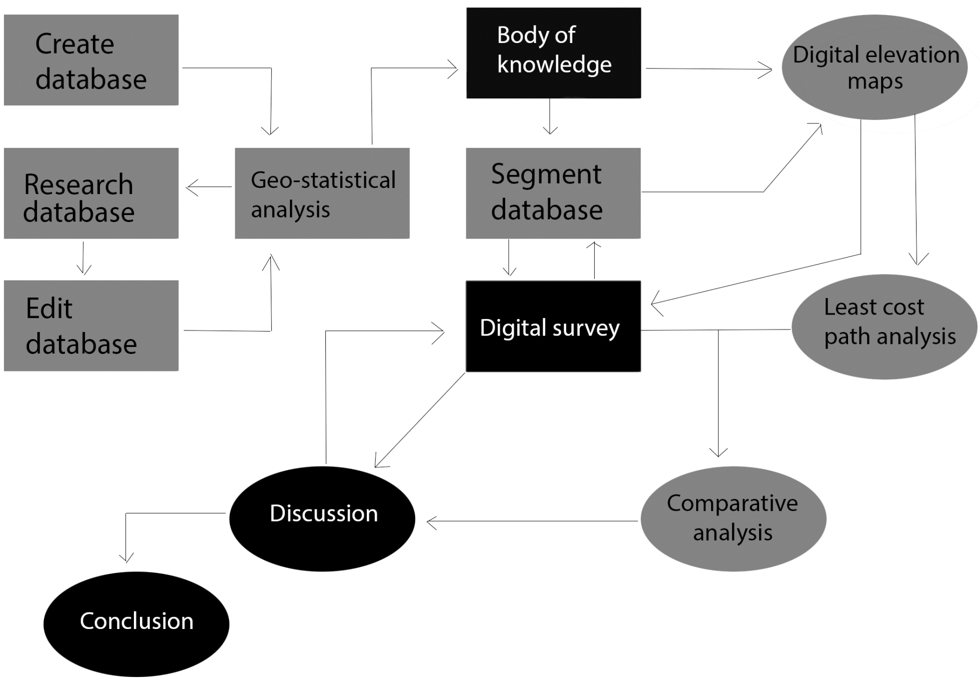

Fig. 2. The workflow of the method used in the study.

Subjecting runestones to the null hypothesis

Symmetry as an ideal seems to be deeply embedded in the brains of primates; symmetry affects how we perceive even the simplest of shapes. We look for symmetry and symmetry also changes how we interpret what we see (Beck *et al.* 2005). This can be said to make the human brain biased when looking for order in, for example, the cultural landscape. Aspects such as these have led archaeologists in search of testable interpretations to look to predictive modelling and spatial statistics; this has above all been true for processual archaeology and cognitive archaeology (Chapman 2009). Another way to look at it is that these tests are employed to show that the patterns and systems we believe we have perceived are not the result of random actions.

For this study two rather common tests were employed, Multi-Distance Spatial Cluster Analysis (Ripley's K) test, and the average nearest neighbour test. In essence they both test the same thing: clustering, dispersion and randomization; they just do it through different means. Worth mentioning is that the tests were run in ArcMap 10.0, which had a few minor bugs when visualizing the results; especially the visualization of the confidence envelope of the Ripley's K's graphs had a mind of its own (see Norburg 2013, 27). However, as the test results of the milestones were used as a benchmark, and it is safe to say that the milestones reject the null hypothesis (with all of them originally having had the same distance to their nearest neighbour), this bug was not an important factor.

Average nearest neighbour

The result of the average nearest pattern is summarized below (Table II); more detailed numbers, visual graphs and a more in-depth explanation of each test can be found in my thesis (Norburg 2013). Among the tests presented in this article, the null hypothesis was rejected in all tests but one, the one with the ten runestones still standing in their original context. This was hardly surprising seeing as these represent only 18.8% of Scania's runestones; with such a small test sample spread out over such a large area it was never likely that the null hypothesis would be rejected. Potentially more unexpected was that the combination of these ten stones and the 33 stones judged to have been moved locally tested as least random (within the Scanian runestone material). Most of these stones have been moved to medieval structures, in many cases Romanesque churches. This shows that my initial assessment of them as not having been moved very far (based on the medieval structures being close to late Iron Age sites), could hold some truth. It also shows that these sites probably have a spatially common denominator, potentially a larger network of infrastructure. Also worth mentioning is that, when paired with the runestone locations based on historical sources, the stones judged to be in their original position fared even worse (Norburg 2013, 39). This suggests that some of these so-called "missing" runestones have either never existed or simply did not stand where they are believed to have stood.

One interesting factor is that the two most similar Z-factors belong to Gotland's milestones and the Scanian runestones judged to be in the same general area where they were originally raised (not counting the results that include irrelevant FMIS posts for Scanian runestones). A mere 1.862 sets their Z-scores apart (Table II). As the milestones are a thoroughly well documented body of material from a historical period, we know that the Gotlandic milestone material represents a very even network of raised stones along the mostly coastal road system. The similar Z-score suggests that the same could potentially be true for the Scanian runestones. The most runestone-dense

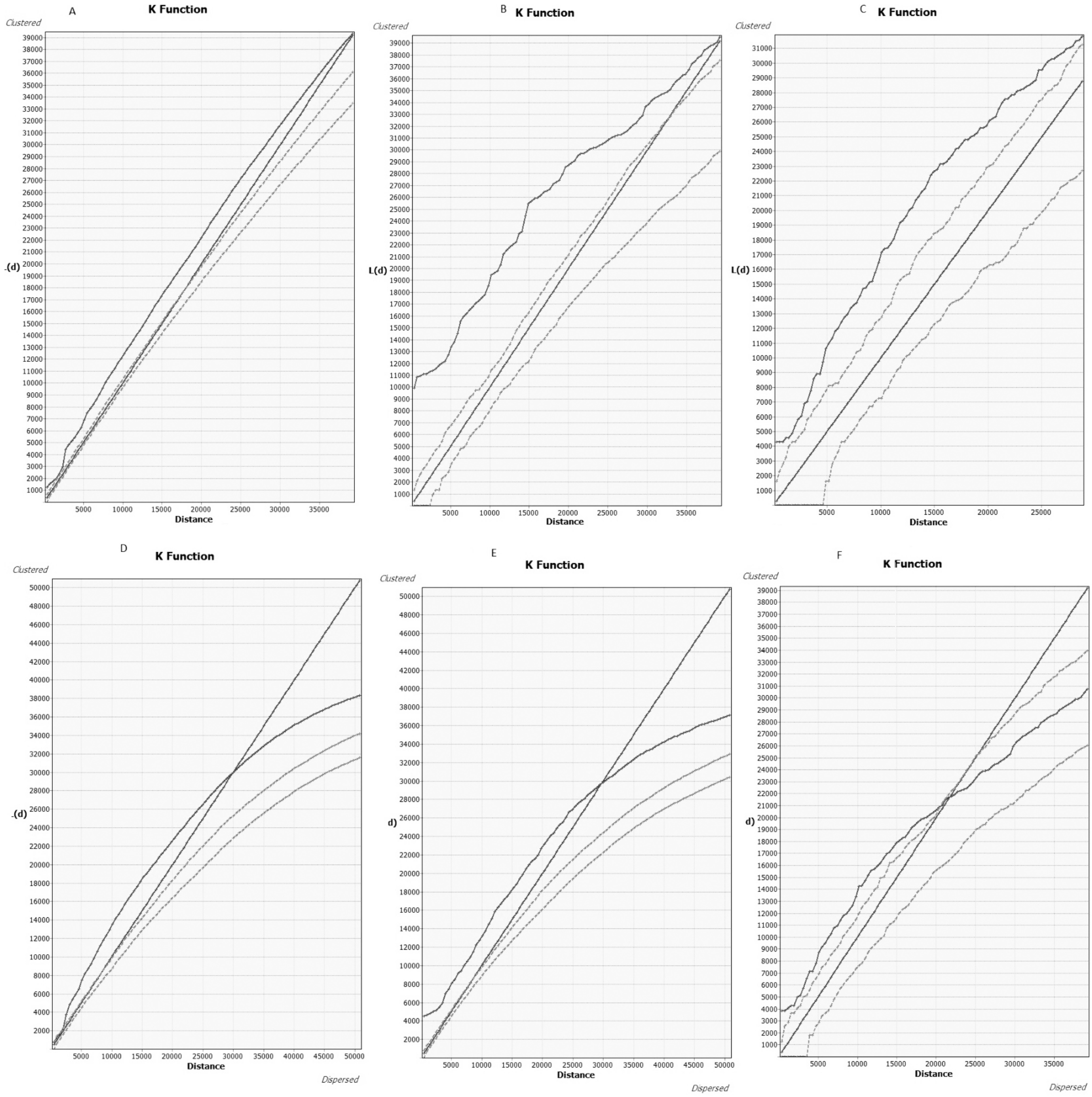

Fig. 3. The straight lines spanning from the bottom left corners to the top right corners signify the expected test results had the testing groups not rejected the null hypothesis. The curved, uneven lines show the actual test results and the dotted lines signify the confidence envelope.
A) Scanian milestones. B) Entire Scanian runestone database.
C) Edited Scanian runestone database. D) Gotland milestones.
E) Entire Gotland runestone database. F) Scanian runestones in original and semi-original context.

areas of Scania are the west and south coast, areas bordering on Danish territory via the Öresund Strait and the Baltic Sea. It is not entirely unlikely that the Z-score of –5.801 indicates a long cross-regional road that binds together a coastal area that was at the very least culturally part of the Danish kingdom.

Multi-Distance Spatial Cluster Analysis (Ripley's K Function)

The Ripley's K analysis, although comparing the material over a larger variety of distances, in the end gave the same indications as the Average Nearest Neighbour tests results. They will thus not be discussed in detail here as a more thorough interpretation of these results is available in Norburg 2013, 40 ff. Worth mentioning is that the Gotlandic runestones and milestones tested virtually identical to each other when put through the Ripley's test, which speaks to the age of Gotland's network of roads (Norburg 2013, 30 ff.). Also important is that the Scanian runestones in original and semi-original contexts again tested very similar to the Gotlandic material, giving greater credence to the results of the Average Nearest Neighbour analysis. A comparison of the results is shown in fig. 3.

Runestone locations were not randomly chosen

Even though some constellations of Scanian runestones fared better than others, all constellations representing a healthy percentage of the total number tested as significantly clustered. Oddly enough, even the constellations that included irrelevant posts for runestones tested fairly well. One could interpret this as a result of these irrelevant carvings by chance being situated on sites that were important in the Viking Age and part of the same infrastructure. Or perhaps the irrelevant carvings that are part of churches (for example rune carvings on grave slabs) are simply so evenly distributed that they compensate for the carvings that do not relate to a Viking Age space in any shape or form. Since removing the irrelevant FMIS posts for runestones resulted in a lower Z-score, the latter is perhaps the most probable explanation.

To my mind the test results show that when a new runestone was raised in Scania, the people behind it were not only aware of the runestones already standing in its proximity, but they also probably raised their stone with a similar goal in mind, with the same frame of reference. This explanation reminded me of verse 1:72 from *Hávamál*: "A son is better, though late he be born, and his father to death have fared; Memory-stones seldom stand by the road, save when kinsman honors his kin" (Bellows 2007). It might be tempting to stop here and claim that the organized, linear pattern of the Scanian runestones, along with sources and previous studies, on their own suggest that the runestones were monuments primarily raised in close proximity to cross-provincial roads. But why stop there when there are other methods in predictive modelling that can actually suggest what kind of linear structure it was that the Scanian runestones had in common? This brings us to the second analytical component of this study's workflow, the least-cost path analysis.

Connecting the runestones

Cost path analysis is the joint name for a variety of different GIS-based algorithms, capable of using digital elevation data to calculate the most energy-conservative path between selected coordinates with the said elevation data. Cost path analysis is not difficult to perform; the easiest way is to pipeline the process through an analysis toolbox matrix. Once one has a good toolbox matrix, all one really has to do is decide which files to use as input, and (if one wants a more specialized path) to adjust the cost of the slope. One starts with a DEM (digital elevation model) in raster format (in this case built from LIDAR data), and the matrix then uses the Slope tool to create a DEM that shows the steepness of the terrain rather than high areas versus low areas. This new slope DEM is then fed through a series of tools that weigh the cost of traversing slopes of different steepness (in-between the selected targets) against the cost of bypassing them. All this can be seen in the matrix I used for this study.

Why calculate a least-cost path? As already discussed, the statistical testing strongly indicated that the runestones were organized in a linear fashion in a similar way to milestones, suggesting that the runestones probably were roadside structures. If this hypothetical road along which the runestones may have been erected was a natural path (a path that has been organically reshaped over centuries to reach its most energy-efficient form), then most of the runestones that stand in their original context could be expected to stand very close to a cost path generated through their area. In other words, cost path analysis can in some cases show whether statistically significant, linear clustering is due to nearby infrastructure (or not). The fact that the software generates a visual path capable of potentially being used in remote sensing is merely a bonus in this study.

It is of course important to keep a critical mindset when dealing with computing, quantitative and algorithm-based testing in archaeology. It may be tempting to view the generated path as a representation of a past landscape, but in truth it is simply a visualization of the data that were used as input for the test. It is also important to know that the programming that makes up the "brain" of cost path analysis often fails to reason as a human would, and this is obviously a large disadvantage. An example of this can be seen in Bell and Lock's study from 2000, where their cost path would cross very steep and dangerous terrain to get to a flatter area, instead of following the ridgeway that is less flat but on the other hand does not have any dangerous slopes and gives its traveller a wider viewshed. Only after making alterations to the way the test evaluated slopes was a path that seemed logical to a human mind generated (Bell & Lock 2000). There is also the problem that a model, no matter how complex, will not recreate past landscapes but rather "create" them (Kamermans 2000, 124), at least on a virtual plane. The model's accuracy is entirely based on the representativity (or even reliability) of the data used, be it archaeological, topographical or environmental, as well as how we archaeologists evaluate the data culturally. There are limitations to how such data can be gathered and quantified (Kamermans 2000, 124 f.). Sometimes such factors are obvious, such as when one's topographical model contains areas that have gone through large-scale development or landscaping, or when the researcher simply did not have access to the right environmental data (e.g. Norburg 2013, 52 ff.). As landscapes are in constant change, however, no model will ever be likely to be a perfect representation of a past landscape, be it a physical landscape or a cultural landscape.

So again, why should archaeologists be calculating least-cost paths? Because even though it is not 100% reliable, predictive modelling still allows archaeologists to make a slightly less biased argument for what is a "logical" site location and what is not. In the case of cost path analysis it allows one to make a slightly less biased argument concerning the energy efficiency of a path, and in my opinion every time we have the opportunity to make a slightly less biased argument, we should take that opportunity.

A path through Scania's most runestone-dense area

One of the cost paths was generated with the Källstorp and Bjäresjö runestones as targets (for a map of the area see fig. 5). This area was chosen because not only does the Scanian south coast have the most runestones (within Scania), but this particular part of the coast also hosts three runestones believed to stand more or less in their original context. The path was calculated five times. The first two times the path ended up in the ocean, most likely because software failed to recognize the area's at times very shallow waters as part of the seabed. Not having access to land-use raster filters, the weighted overlays were adjusted twice (to make slopes in very low areas unattractive) before a path that went on dry land was achieved (see Norburg 2013). This is not an entirely uncommon problem when using cost path analysis without biome data; in these cases the algorithm will not always make choices that seem logical to a human mind (Bell & Lock 2000). However, as environmental studies have suggested that the area was considerably more waterlogged at the time (Berglund 1991, 82 ff.), my weight manual adjustments probably do not differ too much from the weight values that would have been achieved through a land-use raster overlay.

The result was a path that for the first half of its duration passed very close to the road occupied by the milestones and to several runestones, but only to swerve off south after the Östra Vemmenhög runestone, until it reached the coast. This would be a bit odd as both the elevation model (Norburg 2013, 55) and environmental surveys (Berglund 1991) suggested that it would have to pass through marshy areas to get there. Because of this the path was calculated again, this time with the more eastern runestones in Bjäresjö as the path's destination. The result was more or less identical, perhaps indicating that path 1 on fig. 4 represents the most energy-conservative path through the area (at least when calculating by topography alone). However, if the area was indeed waterlogged, such a path could only have been used during the winter when the fens and marshes had frozen. Finding it hard to believe that the runestones would only have been visible to passers-by during winter, I then came up with the hypothesis of a dominant agent in the area, perhaps a magnate farm or large settlement that could potentially have affected the infrastructure around it. A similar phenomenon can be seen in the city of Lund which, even though it lies on a rather steep hill, definitely had a large road running through it in the late Viking Age (Norburg 2013, 62 f.). A fifth and final path was thus calculated (Fig. 4, path 2).

The fifth path (grey path on fig. 5) was calculated with the prerequisite that the path had to pass by the Sjörup runestone. Sjörup was chosen because it was a locally moved stone right between two stones still standing in their original contexts. Rather remarkably, this results in the path overlapping five out of the seven runestones in the area and very close to the remaining two (locally moved) runestones. As this path runs through much drier vegetation, and bears more likeness to the 18th-century road, this path is more likely to represent a cross-provincial road. The fact that this path overlaps all three stones that stand in the same place as they did in the Viking Age makes it entirely possible that what has actually been predicted is the location of a Viking Age road.

Conclusions – interpreting a pattern

I never expected the runestones to be so excellent markers for predictive modelling. But the fact that all three tests in the end suggested the same thing makes it hard to argue otherwise. Both the spatial clustering tests showed that the Scanian runestones were organized in a linear fashion, in a manner that is very unlikely to have been created through chance alone. In a similar way, it is hard to argue that the runestones standing in their original

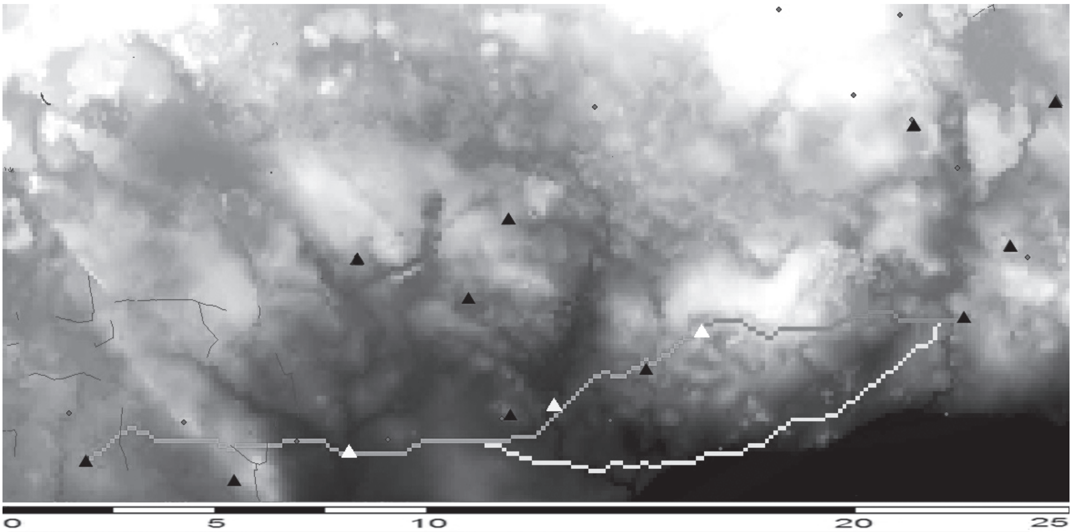

Fig. 4. The 4th and 5th calculated cost paths projected against elevadation data from LIDAR (see fig. 5 for map location). Lower white line: path 1; upper grey line: path 2. White triangles signify runestones believed to be in their original position and black triangles signify runestones believed to have been moved within the local area. The small dots signify milestones. Lantmäteriet, Dnr: i2012/927.

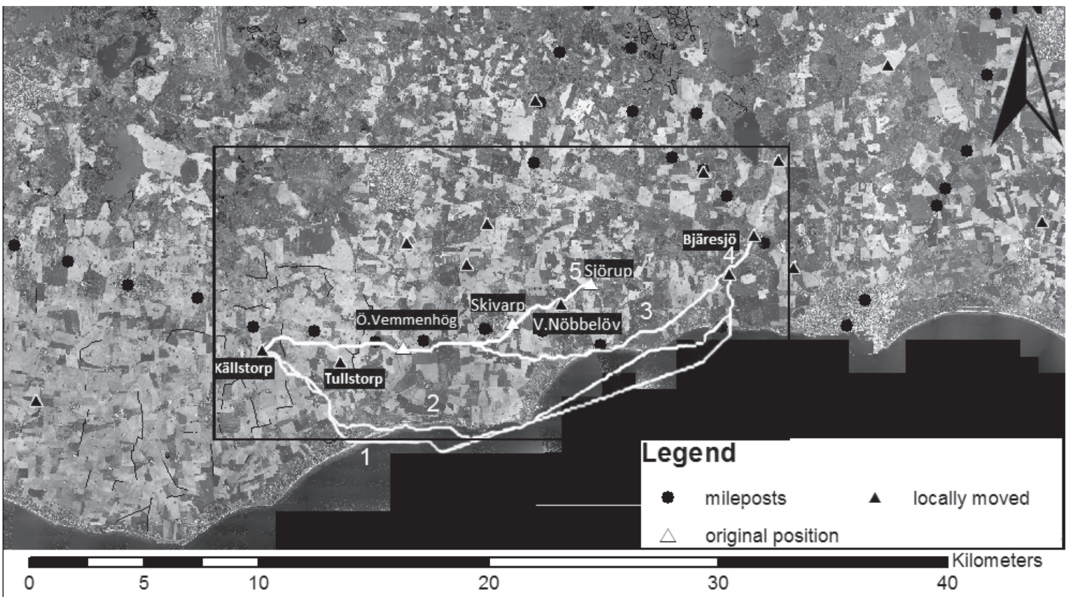

Fig. 5. Map of the study area and its runestones. The map also shows the failed attempts at calculating a path, where the paths ended up in the Baltic Sea. 1: The path fell into the shallow waters outside the coastline. 2: Weight was adjusted for lowest 10% of slopes and the path fell on the modern shoreline. 3 & 4: Weight adjustment was expanded to lowest 20%, which resulted in a path very similar to the 17th century cross provincial road. 5: Path destination marker was changed to Sjörup; path now encompasses all runestones judged to be in their original position. The box marks the areas shown in fig. 4. @ Lantmäteriet, Dnr: i2012/927

context all have ended up on the second most energy-efficient path in the area by chance. Together these two methods of predictive modelling strongly suggest that many of the Scanian runestones indeed were roadside monuments. At the same time, the results raise new questions.

North of the calculated path (Fig. 4) one can see a parallel line of runestones stretching in the same direction. While several of the runestones on the path have been suggested to have been connected with vassalage in the Danish kingdom, the stones in the north have instead been tied to local clans staking their claim to the land. This is because the inscriptions on these stones have fewer titles and focus more on inheritance of land (Randsborg, 1980, 31 ff.; Anglert 1995). Interpreting the cost path in relation to these theories paints a new image of the Scanian south coast *c*. AD 1000. The fact that the vassal stones and the family stones seem to be placed along separate yet parallel pieces of infrastructure is an interesting thought; two separate networks of elite landowners, the younger one bowing to the royal might of the newly founded Danish towns such as Lund, wanting to prosper from being connected to them; and also an older one, connected by separate elements of infrastructure, occupied with spreading the message that they above all had a legitimate claim to the land.

Another new question raised is whether there is a settlement of significant size in the area of Sjörup; the fact that the runestone path bends to cross the hill at Sjörup (Fig. 5) may suggest the site held a special meaning to the Viking Age Scanians. The "Sjörup find" (Swedish History Museum 2663), has already established Sjörup as an important place in the Migration Period, and the results of the cost path analysis suggest that it continued to

Average nearest neighbour results	**Z-score**	**P-value**	**Meaning**
Gotlandic runestones and picture stones	–21.946	0	Significantly clustered pattern
Gotlandic milestones	–7.538	0	Significantly clustered pattern
Scanian milestones	–12.608	0	Significantly clustered pattern
Scanian runestones	–5.676	0	Significantly clustered pattern
Scanian runestones: excluding out-of-context stones	–3.045	0.002	Significantly clustered pattern
Scanian runestones: original position & locally moved	–5.801	0	Significantly clustered pattern
Scanian runestones: original position	–1.555	0.119	Random pattern

Table II. This table summarizes the results of all the average nearest neighbour tests carried out in ArcGIS for this study. The column to the left shows the constellations of runestones that were tested, the two columns in the middle show the resulting Z-score and P-value for each constellation and the column to the right shows the interpretation of each Z-score and P-value.

be an important site well into the Viking Age. Along those lines, the test results could also be used to discussed to theory that Toke on the Sjörup stone was the same man as the Drott Toke Gormsson on the Hällestad runestones (Randsborg 1980, 40 ff.; Lihammer 2003, 103; Norburg 2013, 55 ff.)

These are just a few of many ways a cost path graph can be compared to theoretical and source-based studies of the same material or the same area (a more elaborate discussion can again be found in Norburg 2013). The main point I want to make is that predictive modelling is only half as interesting when left on its own. Statistics and graphs, no matter how elaborate, tell us nothing if they are not placed in the correct context. The results of a predictive model always need to be placed in the milieu of the more traditional research that came before it. Only then can we approach an understanding of what the figures tell us.

This project was my first attempt at predictive modelling on a large scale, and still to this day the results amaze me. It has inspired me and left me convinced that predictive modelling has a lot to contribute to archaeology. The spatial statistics showed that almost any imaginable combination of Scanian runestones will test as organized in a statistically significant manner, and comparing those figures to the test results of milestones also made it possible to say that the runestones tested in a manner that one can expect of a thoroughly organized system of roadside monuments. At the same time, the cost path analysis showed that this organized linear cluster relates to corridors within the landscape that are more easily traversed than others. In my opinion, results like these indicate that predictive modelling should be used more than it already is. If used with land-use rasters it could perhaps even be used as a method of remote sensing along with LIDAR surveys, satellite data and geophysics.

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Out of context / post-Viking Age	
Valleberga 26:2	written source, existence doubtful
Fjelie 43:1	oral source, existence doubtful
Hästveda 24:1	post-Viking Age
Stora Herrestad 4:2	post-Viking Age
Lund 11:6	out of context
Lund 9:4	out of context
Lund 9:5	out of context
Helsingborg 50:1	post-Viking Age
Farstorp 142:1	post-Viking Age
Lund 11:3	out of context
Örtofta 40:1	post-Viking Age
Stora Herrestad 4:1	post-Viking Age
Lund 9:6	out of context
Sjörup 3:2	out of context
Lilla Harrie 25:2	out of context
Lund 9:2	out of context
Lund 11:4	out of context
Västra Sallerup 45:1	post-Viking Age
Allerum 119:1	post-Viking Age
Stävie 15:1	post-Viking Age
Simris 76	out of context
Södervidinge 41:1	post-Viking Age
Lyngsjö 95:1	historical source, existence likely, though post-Viking Age origin
Lund 11:7	out of context
Kristianstad 203:1	post-Viking Age
Hardeberga 32:1	post-Viking Age
Lund 9:3	out of context
Lund 11:1	out of context
Kverrestad 4:1	post-Viking Age
Lund 86:3	out of context
Höör 160:1	post-Viking Age
Lund 11:2	out of context
Sankt Olof 69:1	post-Viking Age
Välluv 32:1	post-Viking Age
Konga 24:1	post-Viking Age
Simris 75	out of context
Lund 9:1	out of context
Lund 11:5	out of context

Historical source	
Lund 43:2	historical source 18th century, stone now in Denmark
Stehag 2:1	historical sources 19th century, existence plausible
Östra Karup 147:1	oral sources, existence likely
Hörja 135:1	oral sources, existence likely
Hästveda 99:1	historical sources, existence likely
Glumslöv 36:1	historical source 18th century, existence plausible
Lilla Harrie 25:1	drawings and surveys from the 18th century and 19th century, existence very likely
Locally Moved	
Glemminge 2:1	moved, probably approx. 200 m
Simris 1:2	moved
Holmby 1:1	moved, probably approx. 1 km
Baldringe 2:1	moved
Skivarp 123:1	moved
Simris 1:1	moved
Hassle-Bösarp 13:1	moved, probably approx. 500 m
Västra Karaby 10:1	moved
Vallkärra 6:1	moved
Örja 3:1	moved
Stora Köpinge 22:1	moved, line of mounds 1 km away
Bösarp 40:2	moved
Bjäresjö 4:1	moved, from one of the local mounds between 500 m and 1.6 km away
Hyby 8:1	moved
Östra Herrestad 5:1	moved, approx. 500 m to closest Iron Age site
Hällestad 2:3	moved, according to runes placed by the hill (500 m)
Tullstorp 1:1	moved, rich prehistoric landscape, mounds approx. 500 m in any direction
Bjäresjö 72:1	moved, line of mounds and milestones approx. 400 m away
Sövestad 2:1	moved, from local grove
Skårby 4:1	moved, milestone 130 m, mound 350 m
Hällestad 2:1	moved – originally placed by the "brother stone, by the mound/hill" approx. 800 m
Hällestad 2:2	moved, likely to be the so called " brother stone"
Bjäresjö 21:1	moved, found in unknown nearby field; closest known Iron Age local approx. 400 m
Västra Nöbbelöv 2:1	moved, line of mounds, medieval keep 250 m
Solberga 2:1	moved, line of mounds 500 m, castle ruin
Örsjö 6:1	moved, from farm with mound 19th century
Villie 4:1	moved, probably approx. 2 km
Källstorp 2:1	moved – runes mention bridge and memorial, river + mounds approx. 1 km
Fuglie 1:1	moved, correspondingly named mound 200 m away
Sövestad 2:2	moved from farm approx. 500 m
Holmby 10:1	moved, according to tradition 4 km
Stora Harrie 2:1	moved, line of mounds 900 m

Lund 44:1	moved, found in the ruins of the Allhelgona monastery in northern Lund
Original Position	
Dagstorp 9:1	original position
Färlöv 166	original position
Uppåkra 2:1	semi-original position
Fuglie 2:2	original position
Skivarp 25:1	original position
Östra Vemmenhög 3:1	original position
Västra Strö 2:4	original position
Fosie 3:1	semi-original position
Västra Strö 2:3	original position
Sjörup 52	semi-original position

Table I. All items for Scanian rune carvings available in the FMIS database in 2013, divided into four categories based on their dating and current location. To the left is the official FMIS number of each rune carving in bold letters and to the right a short comment on why the carving was placed in the respective category.