Developments towards a quantitative phenomenology

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Abstract

This compendium presents the procedure and conceptual underpinnings associated with the developed method of spatial point analysis, coined quantitative phenomenology, of delimited areas around 30 settlement sites dating to the Late Neolithic and the Bronze Age (2350-500 BCE) in southeast Norway. For the theoretical underpinnings, presentation and discussion of the results see (reference removed). The main findings of the analysis demonstrates that method is suited to address conditions that made LN/BA people settle down, and through it get a more nuanced understanding of the environments in which past people lived their life's and how such land-use patterns changed over time. The compendium also contains some elaborations on data selections, including sources and accessibility of the analysed variables, but also highlights some potential improvement of the method and associated approaches.
Keywords: quantitative phenomenology, GIS, spatial point pattern, correspondence analysis

Contents

1 Introduction

This compendium presents the procedure and conceptual underpinnings behind the method coined as quantitative phenomenology using geographical information systems (GIS). The method was developed to assess the relations between settlement sites and mapped variables (source data) through spatial point analysis within delimited point grids. The methodological approach draws on spatial point process analysis, which at a basic level is descriptions of the arrangement of randomly distributed point coordinates in space (Illian et al. 2008). Within geographically limited study areas, or windows of existence, this compendium follows a peer reviewed paper by the author (reference removed) which explores the correlations between longhouse settlement site locations from southeast Norway dating to the Late Neolithic (c. 2350-1700 BCE) and Bronze Age (1700-500 BCE) and selected 12 variables, of both natural and cultural character. The aim of the main paper was to provide a better understanding of how people weighted up various landscape factors when deciding where to settle down in prehistory, and help approach how site locations, here focusing on settlements, can improve our understating of past human-environmental engagements through applying the concept of affordance (Gibson 1979).

In the following compendium, I include some information on the main treatment and robustness of the data through the method of correspondence analysis. The focus is, however, on the developed method of quantitative phenomenology, as for others to adopt and adapt if wanted, including an elaborations on the data selection and choices made during the development of the method.

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2 Data selection

2.1 Settlement sites

The 30 selected settlement sites (see main paper for details, Table 1 holds information on names) are part of a larger dataset currently under development, consisting of 145 buildings from 55 sites, collected from reviewing excavation reports from the Museum of Cultural History (MCH). The sites were selected based on spatial and temporal representativeness within southeast Norway and the Late Neolithic and Bronze Age, but has also been evaluated within an established scaling system:
1) Houses with definable ground plan can be either a) complete, meaning that both roof-supporting and wall posts are preserved, preferably also gable walls; or b) incomplete, meaning that certain elements are lacking, but without it compromising how definable the buildings are.
2) Houses with partly definable ground plan can consist of either a) secure structural elements, such as a line of roof-supporting posts, preferably in combination with partial structural elements, such as an entrance or a partial wall, the building measurements are incomplete, but type and/or form are likely; or b) partial structural elements, such as a gable wall in combination with one roof-supporting post, the building measurements, type and/or form are tentative.
3) Houses with undefinable ground plan can consists of either a) clusters of post holes that cannot be put into any order; b) too few post holes to decide an order.

Although the best suitable sites were chosen according to the scales, a site scaled low can be chosen ahead of one that is scaled higher, if that site is situated in an area with few or no other houses or is dated to a period with few or no other houses.

2.2 Analysed area

To be able to create an as detailed picture as possible, but keep within the scope of the study, I decided to set the geographical area to 5 km from all sides of the site. Subsequently creating a zone with a diameter of 10 km. Research historically, there are several different sizes used when exploring 'catchment areas' or 'exploitation territories' surrounding settlement sites. A distance of 5-10 km results in a 1-2 hour walking distance from the site (Vita-Finiz and Higgs 1970; Higgs and Vita-Finiz 1972; Vita-Finzi 1978), and is argued to be most suitable when studying the LN and BA in southeast Norway (Østmo 1988, pp. 133-134). The buffer zone can, however, be scaled up and down, all depending on the wanted or required mesh of other studies.

2.3 Variables

In addition to reviewing literature and excavation reports (duo.uio.no, community 'Museene' and then 'Kulturhistorisk museum'), data on cultural variables have been retrieved from the Norwegian museum's database Unimus/Musit (partly accessible from unimus.no) and The Directorate for Cultural Heritage's database Askeladden (askeladden.ra.no). These are archaeological databases which are semi-open, belonging to Norwegian cultural resource management (CRM), but were you can ask for permission/insight. Much of the same information, although lacking details on casework and/or dealings with cases, finds, excavations, also exist in version open to the public. To search for contexts, such as grave mounds ('gravhauger') or rock art ('helleristninger') The Directorate for Cultural Heritage have made the site kulturminnesok.no.

Many of the artefacts in Unimus have sources dating back to the 19th and early to mid-20th century, resulting in several artefacts having arbitrary or imprecise locations. Only artefacts that could be securely attributed to a named farmstead and fairly precise location within it were included in the analysis. Available data on grave contexts from Askeladden are often roughly placed within wide raging timeframes. Very few are professionally excavated or surveyed, and I want to stress the insecurity of this data. Those placed within 'Bronze Age-Iron Age' have been omitted unless additional information can support a more precise date (e.g., typological finds or surveys).

The source data for the natural variables are freely available mapped datasets retrieved from the Norwegian Mapping Authority, with source data belonging to different research institutes in Norway. The Norwegian Water Resources and Energy Directorate (NVE) were used for freshwater resources such as rivers and lakes (see also atlas.nve.no). The Norwegian Institute of Bioeconomy Research (NIBIO) for forest (i.e., soils based on forest yielding capacity) and wetlands (see also kilden.nibio.no for easy access to these variables with further detailed information). The variable dry grazing landscape had combined sources, including NIBIO's grazing map ('beitelagskart') and cultural landscapes from The

Norwegian Environment Agency (MD) filtered to corresponding type. The Geological Survey of Norway (NGU) was used for the remaining variables, with so-called loose soil map ('løsmassekart') as the main source; filtered to corresponding type (see also geo.ngu.no) and sub-filtered when suited. For instance, soils suited for agriculture comes in three classed ranging from well-suited to unsuited, here the latter class was necessarily excluded from the analysis. The variable sea has no source data, here I set digital elevation models (DEM) according to the corresponding shoreline displacement (Prøsch-Danielsen 1997; Sørensen 2002; Romundset et al. 2014; Sørensen et al. 2014).

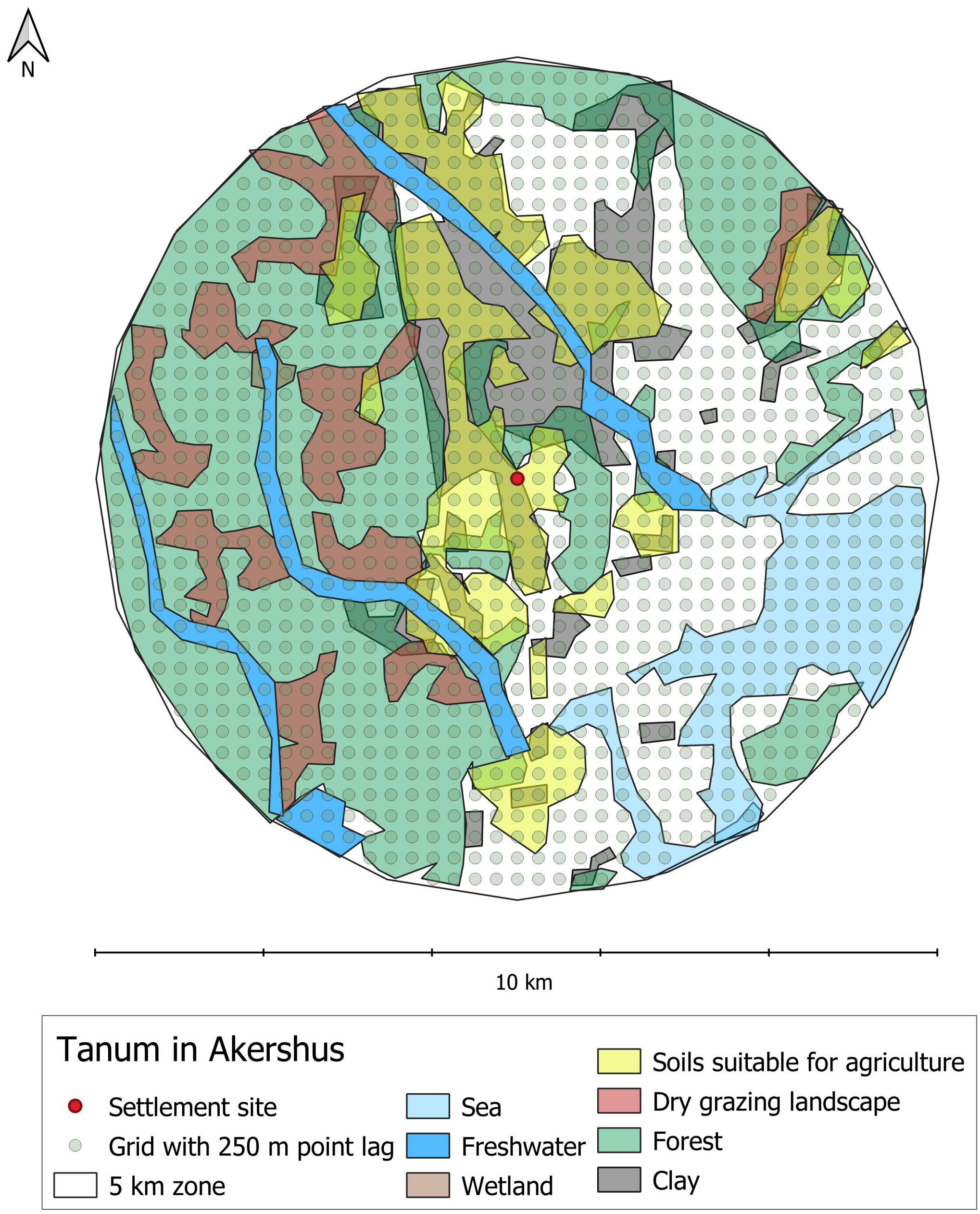

Figure 1: Example of anlysis process. The polygon layers are drawn according to the corresponding (input) source layers, making the clipping of the grid after overlapping polygon possible. The present variables are then saved as points and exported as an table. The figure also shows that variables can overlap, meaning that one point can read data from several variables(map by author).

3 Methodology

To acquire information on the variables from the source data, a point grid was created inside the 5 km areas surrounding the settlement site, with the point lag set to 250-meter. The zone and the point lags can be scaled up and down, all depending on the wanted or required mesh of other studies. The 5 km zone and the lag resulted here in a mesh of 1201 unique points within each grid. Since there are 12 variables, there could be as many as 14 412 data observations within each single site. The number of points within each site depends solely on the presence or absence of variables, some are frequently counted – such as the variable forest – while others are not present within the grid at all or generally more scarcely encountered, such as the four cultural variables. This results in individual point counts and variables assemblages for the sites.

To get the point grid to read the information from the source data, polygon layers of the source data had to be created (Figure 1). The grid was then clipped according to each of the variable layers, resulting in an individual attribute table of the referenced points that overlaps with the variable input data. When this process is completed for all variables within one site, the 12 tables were exported from QGIS and unified using Access. The same process was then preformed on all 30 sites, and then the 30 individual tables were combined to one underlying dataset of 48,130 individual observations for further analysis and visualization. These observations are summaries in the below contingency table (Table 1).

	Variables												
Site	1	2	3	4	5	6	7	8	9	10	11	12	Sum
Arctander	231	64	14	448	26	0	85	312	11	54	3	19	1267
Romsletta	74	96	18	960	29	0	112	6	2	0	2	1	1300
Homme	207	131	4	856	3	0	13	142	7	1	5	1	1226
Klepland	172	135	5	817	106	0	0	142	7	1	5	1	1391
Moi	0	128	22	905	124	0	0	0	0	0	0	0	1179
Larønningen	117	69	7	514	595	0	46	221	2	14	4	1	1590
Eidsten	570	55	16	338	75	91	17	239	0	8	1	6	1416
Nordby	68	148	59	554	263	63	38	244	0	2	16	8	1463
Løveskogen	334	56	46	427	118	27	6	234	2	4	5	19	1278
Heimdal	299	164	9	276	332	58	2	271	5	9	6	7	1438
Rør	205	149	4	341	419	88	8	410	4	21	7	8	1664
Borge	179	121	8	563	317	49	0	287	5	45	6	4	2584
Kjenne	192	7	0	579	69	12	19	312	11	80	4	4	1289
Glemmen	258	25	4	510	276	8	8	272	10	56	4	4	1435
Opstad	184	88	2	378	437	104	0	321	15	72	9	2	1612
Grimstad	334	2	0	461	345	6	13	299	18	92	4	6	1580
Stensrød	391	4	10	634	95	3	10	84	6	2	10	0	1249
Øberg	202	68	0	565	389	45	16	212	1	6	3	2	1509
Rudskogen	0	5	32	837	246	0	33	277	1	0	0	2	2433
Østereng	0	29	3	572	74	0	61	486	0	2	1	0	1228
Nordre Moer	0	77	0	445	950	75	126	658	0	5	3	5	2344
Holstad	11	82	3	423	911	125	57	614	1	14	13	8	2262
Løken	0	64	17	656	632	0	81	480	0	0	1	0	1931
Tanum	104	74	3	602	247	39	133	206	0	10	4	3	1325
Huseby	0	40	23	446	924	0	43	568	1	0	4	1	2050
Asak	0	54	4	526	761	0	102	554	0	0	5	1	2007
Svarstad	0	28	6	593	656	0	64	615	0	2	0	1	1965
Haug	0	41	7	626	480	0	163	393	0	0	7	5	1722
Rudsøgård	0	389	16	626	31	0	36	222	1	2	4	5	1332
Nes	0	56	37	738	342	0	67	431	0	0	0	1	1672
Sum	4132	2449	379	17216	10272	793	1359	9379	103	502	232	125	48130

Table 1: Contingency table from underlying dataset of the analysis. The variables are - 1: Sea, 2: Freshwater, 3: Wetland, 4: Forest, 5: Clay, 6: Terminal moraine, 7: Dry grazing land, 8: Suitable agricultural soil, 9: Grave context, 10: Rock art, 11: Other sites, 12: Finds.

In addition to the individual site numbers and variable numbers, as presented in the main paper (reference to main article removed) the combined datasets (available in online repository) include information on the present variables at individual point ID and the points distance from settlement site. By including the individual point IDs, the data holds potential to derive information on the cardinal direction of variables in relation to the settlement site (Figure 2), but also to each other – either at large or on more singular level. The individual point IDs increasing from left to right, with the settlement sites situated on either ID 821 or 841.

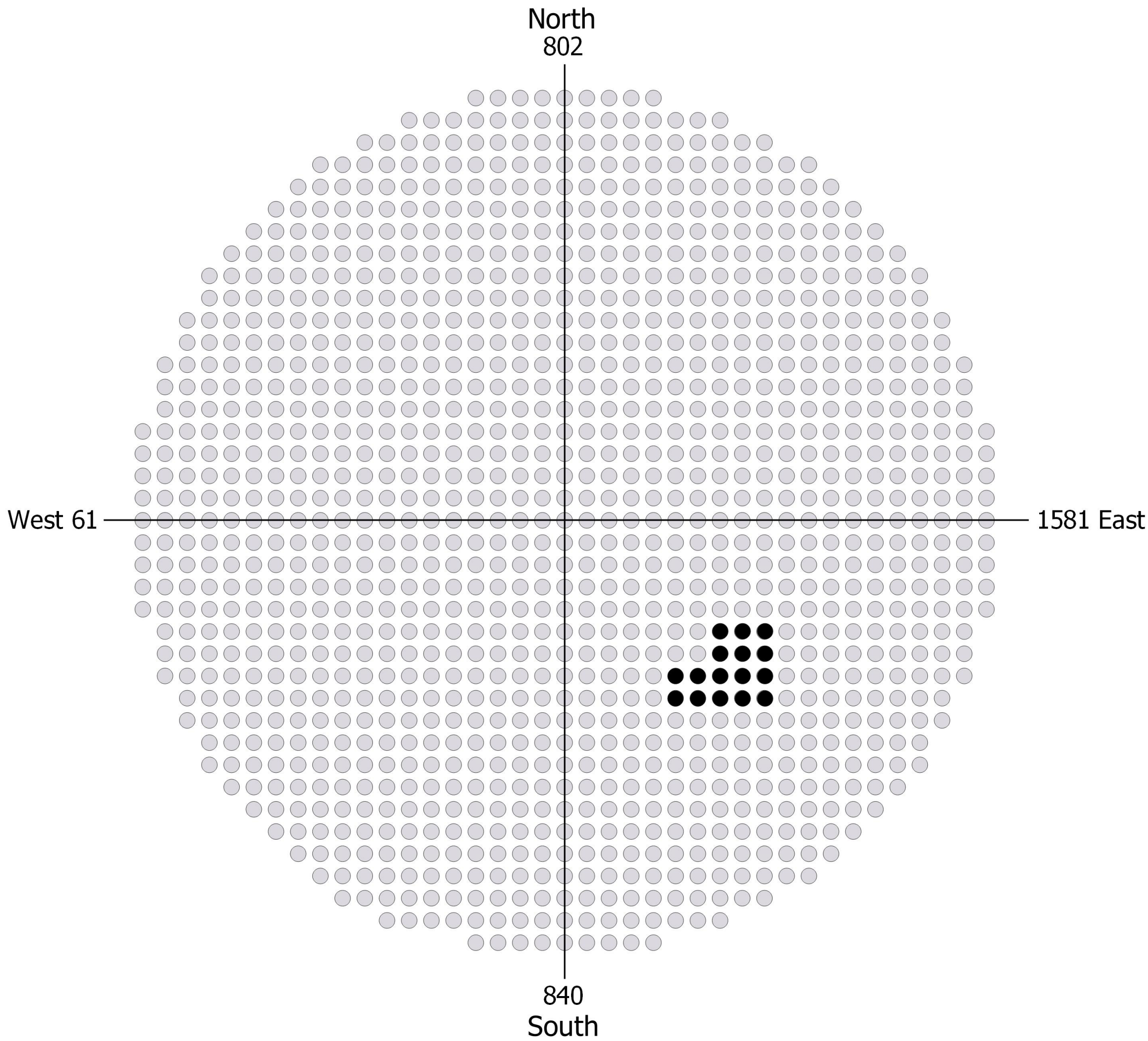

Figure 2: The possibility of the point grid to yield information according to the cardinal direction of the variables, randomly exemplified. All settlement sites are placed at either point 821, as here, or 841 (illustration by author).

A fault of the method is it somewhat static representation of the environment, and particularly its lacking ability to consider topography. As of now, the method can only reveal particular features through the absent of data, for instance rocky terrain, such steep hills and mountain sides. This is likely the case in the above example (Figure 1), with lack off data nearby the sea as indicative of e.g., skerries. Throughout the analysis, I therefore consulted topographical maps (Figure 3) in my analysis.

To account for the possibilities of movement within the zone, I also added data on available paths, tracks, and historical roads to these maps. Although not necessarily equivalent to those existing in prehistory, they are accumulated imprints of human journeys and taskscapes made visible (Ingold 1993, p. 167), and can provide us with an idea of which spaces afforded movement in relation to the settlement sites. I did, however, not find a way to make this part of GIS analysis, but see it as possible way to improve upon the phenomenological approach.

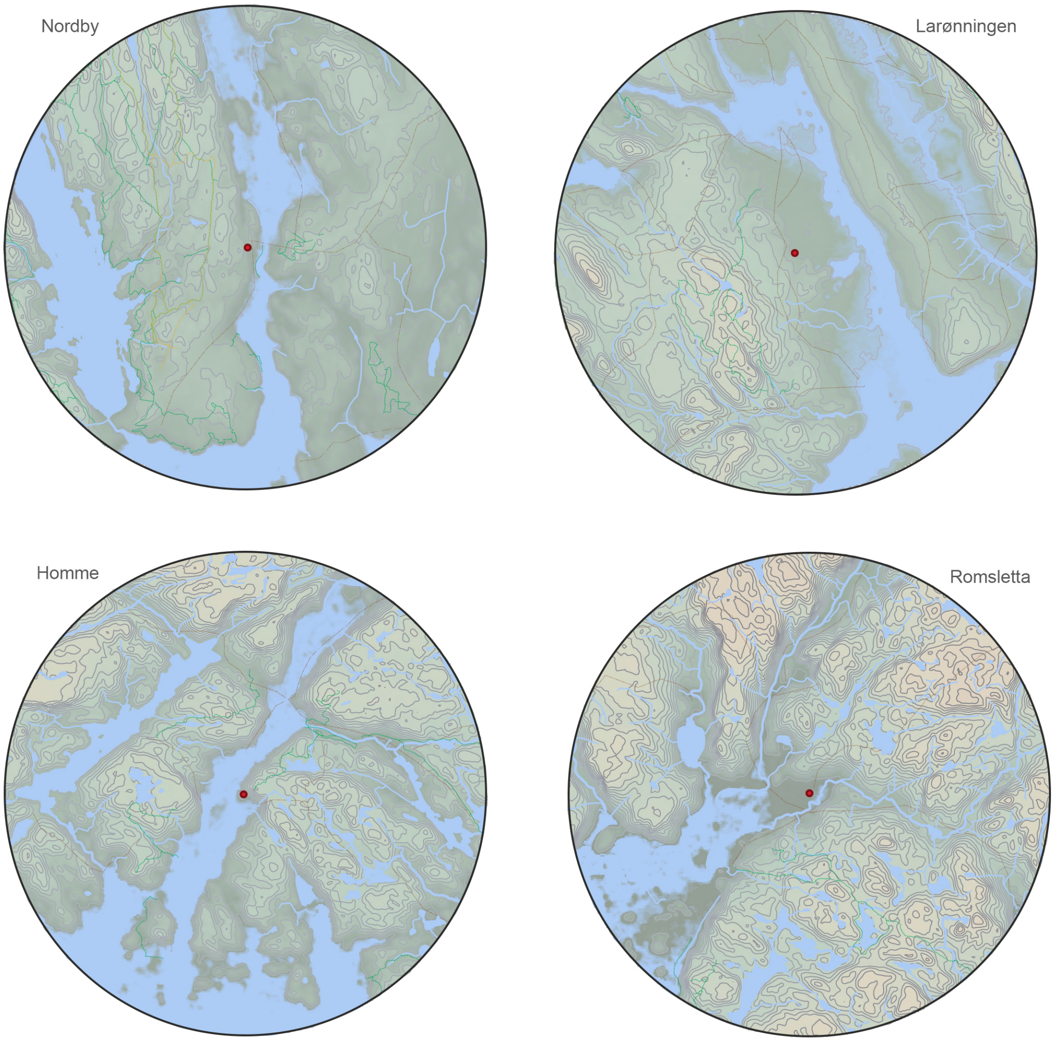

Figure 3: Topographic maps of four selected sites based on temporal representativity within same area. Nordby (LN-EBA) and Larønningen (LBA), although from different districts are rather close to each other on the western side of the Oslo Fjord, while Homme (EBA) and Romsletta (LBA) are from the southernmost part of the study area, the county of Agder (maps by author)

4 Conclusion

The developed method is well-suited to get an overview of landscape surrounding the settlements, and provides a more nuanced understanding environment in which people decided to settle down and lived their life. I would argue that the method can be used a mean for approaching past experiential settings more quantitatively.

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