Research Article

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Modelling Foraging Cultures According to Nature? An Old and Unfortunately Forgotten Anthropological Discussion

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Abstract: In a world of smart desktop approaches, it can be instructive to return to the roots of the discussion of whether it is possible to model the behaviour of small-scale human cultures based on environmental parameters. Present-day modellers appear to have forgotten this debate, which played such an important role in the anthropology of the early twentieth century. The question was never settled. Around the 1960s, a group of theoretical archaeological modellers decided that it was possible to model the landscape behaviour of hunter-gatherers based solely on the environmental data and thereby ignore social anthropological information supporting the opposing view. This was the beginning of a tradition of archaeological modelling that ignored differences in cultural landscape behaviour in similar environments and over time, the information provided by the developing discipline of landscape ecology, and with that the documented environmental complexity and its inherent small-scale dynamics. It is difficult to detect any scientific rationale behind this conscious archaeological isolation from relevant data provided by other disciplines, and the demand for cheap and fast management methods rather than science-based arguments appears the more likely driver. This presentation traces the history of this cultural "nature versus nurture" debate and discusses its implications.

Keywords: deductive modelling, environmental determinism, stone age, foraging cultures

1 Introduction

So-called archaeological "topographical" (deductive) modelling of high-probability prehistoric hunter-gatherer settlement zones in the landscape is typically based on a series of general assumptions about the physical landscape. Parameters such as distance to water, land inclination, sun exposure, and soil type are perceived as being important. A central problem is, however, that no solid and systematic documentation exists for a general relationship between such landscape parameters and a general pattern of settlement behaviour in relation to prehistoric foraging cultures.

One example of misleading assumptions about prehistoric settlement behaviour is the familiar Danish fishing-site model employed in maritime archaeological management. This model assumes that Late Mesolithic settlements associated with inlets and fjords were mainly concentrated at the mouths of these

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water bodies and ignores the inland settlements that are also well known to have existed during this period (Fischer, 1995). The administrative practice has, accordingly, been to only demand funding for surveys of these specific locations, in response to threats to archaeological remains posed by development and other potentially destructive factors.

Examination of well-surveyed areas with the Mesolithic coastal sites situated above the present sea level, where such inlet/fjord circumstances can be studied today, reveals a quite different pattern, with only 25% of the settlements located in direct conjunction with the mouths of the inlets/fjords (Figure 1) (Grøn, 2020). Nevertheless, the fishing-site model apparently continued to live a life of its own, even when contradictory empirical data were readily available. Consequently, many submerged Mesolithic sites located in extensive areas threatened by construction work and other factors have not been managed and/or protected as they should have been according to the relevant Danish legislation.

Examination of several generalising archaeological topographical modelling approaches shows that the relationship between their basic assumptions, on the one hand, and the positions of the prehistoric forager sites in the landscape, on the other, is unclear. One problem appears to be that landscape behaviour varies not only between individual cultural groups but also between their subgroups (Anderson, 1996; Cook Hale & Garrison, 2019; Grøn et al., 2022; Hamer et al., 2019; Miller & Carmody, 2020; Svoboda, 1995).

This kind of archaeological modelling apparently also ignores the significant small-scale dynamics that are recognised today in landscape ecology: These dynamics have an important role relative to the ways in which hunter-gatherers configure themselves spatially in response to the ever-fluctuating available resources (Anderson, 1996; Cook Hale & Garrison, 2019; Grøn et al., 2022; Levin, Powell, & Steele, 1993; Miller & Carmody, 2020; Verboom & Wamelink, 2005; Wiens, 1995).

A central question is how and why such a mismatch could develop between generalising archaeological topographical modelling of prehistoric cultures and archaeological reality. To elucidate this process, I will trace the archaeological, ethnographic/social anthropological debate about environmental determinism back to its beginning and then present a more general discussion of the modelling-related problems.

2 Environmental Determinism in Archaeological Modelling – Background and Development

Environmental determinism is the idea that individual human actions, beliefs, and values are controlled or determined by the ambient environment. Accordingly, societies, cultures, and civilizations are perceived as

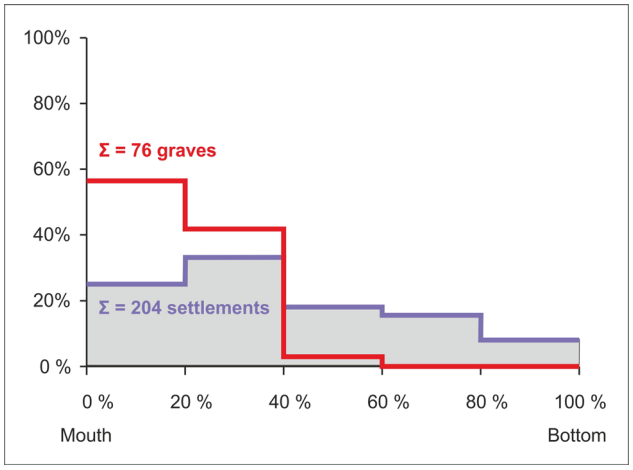

Figure 1: The distance of Late Mesolithic graves (red line) and settlements (blue line) associated with inlets and fjords from the mouth of the water bodies on which they are located, shown in intervals of 20% of the total length of the latter. While the graves follow the pattern prescribed by the fishing-site model, the distribution of the settlements is quite different. After Grøn (2020).

the product of their environments. Such thinking extends back at least to ancient Greek, Roman, Egyptian, and Chinese cultures (Mathewson, 2008). The Chinese chancellor Guan Zhong, who lived in 720–645 BC, maintained that the character of major rivers shaped the character of the surrounding peoples; for instance, swift-flowing, twisting rivers made people "greedy, uncouth and warlike" (Rickett, 1998, pp. 106–107). The sociologist Ibn Khaldún (who lived 1332–1406 AD) believed that the physical environment influenced non-physical factors: Soil, climate, and food determined whether people were nomadic or sedentary and what customs and ceremonies they observed and held, as well as their skin colour (Khaldún, 1967, pp. 59–60):

> *"The black skin common to the inhabitants of the first and second zones is the result of the composition of the air in which they live, and which comes about under the influence of the greatly increased heat in the south. The sun is at the zenith there twice a year at short intervals. In all seasons, the sun is in culmination for a long time. The light of the sun, therefore, is plentiful. People there go through a very severe summer, and their skins turn black because of the excessive heat."*

During the colonial period, many of Khaldún's texts were translated and used, together with numerous other similar texts, to promote colonial propaganda (Hannoum, 2003). For instance, Thomas Jefferson (who lived 1743–1826 AD) supported African colonisation by arguing that tropical climates encouraged uncivilised laziness, relaxed attitudes, promiscuity, and generally degenerative societies, while the frequent variability of the weather in middle and northern latitudes promoted a stronger work ethic and led to a more robust civilisation (e.g. Jefferson, 1787, pp. 228–242).

Friedrich Ratzel's *Anthropogeografie*, published in 1882, attempted to raise the environmental deterministic understanding of all types of human societies to a systematic scientific level. It considered the extensive territorial demands of groups at "lower cultural levels," such as foragers and herders (Ratzel, 1909, pp. 5–6, 73–84, 102–107). Further contributions to anthropogeographical thinking came from researchers such as Huntington (1915), Koller (1918), and Semple (1911), leading up to social anthropologist Julian Steward's culture ecological studies in the 1930s (Steward, 1968), which were extensively published in his *Theory of Culture Change* (Steward, 1955). Steward (1955, p. 37) saw hunter-gatherer "culture, environment and subsistence adaptation" as being intricately linked:

> *"According to the holistic view, all aspects of culture are functionally interdependent upon one another. The degree and kind of interdependency, however, are not the same with all features. Elsewhere, I have offered the concept of cultural core – the constellation of features which are most closely related to subsistence activities and economic arrangements. The core includes such social, political, and religious patterns as are empirically determined to be closely connected with these arrangements."*

In combination with Spaulding's attempt to develop a statistical/spatial interpretational methodology for prehistoric cultures (Spaulding, 1960), this close connection between cultural subsistence and specific central cultural elements was taken so literally by a generation of positivistic/processually oriented archaeologists that it was seen as enabling prediction of the positions of settlements of the various culture types, based on landscape/environmental features (e.g., Bettinger, 1980; Crumley, 1979; Freilich, 1967; Jochim, 1976; Williams, Thomas, & Bettinger, 1973; Wood, 1978). This type of modelling had a special focus on forager cultures, which were perceived as being especially well suited to ecologically based prediction because they were more directly dependent on their environment than other culture types (Bettinger, 1980).

This wave of New Archaeology was centred on ecology and human-land relations and was related to a positivistic focus on ethnoarchaeology, a discipline perceived as a "live laboratory" for archaeology (Binford, 1968; Freilich, 1967; Shanks & Tilley, 1992, pp. 29–45). The human–land relationship was understood within the framework of rather static and generalising natural models, which regarded the various foraging societies as behaviourally uniform and did not consider differences in cultural behaviour (Binford, 1968; Jarman, Vita-Finzi, & Higgs, 1972; Wilmsen, 1973).

The resulting archaeological modelling therefore departed from the assumption that the location of archaeological remains relates to specific characteristics of the natural environment. In practice, this approach often boils down to locational modelling based primarily on topography, as the only generally and readily available type of high-resolution landscape information, supported by a few other rather generalised and/or roughly reconstructed surface quality data such as soil type, vegetation, slope,

elevation, water, and reconstructed micro-climate (e.g., Fischer, 1995; Gaffney & Van Leusen, 1995; Jasiewicz & Sobkowiak-Tabaka, 2015; Kohler & Parker, 1986; van Leusen & Kamermans, 2005; Stančič & Kvamme, 1999; Verhagen, 2007; Wandsleeben & Verhart, 1997).

The lacking inclusion of "socio-cultural" factors, such as the significant differences in behaviour and subsistence strategy evident between cultures at similar "technological levels" and in similar landscape types is recognised as a problem by Verhagen (2007, p. 20), who refers to various recent attempted solutions, typically by the application of GIS and Agent Based Modelling (ABM). Since we still struggle to understand the rationale/logic of hunter-gatherers and the variation in these between different cultural groups, the formulation of realistic rationales/logics for the synthetic agents controlling the behaviour of different groups, in some cases down to the individual level, is clearly unacceptable (e.g., Bullock, 2014; Lake, 2015; Verhagen, Nuninger, Tourneux, Bertoncello, & Jeneson, 2013). Decisions made by single individuals may, in some cases, have a significant and culturally important "turning-point" effect for the entire cultural group to which they belong, as well as for other related groups. It is difficult to imagine a modelling approach that can deal with such events in a realistic way. In general, the idea of realistically reconstructing detailed personal behavioural patterns of individuals, each with his/her own specific identity and role in relation to behaviourally different cultural groups, appears far-fetched at best.

A significant aspect of the archaeological modelling literature is its almost complete absence of references to the ethnographical/social anthropological debate about the degree to which the environment can determine the behaviour of individual cultures. Archaeologists Colin Renfrew and Paul Bahn, probably reflecting the general attitude in the modelling world, see information from ethnography/social anthropology as being difficult to apply to archaeological problems (Renfrew & Bahn, 2000, p. 186). So, quite absurdly, archaeological topographical modelling sets out with a broad basis in ethnography/social anthropology, which is, however, subsequently rejected because this discipline provides confusing data that demonstrate cultural diversity independent of the environment. Instead of basing their assumptions about prehistoric foragers on live cultural observations, archaeologists rest their modelling on simplistic "desktop" assumptions, which imply that cultures at the same technological level behave similarly in similar environments. It is therefore highly relevant to examine the aspect of the environmental determination discussion that the modelling literature has ignored (Grøn et al., 2022).

3 The "Dark Side" of the Theoretical Background for Topographical Modelling

The environmental deterministic thinking that resulted in the development of archaeological topographical modelling has, from the outset, come under fire from the opposing position in ethnography/social anthropology, i.e., that human culture – independent of its technology – plays a significant role in how the human–environment relationship of a specific culture plays out. Researchers such as Boas (1896), Forde (1934, pp. 460–466), Herskovits (1949, pp. 153–166), Kroeber (1939, pp. 205–217), Wallis (1926, pp. 702–708), and Wissler (1926) were significant early opponents, representing a qualifying body of ethnographic/social anthropological fieldwork and experience.

Typical for this opposition is a view expressed by Wallis (1926, pp. 702–708):

> "*In explaining everything the environment explains nothing .... If we wish to predict what a people will do when they move into a new environment, it is more important to know the people than to know the place – or better, one must know both.*"

Herskovits forwarded the interesting argument that, if the environment is an important determinant of culture, similar environments should be inhabited by similar cultures. He then demonstrated, by various examples, that similar cultures have existed in different environments and that different cultures have existed in similar environments: For example, the Inuit and some Arctic Siberian tribes, who inhabited similar environments but interacted with them in quite different ways (Herskovits, 1949, p. 158):

> *"Here in the difficult circumpolar habitat then we have two quite different ways of life... The adaptation of both peoples is equally successful inasmuch as the only test of success in adaptation is survival."*

Later, social anthropology, and the more social-anthropologically orientated ethnoarchaeology, emphasised that, even though ecology always imposes some restrictions on the behaviour of a culture in the landscape, cultural traditions independent of the actual environment also encompass significant economic, social, and spiritual features which influence settlement patterns (Grøn, 2018; Grøn & Turov, 2007; Sutton, 2010; Woodburn, 1972), or as Barth (1969) puts it:

> "[....], *we need a viewpoint that does not confuse the effects of ecologic circumstances on behaviour with those of cultural tradition, but which makes it possible to separate these factors and investigate the non-ecological cultural and social components creating diversity."*

The "historical determinism" of the structuralist branch of modern social anthropology, which focuses on the study of the historical development of structural features within the social-spiritual spheres of societies, leaves significantly less space for environmental determinism (Lévi-Strauss, 1967, pp. 1–28, 229–239). Consequently, it represents an understanding directly opposed to that of New Archaeology, which generally ignores the effects of ideology and spiritual phenomena (Binford, 1968):

> *"This reasoning is functionally linked to a methodology that limits the archeologist to generalizing about the "facts" he uncovers. Since preservation is always imperfect, inferences from the facts of material culture to statements about the non-material culture move us away from the primary data and thus diminish the reliability of our statements."*

Social anthropology in the second half of the twentieth century therefore shifted from a position where the environment's dominant role as a determining factor for landscape behaviour, as well as a significant number of the other cultural traits in relation to the technological levels of the various cultures, was under discussion, to a consensus where other, purely cultural, factors were seen as playing a significant role.

While ethnography/social anthropology, based on a broad spectrum of observations, rejects environmental determination of human culture, the extensive and well-founded literature on "evolutionary psychology" explains how human societies tend to develop cultural differences with quite different realities, rationales, and "foraging strategies" even in similar technological and landscape situations (e.g. Cosmides & Tooby, 1989; MacDonald, 2009; Tooby & Cosmides, 1989).

4 Where to Position Current Archaeological Topographical Modelling in the Study of Small-Scale Human Cultures?

The distance between the approaches to foraging cultures in archaeological topographical modelling and New Archaeology related ethnoarchaeology, on the one hand, and in social anthropology and social-anthropology related ethnoarchaeology, on the other, is so significant that these two areas appear to represent separate and not even parallel universes.

Through centuries, ethnography/social anthropology has accumulated field experience and a theoretical background understanding of all possible aspects of live foraging cultures: How they develop and influence each other, how they mark their identities through differences at even the cultural sub-group level, and so on (e.g., Grøn, Klokkernes, & Turov, 2009). Compared to this, New Archaeology-related ethnoarchaeology has, through the decades it has existed, generally adopted a much narrower approach to such cultures, mainly attempting to relate them to specific rather static physical features. Ignoring the ethnographical/social anthropological data on the landscape behaviour of these cultures, because it is too complex to incorporate into archaeological topographical modelling, categorises this type of modelling as not being scientific or research based.

A parallel pattern of omission of relevant scientific information is evident in the way archaeological topographical modelling deals with the environmental data. Research results from landscape ecology demonstrate that the vegetation, a key factor for the distribution of resources in the landscape and consequently for the landscape behaviour of the small-scale cultures that rely upon them, generally exhibits a major degree of small-scale dynamics, continuously changing the resource situation in the landscape and, accordingly, the premises for cultural landscape behaviour (Grøn, 2018; Grøn & Turov, 2007; Grøn et al., 2022; Hansson, Fahrig, & Merriam, 1995; Wiens, 1995). Detailed reconstruction of the environmental dynamics in prehistoric situations demands environmental data of such high spatial as well as a temporal resolution that, in several instances, these data will be impossible to obtain. One problem is the preservation of such high-resolution information, another is the precision with which this information can be dated, and a third is the immense cost of obtaining and analysing such a high-resolution dataset. Archaeological topographical modelling is normally restricted to relying on easily available – and cheap – environmental data. Therefore, it produces coarse, generalised, and rather static images of the prehistoric environment, which are of limited value relative to a concrete understanding of the environmental dynamics that formed the basis for prehistoric cultural landscape behaviour. Consequently, archaeological topographical modelling can similarly not be categorised as either scientific or research based within this field.

Archaeological topographical modelling is employed as a decision-making tool for identifying areas at high "archaeological risk" or of high "archaeological vulnerability"; a methodological approach that, according to Verhagen and consistent with the viewpoint expressed in this article, cannot be regarded as scientific (e.g., Verhagen, 2007, pp. 13–14; Verhagen & Whitley, 2012). Its fundamental aim is to identify areas with a high density of prehistoric sites. Since this density is the sum of sites derived from the various prehistoric cultures, it represents the "sum" of the archaeological remains resulting from the potentially different landscape behaviour of these cultures. The identification of potential areas at high archaeological risk is consequently based on an assumed general cultural relation to landscape features that however in reality have no documented relationship with the landscape behaviour of the individual prehistoric cultures. For example, topographical features such as surface inclination, distance to water, soil type, and sun exposure must be presumed to identify areas of different importance and use intensity by the different prehistoric cultures.

Published tests on the results of archaeological topographical modelling are mostly restricted to relatively small data samples in relation to individual modelling projects (e.g., Lieskovský, Ďuračiová, & Karell, 2013; Podobnikar, Veljanovski, Stanèiè, & Oštir, 2001; Verhagen, 2007, pp. 106–107; Verhagen & Whitley, 2012). Large-scale empirical testing of the various archaeological topographical modelling methods, employing extensive and varied areas where large numbers of archaeological sites have been recording in relation to the various relevant landscape situations, would therefore be advantageous. This would help refine the assumptions employed in the modelling and thereby contribute to bridging the gap between the models and an empirical archaeological understanding of the landscape behaviour of individual archaeological hunter-gatherer cultures. In turn, this would facilitate the more scientific application of archaeological topographical modelling to prehistoric hunter-gatherer cultures in general. Where such a large-scale test was undertaken for prehistoric hunter-gatherers, this showed that site locations did not correlate linearly with baseline ecological conditions, and where environmental conditions (past and present) did correlate with site locations, sub-regional variation was evident and temporal variation could also be observed (Cook Hale & Garrison, 2019).

5 Conclusion

It must be concluded from this study that it is not possible to model the landscape behaviour of prehistoric hunter-gatherer cultures based solely on topographical parameters. The environmentally complex and culturally individualistic image of recent foraging cultures, which has won general acceptance in ethnography/social anthropology and has recently been documented by a group of North American

archaeologists based on Anderson's extensive database work (Anderson, 1996; Cook Hale & Garrison, 2019; Miller & Carmody, 2020), must form the basis for future attempts to develop more precise and realistic modelling. For it to become a better prediction tool for archaeology, as well as being scientifically acknowledged, archaeological topographical modelling of small-scale cultures must be able to accommodate, and incorporate at a reasonable degree of resolution, differences in landscape behaviour and resource strategies at the cultural group, and even cultural the sub-group level. As it has been practiced to date, this type of modelling systematically ignores important bodies of basic information, thereby reducing its value to the level of "fake research"; i.e., a method with no proper basis in the available data.

The degree to which such a demand can be successfully met – and at what level of resolution – remains an open question. However, as the successful future development of archaeological topographical modelling will depend on it, there is no viable alternative to accepting ethnographical/social anthropological thinking and attempting to find ways of incorporating this into archaeological modelling in good accordance with the important principles of interdisciplinarity.

The focus here has primarily been on the non-inclusion in archaeological topographical modelling of variations in landscape behaviour at the cultural and cultural sub-group level, partly due to a lack of appreciation of small-scale dynamics in the environment, i.e., the substrate that small-scale cultures exploit through their landscape behaviour. There are other problems that must be dealt with in relation to this type of modelling (Grøn et al., 2022), but this is the most pressing and must be dealt with urgently.

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