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TWO LANDSCAPES: REMOTELY SENSED AND INTERPRETED. CONSTRUCTING THE PAST THROUGH NON-INVASIVE METHODS

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Abstract

Recent advancements in the field of non-invasive archaeological prospection methods significantly facilitated their use in archaeological landscape studies. Growing awareness of their potential can be also observed among Polish archaeologists. For many years one of the most popular prospection methods applied in the so-called *settlement pattern studies* in Polish archaeology was fieldwalking. This influenced the analytical categories and archaeological landscape perspective. In this paper I aim to investigate the relationship between preliminary knowledge and interpretation of data collected through non-destructive methods.

Keywords: non-invasive methods, remote sensing techniques, archaeological geophysics, landscape archaeology, settlement pattern studies, fieldwalking

Resumen

Los últimos avances en el área de las técnicas no invasivas de la prospección arqueológica han fomentado el uso de las mismas en los estudios arqueológicos del paisaje. El aumento de la conciencia acerca de su potencial puede observarse, también, entre los arqueólogos polacos. Anteriormente, durante varios años una de las técnicas de prospección muy popular que se aplicó en los denominados estudios de los patrones de asentamiento en la arqueología polaca fue la prospección superficial que influyó en las categorías analíticas y la perspectiva arqueológica del paisaje. En el presente artículo se pretende investigar la relación entre los conocimientos iniciales y la interpretación de los datos recogidos con las técnicas no destructivas.

Palabras clave: técnicas no invasivas, técnicas de teledetección, geofísica arqueológica, arqueología del paisaje, estudios de los patrones de asentamiento, prospección superficial

INTRODUCTION

Recent advancements in the field of airborne remote sensory techniques and archaeological geophysics, together with a decrease in the implementation costs, has significantly facilitated their use in archaeological landscape studies. This process can also be observed in Polish archaeology, where the widespread use of non-destructive techniques has become noticeable of late.

Yet, an important but quite rarely discussed matter is the place and the purpose of non-invasive methods within the research process. Depending on the methodological orientation we choose to refer to, their function as well as the cognitive potential will be understood differently.

No less significant is the understanding of the principles of operation of the applied methods and the characteristics of the recorded phenomena. Knowledge of both the advantages and limitations of applied techniques is essential for working out the critical interpretative approach.

Subjective decisions made by archaeologists during the research process — for example, the selection of the method that is to be used, data processing, visualisation of the collected data etc. — also have a meaningful impact on the final conclusions.

Finally the definition of the crucial research categories such as social space, cultural landscape, the archaeological site is also of vital significance as it restricts the scope of studies, the potential research aims and the manner the collected data is interpreted.

In my paper I intend to focus on the relationship between theoretical orientation and understanding of the purpose of non-destructive methods as well as their role within archaeological landscape studies.

DIFFERENT VIEWS ON THE PURPOSE OF SCIENTIFIC METHODS IN THE RESEARCH PROCESS

The term method can be understood in many different ways, depending on the accepted theoretical perspective. Its place and purpose in the research procedure may also vary according to the chosen paradigm. In common understanding, method is defined as a formalised praxis of conducting scientific research. It contains theoretical assumptions, applied techniques, guidelines and consecutive steps that have to be undertaken during the research process. Method is also the manner we define studied facts, and most of all interpret research results (Rączkowski 2012: 367).

Due to the applied paradigm, method can be understood either as the objective tool for data collection and reconstruction, the means of verification/testing of hypothesis or as an inspiration for constructing persuasive archaeological narration. The status of knowledge, which is a product of archaeological research, also depends on the theoretical orientation. Thus, it can be treated as a truthful reconstruction of past reality or as a hypothetical construction, one of the versions possible to define (Ankersmit 1997; Domańska 1997; Minta-Tworzowska 1998).

Method as an objective means of data collection

The dominating methodological orientation within Polish archaeology can be defined as traditional or cultural-historical as well as positivistic and pre-theoretical. It is based on empiricism, inductive reasoning, naturalism, objectivism and cognitive optimism.

Positivism was inspired by the philosophy of the 18th century philosopher David Hume and developed later by August Comte. It was introduced into natural sciences in the 19th century (Ajdukiewicz 2004). It emphasises the role of empirical cognition emerging from observation, experiment, comparison and analogy and rejects the cognitive values of theoretical considerations. According to positivists, the path to true knowledge leads from the collection of singular facts and observed relations to generalised conclusions (Rączkowski 2011, 2012).

Due to the conception of naturalism, positivists claimed the theory of unity of the world and the laws ruling within it (Grobler 2006; Rączkowski 2011). In their understanding, the same rules applied in the case of the inanimate world of physico-chemical occurrences and the reality of human culture. Thus, any registered phenomenon related to human culture and social life could be, in their understanding, interpreted and explained through the theories of natural sciences. Therefore, archaeology accepted the theory of diffusion borrowed from physics and chemistry by Fryderyk Ratzel (the creator of anthropogeography) and applied it as a means of explanation for the spread of ideas and artefacts (Babicz 1962; Kurnatowski 1977; Tabaczyński 2001). The theory of evolution that

originally describes the variability of living organisms in biology was adopted in archaeology to order and explain the variability of the forms of artefacts (Minta-Tworzowska 1994: 36).

In this methodology, the material remains of human acts are considered to be a part of the past that survived until the present day. Thus, the principal role of traditional archaeologists is to collect the pieces of archaeological evidence. Gathered sources are ordered, classified and explained, as mentioned earlier, by means of evolutionism and diffusionism. The final result of the scientific research is perceived as a truthful reconstruction of a studied fragment of past reality founded on generalisation (Rączkowski 2011: 10).

Empiricism refers to the belief that scientific methods are objective and record the world "as it is". Therefore, the understanding of their results comes directly from their reception, and no preliminary theoretical knowledge is needed. Moreover, such knowledge is often described by inductive empiricists as a harmful factor, which may interfere with the research process by making it non-objective. In such a perspective, together with the growth of collected empirical evidence our understanding of the past should become more complete (Grobler 2006; Rączkowski 2011: 13).

Traditional archaeologists focus more on the practical applications of prospection methods than on the means of their interpretation. This leads to intuitive and colloquial description in archaeological narrations at the expense of sufficiency of critical approach, theoretical discussions and socio-cultural interpretations. Only the collected facts are certain. Thus, any theoretical attempt or hypothetical explanation is treated as highly doubtful and often as unjustified speculation.

Method as a means of testing hypothesis

The fundamental change in the role of empirical evidence and its place in the research process may be related to the introduction of anti-positivistic approaches in archaeology, such as processual, structural or Marxist archaeology. Modernistic archaeology questioned the reliability of inductive reasoning and its conclusions based on observation and generalisation. It also proposed to replace it with deductive reasoning (e.g. processual archaeology introduced the Hempel's model; Ostoja-Zagórski 1988; Rączkowski 2011: 10).

For modernist archaeologists, theory was a starting point for any research. Its main purpose was control of the research procedure. The empirical evidence ceased to be a point of entry and started to serve the purpose of testing the hypothesis. But most of all, it became the subject of theory and the process of data creation (Rączkowski 2011: 16).

In the context of modernistic paradigms, the role of archaeological prospection methods can be seen as the means of verification of hypothesis. Thus, their application, purpose and interpretation depends on many factors defined within the applied theory. All of the modernistic archaeologies shared the cognitive optimism in a similar way. In their opinion scientific methods were objective, and the theory was the warranty of the truthfulness of the final conclusions. Thus, the status of knowledge being the result of scientific process was seen as the reconstruction of past reality.

Not all modernistic approaches in archaeology shared naturalistic convictions. In this aspect processual archaeology was referring to the naturalism and theories borrowed from natural sciences, while Marxist archaeology was anti-naturalistic, historical and based on the functional-genetic method of explanation and humanistic interpretation (Rączkowski 2011: 14).

Modernists acknowledged the variability of status of empirical evidence within the consecutive stages of scientific research. Thus, at the stage of field work it was understood as "archaeological record"; during the process of analysis and description it would become "data" which at the level of explanation was then transformed into "evidence" (Rączkowski 2012: 373).

The objective status of scientific methods was criticised due to the linguistic turn by post-processual archaeologists (Minta-Tworzowska 1998; Rączkowski 2002). Method controlled by scientific theories could not be treated any longer as a warranty of infallibility of knowledge. It was also noted that on

every stage of scientific research, subjective decisions and interpretations are made. All are established within the socio-cultural context of the scientist and refer to the system of values and subjective, culturally embedded visions of reality. Thus, the final result of archaeological research is not a truthful reconstruction of the past but one of the possible hypothetical versions.

SPATIAL PATTERN STUDIES, FIELDWALKING AND ARCHAEOLOGICAL SITES

As mentioned earlier, an empirical approach along with inductive reasoning positions method at the very start of the research procedure. It is treated as the way of collecting data, as an objective source of knowledge and as a warranty of its infallibility. To highlight the impact of positivistic orientation on the application of prospection methods, I will refer to the example of *settlement pattern studies* and AZP programme deriving from the tradition of Polish archaeology.

For many years, the main and usually only prospection method in Polish archaeology was fieldwalking. This influenced the analytical categories and the landscape perspective. A critical approach to the discussed method was a problematic matter as the obtained results could rarely be compared with other prospection techniques. This was more often because of a lack of methodological awareness than limited resources. Its importance grew in 1978 when the state program called AZP was launched and its use was sanctioned by law. Widespread use of fieldwalking contributed to the fast growth of empirical evidence and a database of archaeological sites (Kempisty *et al.* 1981).

The fieldwalking seemed to be perfectly suited for the model of *settlement pattern studies* based on the assumptions of diffusionism. The main aim of the settlement studies was the registration of archaeological sites, determining their chronology and discovering the relationship between human culture and geographical environment (Kurnatowski 1977; Kiarszys *et al.* 2007).

Cultural change was explained by migration and diffusion (Tabaczyński 2001), which could not be traced without knowledge of chronology and localisation of archaeological sites (Kowalski 1975: 41). Also in this matter, fieldwalking proved to be the simplest way to achieve such knowledge.

According to the positivists, the main aim of science is a systematic description of the surrounding world and observed phenomena. Thus, at the outset of the AZP programme, archaeologists were convinced of a close and direct relationship between the number of pottery sherds as well as other artefacts found on the surface of the earth and the extent of archaeological sites, their functions and chronology. Functional classification based only on surface finds was recognised for a long time as both justified and flawless. Therefore, archaeologists did not hesitate to categorise discovered sites as settlements, camps, cemeteries, production sites and so on (Czerniak 1996: 40). Such a procedure was understood as the equivalent to "reconstructing the past".

Facts registered by scientific methods were believed to be objective and neutral. The spread of discovered archaeological sites was a reflection of true spatial patterns of past human settlement systems. It is not surprising then, that all the limitations of the fieldwalking also had an impact on the manner archaeologists interpreted and thought about the cultural landscape. If a certain type of archaeological feature could not be registered by the fieldwalking method it did not exist in archaeological discourse.

Due to the specifics of the fieldwalking method, the idea of space in Polish archaeology was dominated by the category of the archaeological site. The archaeological site is defined as "a finite section of space distinguished by the occurrence of artefacts and cultural layers. It is separated from other archaeological sites by empty spaces lacking in artefacts" (Mazurowski 1980: 18-19). Such an approach reduces the scope of studies down to the definite borders of the archaeological site, leaving the spaces between them (off-site analysis) outside of the interest of archaeologists.

If the archaeological site was to be interpreted in a wider context, only "natural" elements were taken into consideration due to the applied deterministic explanation. However, as we know, not every human activity produced artefacts, and some meaningful social places can more often be identified through the relics of their physical form (microtopography), rather than the artefacts related to them (e.g. roads, field divisions, dikes, exploitation pits etc.).

Fieldwalking is mainly targeted at the registration of spots. Thus, the archaeological landscape "reconstructed" via this method is atomised. It is a common procedure that the recorded archaeological sites are separated into groups according to their chronology. Based on this classification, a series of maps is produced displaying the consecutive stages of development of settlement patterns in individual archaeological phases. The gathered data is always presented in the form of points or polygons (symbolising the archaeological sites) displayed against the background of contemporary topographical maps (scale 1:10 000 or 1:25 000) which is thought to aid in the palaeo-environmental analysis. Each site also has an AZP KEZA questionnaire which describes the observed context of the discovered archaeological site, number, type and the chronology of finds from the surface etc. (Kiarszys *et al.* 2007: 58-62).

The category of archaeological site proves to be indispensable in any situation that requires decision making — for instance, spatial planning where it is necessary to designate an area that needs to be protected or excavated. On the other hand, it is unable to either register or protect those archaeological objects that cannot be related, or have no artefacts in their context. The other matter is the registration of linear, continuous objects or large features, that cannot be decisively defined. Moreover, the question about the cultural purpose of spaces between archaeological sites (off-site analysis) remains unanswered.

After some years of the AZP programme it was discovered that the functional classification of archaeological sites based only on surface finds was often incorrect (Jaskanis 1996). The results of fieldwalking carried out in the same area in the following season were frequently inconsistent (Czerniak 1996; Bienia and Żółkowski 1996). Due to various circumstances, many previously discovered sites could not be confirmed. Such observations directed the interest of archaeologists towards a more critical approach. The importance of post-depositional processes and factors influencing the manifestation of archaeological sites and the conditions of observation were noted (Banaszek and Rączkowski 2010: 121). It proved that the cognitive potential of the fieldwalking method is limited and the collected data is fragmentary and uncertain. However, those observations did not undermine the cognitive optimism within historic-cultural archaeology.

THE OBJECTIVITY MYTH REGARDING REMOTE SENSING TECHNIQUES AND ARCHAEOLOGICAL GEOPHYSICS

In a commonly shared belief that airborne remote sensing techniques and archaeological geophysics are independent methods, free from any theoretical influence of archaeology. They were developed within exact sciences and their main purpose is registration of specific, objective, physical or chemical occurrences. Thus, the data provided is trustworthy and accurate (Rączkowski 2012: 378).

Such a point of view fulfils the criteria of scientific myth as defined by J. Topolski (1996, 1997; Rączkowski 2011: 17-18). This term relates to the social process of knowledge creation and the understanding of its status. Some scientific statements are not verified for a long time, but are still believed to be truthful. These opinions may influence science and become a canon of thought. Only when confronted with empirical evidence does their fallacy come to light. In fact, inductive reasoning does not provide any means of verification for created knowledge. The only possibility within this model of reasoning is the confirmation of generalised facts. Thus, it is especially receptive to scientific

myths and their fixation. However, scientific myths are also present within modernistic methodology, although deductive reasoning is especially suitable for the verification and falsification of such aspects of scientific knowledge. In this case, other subjective factors such as relations of power, preferred structure of knowledge, social relations etc, play the key role.

As with any other scientific method, so too are airborne remote sensing techniques and archaeological geophysics selective. The gathered data is incomplete as it registers only a limited scope of phenomena. Its content depends both on the way the data was recorded and processed. A wide range of factors can interfere with the data collection process: e.g. the quality of instruments used, the applied methodology, local conditions or even atmospheric occurrences. Some of these factors can be controlled by archaeologists, but some cannot (Szadkowski 2012: 15; Wężyk 2006: 121).

At every single stage of the research process, subjective decisions have to be made, starting from the choice of method that is to be used, the selection of device and brand, the required sensitivity, the method of collection of measurements, data processing and its interpretation. All these choices are made by archaeologists and employed specialists in response to current knowledge of the specifics of the studied area, available methods and their technical potential, available resources etc.

Furthermore, data processing and the visualisation of collected results is both a subjective and selective process. In the case of ALS for example, archaeologists filter and classify the data (point clouds) to remove errors and to obtain the points representing ground level. This can be done both through application of automatic algorithms or manually (Doneus and Kühteiber 2013: 33-35; Opitz 2013: 20-22). In the case of opened areas this step may sometimes be skipped. Similar rules apply in the case of data sets from geophysical survey, where filtration is needed to remove both false and noise measurements. Aerial photographs also require processing, as the collected photographs have to be adjusted, rectified and geo-referenced. In the case of multi- or hyper-spectral satellite imagery, the selection of specific channels suitable for quantitative analysis of required physic-chemical characteristics of registered objects is necessary, and so on (Rączkowski 2012: 379-389). Every such step leads to the reduction and rejection of some of the potential information that was present primarily in the data-set. Because of the imperfections of the tools we utilise, and due to arbitrary decisions made by archaeologists, certain valuable information can be rejected in this process.

The data gathered through remote sensing techniques and archaeological geophysics can be presented as a table of geo-referenced points and the values that describe them. Due to their mathematical forms they are difficult to interpret. Therefore, they need to be visualised and transferred to an image. Many different techniques and algorithms can be used for the interpolation of an ALS point cloud or geophysical measurements into a raster image. Thus, the acquired results may differ. The choice of one of these methods is significant, as it always influences the final results.

Visual interpretation appears to be more intuitive and easier for humans to perceive than the primal form of data — the mathematical matrix. In the case of geophysical survey results, the image may be equalised, sharpened, contrast adjusted, smoothed etc. (Rączkowski 2012: 388). The final result can be presented as a colour composition, or either a pseudo or true 3D image gained with lights and shadows etc.

Different rules apply also in the case of the visualisation of ALS results. If the amplitude of measured values is low, most of the critical information can be revealed, for example, through the appropriate colour coding of interpolated raster. In the case of great differences in the amplitude of the collected measurements, such methods prove to be insufficient as it is necessary to use a very wide range of colours to communicate the whole scope of the variability of the recorded phenomena. The human eye often fails to differentiate the subtle variations between displayed tone, making the colour map illegible. Therefore, archaeologists reach for more complex means of visualisation which "selects" for them the "meaningful data" and automatically omits those that may be considered unnecessary obstructive noise (e.g. LRM, SVF, HSR, PCA etc.; Hesse 2010; Zakšek *et al.* 2011, 2013).

The application of the specific visualisation algorithm depends on general landscape characteristics, the state of preservation of archaeological sites, the expected results as well as the individual preferences of the archaeologist. Some of the algorithms are better for the registration of micro-topography of almost completely levelled landscape forms, while others prove to be sufficient for the study of well-preserved anthropogenic remains. In hilly landscapes, LRM or SVF may be a better choice than HSR or colour coded DTM.

The proper type of visualisation algorithm for the defined set of data can produce an image that will appear more clear and persuasive. But depending on the specifics of the visualisation algorithm that have been used, some of the information is always removed from the processed data set, and some new elements that were not in the primal set may be added. Usually the data set and the set up of the chosen visualisation method are manipulated while formulating the result in order to be subjectively pleasing to the archaeologist. This means that it meets the expectations of the archaeologist (the image is sharp, aesthetic and has the required contrast etc.) and in a definite way it confirms or denies the preliminary assumptions and knowledge the archaeologist defined before he/she attempted to research.

METHOD AS A MEANS OF INTERPRETATION AND UNDERSTANDING

The 18th century Irish philosopher George Berkeley, investigating the way human beings learn to understand and order the surrounding world, noticed that we do not perceive with our sight anything more than light, colours and shapes. Access to the material world comes via our senses. Therefore, we can only reach its materiality indirectly, through ideas. This remark does not deny the existence of the material world itself, because as Berkeley stated "I do not argue against the existence of any one thing that we can apprehend, either by sense or reflection" (Berkeley 1709: 35). However, he points out that pure perception is not enough to gain an understanding of the phenomena we observe. We need to refer to the preliminary knowledge through which we name and recognise the things we are involved with. Without this knowledge the world will forfeit its reason and become an irrational stream of countless stimuli.

Some time later the German philosopher and mathematician Edmund Husserl argued that pure perception is not possible. It is always the perception of something controlled by defined intentions (Gosden 1994: 104). Even the simplest man's act is driven by a certain aim and perspective. Thus the reality "reflected" in the human mind is rational and causative. In other of words, the order of the world we cope with is internal, and comes from the structure of our mind and the culture that produces its shape.

Non-invasive prospection methods extend natural human senses, as they are able to record and visualise occurrences that are often out of reach of human perception. Yet, knowledge of their principles of operation is essential for the understanding of the collected results, as it may tell us not only about the type of occurrences that can be registered, but also point out things that will never appear in the record. Thus, images of archaeological landscapes constructed through remote sensing techniques are not only incomplete but also ambiguous and always require verification. However, the same can be said about any other group of archaeological methods.

Remote sensing techniques are usually targeted towards the registration of different types of "contrasts" produced by fluctuations in the values of the registered phenomena. In the case of aerial photography, such contrasts may be caused by light and shadows, cropmarks, soilmarks etc. For satellite imagery, electromagnetic radiation or different light spectrums can be a source of contrast. Airborne laser scanning registers differences in topography and the intensity of reflection of the laser beam. In the case of a wide range of archaeological geophysics, a contrast may be produced depending on the applied method: by differences in ground resistance (electrical resistivity tomography), magnetic

anomalies (magnetometry), changes in the spread of electromagnetic waves (ground penetrating radar) etc. (Misiewicz 2006: 10; Jones 2008: 20-24; Harding and Rączkowski 2010; Małkowski *et al.* 2013).

Registered contrasts in certain circumstances can be interpreted as indirect indicators of archaeological features. However, they can also be produced by a wide range of other factors, not related to past human activities. Therefore, their interpretation is never straightforward as there is always more than one possible explanation for the recorded phenomena. For that reason, the collected data requires a critical approach and verification.

The explanation of collected results requires formal knowledge about the conditions of the appearance of recorded phenomena and their characteristics. Archaeological geophysical results, depending on the technique used, need to be analysed through different kinds of theories describing the electromagnetic field, electrical resistivity, properties of soils and rocks etc. In the case of aerial photography and satellite imagery, a wide range of knowledge referring to optics, electromagnetic waves, agronomy, geomorphology, geography and meteorology applies. Interpretation of ALS and TLS refers to the theory of light and general laws of physics. In every case, computer processing plays an important role. These few examples do not cover the whole range of non-invasive techniques used in contemporary archaeology, although they make us aware of the complexity of the interpretation process.

Yet, this first stage of interpretation has nothing to do with the identification of registered archaeological features. It explains only the physical or chemical characteristics of the recorded occurrences, and does not prejudge their source. In other words, it is the archaeologist, not the method that decides in the end what is an archaeological feature and what is not. Such decisions are made by means of preliminary knowledge about previously known archaeological features and their similarities. It is subjective, hypothetical and uncertain.

In some circumstances, recorded contrasts may cause the impression to be similar in pattern and appearance to objects interpreted previously as archaeological remains, but after verification it proves to be the result of some other process not related directly to human presence, or an object of completely different function than expected. There is a discontinuity between the registered physical phenomena and its recognition as archaeological object. The only link between them is hypothetical presumption. Simple identification of the object through its shape may be misleading (e.g. Figure 1).

The interpretation of the archaeological record is always based on the preliminary knowledge we have at the outset. We can recognise those registered objects and phenomena that we already know, or anticipate to find. It can be expected that non-destructive methods have much greater cognitive potential than we are currently aware of. However, at the present moment we do not posses adequate means to be able to recognise this.

THE AMBIGUITY OF THE ARCHAEOLOGICAL RECORD. SOUTHERN WOLIN ISLAND CASE STUDY

The interpretation of the results of non-invasive methods depends also on the definition of the applied cognitive categories. Such fundamental concepts in the case of archaeological landscape studies is the understanding of terms such as: social space, cultural landscape, archaeological site, archaeological object etc. This problem is seldom discussed or critically analysed by Polish archaeologists as the research categories referred to are considered to be obvious and objective. Depending on how it is understood, the potential of non-invasive methods for archaeological landscape studies will appear completely different.

To highlight this problem I will present two different interpretations of the results of studies from the south-western part of Wolin Island. One of those interpretations derives from the tradition

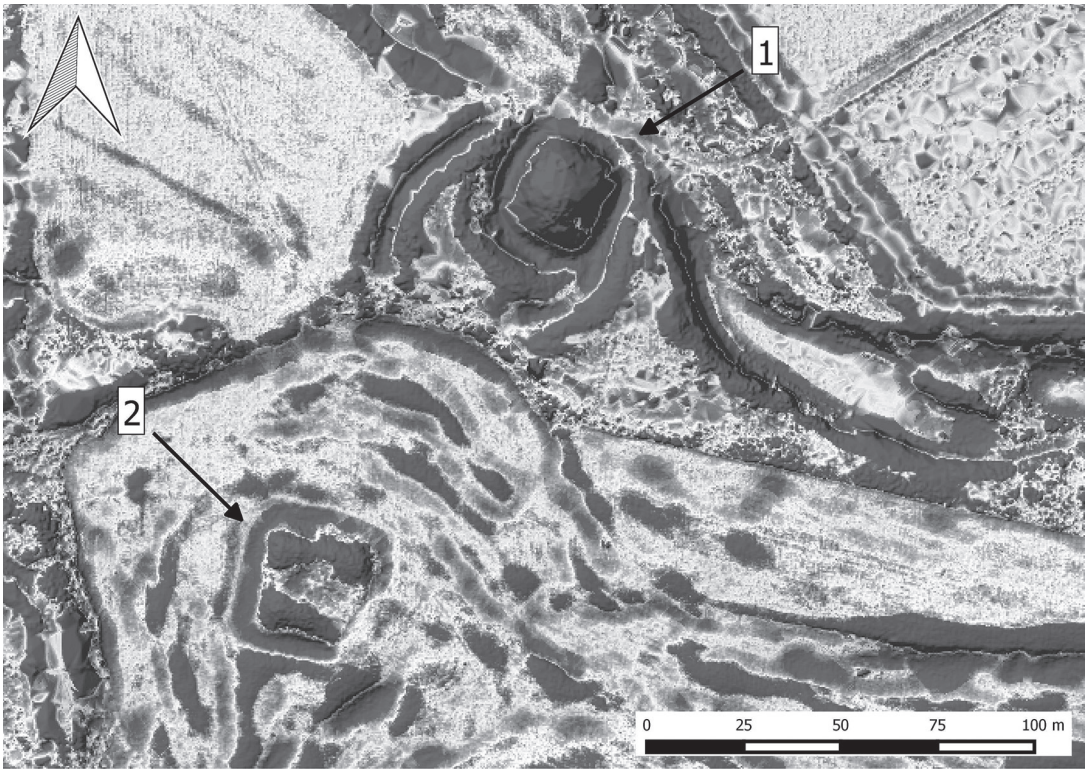

Figure 1. Local Relief Model of two adjacent anthropogenic terrain forms. Both features have very similar size, orientation and shape. The object no. 1 is the remains of late medieval motte. The object no. 2 is the spoil heap leftover after regulation of nearby river.

of *settlement pattern studies*, while the second one refers to the general ideas deriving from the archaeological landscape studies created in British archaeology. I will attempt to combine those two visions within the one narration.

In this example I shall discuss the consequences of the understanding of most fundamental terms only. Even the very basic analytical categories are never neutral, as they define the properties of the studied subjects at the admission phase of the undertaken studies. Due to the limited size of this article I will apply the convention of a report. Thus, I will purposely not discuss the critical approach to the topics such as: data processing, visualisations chosen, methodology or semantics of the interpretative schemes I used to categorise the function of the studied objects (e.g. stronghold, hillfort, road, settlement) etc. since those problems were analysed earlier in this paper.

The idea of atomised space created within the *settlement pattern studies*, discussed in the earlier chapter, seems to be an inadequate scheme for the presentation of the results delivered by remote sensing techniques. As mentioned before, its main prospection method — fieldwalking — is aimed mainly towards the registration of spots where artefacts are present, while the outcome of non-invasive methods is usually a continuous image.

The concept of cultural landscape created within British archaeology is substantially different from the atomised space of *settlement pattern studies*. The whole landscape itself is perceived as a

product of human activities. Both "natural" and "cultural", as well as "past" and "contemporary" elements are important as they can prove to be helpful in understanding the formation processes. Archaeologists often refer to the metaphor of a palimpsest to describe this very specific cognitive situation of studied relics.

The holistic approach in landscape studies is the product of the widespread use of aerial photography — the main prospection method used in British archaeology. Unlike fieldwalking, it is not targeted towards the registration of single artefacts but features and landscape forms. It records archaeological sites within their wider context, making it easier to recognise the spatial coincidence of registered phenomena.

Such understanding of the cultural landscape creates an interpretative scheme more suitable for analysing the results of non-destructive prospection methods. However, it also produces certain problems. The chronological interpretation of recorded relics is possible only in the case of very characteristic spatial patterns, as opposed to fieldwalking, where it is usually the first conclusion.

Currently, the tradition of *settlement pattern studies* is dominant in academic archaeology. It is also the accepted standard for field documentation and defines the structure of the database used by the Regional Conservator Office and National Heritage Board of Poland. Thus, some useful archaeological information gathered through remote sensing techniques and archaeological geophysics cannot be recorded within this system, because of the limited scope of categories referring mainly to the analytical categories of fieldwalking and *settlement pattern studies*.

Figure 2 presents the results of fieldwalking and archival finds, gathered during the AZP programme in the southern part of Wolin Island. Archaeological sites marked on the map are mainly present in rural areas, where the conditions are favourable for the fieldwalking method. These territories contrast with the forested part of the island where only four archaeological sites were recorded due to the

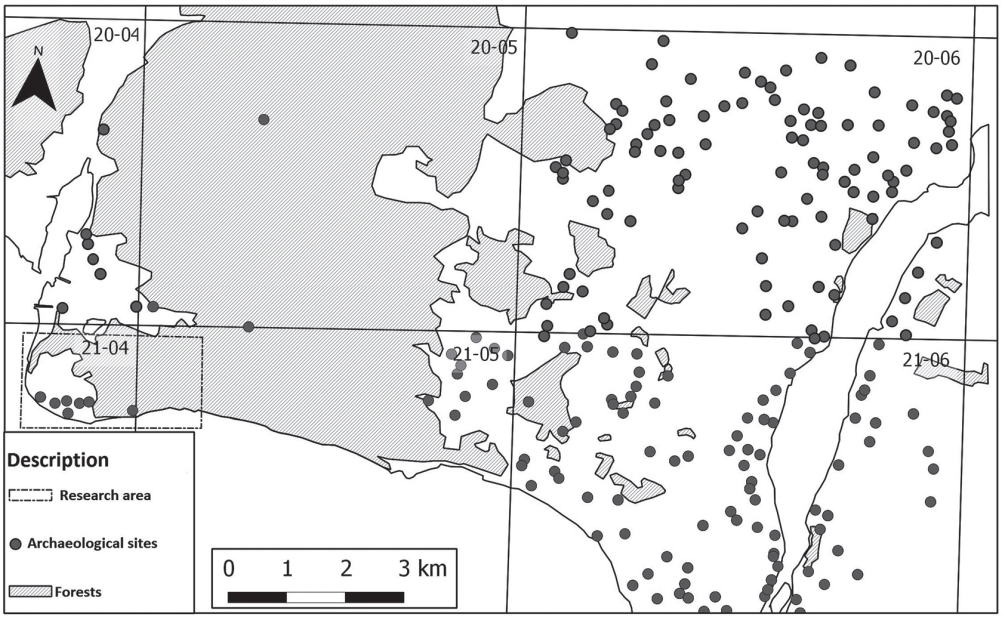

Figure 2. The results of fieldwalking and archival finds gathered during the AZP programme in the southern part of Wolin Island (HSR).

difficult conditions for surface observation. The limited potential of fieldwalking in forested areas was widely discussed in the past, so I will not focus on this problem here.

An area of 3 km^2 around Lubin village was selected for detailed analysis (district Międzyzdroje, voivodeship zachodniopomorskie) (see Figure 2). The tested area consisted of about 1 km^2 of rural landscape surrounding the village and about 2 km^2 of forested area. Due to information from AZP sheet no 21-04 there were seven archaeological sites registered in the tested area: site no 1 – early medieval stronghold (9th-13th century), sites no 2, 3, 4, 5 – early medieval settlements located in the vicinity of the stronghold, site no 6 – cemetery (11th-12th century), site no 8 (AZP number) – an early iron age hillfort (Rębkowski 2011: 103-108).

The interpretation of the chronology and function of archaeological sites no 1, 2, 3, 4, 5 is based on surface finds and written sources as well as some excavation works. Site no 1 (early medieval stronghold) was excavated several times since 1840 when the first excavations were undertaken. Archaeological site no 6 (early medieval cemetery) was discovered in 1937 due to construction work, and site no 8 (early iron age hillfort) was discovered and verified in 1964 (Hamling 1964). From the above archaeological sites, only site no 8 is located in a forested area. The remaining 6 sites are in the rural terrain. Relics of sites no 1 and 8 are visible on the surface, the remaining 5 archaeological sites are flat. It is important to note that sites no 2, 3, 4, and 5, classified originally as early medieval settlements, can in fact represent the remains of different parts of one and the same village built beside the stronghold. However, due to landscape processes they were manifested on the surface as 5 separate concentrations of artefacts. There is also a possibility that some of the concentrations of pottery were moved to where they were discovered as a result of post-depositional processes.

In the studies undertaken, airborne laser scanning was used as a means of verification. Newly discovered terrain forms were later verified by the fieldwalking. For the whole tested area a digital terrain model based on ALS was produced. The source point cloud had an average density of 4 points per square meter representing the ground level. The interpolated raster had a ground resolution of 0,5 m x 0,5 m. For the visualisation of the results, the composition of hill shaded relief and colour coded DTM was used as well as SVF.

Only archaeological sites no 1 and 8 were recorded by airborne laser scanning, as their relics are still well preserved (Figure 3 and 4). Along with details related to their topography, ALS provided valuable information about erosion processes and the surrounding environmental context. For obvious reasons, sites 2, 3, 4, 5 were not registered, either on DTM or on the raster interpolated from intensity value. These discrepancies between the results delivered by the two different prospection methods, proves their deficiencies and limitations.

Due to the ALS application, some previously unknown landscape forms that can be related to past human activities were identified in the designated area. Numerous old, unused dirt roads have been recorded (Figure 5). Some of these caused substantial erosion of the ground and were overgrown by old beech trees. In the forested areas to the east of contemporary Lubin village several sites of well preserved old field systems with clearly visible land divisions were revealed (Figure 6). Some archaeological sites of unknown function were discovered (e.g. an area surrounded by a shallow ditch and earthen bank, exploitation pits etc.; Figure 7). The whole landscape, equally in the rural and forested areas, bears the remains of World War II fortifications – lines of trenches, strong points, firing positions, anti-aircraft positions etc. (Figure 8).

Most newly discovered anthropogenic objects were located in the forested areas. And yet, none of them could be legally registered and protected by law as an archaeological site. There is no category in the traditional scheme of settlement studies either for the remains of old routes, or historical field divisions preserved in the landscape. When the system was created there was no prospection method that could effectively register such objects. From all the described objects, the remains of fortification systems from World War II fulfil all formal requirements for being officially classified

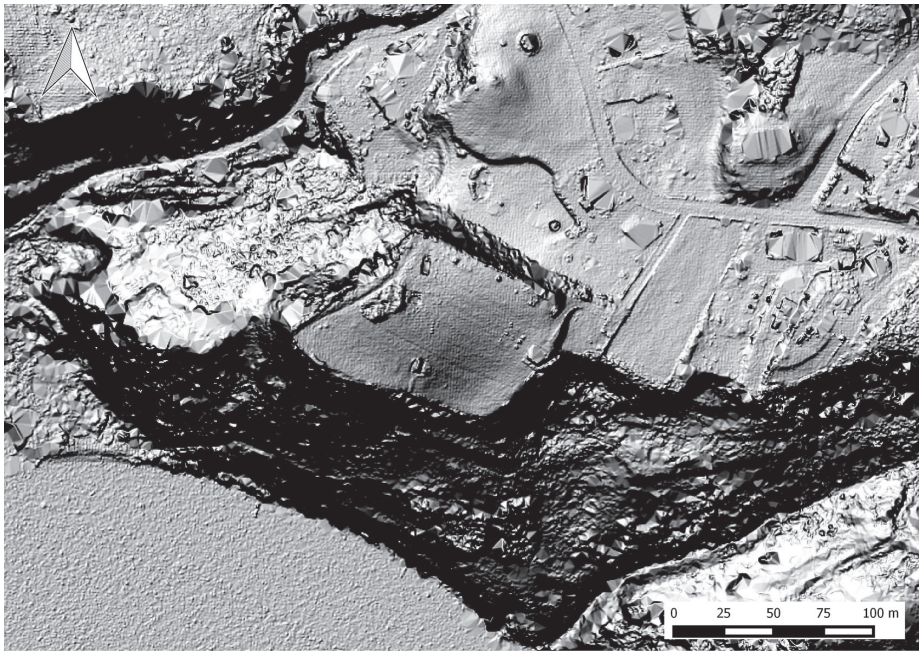

Figure 3. Site no 1. Early medieval stronghold destroyed due to land cultivation and other human activities. The eroded ravines are visible to the north and south from the site (HSR).

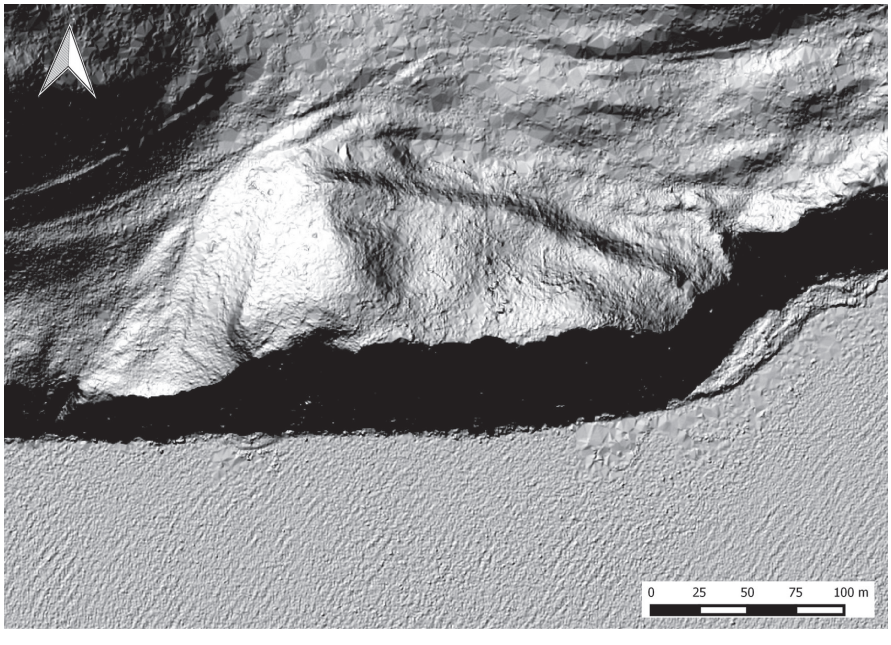

Figure 4. Site no 8. Early iron age hillfort partly destroyed due to the cliff erosion (HSR).

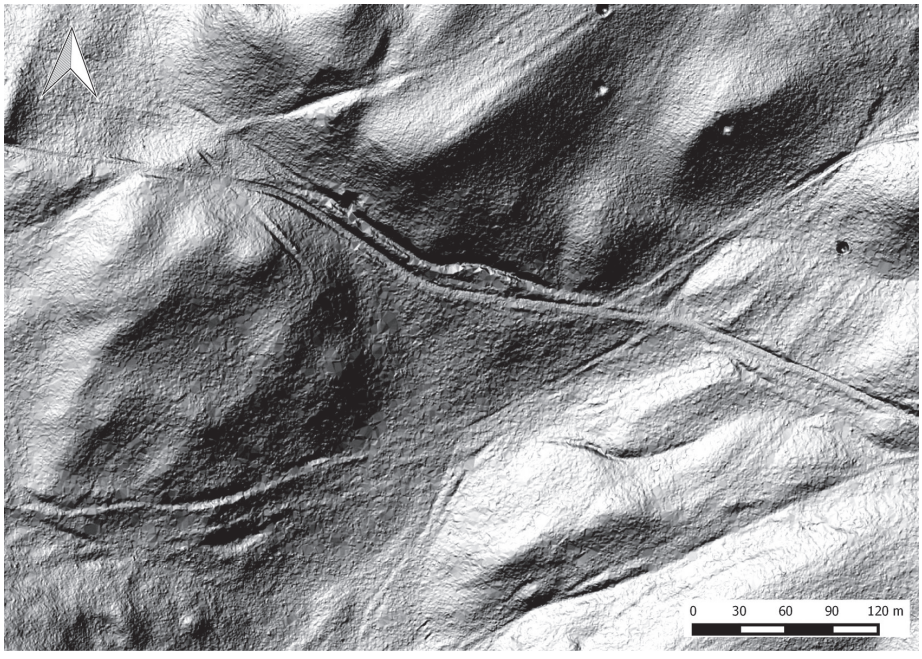

Figure 5. Unused dirt roads currently overgrown by old beech trees (HSR).

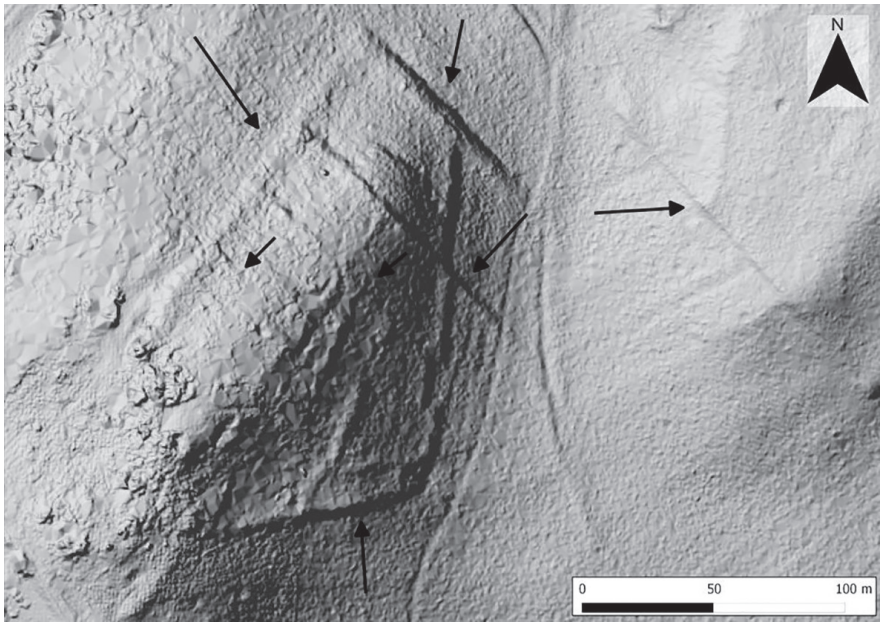

Figure 6. Old field systems with visible land divisions. Currently overgrown by beech forest (HSR).

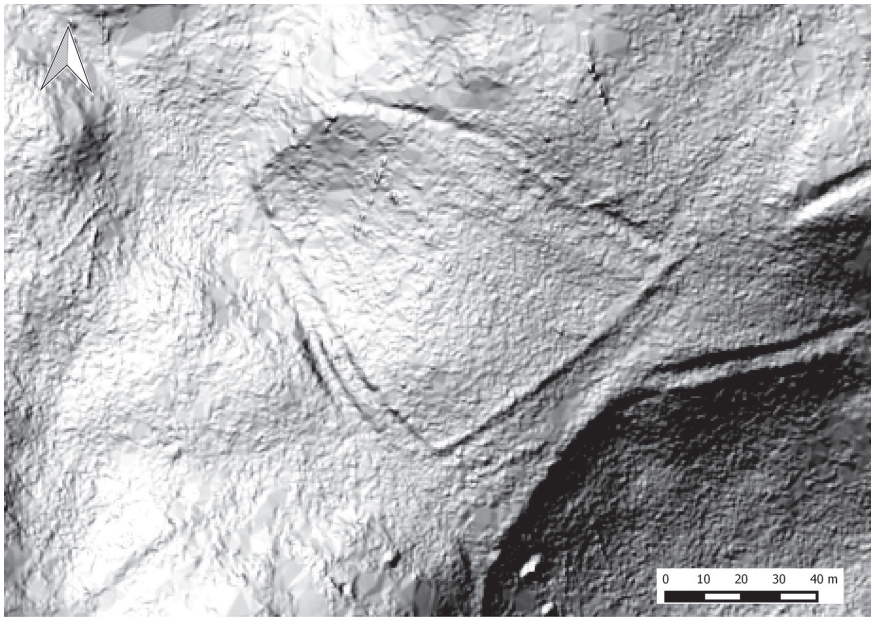

Figure 7. Anthropogenic terrain form of unknown function (HSR).

Figure 8. The remains of World War II fortifications (SVF+HSR).

as archaeological sites – they have both microtopographical forms and remains of material culture present in their contexts. However, they are commonly considered to be too young and too common to be worth protection.

Such circumstances highlight some gaps and inconsistencies in the way the cultural landscape and archaeological sites are studied and protected in Poland. Contemporary interpretative schemes applied in landscape studies appear to be unsatisfactory. The potential of remote sensing techniques derives not only from their technological advancement but our ability to interpret the collected results, and for now it is limited by the imperfections of our preliminary knowledge. The gathered data is voiceless until it is interpreted and incorporated into the archaeological narrative.

CONCLUSIONS

Every single stage of the procedure of archaeological landscape studies is separated from the consecutive steps by a certain discontinuity. Such qualitative gaps can be observed throughout the whole research process. There is no direct link between the material culture functioning in the past society and its relics studied by archaeologists. Remote sensing techniques and archaeological geophysics registers only indirect occurrences caused by those remains. The analytical tools and algorithms used for data processing and visualisation have no relationship with those relics as they are researcher-oriented and their main aim is to make the collected data as persuasive and communicative as possible in terms of human perception. The identification of specific archaeological features does not result from direct observation either, including the incorporation of this conclusion to the applied method of reasoning. Even the way we formulate the final conclusions and create archaeological narratives depends on our cultural patterns and socio-political context. All of these steps are related only by indirect hypothetical assumptions subjected to an applied paradigm.

Positivistic and modernistic methodology emphasises the dualism of the object and the subject of cognition (Rączkowski 2011: 9). However, even the simplest scientific statement always refers to the system of values and ideas and cannot be seen as a representation of reality (Minta-Tworzowska 1998: 335). It is the result of the intellectual and subjective effort of the archaeologist.

We can either pretend that there is no such mechanism, or try to define and control the theories and cognitive categories we use in the interpretation process. Only from this perspective can a critical approach be developed and both the cognitive potential and limitations of the methods be discovered. The growth of empirical evidence is insufficient to cause the development of knowledge, because it depends most of all on our ability to interpret and exploit it.

Polish archaeology has a long tradition of dealing with artefacts. Thus, more information can be retrieved from a few sherds of pottery found without context on the surface of the earth than the whole well-preserved abandoned field system or the old road course registered by ALS or aerial photography. Our intuition tells us, that there is much more to be said about landscape, based on non-destructive methods, although we do not possess the necessary analytical tools to achieve this aim as of yet.

The simple inductive comparison of results collected through different methods, as I have tried to argue in this paper, is insufficient and reductive. Thus, the main theoretical effort of archaeologists needs to be focused currently on working out new interpretative schemes that will not only allow us to understand and analyse anthropogenic forms registered by non-destructive methods but also to integrate different prospection techniques. Without these analytical tools, archaeologists will still be forced to ignore or omit those archaeological features that do not have their place in the traditional scheme of interpretation. This clearly illustrates how strongly the cognitive potential of scientific methods may be limited by declared theoretical orientation.

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