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Facts and their interpretation in paleoanthropological enquiries

Summary

Fakt i jego interpretacja w badaniach pradziejowych

The search for truth in the sciences which deal with the prehistoric past seems exceptionally attractive. What is involved in them is not only the historical dimension, but also an attempt at understanding the present moment. This trivial statement may in practice cause a lot of trouble, since the issue at stake is actually not how "truth" is defined, but rather how we arrive at it. We need to remember that while the first stage of the scientific inquiry usually involves the gathering and description of facts, the second stage is mainly concerned with their explanation and interpretation. At both stages of scientific cognition – that is both in the process of obtaining facts and interpreting them – truth can be falsified by mistake or on purpose. Thus, the main aim of science – to make our comprehension agree with the subject (the state of affairs) under scrutiny – can be suppressed by subjective motivation. It is therefore recommendable to present various reasons behind such a peculiar "emendation" of truth in prehistoric research.

Key words: paleoanthropology, paradigm, hypothesis, fact, interpretation

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1. Two stages of the scientific inquiry

Science aims at searching for truth. We therefore want the content of cognition to agree with the subject (or the state of affairs) under scrutiny. However, this trivial statement may in practice cause a lot of trouble, since the issue at stake is actually not how "truth" is defined, but rather how we arrive at it. We need to remember that while the first stage of the scientific inquiry usually involves the gathering and description of facts (No 1.), the second stage is mainly concerned with their explanation and interpretation (No 2.).

No 1. In paleoanthropology and/or archaeology the acquisition of facts is mostly reduced to toilsome fieldwork which may often be carried out to little or even no avail. Frequently, its success depends less on the researcher's experience than on mere luck, as Eugène Dubois, who arrived in 1887 at Padang in Sumatra, to work as a doctor in a local hospital. In his free time, Dubois busied himself with excavations, but apart from a few bones of archaic animals he found no interesting remains. Then an outburst of malaria forced him to move in 1890 to Java where he took up further explorations (Schwartz, Tattersall 2003: 521–523; Shipman 2001: 139–142). At the end of 1890 and the beginning of 1891, in the riverbed of the Solo near a village called Trinil, he first found three teeth with homind features, then a left femur and finally a primitive calvaria. The finding was classified not only as a new species, *Pithecanthropus erectus*, but also as the new family *Pithecanthropidae*, and was at first recognized as a missing link between the apes and humans, which had been long searched for before (Dubois 1894: 31; Shipman 2001: 210). Tracing the history of paleoanthropology and/or archaeology one can conclude that many other fascinating findings were obtained only thanks to the undiscouraged resolution and unceasing perseverance of a hard-trying investigator who had been sifting waste land for years.

No 2. Interpreting and explaining the previously discovered facts comes second in the course of scientific research, and although this stage is most often concerned with hypotheses which are accepted only tentatively, and therefore it has temporality inscribed in its very

nature, it nonetheless constitutes an integral and indispensable part of science. A good example of the provisional and also short-lasting character of various hypotheses is the changing phylogenetic position of the Neanderthal man, which has been the cause of an ongoing controversy, from its discovery up to the present moment. At the ending of the nineteenth and beginning of the last century it was believed that he had to be a primitive and obtuse ape-man. In the book *Originae de I'homme et des societes* published in 1870 Clemens Royer portrayed the Neanderthal as a wild creature with brutish appearance: "(…) a beast strong and rough, fearful and timid, avoiding the stronger, hiding in caves when food was scarce. [He] seeks refuge on trees or among the rocks and in need arms himself with broken branches. His life consists in want of peace, abominable pleasures, bloody feasts and wild orgies. The roaring of a lion makes him tremble, but he willingly fights with a clumsy aurochs afflicted by old age, or watches his opportunity waiting for a feeble goat" (Niewiadomski, 1870: 292). In Herbert G. Wells's short story *The Grisly Folk* we also come across a comparison which likens the Neanderthal to a wolfish creature with grey, shaggy hair and fearful appearance: "(…) They walked or shambled along with a peculiar slouch, they could not turn their heads up to the sky, and their teeth were very different from those of true men" (Wells 1927: 1). A similar picture of the Neanderthal was drawn by J.H. Rosny-Aîné (the pseudonym of Joseph Henri Honoré Boex) in his book *Quest for fire*. In his opinion, the people from the Neanderthal Valley were wild and bestial individuals with apish faces (Rosny-Aîné 1982: 17). In accordance with this literary belief scientific description also presented that Neanderthals posture was not entirely upright, and that he walked crouching, with his knees bent and his entire body leaning forward. Such was the picture of the Neanderthal which emerged from the famous reconstruction of this species based on Marcellin Boule's anatomical studies (Boule 1909: 1352). It was only after the Second World War that such images were completely discarded (Trinkaus 1985: 19–20). However, the Neanderthal people were still considered a separate species, characterized by a large capacity of the cranium (*ca*. 1500cc); big, arch-shaped supraorbital

toruses; wide and prominent nose; mandible without a mental eminence and a generally stumpy posture (e.g., Trinkaus 1986: 205–206; Stringer, Gamble 1993: 73–84; Klein 1999: 377–386). Now we know that although the Neanderthals indeed differed anatomically from a contemporary man in some morphological details, in fact they were not unlike us in terms of behavior. They were mostly hunters and collectors, creators of artefacts; they made fire, hunted for big animals and they possessed the faculty of articulate speech (Fiore *et al.* 2015:31–32; Johansson 2015: 316–319; Roberts *et al.* 2014: 40–41). Moreover, archaeological discoveries provided us with evidence of ritual burials of the dead. Symmetrically pierced shells or teeth were spotted in many burial places, which seem to support the idea that they could have been worn on a thread and used as an ornament or a kind of amulet (e.g., Grotte du Renne) (Benazzi 2012: 4; Caron *et al.* 2011: 2; Mellars 2010: 20147–20148). Some Neanderthal bodies were covered with paint, for instance red ochre (haematite), yellow ochre (limonite) or black coal (d'Errico, Stringer 2011: 1063; Zilhão *et al.* 2009: 1027–1028). Archaeological findings show that food and tools were planted in many graves, which seems to point to the belief that after death a human being continued to live in another dimension (Bahn 1998: 719–720; Klein, Blake 2002: 192–196; Stringer, Gamble 1993:88; Tattersall, Schwartz 2000: 213–218). All the above mentioned discoveries speak in favour of the taxonomic affinity between the Neanderthal man and our species. The fact of the "taxonomic vindication" of the Neanderthals should therefore come as no surprise, and they came to be treated as our kin, which was even expressed in the new name given to them: *Homo sapiens neanderthalensis*. And yet, what the change of the taxonomic status involves is the question of their possible miscegenation with the anatomically modern *Homo sapiens*, which would mean that they should have a share in our species' pool of genes. It is finding the confirmation in the newest research, which points to the genetic bond of the two forms (e.g., Green *et al.* 2010: 721; Noonam 2010: 550–552; Sankararaman *et al.* 2014: 355–357).

The changing taxonomic position of the Neanderthal clearly shows the hypothetical character of the interpretations of scientific

discoveries, which, of course, should not be understood as a weakness or a disadvantage of the science, but rather discloses its evolutionary character.

2. Do facts always describe reality?

At both stages of scientific cognition – that is both in the process of obtaining facts and interpreting them – truth can be falsified by mistake or on purpose. Thus, the main aim of science – to make our comprehension agree with the subject (the state of affairs) under scrutiny – can be suppressed by subjective motivation.

No 1. The value of truth in empirical sciences (physics, chemistry or biology) is manifested by the repeatability of the experiment. In fashioning the same, clearly defined initial conditions, the researcher should obtain the same results. In historical sciences, like paleoanthropology or archaeology, the obtained facts are, however, single and unique. This creates temptation to forge discoveries, which can be well illustrated on the basis of the so called "man from Piltdown". As we know, at the beginning of the 20th century, an amateur geologist, Charles Dawson discovered some ancient parietal and frontal bones in the gravel-pits of Piltdown, County Essex (South East Britain). At first the news caused enthusiasm among paleoanthropologists who immediately started excavations. The result of their efforts was indeed spectacular, as they found two fragments of a skull and a slightly damaged mandible with molars and a canine. The remains were accompanied by fauna from Lower Pleistocene (remains of a mastodon, rhinoceros, great beaver and deer). Morphological analysis showed that the cranium of the creature from Piltdown was of human size (*ca*. 1200cc), while the teeth and the mandible were characterized by a primitive shape, resembling rather that of an ape than a hominid (Dawson 1913: 73–80; Dawson 1915: 182–184; Oakley *et al*. 1971: 34–35). On the basis of this discovery, Charles Dawson and a curator of the British Natural Museum, Smith Woodward, announced that the remains belonged to the oldest fossil man found so far; it was given the name *Eoanthropus dawsoni* (Dawson,

Woodward 1913: 147). In this light, the remains of the Neanderthal people as well as those from Java seemed much more primitive when compared with the *Eoanthropus*, since, despite their size, the skull of these creatures were strongly flattened in the forehead area. This made Dawson and Woodward conclude that *Homo neanderthalensis* must has been a biologically degenerate and extinct line of fossil hominids – "(…) Mustierian man was a degenerative offshoot of early man, and probable became extinct; while surviving man may have arisen directly from the primitive source of which the Piltdown skull provides the first discovered evidence (…)" (Dawson, Woodward 1913: 139). Thus *Eoanthropus dawsoni* provided the only link connecting modern man with fossil apes from the Middle Tertiary.

The taxonomic position of the man from Piltdown gained wide recognition, which might have stemmed from the fact that the creature perfectly fitted the cranial concept of anthropogenesis; according to it, the development of the brain was phylogenetically earlier than bipedality or the appearance of hominid teeth (Tomczyk 2002: 86–87). It is nonetheless worth noticing that despite wide interest in the finding, it was not totally and unreservedly accepted by everybody. One can recall, for instance, doubts expressed by Hrdlička (1930: 89), who claimed that the remains found in Piltdown could have belonged to two distinct taxons. His suspicions originated from a mixture of geographic, morphological and historical factors. First, Europe was not inhabited in Plio- Pleistocene by huge apes. If the *Eoanthropus* was to be their descendant, one should first explain the reasons of their sudden disappearance. Secondly, although the morphology of the molars was apish, the surface of the occlusal wear was typical for a modern man. Finally, historical doubts concerned the very circumstances of the discovery. Dawson presented Woodward with two first bone fragments in 1912, although at the same time he admitted himself that he had found them much earlier, in 1908. Why, then, was there such a long delay in announcing a discovery of such importance? When Arthur Keith, a renowned authority in paleoanthropology, refused to accept the finding because it lacked canine teeth, the missing teeth "miraculously" turned up almost at a moment's notice, in 1913. Two

years later, further fragments of parietal and frontal bones as well as another lower molar were discovered about four kilometers away from the site of the first findings (so-called Piltdown 2) (Oakley *et al.* 1971: 34–35). Then, despite all the misgivings, the discovery of Man from Piltdown entered the annals of anthropology.

However, the discussion about the *Eoanthropus* soon returned with a vengeance when rich fossil material was found in Africa at the turn of 1930s. The newly obtained fossil data pointed to the fact that the appearance of human teeth and bipedality must have come before the development of the brain in the course of phylogenetic development. This was why in the 1940s the creature from Piltdown came to be considered an oddity, which simply did not fit the then--accepted model of human phylogenesis. In 1953, the remains were officially deemed a forgery, since it was established that the dark coloring of bone fragments, suggesting old age, had been fabricated by means of chemical substances. The application of the fluorine test allowed for estimating the age of both the remains, so they turned out to be almost our contemporaries. The skull in fact belonged to a human being, but the mandible with the teeth were an orangutan's and these parts must have been specially prepared (Tobias 1992: 246; Walsh 1997: 68). Extremely valuable is the J.S. Wiener's statement summarizing the research of Piltdown Man: "(…) From the evidence which we have obtained, it is now clear that the distinguished paleontologists and archaeologists who took part in the excavations at Piltdown were the victims of a most elaborate and carefully prepared hoax (…). For it has to be realized that Piltdown Man (*Eoanthropus*) was actually a most awkward and perplexing element in the fossil record of the Hominidae, being entirely out of conformity both in its strange mixture of morphological characters and its time sequence with all the palaeontological evidence of human evolution available from other parts of the world" (Weiner *et al.* 1953: 145). Thus, the story of the man from Piltdown shows that sometimes false facts can easily enter the field of science, especially if they seem to agree with the wide-spread schemata of scientific concepts.

As we have tried to show, the process of obtaining material in prehistoric research is therefore neither easy, nor free from false attractions. Thus, it is already at this stage that facts are either falsified or "modified" for many different reasons.

No 2. The second stage of scientific enquiry consists in providing a viable interpretation of facts. As Thomas S. Kuhn, a historian of science, argued, rather than observing "bare facts", we are always bound to see them through an accepted paradigm. This is certainly a very fuzzy notion, which is most often interpreted as a commonly approved theoretical conviction, endorsed by a group of scientists. What a scientist sees depends then not only on what he is looking at, but also what criteria he has learned before and how he employs them in his perception of the world, whereas we also know that such criteria are neither universal nor common. On the contrary, they are unique for different research centers. Scientists grouped around such a centre form a community; they participate in the same conferences, exchange ideas and projects, together work out specific standards of perceiving, examining and interpreting the world. Young adepts observe their mentors and take over their ways of thinking. This is how a given tradition is born, and then is passed on from one generation to another. This tradition certainly influences the ways of interpreting the obtained material. As soon as there appear more and more facts which simply cannot be explained by the so-far affirmed and approved scientific tradition, this tradition must come under scrutiny, and, in consequence, be rejected and replaced by another one. In practice, however, this may often prove a very difficult challenge, sometimes even unattainable. After all, what it involves is the rejection of the beliefs that a person may have affirmed through his or her life. It is a kind of revolution in the scientist's life. Kuhn (1996: 7) described this state of affairs in a very vivid manner: "what before the revolution was in the scientist's world a duck, after the revolution becomes a rabbit". This is why discussions concerning the interpretation of facts can last for years (Mayo 1996: 284). Their conclusion is rarely brought about by someone's generosity of spirit, which would allow this person to give up his or her convictions; far more often it

is the natural consequence of somebody's death or the dissolution of the research centre.

A good example of how facts are interpreted in the light of an existing paradigm will be the discovery of the first Australopithecus. Up till the 1940s scientists accepted the cranial model of anthropogenesis which originated on the basis of comparative biology as well as paleontological discoveries. A German naturalist, Ernst Haeckel, formulated in the mid-19th century a biogenetic law, according to which the process of ontogenesis is a quick and abridged version of phylogenesis; in other words, this means that each individual's ontogenetic development repeats the track of this species' evolution. An observation of the foetal development of the vertebrates seemed to corroborate Haeckel's hypothesis, since the successive stages of the upper vertebrates' prenatal development look like a row of lower vertebrates. Similarly, Haeckel (1899: 7) believed that the examination of the changes that take place in the development of the primate's embryos ought to allow for drawing phylogenetic conclusions. Notwithstanding some doubts, Haeckel's law soon became very popular because it not only corresponded with Darwin's theory of evolution, but also disclosed the evolutionary mechanisms and allowed for describing extinct forms.

Aware of Haeckel's law, in 1905 Julien Kollmann compared the skulls of the fetuses of apes and humans, and he noticed a great similarity between the examined skulls. It is only after birth that the apes' frontal bones become flattened, unlike human skulls which remain strongly arched. In consequence of the ontogenetic changes, human skulls are characterized by a large neurocranium and small, orthognatic facial part, whereas the skulls of apes have a small neurocranium and a large, prognatic face (Kollmann 1905: 18). According to Kollmann, this embryonic similarity between apes and man means that their common ancestor had a large skull. If, then, such a common ancestor had a large skull, then apes, whose crania are small, must be a side branch in the anthropoid's main line of descent. Fossil material seemed to substantiate Kollmann's presumption. The remains of the Neanderthal people from Belgium (Engis 1830),

Gibraltar (Forbes' Quary 1848) or Germany (Neanderthal 1857) were all characterised by a big cranial capacity, far exceeding 1000cc. Also the discovery of the *Pithecanthropus erectus* in Trinil (1890/91), characterised by a relatively big neurocranium well agreed with the cranial paradigm of human evolution.

Worth noticing is the fact that this model was perfectly consistent with the general conviction that the human brain "hides" all the most basic and important qualities of humanity, such like intelligence, sensitivity or religious beliefs. If then these features, which distinguish us from the rest of the animal kingdom, were to be found in the brain, it was also concluded that creatures who came before us in the line of evolutionary descent must have head big brains. Elliot G. Smith argued, for instance, that the development of the brain and the successive improvement of the nervous system was the first step in human evolution and the motor of further development. In his monograph, he wrote: "It was not the adoption of the erect attitude that made Man from an Ape, but the gradual perfecting of the brain and the slow upbuilding of the mental structure of which erectness of carriage is one of the incidental manifestations (…)" (Smith 1924: 39). The cranial model was further developed and fortified by L. Bolk. In his opinion, it was the great brain, just like the peculiar shape of the hands, feet or lack of hair that decided about the human peculiarity. Bipedality, although important, according to him belonged to the secondary morphological features of man. Bolk based his phylogenetic convictions on the related concepts of ontogenetic retardation and fetalisation. What these concepts meant was that in the phylogenetic development of man, some fetal features were thought to hold in adult individuals. An adult human being could therefore share some features with the fetuses of the apes, big brain being one such feature (Bolk 1926: 9).

The presented paradigm of cranial anthropogenesis stood behind the discovery of the first australopithecine which took place in 1924. It was Raymond Dart who, in Taung discovered an almost complete splanchnocranium with primary dentition and coming permanent molars as well as a cranium cast which was the product

of accumulating a large amount of mineral salts in the neurocranium. Low set, round orbital cavities with a lacrimal bone shifted inwards pointed to a hominid morphology. On the cast, Dart was able to identify the lunate sulcus which in human morphology runs arch-wise near the calcarine sulcus. The utmost rearward positioning of *sulcus lunatus* is directly connected with the growth of the associative cortex and one should keep in mind that because of this extreme position *sulcus lunatus* does not always occur in the case of man. The fact that it could be identified on the cast suggested, according to Dart, a reorganization of the brain, or, in other words, a development of australopithecine's psyche (Dart 1925: 197). Thanks to such a mental advancement, the australopithecine could take control of the inhospitable expanses of South Africa and exist there. In this context Dart recalled that apes never spread beyond the Kalahari desert which forms a natural geographical barrier separating the south African continent from the central parts. The fact that the australopithecine managed to cross this barrier and live in Taung showed their intelligence and the efficiency of bipedal locomotion (Dart 1926: 326). Also the teeth of a creature from Taung were more like the teeth of humans than of apes. And yet, its cranial capacity was only 530cc, which is comparable with that of apish crania. In February 1925, Dart published the results of his research in an article in *Nature* with the telling title: *Australopithecus africanus: the man-ape of South Africa*. He was fully convinced that the skull of an infant individual from Taung was similar to that of a human and not of an ape. All in all, the described features provided ample evidence that the australopithecine was the distant ancestor of a contemporary human being.

However, in the light of the then-accepted cranial paradigm of anthropogenesis the small-headed creature with human teeth from Taung could only be recognized as an 'oddity', in which case the development of teeth outpaced the evolution of the brain. Anthropologists were thus confronted with a difficult choice – although they were still reluctant to admit it openly – whether to abide by this paradigm, or discard it. Arthur Keith argued, for instance, that the creature from Taung was simply a juvenile form of an ape, since

he still considered cranial capacity to be the main criterion of belonging to a group of hominids. Keith assumed that only the creatures whose cranium was greater than 750cc could be included in this group. Only the remains of the Neanderthal man, the *Pithecanthropus* and the individual from Piltdown met these criteria. Keith stressed that brains smaller than 900cc generally belonged to 'idiots or imbecile'; while the cranial capacity of the anthropoids never exceeded 650cc (Keith 1931: 67). Since the remains discovered by Darta had the cranial capacity of 520cc, they obviously failed to meet the basic criterion qualifying for the family *Hominidae* – "(…) When we take all of these circumstances into consideration, it will be seen that the youthful Australopithecus does not help us to bridge the hiatus twixt the brain of ape and man. Yet it is the "brainiest" of all know anthropoid forms" (Keith 1931: 68). Another factor which would have evinced the apish status of the australopithecine was, according to Keith, the shape of the bones in the facial skeleton, i.e. the incisive bones, as well as the size of the orbital cavities and the shape of the piriform aperture. Even the size of the palate resembled the anthropoids. The morphology of the teeth, namely the size of the molars and the shape of the incisors separated the *Australopithecus* from humans and indicated his apish descent. The results of the research persuaded Keith that the *Australopithecus* represented merely an anthropoid ape. Moreover, Keith accused Dart of completely ignoring the question of chronology. The small-headed creature from Taung was geologically too young to aspire to the name of a hominid link, though at the same time he admitted that Dart's hypothesis could have been accepted had the *Australopithecus* been older, that is, had it lived in the Miocene (Keith 1925: 234).

Consensus was put forward by Robert Broom and Raymond Dart who contended that the discovered *Australopithecus* was a late specimen and a remnant of an earlier population, which gave rise to the *Eoanthropus* (Broom 1925: 571). The suggested solution, although probable, was nonetheless rejected by most naturalists. For if the African ancestor had human teeth, but a small skull, and the *Eoanthropus* was characterised by a human neurocranium and apish teeth, then

the evolution of teeth would have to bring up first regressive and then progressive changes. This, as M. Boule (1925: 402) admits, verges on the absurd as well as on scientific ignorance. In the end, the debate concerning the inclusion of the australopithecine in the *Hominidae* family finished in the 1940s. Rich fossil material convinced anthropologists that the cranial paradigm was misleading; a new paradigm had to be constructed, one which would incorporate the *Australopithecus* into the group of hominids.

It seems that today we are witnessing a similar debate concerning the remains from the Indonesian island of Flores, which were discovered in 2003 (e.g., Brown *et al.* 2004: 1055; Morwood *et al.* 2004: 1087). This hominin is remarkable for its small body and brain (ca. 380cc). The skeletal remains are dated to the period between 94 to 13Ka. It means that *Homo floresiensis* lived contemporaneously with modern humans. The small-headed hobbit looks like an 'oddity', which does not fit to the modern paradigm of anthropogenesis. According to it the smallest cranial capacity in genus *Homo* is about 510–660cc and characterized *Homo habilis*. Much younger representatives genus *Homo* (e.g. *Homo erectus*, *H. neanderthalensis*) show increase in cranial capacity to about 1000cc (Holloway *et al.* 2004: 285–291; Rightmire 1990: 195). For some anthropologists a study of comparative body measurements provided support for the hypothesis that *H. floresiensis* and *H. sapiens* are separate species (Brown *et al.* 2004: 1055; Gordon *et al*. 2008: 4652). The others do not believe the specimens represent a different species and try to explain finding from Flores by the pathologies (e.g. larone syndrome, microcephalic or endemic cretinism hypothesis) (Argue *et al.* 2006:461; Hershkovitz *et al*. 2007: 206; Obendorf *et al*. 2008: 1291) or anatomical remodeling (e.g. craniofacial asymmetry) (Eckhardt, Henneberg 2010: 332; Falk *et al*. 2010: 341; Jacob *et al*. 2006: 13415). The discussion remains, however, interesting, as it throws light on the functioning of scientific hypotheses and theories. Secondly, it debunks the myth concerning the indisputable objectivity of scientific research methods. The tendency to defend the given schemas, and the desire to interpret facts in their light, is an inherent element of all science.

3. Conclusion

The search for truth in the sciences which deal with the prehistoric past seems exceptionally attractive. What is involved in them is not only the historical dimension, but also an attempt at understanding the present moment. It turns out that truth can be distorted or completely falsified at both stages of scientific research. The awareness of this danger on the one hand calls for constant vigilance in the face of facts and interpretations that a scientist encounters in his work, while on the other it warns against the temptation to amend facts so that they fit into the accepted mental schemata. A researcher who undertakes excavations must also take into account the possibility that s/he will obtain facts which will not change in any way the current state of knowledge – in other words they will simply confirm the already existing hypotheses and theories. One cannot exclude, however, another possibility, namely, that the obtained facts will force one to revise completely one's former opinions. Prehistoric research, although they belong to historical sciences, demand thus an open mind, ready to accept any truth.

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