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Research Article

On the Paleo-Psychology of the Neanderthals

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Abstract

We must now recognize Neanderthals as fully human, endowed with all intellectual, psychological, and social functions, capacities, and competencies, including a developed intelligence. They were human beings who were highly adapted to their changing environment and knew how to solve the problems and challenges of their reality in creative, flexible, and intelligent ways. For a long time, however, Neanderthals were portrayed as primitive, intellectually inferior, and cognitively less capable than modern humans. This view was shaped not only by early interpretations of the archaeological record but also by the difficulty of applying modern concepts of intelligence to prehistoric human populations. The present contribution examines the question of Neanderthal intelligence and cognitive abilities from an interdisciplinary perspective. It considers archaeological, anthropological, and behavioral evidence relating to brain development, adaptation to changing environments, tool production, the controlled use of fire, artistic and symbolic expression, hunting strategies, burial practices, social behavior, seafaring, and language. These aspects provide important indications of planning, problem-solving, learning, communication, social cooperation, emotional capacities, and the transmission of knowledge. Rather than interpreting Neanderthal behavior solely in terms of technological simplicity, the evidence suggests a highly adaptable human population capable of responding creatively and flexibly to diverse environmental and social challenges. Their technological, social, symbolic, and communicative behaviors reveal a complex cognitive and psychological repertoire that challenges traditional assumptions about their supposedly primitive nature. Since April 2010, we also know that Neanderthals and modern humans interbred genetically. This finding further emphasizes their close biological relationship with Homo sapiens and contributes to a more differentiated understanding of Neanderthals as an integral part of human evolutionary history.

Keywords

Neanderthals, Homo Neanderthalensis, Cognition, Intelligence, Neanderthal Behavior, Paleolithic Archaeology, Human Evolution, Paleoanthropology

1. Introduction

When the term “Neanderthals” is used in abbreviated form in the following, it should be noted that the main phase of their development lies in the Late Pleistocene, that is, in a long developmental period of approximately 100,000 years, from about 127,000 to 27,000 years ago [50]. The interpretive history of the Neanderthal provides a scientifically and historically fascinating example of a phenomenon that could be described as the “de- primitivization” or humanization of the Neanderthal.

The fossil discovery of the 40,000-year-old Neanderthal in early September 1856 fit perfectly into the then-emerging framework of biological evolutionism, as advanced by

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Charles Darwin (1809–1882) and his followers since 1859 and was elevated to the status of a central piece of evidence for the biological evolutionists. According to this view, the Neanderthal had to be a primitive, ape-like, awkward, and essentially "dull-witted fool" and cannibal, especially when compared to modern humans, descendants of Homo sapiens [51]. Already in 1961, *Karl J. Narr* [42] referred to the "alleged intellectual inferiority of the Neanderthal."

However, the prejudiced and "cultural-racist" image and stereotype of the Neanderthal [23, 36] - arguably the best-studied prehistoric human aside from "Ötzi" - underwent a significant transformation with the gradual emergence of paleoanthropology as a distinct discipline with its own research methods and theories. The picture became increasingly differentiated and complex, and scholars eventually even spoke of Homo sapiens neanderthalensis.

> "After many confusions and misinterpretations, the Neanderthal found its way back into the human family tree. Yet the myth persisted of the shuffling, muscle-bound primitive man with little intelligence, who spent his life armed with a club. The much-quoted image problem of this misunderstood human continues to find its way, even today - 150 years after the spectacular discovery in the Neander Valley - into the living rooms and classrooms of modern humans." [51]

Initially, there were scientific prejudices and misinterpretations that stemmed primarily from early evolutionism, craniology, phrenology, and physiognomy. A similar development can also be observed in other human sciences such as ethnology and psychology [13, 18, 30, 33, 58, 60, 68, 69].

2. How Intelligent was the Neanderthal

Modern quantitative-experimental intelligence research, developed with reference to Homo sapiens sapiens, has existed for over 100 years [32] and has produced various concepts of intelligence. Important aspects of the modern understanding of intelligence include the novelty of the problems to be solved and the ability to restructure given patterns of thought and behavior. Equally significant are creativity, problem-solving, recognition, thinking, information processing, and a pronounced degree of interest and involvement in the relevant fields of work [21].

An operational definition of intelligence such as "intelligence is what intelligence tests measure" is, of course, not applicable to paleo-psychology [4, 5, 17, 62, 66, 71] firstly because intelligence tests are inherently culture-dependent [22], and secondly because the individual tasks of such tests do not correspond to the life circumstances and environmental conditions of the Neanderthals. A modern human being, deprived of technological aids, would likely have appeared as a "feebleminded dullard" in Neanderthal culture and environment. Nevertheless, reliable conclusions can be drawn from the archaeological finds of Neanderthal culture regarding the intelligence-related behavior and the "primitive or archaic thinking" of the Neanderthals. When speaking of "primitive thinking" [62], we must first offer a conceptual clarification by distinguishing it from so-called archaic thinking, that is, the thinking of prehistoric humans. From an evolutionary-psychological perspective, this type of thinking can be characterized by the following four features, according to *Friedhart Klix* [26]:

1) high integration of the individual with nature
2) high integration of the individual with the social community, of personality with ethnicity
3) high emotional sensitivity and affective responsiveness
4) high degree of imagistic thinking and thus iconic fidelity of mental representations and memory

According to this, archaic thinking fulfilled primarily two functions: first, it interpreted the unknown, the new, and the unconscious aspects of events, effects, and phenomena in nature by relating them to familiar things through similarity or analogy; second, it created social identification within the community by aligning the self with the rules of the group or ethnic identity.

Dietrich Mania [35] writes the following about the consciousness of Homo erectus in Europe:

> "Purposeful and planned actions, as demonstrated by Homo erectus in the application of his technology and the manufacture of his specialized tools, already presuppose a high degree of mental capabilities. Above all, the ability for abstract thinking must have been developed to a certain extent. This was also linked to linguistic communication. We see direct evidence of this in some bone artifacts from Bilzingsleben with intentionally incised sequences of lines and patterns."

The Neo-Darwinist *Robert Foley* [14] proposed an insightful heuristic model illustrating the interrelationship between social life, intelligence, and ecology, referred to as the so-called eternal triangle.

> "When we asked what role social factors played in the development of larger brains, we were able to identify two connections: First, brain volume was markedly linked to social life – a positive correlation, then, suggesting that the more complex the social behavior or the more numerous the group, the larger the brain is expected to be. Second, we found that there is a relationship between brains and food quality – or, more generally, ecology. However, this does not refer to the earlier-mentioned idea that large brains are necessary for exploiting certain resources, but rather that brains are metabolically expensive organs and their evolutionary existence therefore depends on the availability of high-quality nutrition. Our discussion thus completes the triangle of biological relationships, specifically at the intersection of sociality and ecology. This triangular framework enables us to decipher the nature of complex evolutionary events." [14]

Some prominent and interrelated pieces of evidence for the intelligence-related behavior of Neanderthals shall be briefly listed below. Moreover, it must be assumed that the distribution of intelligence-related behavior within a Neanderthal

population followed the Gaussian normal distribution, meaning that it likely also included highly intelligent and gifted Neanderthals (approximately 1.5%)!

2.1. Brain Size

Although a larger brain does not necessarily imply higher intelligence [14, 18, 23], the cranial capacity of Neanderthals ranged from 1,200 to 1,750 cubic centimeters and was therefore larger than that of modern Homo sapiens (approximately 1,450 cubic centimeters).

> "If we examine brains primarily from an ecological perspective, we are approaching the problem from the wrong angle. It is not the case that a large brain became necessary for a more complex form of food acquisition; rather, high-quality nutrition—that is, a stable and rich source of energy and protein—was required in order to sustain larger brains. This explains the relationship between brain volume and dietary range."
>
> "When we factor in the costs, the rarity of human evolution becomes more comprehensible. Certainly, large brains may offer advantages, both from a social and ecological point of view, and there are indeed selection pressures in favor of larger brains, but under normal circumstances, the costs outweigh the benefits."
>
> "The selection pressures that promote brain enlargement are likely connected to environmental complexity or multilayered social structures, or a combination of both factors; but the conditions that allow the benefits to outweigh the costs must ultimately be energetic in nature." [14]

To date, no clear conclusions can be drawn about the brain-based mathematical abilities of Neanderthals [19]. However, there is evidence of a sense of symmetry and of abstract motifs such as zigzag patterns and cross symbols [12].

2.2. Adaptation to Different Climates and Geographical Regions

> "As a 'generalist,' Homo erectus, who settled in a wide variety of geographical regions, evidently possessed the ability to cope with nearly all climatic and vegetative zones. Whether savanna, desert, high mountains, or tropical rainforest. His species proved to be successful and capable of survival everywhere, largely because he had lost his body hair and developed sweat glands."
>
> "While humans were therefore superior to most other animals in hot regions, their nakedness became a disadvantage in colder climates with pronounced seasonal variations. To survive there, they had to invent warm clothing as a substitute for their lost fur, which was initially made, without doubt, from the pelts of other mammals. This, in turn, required anticipatory thinking." [34]

As is well known, the lifespan of Homo erectus also coincided with several significant climatic fluctuations [9, 34, 50, 51], which brought about major changes in the environment and all areas of Neanderthal life. Coping with these challenges required a high degree of cognitive flexibility (flexibility is an intelligence factor!), creativity, and physical robustness (cf. also their relatively high life expectancy) [51]. The Neanderthals mastered these challenges impressively, as *Schrenk & Müller* [51] write:

> "The Neanderthals were also well established in the alternating cold and warm climates of Ice Age Europe. Although a total of 18 detectable climate fluctuations occurred between 50,000 and 30,000 years ago, their extinction therefore seems unlikely to have been caused by climatic catastrophes."
>
> "…what is certain is that the Neanderthals were the final link in a very successful human lineage in evolutionary history, and that they effectively responded to the Ice Age environmental conditions with strategies and techniques and managed well in their surroundings." [51]

Neanderthals are described as "short, robust, and strong" [51]. However, muscle-bound individuals do not automatically imply a lack of intelligence, as demonstrated by the Klitschko brothers in the present day, both of whom hold doctoral degrees.

2.3. The Manufacture and Use of Tools

Our knowledge of the longest period in human history, the Paleolithic, is based primarily on skeletal remains and, to a large extent, on stone tools.

> "There is no doubt, however, that these represent only a small portion of the total number of objects used and manufactured by early humans. Items made from plant-based and animal materials, which are subject to decay, have for the most part not been preserved." [34]
>
> "Based on tool finds, it can be inferred that the stone material was collected from as far as 80 kilometers away from certain settlement sites—an enormous achievement that required forward planning, deliberate action, and, not least, cultural flexibility on the part of the toolmakers." [51]
>
> "Sharpened mammoth bones from the Neanderthal site at Salzgitter-Lebenstedt, and evidence of 45,000-year-old birch pitch a natural adhesive presumably used to bind wood and stone, which could only be obtained through a rather complex distillation technique, leave no doubt: the Neanderthal's toolkit included more than just stone tools. The assumption that Neanderthals relied exclusively on stone implements, long upheld due to the better fossil preservation of stone compared to softer materials like wood, has now been disproven." [51]

Stone tools such as hand axes, scrapers, and hatchets, as well as wooden implements like spears (used as early as 400,000 years ago) [50, 65], were increasingly refined over time and adapted to their diverse functions. For the Paleolithic period, approximately 20 types of tools with over 200 variations are known. As hunters and gatherers, Neanderthals were highly adept at adapting to specific environmental conditions,

changing climates, and shifting animal and plant life.

The manufacture and use of these tools can be regarded as clear evidence of a developed practical intelligence, of the kind also measured in many modern intelligence tests (cf. the german intelligence-Test HAWIE).

2.4. The Controlled Use of Fire

The question of when early humans first mastered the controlled use of fire cannot even be answered with any real precision, as the available evidence from excavated hearths does not allow for definitive conclusions regarding the intentional kindling and sustained maintenance of fire [25, 34, 41, 42, 50, 51].

Early humans probably began using fire around 1.8 or 1.6 million years ago. A hearth at Gesher Benot Ya'aqov in Israel has been dated to approximately 790,000 years and may provide evidence for the controlled use of fire. A hearth surrounded by a ring of stones in the cave of Ménez-Dr égan on the Breton coast, estimated to be 450,000 years old, clearly indicates controlled fire use. The oldest known hearth in Germany is located at Bilzingsleben in Thuringia and is dated to between 400,000 and 350,000 years ago. *Bernhard Vandermeersch* considers the use of fire to be the most important prerequisite for the settlement of Europe by Neanderthals. Without fire, they would hardly have been able to survive the cold climates of the Ice Age in Europe [27].

The production, control, and diverse uses of fire, which represent a true "cultural revolution" in human history, presuppose a complex psychological interplay of cognition, emotion, and manual dexterity. The "natural" primal fear of fire had to be overcome, and at the same time, its usefulness as a source of warmth (protection against cold and moisture, fuel for cooking) had to be recognized. It is also well known that making fire requires a high degree of manual skill and fine motor coordination.

In addition to its function as an external source of energy, fire also served a protective role against dangerous animals.

Torches were used for the drive hunt.

> "At Torralba in Spain, F. Clark Howell discovered a complete herd of elephants that had been driven into swamps over 300,000 years ago with the aid of burning torches." [50]

Fire was even used for landscape management. At the end of 2021, researchers reported in the journal 'Science Advances' that Neanderthals were already reshaping their environment on a large scale 125,000 years ago. According to their findings, their regular presence led to the creation of an open landscape for around 2,000 years – in contrast to the surrounding dense forest areas. The team led by Leiden archaeologist *Roebroeks* concluded this from an analysis of sediments from lakes of that period. Their findings suggest that Neanderthal activities – particularly large fires – created the treeless landscape. [2, 38, 46, 53].

On the social function of fire *Ludwig* [34] writes:

> "In addition to providing warmth on cold nights and keeping predators away, campfires also had an important social function. They served as gathering places for members of a group who likely spent their days apart as hunters and gatherers, offering an opportunity to exchange experiences and to plan future collective activities. The hearths of early humans were therefore probably of great importance for both community cohesion and the development of language." (…) "…fire and the smoke rising from it also played an important magical-religious role…"

Gerhard Bosinski [8] rightly states:

> "The mastery of fire as a decisive step in our history can hardly be overestimated. Fire provided effective protection against predators, especially big cats, which had been the most dangerous enemies of our species up to that point. The possession of fire was also of crucial social importance. People gathered around the fire, and the hearth became the center of the group and of life itself. Only humans master fire, and when a lion roared outside, there was no doubt: it was an animal. The mastery of fire marked the definitive separation between humans and animals. Fire provided warmth and made it possible to inhabit cooler regions."

The mastery of fire, together with the use of tools, likely contributed indirectly to the development of human speech, that is, to language-based thinking, by gradually relieving the jaw, not least due to the newly possible cooking of food. Fire not only brought "light into darkness," but also fostered the development of consciousness and social life.

Sigmund Freud engaged with the theme of fire on various occasions, beginning with "The Interpretation of Dreams" (1900) [16]. At the end of his essay "On the Acquisition of Fire" (1932) [15], he writes:

> "And the primitive man, who was dependent on understanding the external world through his own bodily sensations and physical conditions, can hardly have failed to notice and make use of the analogies revealed by the behavior of fire." [15]

In this text, as well as already in "The Interpretation of Dreams" [16], *Freud* also noted a connection between fire and the urge to urinate and stated that "the acquisition of fire presupposed an act of instinctual renunciation" [15, 44].

2.5. Artistic Productions

Stone Age artworks - although no linguistic or musical documents have survived (cf. the prehistoric flutes) [10] - can also provide insight into the intellectual development of humans. The oldest known ornaments attributed to Neanderthals date from approximately 115,000 to 35,000 years ago. There is also evidence of (bone) engravings and the use of pigments, particularly ochre and black manganese oxide [1, 3, 27, 31, 48, 51].

> "Until just a few decades ago, Neanderthals were not thought to possess any particular intellectual capabilities. This view has since been challenged by the discovery of a

facial mask, estimated to be at least 32,000 years old, found in 1975 between Tours and Saumur (Loire region, France) in the cave of La Roche-Cotard. The piece, measuring only about 10 by 10 centimeters, consists of a flint stone into which a 7.5-centimeter-long bone splinter has been inserted through a natural opening in such a way that its visible ends appear to form eyes. The object gives an immediate impression of a face and is thus regarded as a kind of primordial figurine on the path to Paleolithic art." [34]

"…and for the first time in human history, art can be identified that presupposes advanced manual dexterity, a high capacity for abstraction, and a sense of aesthetics. This includes the 32,000-year-old Lion Man figurine from the Swabian Vogelherd Cave, mammoth ivory pendants shaped like horses from Sungir in Russia, flutes, and cave paintings—all created at the same time that the last Neanderthals were struggling in vain to preserve their population." [51]

A 50,000-year-old shell ornament, recently discovered by *João Zilhão*, was found to be painted with red and ochre pigments and featured two perforations, suggesting that Neanderthals likely wore it on their bodies [63].

The production of ornaments, as well as the use of pigments, represents a considerable cultural and intellectual achievement and highlights the significant role of art in prehistoric societies.

Methodological difficulties can generally arise in the analysis of engraved drawings, for example those produced by Ice Age hunters, whose art was, until the 1920s, often compared with that of children and "primitives." After *Lartet* (1801–1887), the founder of Paleolithic research in France, discovered in 1864 (five years after *Darwin's* "On the Origin of Species…"!) an engraved image of a mammoth on a piece of bone in an Ice Age cave (La Madeleine) - the first figurative drawing by a Paleolithic human - the exciting search for further artistic productions by prehistoric humans began. In 1879, the cave paintings of Altamira were discovered by a young girl, but were ignored by researchers for twenty years. By 1895, five caves with Ice Age paintings were already known: Altamira, Pair-non-Pair, Marsoulas, La Mouthe, and Chabot. Between 1903 and 1908, the French prehistorian *Breuil* (1877–1961) and *Obermaier* (1877–1946) published the first studies on Ice Age art [28, 29]. This is a brief overview of the prehistory of prehistoric research.

In 1968, during an excavation of an Ice Age camp (Magdalenian, ca. 10,100–10,400 BCE) at Gönnersdorf (Germany), slate tablets were discovered bearing approximately 400 human figures (mostly women), about 200 animal depictions (74 horses, 61 mammoths, etc.), and an unspecified number of symbolic signs. While the animals are depicted so realistically that one might speak of a "photographic style," the human figures are systematized or abstracted—a typical stylistic feature of Ice Age art. The distinctive, encrypted, abbreviated, and abstract image of the human being is deliberately contrasted with the image of animals [6, 7].

If one were to apply the method of statistical detail analysis of human drawings developed by *Ziler* [72] to these Ice Age works, a very low "human-figure quotient" would be calculated (a measure that is currently highly correlated with the intelligence quotient). This could lead to the mistaken conclusion that Ice Age humans were of low intelligence or developmental level. However, anyone who considers their remarkable technology and ergology will quickly be convinced otherwise.

In addition, a fundamental question arises as to whether actual human beings or supernatural entities were being represented, whether they depict specific individuals (whom it may not have been permissible to portray realistically for magical reasons?), or whether they are representations of particular ideas and motifs such as female fertility, the "maternal principle," or sexual desire. A scholarly explanation must therefore be based on the archaeological context of the respective objects and the general cultural conditions [57].

2.6. Hunting Behavior

The world's oldest fully preserved wooden spears, recovered from the lignite opencast mine at Schöningen (dating to approximately 400,000 years ago),

"provide clear evidence that early humans did not, as is still frequently assumed, secure their food supply by scavenging carrion, but were in fact highly skilled hunters, equipped with outstanding technical abilities in woodworking and already capable at this early stage of planning, organizing, coordinating, and successfully executing big-game hunts using specialized weapons. These spear finds thus offer broad and at the same time subtle insights into Lower Paleolithic working and living practices, particularly with regard to effective food procurement and the associated cooperative labor, thereby contributing to a new image of early humans, their intellectual capacities, and also their social behavior." [64]

"Hunting large game such as mammoths required not only an arsenal of weapons including throwing spears and thrusting lances, but also the hunters' ability to plan, to abstract, and to act strategically." [51]

"Massive animals such as mammoths and bison were by no means easy prey, and yet they were hunted by Neanderthals - a true challenge which, according to archaeologists such as Bärbel Auffermann and Jörg Orschiedt, could only have been managed by a wellcoordinated hunting team of at least twenty individuals." [51]

Even huge forest elephants were hunted and expertly butchered [54]. It is actually difficult to imagine this organised, dangerous group hunting of large game (cf. hunting accidents!) [51] taking place without verbal communication. In any case, the skeletal remains of the prey found at the sites provide clear evidence of the excellent hunting skills of, for example, Neanderthals [61].

2.7. Burials and Mourning Behavior

Burial serves both the ritual disposal of the body and the ritual processing of the experience of death and separation [39-41, 47, 55, 56, 67, 70].

In addition to pragmatic considerations, burials may be psychologically motivated, among other things, by fear of the "powerful" dead. Since the deceased often "reappear" in the dreams of the bereaved, this can evoke fear or ambivalence, which may be managed through ritual practices. At the same time, the loss of a fellow human being invariably triggers mourning reactions in both the individual and the group.

> "The most compelling evidence for the existence of rituals is provided by the dead of the Ice Age. For the first time in human history, burials occur, which can certainly be interpreted as a sign of care, compassion, and culturally developed forms of interaction among members of a group. However, this view was not necessarily shared until the early 20th century. At that time, the prevailing academic opinion held that such burials could hardly have been carried out intentionally according to our standards. Yet the burial of a person ultimately presupposes that the survivors mourn and, in their grief, honor the deceased." [51]

About 40 years ago, *Stubbe* expressed some skepticism in his book "Formen der Trauer" (forms of mourning) regarding the mourning behavior of prehistoric humans, particularly in relation to the archaeological findings and their interpretation:

> "It is primarily burials that can provide us with clues about prehistoric mourning behavior. However, the difficulties that can arise in interpreting such findings become clear through a detailed description of the burial of a girl that took place in 1966 among the Kogi 'Indians' (Chibcha) in the Sierra Nevada de Santa Marta in Colombia [45]. After the burial site is selected, the shaman performs a series of ritual acts and declares: 'This is the village of death; this is the ceremonial house of death; this is the uterus. I open the house. The house is closed, and I will open it.' He then proclaims: 'The house is opened,' and withdraws. The deceased is wrapped in a white cloth, and the father sews the shroud closed. While all of this is taking place, the mother and grandmother of the deceased sing a solemn song, almost without words. At the bottom of the grave, green stones, shells, and the shell of a gastropod are placed. The shaman then makes several failed attempts to lift the body, pretending that it is too heavy. Only on the ninth attempt is he able to raise it. The body is laid in the grave with the head facing east, and 'the house is closed,' that is, the grave is filled in. Further ritual movements around the grave follow, and finally all participants withdraw. The ceremony lasted two hours."
>
> "As *Reichel-Dolmatoff* notes, a future archaeologist examining this grave would find only a skeleton oriented with its head to the east, along with a few stones and shells. The rituals and, above all, the religious ideas implied in them can no longer be 'reconstructed' from these remains. It must be emphasized that the symbolism associated with the burial, when considered solely on the archaeological level, remains as inaccessible to us today as that of a Paleolithic grave. This is the particular nature of archaeological arguments, which limit and constrain their potential 'messages.' This, in fact, constitutes the 'poverty and opacity' of our sources on prehistoric mourning behavior." [55]

Today, a wide range of evidence exists that strongly suggests the presence of developed mourning behavior among Neanderthals. On the one hand, mourning behavior is already observed in our "closest relatives," the great apes [24, 55, 59], as well as in other mammals. On the other hand, burial and mourning rituals in prehistoric societies serve to consolidate both social roles and social structure, while also reinforcing the bonds among members of the group. These bonds are expressed, among other things, in grave goods, the special treatment of skulls (possibly even their transport), and in endocannibalism [51, 58]. Furthermore, burial rites are situated within a religious context [33, 42] and, as an additional binding element, take on the form of ancestor worship. This creates a continuum between the living and the dead. These various ways of connecting and stabilizing the group represent clear factors of outstanding importance in the evolution of humankind [9, 59].

Both the burials and mourning behavior of Neanderthals can thus be seen as expressions of their developed emotional intelligence and competence, as the American psychologist *Carolyn Ingrid Saarni* (1945–2015) calls it, as well as of their capacity for empathy.

2.8. Seafaring

Today, scholars are discussing the possibility of a direct migration of Homo erectus via the Strait of Gibraltar, which reopened around 5.5 million years ago [25, 37].

> "If Homo erectus actually constructed vessels—such as rafts—that enabled them to cross sea passages several kilometers wide, this would presuppose both a high degree of social organization and more than just rudimentary verbal communication. Without such communication, cooperation among several group members on a project based on a shared plan would be hardly conceivable." [34] (cf. also the recent findings on Flores!)

2.9. Social Behavior

Today, when speaking of "social intelligence," the term generally refers to behavior within groups that is guided by social competence and organization [52].

How "human" and socially oriented Neanderthals were

> "is shown by the fact that 40% of burial findings involve children and adolescents. This suggests that both the young and the elderly - who were cared for until their deaths - were just as important within the social structure of our Ice Age contemporaries as fully capable Neanderthals." [51]

> "Life-sustaining measures such as the care and feeding of the sick and toothless elderly can be demonstrated in many findings of older Neanderthals. The old man from the Neander Valley was thus not a solitary case of care. Healed injuries even suggest a form of 'medical' treatment involving medicinal plants." [51]

Cornelia Hackler (1999) also concludes from the existence of burials, the care of the sick and frail elderly, and well-healed bone fractures that Neanderthals exhibited pronounced social behavior. She writes:

> "These individuals, who due to their limited mobility were unable to feed themselves, were cared for by the group - despite the fact that this must have placed a considerable burden on the community as a whole. This applies particularly to elderly people, who were evidently considered valuable enough by their social group to be kept alive. One cannot help but think that it was their years of rich experience and knowledge that provided the group with an invaluable intangible advantage in knowledge - and thereby in biological survival. How else but through language could such complex communicative transmission of knowledge have been possible?" [20]

2.10. Language Ability

The capacity for language in Neanderthals is highly probable. Brain anatomy, tool production, social life, group hunting, the use of symbols, and burial practices all clearly point in this direction [11, 20, 50].

> "Endocranial casts, that is, internal casts of braincases, indicate a highly developed brain with both Broca's and Wernicke's areas, along with the cerebellum, as further prerequisites for human language ability." [51]

> "Even though the discovery of the Kebara hyoid bone is not definitive proof of Neanderthal language capacity, the mere fact that Neanderthals were biologically capable of producing shaped sounds using their palate is a significant indication, at the very least, of their anatomical ability to speak. Their lifestyle, hunting practices, and the production of tools and culture all point to a communication system whose complexity was comparable to that of modern humans." [51]

The engraved bone artifacts from Bilzingsleben with sequences of notches are, for *Dietrich Mania*, clear evidence of the existence of language in Homo erectus.

> "For us, these artifacts, especially the first one described with its fan-like sequence of incised lines, represent the transmission of thoughts and ideas in a visually effective form. The use of geometric, almost symbol-like patterns demonstrates the capacity for abstraction. A being capable of abstract thinking could have communicated on this level only through a language based on word symbols or through transformation into graphic representations of the type described here. For us, this is proof of our developed Homo erectus' capacity for abstract thought and language." [35]

2.11. Starry Night/Cosmology

What effect the fascinating experience of the starry night sky (which, unlike today, was not yet obscured by city lights), with all its phenomena, had on the thinking and cosmological vision of the Neanderthals is something we do not know. But we may assume that it was significant (cf. Archeoastronomy) [49].

3. Conclusion

Even if it may be difficult for some "stone and bone paleoanthropologists" to admit, we must now recognize Neanderthals as fully human, endowed with all intellectual, psychological, and social functions, capacities, and competencies, including a developed intelligence. They were human beings who were highly adapted to their changing environment and knew how to solve the problems and challenges of their reality in creative, flexible, and intelligent ways. Since April 2010, we also know that Neanderthals and modern humans interbred genetically [10, 43, 62].

Abbreviations

HAWIE	Hamburg-Wechsler-Intelligenztest für Erwachsene (Hamburg-Wechsler Intelligence Test for Adults)

Author Contributions

Hannes Stubbe: Conceptualization, Investigation, Supervision, Writing – original draft

Anja Noëmi Stubbe: Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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