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Peer Review

Review of: "Derivation of Human Constructs of Reality"

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Taking the Long View of Reality, a review by Michael Walker of *Derivation of Human Constructs of Reality* by Robert Bednarik

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Robert Bednarik asks us to accept his opinion that biological evolution of human beings took place by a process of unintended self-domestication, which between forty-thousand and thirty-thousand years ago began to leave traces, in the archaeological record, of aspects of human constructs of reality that he alleges are recognisable by us as putative "*exograms*", to use Merlin Donald's[1] neologism that, by supposed analogy, alludes to cerebral mnemic traces or "*engrams*" which were proposed over one-hundred years ago by Richard Wolfgang Semon [2] and demonstrated ten years ago as involving the consolidation of cerebral memory by "*engram*" cells detected by M.I.T. neurophysiologists Takashi Kitamura, Mark Morrissey and Nobel Laureate Susumu Tonegawa [3]. By contrast, the supposedly analogical "*exograms*" elude experimental elucidation; anyway, it is a false analogy.

Which is why Bednarik's proposal is a house of cards. Not only do archaeologists and anthropologists voice disagreement about how to interpret Bednarik's "*exograms*", but also, furthermore, evolutionary biologists disagree about the very notion of self-domestication that Bednarik takes for granted and applies to the evolution of human cognition. A generous view of his conjecture might be that it is not unthinkable with regard to the vast timespan that began around half-a-million years ago when *Homo sapiens* forebears were evolving biologically from the successors of *Homo erectus*, and perhaps were evolving, imperceptibly, fluent ways to communicate with one another (for example, by proto-linguistic symbols), though the dearth of even putative "*exograms*" leaves us only with their skulls on which to base conjectures about their possible "*cognitive self-domestication*". Because Bednarik has built up his house of cards on the notional foundation of putative "*exograms*", he fails to take due account of important matters (about which, scholarly prudence recommends studious neutrality) that concern biologists who consider the concept of self-domestication in animals; see, for instance, two thoughtful reviews [4]. In my opinion, these matters ought to have merited Bednarik's attention far more than that which he gives to Nick Bostrum whom Bednarik laboriously sets up as a straw man for immediate demolition.

Empirical archaeological and anthropological findings that are adduced as allegedly corroborative support for an evolutionary neurobiological process of unintended human self-domestication, are, like beauty, in the eye of the beholder; they must be perceived as reflecting metaphysical truths. Thus, we are enjoined to accept as a matter of faith, rather than fact, that "*As competence in using exograms became an evolutionary selection criterion, it also invited the volitional formulation of reality constructs.*" Or more explicit still, "*Exograms can be assumed to have had a profound effect on human cognition.*" Assumed by whom? Not by me, for a start. It is make-believe and wishful thinking. Bednarik's wish has become the father of his thought. He asserts that around forty- to thirty-thousand years ago "*(t)his timeframe coincides with the widespread introduction of figurative palaeoart and other developments signifying the induction of essentially modern cognition and consciousness. These are thought to have developed from the exploratory behaviour prompted by neoteny.*" This is a strange assertion, because neoteny in humans is a descriptor of morphology that often is used in comparative hominoid anatomy when biological or physical anthropologists liken similarities of adult forms to those of a foetus at term or a newborn infant. Paedomorphosis (or paedomorphy) in human ontogeny is an aseptic, less loaded and therefore preferable way of referring to an evolutionary phenomenon that Bednarik calls "*neotenisation of humans*" [5] and hints, by so doing, at the processual determinism that all too often is implicit in concepts of self-domestication. In any case, it is far from clear what precisely he means by "*...developments signifying... modern cognition and consciousness... thought to have developed from the exploratory behaviour prompted by neoteny.*" A possible interpretation might be the conjecture that, in contrast to great apes and maybe *Australopithecus*, prolongation in *Homo* of the time-span between birth and full skeletal maturity gave immature primeval humans more time to engage in exploratory behaviour before, presumably, customary, stereotypical, normative, routine adult behaviour was required or imposed.

However, human youngsters were not primeval, and their skulls were little different from ours, forty- to thirty-thousand years ago when, inside European caves, their visits bequeathed us traces that Bednarik adduces in support of attributing their alleged production of "*exograms*", and also maybe "*figurative palaeoart*", to their modern cognition and consciousness. He cites *The Nature of Paleolithic Art* by Dale Guthrie, whose exhilarating book I reviewed in 2006 [6] following its publication in 2005 by the University of Chicago Press. Guthrie's imaginative view of aspects of "*paleoart*" from a perspective of adolescent boys learning how to hunt is an attractive conjecture. His suggestion that youngsters' playful behaviour influenced the creation of diverse aspects of "*paleoart*" is a conjecture that is not incompatible with Derek Hodgson's neurovisual resonance theory (I discussed ten of Hodgson's published articles together with Guthrie's book in the same 2006 review [6]; see also D. Hodgson [7]). Whereas Guthrie's approach is commensurable with Bednarik's forty- to thirty-thousand years ago "*timeframe*", Hodgson's is appropriate for a plausible half-a-million year-long period of evolutionary neurobiological adaptation.

Taking the long view, a drawn-out, gradual process of natural selection, over hundreds of thousands of years, is compatible with two separate but interrelated matters referable to *active inference* and the *free energy principle*. The first of these is the evolutionary expansion in *Homo* of the cognitive "*zone of bounded surprisal*" or ZBS [8] and the slow, uneven trajectory of the development of human skilfulness during the past two-million years of evolution in the genus *Homo* [9] with the corresponding cerebral neurobiological evolution of the requisite memory capacity [10]. The information theoretic "*surprisal*" (*a.k.a.*, "*self-information*") is regarded, for practical purposes, as equivalent to cognitive "*surprise*", or, more simply, to *prediction error* in predictive-coding accounts of the Bayesian brain. The lesser or greater tolerance of cognitive surprise corresponds, respectively, to a narrower or a broader ZBS. ***In***tolerance can be interpreted as failing to model or infer the counterfactual outcomes of observed novel behaviour, simply because there was no (evolutionarily-endowed) generative model at hand (or in the head) to predict that kind of behaviour, which even can be, and often is, one's own unintended accidental behaviour or slip-up! Plausibly, the experience of cognitive surprise is an outcome of an evolved neurobiological propensity for exploring unorthodox possibilities of available affordances that are recognised in an animal's natural or social environments. It should be borne in mind that the free energy principle posits that the *minimisation* of surprise, as scored by *variational free energy*, is a hallmark of self-organising systems such as are animals' brains.

The second matter to keep in mind, when considering the drawn-out, gradual process of natural selection of our broad human ZBS, is that the archaeological record is still very far from providing us with a satisfactory guide-line, and this has been brought into high relief by the dating to *before fifty-thousand years ago* of rock paintings in Sulawesi [11], which renders as being by no means implausible the possibility of similar antiquity underpinning "*palaeoart*" in Australia, long before Bednarik's thirty- to forty-thousand year-ago "*timeframe*" for the "*self-domestication*" that he envisages took place in Europe.

All considerations about the length of time (whether short or long) during which the evolution takes place of any cerebral neurobiological adaptive change must take into account the part played by the various kinds of memory, especially when the evolutionary outcome is a disposition or propensity towards behaviour that was absent previously (*e.g.*, repeated execution of "*palaeoart*", in the case under review). The gradual morphological evolution (during almost three-million years according to human palaeontology) of the genus *Homo* suggests that the pace at which significant biological change took place was not excessively faster than that which has been estimated for some other complex organisms that have been studied in our Earth's palaeontological record that stretches back several hundred million years. Therefore, other things being equal, it seems most reasonable, on balance, to infer that there was evolution in *Homo* of significant biological changes during time-spans of hundreds of thousands of years (rather than, say, a ten-thousand year "*timeframe*"), given the paucity, near dearth, of incontrovertibly-overwhelming biological (or perhaps palaeobiological or palaeo-ethological) evidence to the contrary. It is unclear whether or how "*palaeoart*" could be interpreted as an outcome or consequence of the evolution of human neuroethology (see below), but, in any event, it is hard to envisage, let alone uncover and define, unambiguously-specific palaeobiological or palaeo-ethological associations, by using contemporary empirical methods (*i.e.*, excavation, with meticulous analysis of archaeological and palaeobiological findings, and relevant off-site or field data).

A less fraught approach, in my opinion, is to suggest that the cerebral neurobiological adaptive changes in *Homo* that underpinned a possible propensity towards behaviour of which an outcome was "*palaeoart*", were changes brought about by natural selection, throughout the evolution of the genus *Homo*, towards an ever-increasingly broad "*zone of bounded surprisal*" (ZBS) and its corresponding open-ended self-awareness with regard to conceivable alternative cognitive responses to the "*affordances*" (*sensu* Gibson [12]) provided by interaction with an individual's surroundings. These include other individuals, as well as environmental aspects of every kind, from plants to ants or antelopes, from rock, soil and water to snow, rain, wind, lightning and wildfire. Put somewhat crudely, open-ended awareness of alternative behavioural possibilities can be enhanced if archetypical "brakes" (figuratively speaking) are "loosened", that otherwise constrain our reflexion on - and thereby automatically produce exclusion of – our cognition (often unconscious or barely conscious) of possible "*affordances*" that may have become newly available following unusual surprising impingements on our ZBS, which may include unaccustomed novel actions by ourselves or others. The several flavours of memory have parts to play: short-term working memory and longer-term procedural memory, semantic memory, and episodic memory, and, of course, last but not least, prospective memory. How these likely evolved imperceptibly in *Homo* to their present remarkable outcomes that are unparallelled in great apes, is a matter that is considered at length in the four recent articles mentioned above of which I am co-author. So let us return to Bednarik's concern. What can be gleaned about how prehistoric humans constructed reality? And, indeed, about we continue to construct reality.

If, throughout human evolution, there has been a propensity towards a kind of *human* construction of reality, then memory and memories play their part. Consideration cannot be ignored of the possible neurobiological consequences of genetic or epigenetic variability for behavioural (socio-cultural) changes. Variable skewness may result from matters that are well-known in population genetics about the size of reproductively-effective communities (*e.g.*, positive assortative mating; "founder" effects, etc.). Moreover, if cognitive adaptation has evolved by natural selection, it is plausible that the so-called "*Baldwin effect*" may well have played a part in influencing the genetic heritages of human groups and fossils assigned to various "palaeospecies" of the genus *Homo* (see below), as explained mathematically in an elegant article forty years ago that was co-authored by the 2024 Nobel Physics laureate Geoffrey Hinton [13]. In short, the interplay between biological and socio-cultural change possibly produced a non-linear outcome, though the dating of the Sulawesi "*palaeoart*" could imply a far deeper preceding time-span of emergent change than the ten-thousand year-long "*timeframe*" proposed by Bednarik. Numerous publications document archaeological indications of sporadic occurrence, long before fifty-thousand years ago (even from half-a-million years ago), of finds which imply behavioural practices that seem to reflect self-generated activities by early humans, which only by our recourse to the disingenuous realism of self-serving rationalisation can be related to some possible fulfilment of elemental existential requirements. To attribute the infrequency of such finds to the rarity of site-preservation highlights the question of just how widespread among early humans (*Homo erectus*, *H. antecessor*, *H. heidelbergensis*, *H. naledi, H. floresiensis, H. luzonensis, H. juluensis,* "*Denisovans*", *H. longi*, *H. neanderthalensis*, *H. sapiens*) may have been the cerebral neurobiological propensity for the translation of cognitive apperceptions (which implicate memory and remembrance) into active modification of selected aspects of their surroundings.

Even were *H. sapiens* before forty-thousand years ago to have begun to be "self-domesticated", that notion *by itself* does not imply that "self-domestication" was less developed (or had not developed) in any other of the various anatomical forms of *Homo* in existence at that time. Archaeogenetic findings indicate shrinkage of the reproductively-effective *H. neanderthalensis* population when, as we know now, *before fifty*-thousand years ago, the earliest, albeit short-lived, presence in Europe of *H. sapiens* was of small groups whose genetic composition was different from, and not particularly ancestral to, that of the Upper Palaeolithic people who painted European cave walls. Other than by self-serving conjecture, *post hoc ergo propter hoc*, there exists no way of inferring that *any* form of *Homo* that lived fifty-thousand years ago was self-domesticated, let alone any more self-domesticated than any of the others. The only biologically inference that can be drawn safely is that forms of *Homo* other than *H. sapiens* failed to maintain viable, reproductively-effective genetic populations. It is to pile one self-serving conjecture on top of another to imagine that "self-domestication" in *Homo* is an evolutionary process that can take place at rates that have variable acceleration; before this imaginative notion can be regarded as worthy of serious consideration, scientific enquiry is required to show convincingly that working hypotheses, referrable to the notion, can withstand empirical tests to refute, or falsify, them (perhaps such an enquiry might involve secular genetic research into "*self-domestication*" conducted on land-living gregarious mammals in the wild, *e.g.*, into different populations in the wild of a particular genus or species[14].

The long view, of a drawn-out evolutionary scenario, is plausible from the standpoint of human biological evolution, and not implausible from that of archaeology. Plausible also, from the standpoints of neurobiological evolution and the evolution of human behaviour, is the argument in support of an imperceptibly gradual evolution of our human constructs of reality. These surpass any that could have been possible around six million years ago for the last common ancestor that existed before phylogenetic separation took place between the forebears of chimpanzees and our

Australopithecine precursors. In contrast to chimpanzees or bonobos, in humans there have evolved a broader "*zone of bounded surprisal*" (ZBS) and greater tolerance of cognitive surprise and novelty, to which may be directed diverse behavioural responses that are available in *Homo*'s open-ended repertoire of alternative possibilities of which far fewer are available in the narrower phylogenetically phenotypical repertoire of great apes. Humans' responses to their surroundings underpin a wide variety of "*niche-constructions*" by which co-existence is sustainable with the natural environment. Before considering further the bearing that this has on how humans construct reality, a brief digression is in order about "*palaeoart*".

Perhaps I am in a minority by preferring a deflationary approach to "*palaeoart*", taking my stand on critical realism and eschewing those sanguine attitudes infused with disingenuous realism which purport to "understand" prehistoric motives and motivations underpinning the creation of particular motifs depicted. I prefer the hard-headed, dispassionate approach of anthropologist Peter Ucko and archaeologist Andrée Rosenfeld's 1967 book *Palaeolithic cave art* [15] that has withstood the test of time and should be read by all who are interested in "*palaeoart*". Peter had given a series of postgraduate seminars at Oxford University that I attended in 1968 as part of what today is a "Master of Studies" degree programme, but back then was the Postgraduate Diploma in Prehistoric Archaeology, taught by Derek Roe (who was to become Oxford's first Professor of Palaeolithic Archaeology) and the copper-and bronze-age archaeologist Dennis Britton. I was entitled to be admitted to the postgraduate course because I was an Oxford graduate in Medicine and Animal Physiology (also, incidentally, I had assisted in experimental neurophysiological research at Göttingen under Professor Paul Glees). After a research studentship in Archaeology at The Queen's College, Oxford, I held a lectureship in Human Anatomy under Professor George Romanes at Edinburgh University where I introduced palaeoanthropology, before taking up a lectureship at Sydney University in 1973.

I shall not try to compete here with the endless shelves of academic libraries devoted to erudite consideration of "art" objects that have interested archaeologists and anthropologists. Instead, I offer selective anecdotes. I was born in 1941. Later on, when a school-boy curious about both Evolution and Archaeology, I was intrigued by petroglyphs on moorland near my Yorkshire home in the North of England. I abandoned attempts to tangle with those whose febrile imagination concocted specious notions that purported to explain, interpret or "understand" the motifs *superficially* in the literal as well as the figurative meaning of that word! Empirical analysis of the archaeological record cannot sidestep the visibility in it of phenomena from the past that appear to be characterised, superficially (and sometimes spatio-temporally), by their regular irregularities and irregular regularities. A fundamental archaeological problem about these is how to enquire most appropriately into the mechanisms or processes that can give rise to them. I began to consider the geographical and archaeological contexts of petroglyphs. It is an approach open to *practical empirical* challenge (*e.g.*, further statistical analysis or new field-research) Soon after taking up a lectureship in Anthropology at the University of Sydney, I presented my view to an international meeting in Canberra [16].

I undertook my doctoral research mostly in the south-east Spanish region of Murcia, studying prehistoric skulls and mesolithic (epipalaeolithic), neolithic, and copper-age archaeological contexts, including sites with rock paintings that I regarded prosaically from the standpoint of the evolving Holocene climate, fauna, and landscape, such that I could see no good reason against my inference that the paintings of anthropomorphs and zoomorphs suggested that activities with wild animals took place, where (1) the animals depicted were all wild beasts and there was no depiction of domesticated fauna or of agricultural practices; and where (2) reconstruction of the vanished Holocene landscape did not contravene an inference that the wild fauna depicted had been present in the vicinity of the sites when the paintings were executed; and (3) that, even if, at some of the cave sites, supposedly "neolithic" objects, such as pottery, had been excavated, this need represent no more than the acquisition and adoption, for adaptation to an indigenous hunter-gatherer way of life, of some objects made perhaps by immigrant neolithic settlers not far away [17]. Little was I to know, fifty years ago, that this century would see the publication of archaeogenetic data indicating the strong persistence in Spain of its indigenous stone-age hunter-gatherer populace in neolithic and copper-age communities that practised mixed agriculture! My approach was open to *practical* challenge by *empirical* archaeological and palaeoecological research. Instead, it was by-passed at the time by prehistoric archaeologists who aspired to be "prehistorians" (*i.e.*, historians *avant la lettre*) who, influenced by self-serving "post-processual" notions that by 1980 were growing in popularity among archaeologists, asserted the self-fulfilling "*Just So*" fable that neolithic settlers "must" have extended their territory and executed the rock paintings as a possible demonstration of their widening territorial control.

Researchers undertaking "*palaeoart*" field-work need to be fully aware of the ever-present likelihood, not only of misinterpretation, but also even of faunal misidentification: with regard to both, a salutary lesson was given, about his visits to some decorated rock-shelters, by the late Norman Macintosh

(Professor of Anatomy at Sydney University whom I knew through Edinburgh's George Romanes), whose Aboriginal informant, at a site that interested him, told him that he had misidentified some depictions (most of which had been executed by adult males, very few few by children or women), and only provided a deeper explanation of how they related to indigenous understanding of their significance when he was accompanied by Sydney University's erudite Professor of Anthropology, A.P. Elkin, to whom alone the informant's privileged knowledge was imparted, knowledge that must

vanish for ever on the informant's death, after which the interpretation of the depictions never can give uninformed observers detailed knowledge about the construction of reality by whoever executed them [18].

In the light of the foregoing anecdotes, prudence recommends that "*palaeoart*" be studied at most as an adjunct to mundane, routine archaeological enquiry about the spatio-temporal relationships of remains from the past. But, if so, and given that any approach invoking disingenuous realism is untrustworthy, then where does that leave the matter of the *derivation* of the construction of the contemporaneous reality of those remains, and, for that matter, of present contemporary "artistic" reality? I offer Bednarik a suggestion that is both deflationary and daringly adventurous. As already mentioned, a gradual process of natural selection is compatible with the notion of the evolutionary expansion in the genus *Homo* of the cognitive "*zone of bounded surprisal*" (ZBS) that characterises sentient animals, which is referrable to the *free energy principle* of classical physics and the concept of *active inference* [19] which is about *self-evidencing*.

Put somewhat crudely, selected evolved neuroethological responses depend, as a necessary consequence of *quantum field theory* in contemporary physics, on a creature's surroundings that themselves undergo continual and continuous change, not only as part and parcel of widespread, naturally-evolving changes in the landscape overall, but also, *additionally*, very locally, as a consequence of the impingement on them of creatures including humans for whom these particular additional modifications of their environment can have ("cultural") deontic value [20]. Again put crudely, those notions are but wishful thinking and make-believe, which still lead many thinkers in the Humanities and Social Studies to presume that "in reality" all the world is but a stage with a stable backdrop against which their subjects play (or played) out their experiences. In short, twenty-first century biology subverts that delusion, because modern evolutionary theory (*a.k.a.*, the integrated or extended evolutionary synthesis) insists on the consideration that the ***derivation of human constructs of***

reality involves acceptance of the deflationary viewpoint that humans are always, and *necessarily*, less in control of their actions than they (we) care to imagine.

It is in neuroethological synergic contexts that are applicable the biological concepts of stigmergic behaviour and sematectonic communication (“*exograms*” may be regarded most appropriately in this light). We are thereby forcefully reminded that co-existence with our surroundings is no less a two-way affair for humans than it is for ants, frogs, cuckoos, or rabbits. Their environments impinge on them no less than those sentient creatures impinge on their surroundings, be these physical, natural, or social. The scientific study (ethology) of animal behaviour demonstrates that mobile sentient creatures tend to respond to their environments with specific *niche-constructions*. Even among the very versatile Primates, humans are distinctive in carrying out a remarkably wide and varied range of niche-constructions that often are socio-culturally differentiable. To aspects of these, moreover, we are able to assign mnemonic signifiers that we can communicate or transmit selectively in ways that are particularly flexible and efficient with regard to trying to achieve appropriate rapid outcomes. Outcomes are easier to envisage, and subsequently to recognise, than were our motives and underlying motivation. This

is so, whether the outcome is playfulness, obtaining food or drink, making this or that object, speaking or singing, walking or dancing, doodling or sculpting. As pointed out in some of the publications mentioned above, the exceptional human capacity to draw on the different varieties of memory, retained in our brains, enables our hierarchical mechanistic minds to work as self-evidencing, neurobiological inference machines by a generative process dependent on neuronal predictive processing and consequent updating of Bayesian model evidence referrable to neuronally-stored priors [21].

Just how this works inside nerve (or other) cells is a matter of neuroscientific interest. An intriguing explanation invokes quantum field theory, such that sentience derives from an (essentially topological) quantum reference frame that involves a holographic interface (with mathematical attributes of a "*Markov Blanket*" whose interior is conditionally independent of its exterior) on one side of which encrypted external inputs of quantum phase information from the ever-changing environment are registerable for decoding on the other side by internal property-detectors modulated by a mnemonically-informed, temporal comparator [22]. The explanation is fundamentally empirical, not ontological. If all that seems abstruse, it highlights the matter that the development of our modern human brain's complex consciousness, characterised by widespread attention-sharing and communal reflexion about alternative policies, is a matter that has to habeen, without doubt, a drawn-out biological process. It involved aspects of genetics which enhanced "gene-culture" evolution, plausibly including skewed reproductively-effective communities (in which, plausibly, learnt transmission of behaviour played a part) and epigenetic impingements on gene-expression, any or all of which influenced human ontogenetic evolution in which neurobiological evolutionary changes cannot have been rapid. Bear in mind that, separated within the skull from the world beyond, our brain houses about ninety-billion neurones, many of which have hundreds or even thousands of synapses with others, so that interchange of each with its surrounding cells affects outcomes of active inference and consequent exchange with the surrounding neighbourhood of our body, including of course our fellow humans.

The evolution of such a complex filtering mechanism cannot have been other than a long, drawn-out process. Nevertheless, by natural selection the evolved neurobiological adaptation enabled early world-wide dispersal of the ancestors of many contemporary indigenous *H. sapiens* communities, among whom were probably the painters of Sulawesi caves fifty-thousand years ago. It has been suggested lately that, in humans, "*cooperative communication*" could be the result of "*an evolved* adaptive prior belief *that their mental states are aligned with, or similar to, those of conspecifics*" prioritising behaviours that "*minimize uncertainty and optimize an individual's internal model of the world… allowing for the development of a shared narrative that is used to disambiguate interactants' (hidden and inferred) mental states. Thus, by using cooperative communication, individuals effectively attune to a hermeneutic niche composed, in part, of others' mental states; and, reciprocally, attune the niche to their own ends via epistemic niche construction. This means that niche construction enables features of the niche to encode precise, reliable cues about the* deontic *or* shared value *of certain action policies (e.g., the utility of using communicative constructions to disambiguate mental states, given expectations about shared prior beliefs). In turn, the alignment of mental states (prior beliefs) enables the emergence of a novel, contextualizing scale of cultural dynamics that encompasses the actions and mental states of the ensemble of interactants and their shared environment*" [23]. This proposal offers a rational approach, consistent with modern biology, to the ***derivation of human constructs of reality***. The proposal should stimulate reappraisal by archaeologists and anthropologists of the documented variability in each and every aspect of the Pleistocene record, from different kinds of hand-made phenomena (*e.g.*, cut-marks on animal bones, to "tools", "adornments", "*palaeoart*", "hearths", "settlements", *etc.*) to relationships with local environments and wide-spread landscapes and climates.

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5. Bednarik is sometimes less than fortunate in his choice of various words that he borrows from biological and physical anthropology. An egregious instance his misuse of "prognathism": far from having prognathous jaws (gnáthos, *γνάθος* is "jaw" in Greek) archaic human skulls (unlike contemporary *H. sapiens*) often present noteworthy elongation in the sagittal plane, and many Neanderthal skulls show "inflation" or protrusion of the middle third of the facial (rostral) skeleton that supports the cheeks (in so far as modern humans have chins, in relation to the mid-face the anterior jut of our lower jaw is without doubt more prominent than the anterior part of chinless Neanderthal lower jaws).
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mammals, perhaps observed using drones only, during many (perhaps 50) generations, in order to try to detect whether, *within* the population being studied, the identification of an exceptionally reproductively-effective group of individuals could be correlated with *not only* the unique inherited or heritable (e.g., learnt) behaviour peculiar to it, *but also* its manifestation of "*self-domesticated*" morphological or anatomical features *vis-à-vis* the rest of the population under observation.

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Declarations

Potential competing interests: No potential competing interests to declare.