

Chapter 5

AN ETIOLOGY OF THEORY OF MIND IN DEEP TIME

Robert G. Bednarik*

International Federation of Rock Art Organizations
(IFRAO), Melbourne, VIC, Australia

ABSTRACT

No condition of an organism can be understood effectively without exploring its etiology through time. In the case of the condition of human Theory of Mind this necessitates an investigation of its hominin history: where did it originate and how did it develop throughout the history of the genus *Homo*? How does its status or development differ from the ToM of other species, how can we account for the differences, what does this mean in understanding the condition of the human species? Most importantly, what factors in hominin evolution may be related to the development of human ToM? These are essential questions to be considered in exploring an etiology of human ToM, because without at least a basic understanding of it our comprehension of its roles in the development of children and neurological conditions is limited to empirical aspects of symptoms rather than causes. Science, however, must be cast in the format of cause and effect, and this will be attempted here, in a preliminary format.

“Authorities”, “disciples”, and “schools” are the curse of science; and do more to interfere with the work of the scientific spirit than all its enemies.

(Thomas Henry Huxley, cited in Bibby 1959: 18.)

INTRODUCTION

Theory of Mind (ToM) is a term defining the ability of any animal to attribute mental states to itself and others, and to understand that conspecifics have beliefs, desires and intentions; and also that these may be different from one's own (first proposed by Premack and Woodruff 1978; see also Baron-Cohen 1991; Frith and Happé 1994; Ozonoff and Miller

* Corresponding author: Robert G. Bednarik. Convener and Editor, International Federation of Rock Art Organizations (IFRAO), P.O. Box 216, Caulfield South, VIC 3162, Australia. E-mail: robertbednarik@hotmail.com.

1995; Happé et al. 1996; Happé 1997; Baron-Cohen et al. 1997; Heyes 1998; Jarrold et al. 2000; Jacques and Zelazo 2005). Just as consciousness and self-awareness (De Veer and Van Den Bos 1999; Gallup 1970, 1998; Gallup et al. 2002; Keenan et al. 2003; Mitchell 1993, 1997, 2002) are shared by human and many non-human animals, ToM is thought by many not to be limited to humans, but has been attributed to many species, including all hominins of the Pliocene and Pleistocene (Bednarik 2012, 2013a). It needs to be emphasized that the concept of a ToM is merely a theoretical construct, because there is no such thing as a mind; it has no mass, composition, substance, or definable location. This is simply a traditional shorthand generic term for neural and endocrine processes occurring in the human brain (Bednarik 2014a). Therefore the issue is perhaps not black and white, but one with many shades of gray.

The basis of a ToM is the presumption that other cognizing organisms, including conspecifics, have beliefs, intents, desires, pretending, knowledge, etc. It has perhaps attracted most attention in the study of two groups, children and apes, and the level they conceive of mental activity in others, attribute intention to, and predict their behavior (Call and Tomasello 1998). It is thought to be largely the observation of behavior of other organisms that can prompt a ToM, and it is widely assumed that mirror neurons, discovered in macaques in the 1990s (Di Pellegrino et al. 1992; Rizzolatti et al. 1996), are involved in the formation of ToM (Gallese and Goldman 1998; Iacoboni et al. 2005). The simulation theory, one of the two traditional theories accounting for ToM, relies much on this connection with mirror neurons. It holds that the “mind” projects from the understanding of one’s own mind to the mental state of others (Goldman 2005; Newman-Norlund et al. 2007; Michael 2012), but this fails to explain the formation of a construct of one’s own “mind.”

There is also evidence against attributing ToM to mirror neurons: brain regions implicated in it are the anterior paracingulate cortex, the superior temporal sulci, and the temporal poles bilaterally (Gallagher and Frith 2003), among others (Siegal and Varley 2002). But the mirror neurons are located in the inferior frontal cortex and superior parietal lobe. Also, macaques lack a developed ToM despite having mirror neurons. The alternative principal model, called “theory theory,” views ToM as a detached theoretical process that is an innate feature (Carruthers and Smith 1996; Gopnik and Meltzoff 1997; Rehder 2003; Gopnik and Schulz 2004). When considering the most primitive traces of ToM, the simulation theory tends to be less persuasive. For instance any potential quarry animal needs to be able to read the intention of a nearby carnivore, which could be seen as an incipient ToM.

It is unlikely, though not impossible, that this would involve mirror neurons. The more recent interaction theory (Gallagher 2001; Michael et al. 2013), which focuses on bodily behaviors and environmental contexts or social cognition rather than on mental processes, would seem more amenable (Gallagher and Hutto 2008; De Jaegher et al. 2010).

Much of the importance of ToM in a clinical sense derives from the evidence of its diminished state in autism spectrum disorder. The human brain condition autism (Hermelin and O’Connor 1970; Baron-Cohen et al. 1985; Frith 1989; Hobson 1993; Happé 1995; Hughes et al. 1997; Baron-Cohen 2002, 2006; Allman et al. 2005; Balter 2007; Grinker 2007; Burack et al. 2009; Brasic 2009a, 2009b, 2010; Helvenston and Bednarik 2011; Bednarik and Helvenston 2012) has often been characterized as possessing deficits in ToM, but these do occur also in other circumstances, such as in schizophrenia, attention deficit hyperactivity disorder, or neurotoxicity (derived from a wide range of sources, including alcohol, drugs,

chemotherapy, heavy metals, cleaning solvents, even cosmetics). Autism also involves other aspects of social-affective information processing (Tager-Flusberg 2007). What renders autism of particular importance is its latest epidemiology. Most recently autism spectrum disorder has developed into a very common illness, reported to be affecting one in 5,000 children in 1975, one in 150 by 2002, one in 110 in 2006 (Weintraub 2011), and one in 88 US children in 2008. Moreover, these figures very probably underestimate autism's US prevalence, because they rely on school and medical record reviews rather than in-person screening. A more thorough study conducted on a large population of South Korean children found that one in 38 had autism spectrum disorder (Kim et al. 2011). It has been emphasized that the epidemic increase in these diagnoses cannot be entirely attributed to changing diagnostic criteria (Buchen 2011).

Although the condition now includes "autistic disorder, Asperger's disorder, childhood disintegrative disorder, and the catch-all diagnosis of pervasive developmental disorder not otherwise specified" (DSM-5 2013), this does not adequately account for the vast increase in the incidence of the illness.

For this reason alone, ToM has considerable significance, much of which will be reflected in other chapters of this volume, by authors much better qualified to address these topics. The present chapter is dedicated to a rather more esoteric subject, but not without good reason. Any clinical observation about the conditions of human subjects, including in psychology and psychiatry, is based on symptoms, of whatever nature they may be. Indeed, the taxonomy developed by medical science is generally built on empirically observable or communicable symptoms. This, however, only satisfies one of the essential requirements of science, which fundamentally is a pursuit of understanding that is concerned with cause and effect reasoning: symptoms provide effects, but only a limited explanation of causes (Bednarik 2012, 2013a). Ultimate causes of any human condition (Bednarik 2011a) remain generally shrouded in mystery and may be perceived as being too difficult to deal with. Yet to fully understand, for instance, human behavior, it cannot be sufficient to describe and taxonomize, or to define behavior as either normal or aberrant. One needs to establish the original reasons why certain characteristics developed, rather than others. The etiology of the behavior of members of the human species has remained almost completely unexplored (but see Bednarik 2012) and yet, to understand modern human behavior fully it would be obligatory to acquire some understanding of hominin behavior over the last two or three million years.

Here we are concerned with the etiology of ToM, i.e., with the course of its development through human history; with its causation; and with the reasons for its apparently central role in facilitating the development to the ostensibly sophisticated cognition of modern humans, relative to all other animals. This subject has not before been broached in any comprehensive way, but if ToM is to be understood in terms of its evolutionary history, it is an essential component of learning to understand the "undiscovered primate" (Preuss 2000: 1219). As a neuroscientist, this is how Todd M. Preuss perceives *Homo sapiens*, and with good reason. It is precisely because the study of the human ape has been so distorted by the fact that it is conducted by that very species that happens to be its subject that it has been imperiled by countless distortions. When a narrow-minded organism such as a human deigns to study itself the result can only be self-referential.

Human consciousness is ultimately self-referential awareness (Bednarik 2011a, 2014b), the self's sense of its own existence, which may explain why its etiology remains unsolved.

Hofstadter (2007) likens this quest to finding a self-consistent set of axioms for deducing all of mathematics, which Kurt Gödel has shown to be impossible, due to the self-referential nature of mathematical statements. A similar impasse applies to humans understanding humans, and humanistic concerns are by definition self-referential and unscientific (Bednarik 2011b; cf. Fish 2008).

There are two significant added encumbrances in examining the ToM of hominins. One is the embryonic state of the two disciplines traditionally providing details of the historical context, Pleistocene archaeology and paleoanthropology. The pre-paradigmatic status (Kuhn 1962) of both is illustrated by their susceptibility to sectarian fads and systematic blunders throughout their history, as well as their theoretically and methodologically fragmented nature (Bednarik 2011a, 2013b). Secondly, these disciplines are said to be under the control of what has been eloquently described as a “high priesthood,” determining the unstable orthodoxies of inherently flawed pursuits (Thompson 2014). Since their very beginnings in the first half of the 19th century, these high priests have consistently rejected all major discoveries and new paradigms. These had in all cases been offered by non-archaeologists/ anthropologists and rejected by the entire discipline, a tendency that continues right up to the present time (Bednarik 2013b). This pattern of denial and much later (several decades later) grudging acceptance of any major innovation has even intensified in recent decades. Faddish interpretations dominate these two disciplines, often determined by popular science writers, and distort academic perceptions of the hominin past in much the same measure as they did up to two centuries ago. Clearly this is not a good starting point to begin establishing trajectories of human development, be they cultural, technological, or cognitive. Before this is realistically possible, these disciplines need to be purged of their current falsities.

CLARIFYING THE BACKGROUND

Some of the most consequential fallacies concern the model of “cultural evolution” archaeology provides. The notion of such an evolution is itself flawed, because evolution, as a biological concept, is an entirely dysteleological process; it has no ultimate purpose and it is not a development toward increased complexity, which is how archaeology perceives the “human ascent.” The concept of cultural evolution, however, involves the teleologically guided assumption of progress toward greater sophistication—ultimately, in the archaeological mind, resulting in that glorious crown of evolution, *Homo sapiens sapiens*. This progressivist fantasy (the modern human is a neotenous form of ape, susceptible to countless neuropathologies and plagued by thousands of genetic defects; Bednarik 2008a, 2008b, 2011a, 2014b) implies that archaeology is guided by a species-centric delusion of grandeur. Moreover, its definition of culture is itself erroneous, being based on invented tool types (in the Pleistocene usually of stone implements). Culture, obviously, is not defined by tools or technologies, but by cultural factors. Some of these are available from very early periods, but archaeology has categorically excluded them from delineating the cultures it posits. Indeed, when it does consider cultural elements such as undated rock art it strenuously tries to insert them into its invented cultures based on stone tools, rather than try to create a cultural history from them. Archaeology goes even further in its obsessive taxonomization by then assuming that these imagined cultures were the work of specific human societies. So for

instance certain combinations of invented tool types found in discrete layers of sediments are called the “Aurignacian culture,” and this imaginary culture is seen as the signature of a people called the “Aurignacians.”

Although archaeologists lack any significant knowledge of who these imaginary Aurignacians were (Bednarik 1995a: 627), they regard them as real, identifiable entities, when in fact there is not one iota of evidence that all the people that produced the tools in question were in any way related, be it ethnically, linguistically, genetically, politically, or even culturally.

This is a fair indication of the misinformation Pleistocene archaeology has inflicted on modern society, and it is greatly attributable to the complete lack of internal falsifiability of the discipline and the demeanor of its “high priests.” Many other examples could be cited, but one that is of particular relevance in the context of properly understanding the human past relates to a major archaeological fad of recent decades.

The replacement hypothesis, termed the “African Eve” model by the media, derived initially from an academic fraud begun in the 1970s (Protsch 1973, 1975; Protsch and Glowatzki 1974; Protsch and Semmel 1978; Henke and Protsch 1978; Bräuer 1984), which by the late 1980s suddenly gained almost universal acceptance and has since been the de-facto dogma of the discipline, especially in the Anglo-American sphere of influence (Cann et al. 1987; Stringer and Andrews 1988; Pennisi 1999; Eswaran 2002; Smith et al. 2005; Jobling et al. 2014).

This unlikely hypothesis proposes that all extant humans derive from a small population—indeed, from one single female—at an unspecified location in sub-Saharan Africa. They became miraculously unable to interbreed with all other hominins before expanding and replacing other humans because of their superior intellect and cognition.

First they then expanded across Africa, including northern Africa (which is in fact easily disproved by the available evidence; Bednarik 2008a, 2013a), then to the Middle East, and colonized all of Eurasia, wiping out all other people in their wake. Reaching South-East Asia 60 ka (60,000 years) ago, they promptly invented seafaring to sail to Australia.

One of the first to point out some of the many flaws of this modern origins myth (Bednarik 2008a) was Alan Templeton (1993, 1994, 1996, 2002, 2005, 2007; cf. also Barinaga 1992; Brookfield 1997), who noted that there was no genetic evidence supporting the replacement hypothesis, but much genetic evidence that falsified it. He refuted the only attempt ever made to test the replacement hypothesis statistically (Fagundes et al. 2007), exposing it as a statistical atrocity (Templeton 2010). Fagundes and colleagues had produced incoherent probabilities (both logically and mathematically impossible) for the hypotheses they considered. The models of the thousands of “African Eve” advocates are plagued by countless inconsistencies, examples of misinformation, and errors of logic (Bednarik 2008a, 2013a; Klyosov 2014a). Among them is the common mistake to see “genetic diversity” as implying a long ancestry (e.g., Hellenthal et al. 2008; Campbell and Tishkoff 2010). Moreover, the claims concerning greater genetic diversity of Africans, compared to Asians and Europeans are also false (they are in fact very similar: 0.0046 for both Africans and Asians, and 0.0044 for Europeans). Genetic diversity is greater in African farming people than in African hunters-foragers (Watson et al. 1996), yet the latter are not assumed to be ancestral to the former (cf. Ward et al. 1991). As Klyosov (2014a) has wryly observed, the greater genetic diversity in New York City in comparison to Boston does not mean that New York City is the homeland for Boston. Numerous authors have published their estimates of

when the exodus of the putative “anatomically modern humans” (an absurd definition because “[w]e have never been modern”; Latour 1993) occurred, and these recent “determinations” range from 27 ka to 200 ka (Thomson et al. 2000; Underhill et al. 2000; Forster et al. 2001; Jobling and Tyler-Smith 2003; Edmonds et al. 2004; Forster 2004; Xue et al. 2005; Carrigan and Hammer 2006; Sahoo et al. 2006; Hudjasov et al. 2007; Behar et al. 2008; Chiaroni et al. 2009; Patin et al. 2009; Soares et al. 2009; Campbell and Tishkoff 2010; Majumder 2010; Ottoni et al. 2010; Shi et al. 2010; Stoneking and Delfin 2010; Henn et al. 2011; Hublin 2011; Li and Durbin 2011; Yotova et al. 2011; Mellars 2011; Moorjani et al. 2011; Curnoe et al. 2012; Fernandes et al. 2012; Stewart and Stringer 2012; Cann 2013; Francalacci et al. 2013; Hayden 2013; Poznik et al. 2013; Rito et al. 2013; Wei et al. 2013). None of these numbers are based on any empirical data; they are simply fabricated, meaningless fantasies about a “genetic clock”, because none of the variables involved are known (Bednarik 2008a, 2013c; Klyosov 2014a, 2014b). Klyosov, who details evidence for gene flow *into* rather than *out of* Africa, has emphasized that non-Africans possess no SNPs (single nucleotide polymorphisms, which are practically irreversible mutations in DNA) that are observed in Africans but not in chimpanzees (Klyosov 2014a, 2014b). He also argues that non-Africans descended from haplogroup A subclade A1, and have not descended from African subclade A0; A0 mutations are absent in non-Africans, which descended from haplogroup BT.

The inherent errors of the replacement hypothesis are so numerous that it is hard to believe it was not stillborn. The computer modeling of Cann et al. (1987) was botched and its haplotype trees were fictions that could not be provided with time depth even if they were real. Based on 136 extant mitochondrial DNA samples, it arbitrarily selected one of 10^{267} alternative and equally credible haplotype trees (which are very much more than the number of elementary particles of the entire universe, about 10^{70} !).

Maddison (1991) then demonstrated that a re-analysis of the Cann et al. model could produce 10,000 haplotype trees that were actually more parsimonious than the single one chosen by these authors. Yet no method could even guarantee that the most parsimonious tree result should even be expected to be the correct tree (Hartl and Clark 1997).

Cann et al. had also misestimated the diversity per nucleotide (single locus on a string of DNA), incorrectly using the method developed by Ewens (1983). Some of the Cann et al. coauthors listed many of their own mistakes (Vigilant et al. 1991), citing “confusion”, “perceived weaknesses”, “inferior method”, “no statistical justification”, and “inadequate calibration.”

And yet the African Eve fad took over nearly the entire discipline without much opposition. As Gibbons (1998) noted, by using the modified putative genetic clock, Eve would not have lived 200,000 years ago, as Cann et al. had claimed, but only 6,000 years ago.

The various genetic hypotheses about the origins of “Moderns” that have appeared over the past few decades placed the hypothetical split between these and other humans at times ranging from 17,000 to 889,000 years bp (Bednarik 2008a).

In addition to being devoid of any credible genetic basis, the replacement hypothesis also lacks supporting evidence from paleoanthropology and Pleistocene archaeology (Bednarik 2008a). It is a theory that began its life in 1973, based on fake datings of hominin remains by an academic charlatan, Professor Reiner Protsch (Paterson 2004; Schulz 2004; Harding 2005; cf. Terberger and Street 2003), and it was adapted to suit genetic assertions only in the late 1980s. In contrast to the assumptions inherent in the fantasy of “African Eve” the paleoanthropology of Eurasia, Africa, and Australia is replete with numerous examples of

gradual changes in human morphology from many regions, and Graciles (supposedly “modern humans”) coexisted with Robusts (robust *Homo sapiens*, including *H. sapiens neanderthalensis*) for tens of millennia in several geographical areas (Bednarik 2008a).

Similarly, the archaeological record of many regions defines the slow and gradual development from Mode 3 (Middle Paleolithic or Middle Stone Age) to Mode 4 (Upper Paleolithic or Later Stone Age) technologies (Bednarik 2008a, 2011a, 2013a, 2013c). Introgressive hybridization (Anderson 1949), allele drift based on generational mating site distance (Harpending et al. 1998), and genetic drift (Bednarik 2011c) through episodic genetic isolation during climatically unfavorable events can easily account for the observed genetic, anatomical (skeletal), and technological changes during the last third of the Late Pleistocene.

But there are still more fundamental objections to the notion of replacement, and they are of considerable relevance to appreciating the background of the development of the hominin ToM. The replacement hypothesis has misinterpreted that period’s human phylogeny because of its preoccupation with teleological explanations. This inclination is a vestige of the inherent religious predisposition of Western science in general, and teleological archaeology in particular, to perceive human progress as leading to a superior outcome—a creature in the likeness of deity, no less. This is part of humanity’s irritating capacity of self-glorification, which feeds archaeology’s obsessions with “civilization” and “culture,” two concepts it is incapable of dealing with effectively even though they are clearly fundamental to the hobby of archaeology. In reality humanity’s history, as far as it is known, is far from glorious, nor has this species been much of a blessing for our planet. More relevantly, recent human development is marked by a suite of distinctly disadvantageous somatic, neural, and genetic changes (cf. Post 1971). Within an instant in evolutionary time, the size of the hominin brain decreased by about 13% (Henneberg 1988, 1990, 2004; Henneberg and Steyn 1993; Bednarik 2014b), cranial and other skeletal robusticity declined markedly, as did physical strength. This was accompanied or followed by the rise of almost countless neuropathologies, including the genetic preservation of literally thousands of syndromes and disorders endemic to humans (Rubinshtein et al. 1994; Walker and Cork 1999; Enard et al. 2002; Olson and Varki 2003; Marvanová et al. 2003; Sherwood et al. 2011; Bednarik 2011a). These include numerous neurodegenerative diseases as well as frontal lobe connectivity problems, demyelination, dysmyelination and several thousand Mendelian disorders. Yet there is a host of further deleterious conditions: cleidocranial dysplasia, malformed clavicles and dental abnormalities, type 2 diabetes, microcephaly, and the many mental and neurodegenerative illnesses established in the human genome since the appearance of what is often called “anatomically modern humans”—especially in recent millennia, even in recent centuries (Bednarik and Helvenston 2012; Helvenston and Bednarik 2011). The most obvious difference between Robusts and Graciles is that the latter are the result of neoteny (Bednarik 2008a, 2008b, 2011a), yet the dominant explanation claims the precise opposite: that these changes are the result of one species outcompeting or eliminating the other, replacing it completely.

It could be asked how the “high priests” of archaeology and paleoanthropology (Thompson 2014) could have arrived at such an unlikely explanation of “modern” human origins, and how they reached their positions in academia in the light of such a profound lack of judgment.

But it is perhaps more interesting to establish how tens of thousands of practitioners in these disciplines were so easily misled, and why dissent was so effectively silenced for three decades. Thompson's (2014) principal explanation is that the high priests he writes about managed to goad a few influential "mainstream" journals into quenching all opposition.

The negative influence on science, of monopolizing "luxury" science journals, is a significant concern, eloquently expressed by Nobel laureate Randy Schekman, who proposed a boycott on *Nature*, *Science* and *Cell*, arguing that their policies stoke demand "like fashion designers who create limited-edition handbags" (Sample 2013). He also attacked the "impact factor" used by such journals in their marketing strategies.

Moreover, it is true that especially the first two of the journals he singled out for criticism are guilty of many past errors of judgments; they avoid admitting mistakes, and have policies to disallow the publication of dissenting views on their pages—all practices that contribute greatly to distorting the scientific process. Science writers, too, have significantly contributed to the "African Eve" bungle, just as they have acted as mouthpieces for a few major science journals.

Clarifying these issues is likely to become a small cottage industry in the disciplines affected, but in the present context it is more important to clarify how the collapse of the dominant model of human origins affects questions related to human ToM.

Virtually all factors that could be of relevance in that quest have to be reviewed critically, and most received relevant knowledge should now be regarded as tainted. Much of the archaeological data concerning human evolution are contaminated by the replacement model, because they were not collected in a theory-free mode, but in efforts to confirm an ideological notion: that all living humans are distantly related. This is merely a quasi-religious reformulation of the obvious truth that *all* members of a species are related to one another.

One of the immediately relevant issues is that the replacement advocates sought to create the greatest possible cognitive distance between the brutish Pleistocene Robusts and their crown of evolution, those enlightened Graciles. Therefore they denied the "pre-modern" people all purported indications of cognitive sophistication, including what they called "art" and body decoration, or what they considered as evidence of symboling. Just as their humanistic definitions of culture and civilization lack scientific significance and relevance, humanistic comprehension of art and symbols is impaired by simplistic understanding of what these concepts embody. Paleoart (a generic term defining art-like productions preceding written records) was not necessarily "art," in the sense of that term today (Davies 1991; Stecker 1997; Carroll 2000); nor can we know if it was symbolic. The term "art" always derives from an ethnocentric concept: "the status of an artifact as a work of art results from the ideas a culture applies to it, rather than its inherent physical or perceptible qualities. Cultural interpretation (an art theory of some kind) is therefore constitutive of an object's arthood" (Danto 1988).

It would be preposterous to contend that modern (Westernized) humans could fathom the ideas past cultures applied to paleoart tens of millennia ago. They cannot even establish the status of recent ethnographic works (Dutton 1993) with any objective understanding: interpretation is inseparable from the art work (Danto 1986: 45; Convey 2014). To regard paleoart as art is therefore an application of an etic and ethnocentric idea to products of societies about whose emic parameters nothing is known in most cases ("emic" refers to knowledge and interpretation within a culture, "etic" refers to interpretation by another culture).

A significantly more productive perspective is to define paleoart as the largest surviving corpus of evidence of the production of very early exograms, but Pleistocene archaeology has always preferred the naive interpretation of paleoart as art and symbol. The term exogram derives from the concept of the engram, which was first proposed by Richard Semon (1904, 1921: 24) over a century ago. An engram is a memory trace, a hypothesized but never demonstrated, persistent protoplasmic alteration of neural tissue thought to occur upon stimulation of the brain, and accounting for memory. The change was thought to be biophysical or biochemical, prompted by external stimuli. Karl Lashley (1923a, 1923b, 1924, 1930, 1932, 1935, 1943, 1950) spent most of his working life searching unsuccessfully for engrams, instead establishing that there is no single biological locus of memory in the brains of rats (cf. Thompson 1967, 1986, 1990; Thompson et al. 1976; Steinmetz et al. 1987, 1991, 1992; Christian and Thompson 2005).

The concept of the storage of memory traces outside the brain, as “symbolism”, i.e., in a variety of objects and their properties, was first proposed by Gregory (1970: 148). He realized that this would be a relatively stable and permanent expression. This idea of an external, “surrogate cortex” was further developed by Goody (1977), and later by Carruthers (1990, 1998). The notion that such deliberate markings as early non-figurative rock art represent an externalized, permanent form of “engram” to which the human intellect could refer was introduced by Bednarik (1987), who subsequently speculated about the cognitive development of hominins on that basis (Bednarik 1990, 1992). He considered the externalizations of memory traces in the form of rock art in some detail, but retained Anati’s (1981: 206) neologism “psychogram” rather than creating a new one. Donald (1991: 308–333, 1993, 2001: 305–315) then coined the name “exogram”, also contrasting it with the concept of the engram, but he seemed oblivious of Bednarik’s previous work just as Richard Dawkins was of Semon’s when he invented the concept of the “meme” 72 years after Semon (1904) had named the “mnemic trace.” Similarly, Donald’s three stages of cultural evolution had been foreshadowed by Fairservice (1975). Although Donald was unaware of the substantial corpus of surviving exograms, in the form of paleoart, that predate the purported replacement of Robusts by Graciles, he correctly defined the properties of exograms. They are semi-permanent, unconstrained and reformatable, can be of any medium, have virtually unlimited capacity and size, and can be subjected to unlimited iterative refinement. Bednarik (2014a) defined exograms as indispensable to modern human society, forming the strongest link between brain activity of consciousness and the external world. This is the key mechanism by which humans experience “reality” “consciously,” and it is also the neural basis of what is termed “volition.”

This human ability of deriving abstract goals from the prefrontal cortex is unique in the animal world, and it would have been rendered possible by this system of external memory storage. Today human culture is based almost entirely on exograms that have developed into forms of incredible complexity.

In short, the academic mainstream defines the background to cognitive human evolution in the last part of the Pleistocene as a “catastrophist scenario,” in which inferior human forms (the Robusts) were decisively and completely replaced by the superior (in the intellectual, cognitive, cultural, and technological senses) Graciles. They were either outcompeted or exterminated, or both. According to the African Eve scenario, the two groups were also incapable of interbreeding because they were two distinct species. Genetic research has already established the falsity of the latter proposition, and the African Eve or replacement

scenario is now defunct. The alternative establishing itself currently is, however, just as false: that there was “some” interbreeding but that the “modern” genes essentially derive from sub-Saharan Africa. Because this idea of African modern origins is so established in the minds of most researchers in the field, they seem to find it impossible to think outside the square, and to grasp the most rational explanation: that Final Pleistocene hominins experienced relatively rapid genetic changes in four continents, leading to gracilization and, more importantly, precipitous neotenization. These changes have been fully explained and those rationalizations have not, so far, been refuted in any part (Bednarik 2008a, 2008b, 2011a, 2011c).

Instead of attempting such refutation, mainstream Pleistocene archaeology and paleoanthropology continue to pursue the African origins scenario without providing any evidence for it—other than their belief that somehow there were two separate populations. This tinkering with a model that has, in principle, already been disproved by genetics, is a severe obstacle to progress in these fields. In the context of considering the development of the human ToM it needs to be fully ignored: all members of *Homo sapiens*, including the Neanderthaloids and very probably earlier sub-species, should be seen as belonging to a single species experiencing somatic gracilization over time. In searching the genome of modern people, Vernot and Akey (2014) found that about 20% of the “Neanderthal” genome is found in it, and living east Asians possess even 21% more “Neanderthal” DNA than do Europeans.

Most relevantly, hominins have created and used exograms at least since the times of *Homo erectus*, i.e., over a million years ago. Any theory unable to accommodate these factors cannot realistically consider the cognitive evolution of hominins.

HUMAN THEORY OF MIND

The almost complete lack of interest Pleistocene archaeology has shown in the role of exograms in human cognitive evolution illustrates that this discipline lacks a basic understanding of that function. As noted it also misconstrues the concept of culture, replacing it with variables of technology, especially etic (invented) tool types, and limiting it to humans. The scientific definition of culture is the *non-genetic transference of practice* (Handwerker 1989), and tools are widely used by non-human animals, ranging from otters to primates. Lithocentric constructs (“observer-relative, institutional facts”; cf. Searle 1995) are then regarded as diagnostic in identifying cultures (see Thompson 2012 for critique), while true cultural elements, such as paleoart, are relegated to one-dimensional categorizations—such as “art” or “symbols”—that can be comprehended within the social reality the discipline of archaeology subscribes to. Within such a simplistic framework it is quite futile to address topics such as hominin cognition or the etiology of human behavior (Bednarik 2012) with any semblance of due diligence. But that does not mean that they cannot be tackled by the sciences. For this it is essential that credible archaeological and paleoanthropological data be separated from the countless interpretations they have led to, and that those that are contaminated by these superficial understandings be appropriately qualified. This is a major task but some progress has been made by ignoring the mainstream models of archaeology and turning to the cognitive and neurosciences (Bednarik 2011a, 2012, 2013a; Bednarik and Helvenston 2012; Dielenberg 2013; Helvenston 2013).

Various states of ToM have been attributed to many non-human animals, ranging from chimpanzees to birds, but nonmentalistic accounts of primate behavior (Heyes 1998) can often account for observations cited in that context. The issue remains unresolved, which both extremes of the spectrum of views need to recognize. Just as there are nuances of consciousness and self-awareness, ToM is also unlikely to be bound up in a single package. Ontogenically, ToM has been shown to be acquired gradually, and it is highly likely that the same applies phylogenically. The alternative, that one hominin suddenly attained this faculty seems as unlikely as the idea of one hominin, one day in the Pleistocene, miraculously acquiring a “soul,” distinguishing her from all conspecifics. Therefore precursory social behavior patterns preceding modern ToM can safely be postulated. Understanding attention (Baron-Cohen 1991), understanding of others’ intentions (Dennett 1987), and imitative experience with conspecifics (Horowitz 2003) are hallmarks of a ToM.

The “false-belief task” (Wimmer and Perner 1983), which establishes the ability of an individual to attribute false beliefs to a conspecific, is seen as a key indicator of the level of development of ToM. In humans it occurs normally around the age of four, but while it is found in children with Down syndrome, it is absent in most of those with autistic spectrum disorder (Baron-Cohen et al. 1985; Leslie 1991), and a link with mirror neurons is suggested (Oberman and Ramachandran 2007; Oberman et al. 2005; Williams et al. 2001). Another such test (see Gopnik 1988; Gopnik and Astington 1988) can be passed by most five-year-olds (see also Leslie and Thaiss 1992; Sabbagh and Moses 2006; Zaitchik 1990). These abilities would seem to mark the threshold of human ToM, but since precursory behaviors indicative of ToM are found widely among non-human species, such behavior would be expected in human phylogeny well before the australopithecines. Similarly, in a rational model well-developed stages of ToM would realistically need to be attributed to such species as *Homo habilis* or *Homo erectus*. The ontogenic parallels are relatively well understood. Intentional behavior can be detected by infants five to nine months old (Woodward 1999), while at 15 months infants can classify actions according to their goals (Csibra et al. 2003). The same abilities are available to chimpanzees and orangutans (Call and Tomasello 1998), but apparently not to monkeys (Jellema et al. 2000). Between 18 and 24 months, the child establishes joint attention (Franco and Butterworth 1996), as well as engages in pretend-play, and it develops an ability to understand desires (Rapacholi and Gopnik 1997; Wellman and Wooley 1990; Wellman and Liu 2004). Again, apes use gaze monitoring to detect joint attention (Hare et al. 2000), but monkeys apparently do not. These observations imply a certain distance between the levels of ToM in the great apes and other nonhuman primates. But it is with the appearance of “metarepresentation,” the ability to explicitly represent representations as representations (Baron-Cohen 1995; Leslie 1994; Perner and Garnham 2001), and with recursion that human ToM emerges, as these are lacking in the great apes (Call and Tomasello 1999; Suddendorf 1999). Similarly, the apes have so far provided no evidence of episodic memory or future planning (Suddendorf and Busby 2003). Episodic memory, which is identified with autonoetic consciousness, can be impaired in humans also, e.g., in amnesia, Asperger’s syndrome, or in older adults (Gardiner 2001). It can be attributed to differential activity in the medial prefrontal and medial parietal cortices, imaging studies of episodic retrieval have shown (Lou et al. 2004). Autonoetic consciousness is the ability to mentally place ourselves in the past, in the future, or in counterfactual situations, and to analyze our own thoughts, and it is thought to be limited to humans. However, it remains profoundly unknown how far these abilities, or metarepresentation and recursion, extend back

in time. Here it is again fundamental to distinguish between the replacement and other models of Africa-derived modernity on the one hand (Protsch 1973, 1975; Bräuer 1984; Cann et al. 1987; Stringer and Andrews 1988; Vigilant et al. 1991; Stoneking and Delfin 2010; Hublin 2011; Cann 2013), and the domestication hypothesis (Bednarik 2008a, 2008b) on the other. The first model implicitly excludes these abilities prior to the descendants of the African Eve; the second model allows a much greater time depth for them.

Already at this point it becomes obvious that the first model is entirely unrealistic. For instance the ability of maritime colonization, which demands that viable breeding populations must have traversed the open sea, is known to be roughly one million years old, as shown by well-established populations on several islands that have never been connected to other land masses (Bednarik 1995b, 1999, 2001, 2003, 2014c; Bednarik and Kuckenburg 1999). Similarly, the use of exograms and complex technologies extends back at least that far in time. Therefore, the replacement model fails even in this scenario, having already failed in every possible other respect.

The previous paragraph implies that homology can provide some preliminary indications about the putative levels of ToM over the course of human evolution, from reviewing the known ontogenic development of present-day humans. It is roughly at the age of forty months that the human child surpasses the ToM level of the great apes. Thus the executive control over cognition unique to humans, together with metarepresentation and recursion, would be expected to have developed during the last 5 to 8 million years, i.e., the period since the hominin clade is believed to have separated from the pongid (the true timing of which remains unresolved). Although the brain areas accounting for the faculties of metarepresentation and recursion remain unidentified, executive control resides in the frontal lobes. Since the frontal and temporal areas have experienced the greatest degree of enlargement in humans (Semendeferi et al. 2001; cf. Bednarik and Helvenston 2012), uniquely human abilities would be expected to be found mostly there, although inter-connectivity rather than discrete loci may be the main driving force of cognitive evolution. It is precisely the expansion of association cortices that has made the human brain disproportionately large, and encephalization has been such an *evolutionary burden*, in terms of the costs of prolonged infant dependency, reduced fertility, and obstetric demands and their consequences (Joffe 1997; O'Connell et al. 1999; Falk 2009; Bednarik 2011a).

But it is widely assumed that it was essential in achieving the cognition or intelligence attained by hominins, although this belief could be challenged. Unless the severe and accelerating atrophy of the human brain in the last 40 ka can be shown to have resulted in reduced cognitive and intellectual performance in humans, the need for encephalization would need to be justified. This rationalization seems to question some of the most fundamental tenets about the process of brain evolution (Shultz and Dunbar 2010), bearing in mind that the atrophy has proceeded at a rate 37 times (!) greater than the average rate of encephalization over the previous million years. This would seem to challenge all rationalizations developed about brain evolution for well over a century, because there is no evidence of humanity having become dumber since modern humans developed from the Neanderthals and other Robusts. Fortunately an explanation has been recently found for this unexpected conundrum: the human brain began to delegate many of its higher functions to external storage, in the form of exograms, much more effectively and routinely than it has done so in the past (Bednarik 2014b).

This restores the need to justify encephalization in terms of its importance to the higher cognitive functions, which can be paraphrased thus: evolution cannot select in favor of potential advantages; it can only select from expressed mutations. Therefore these expanding brains must have been used for something beneficial to humans, and catastrophic explanations of human evolution (“big bang of consciousness”, Klein and Edgar 2002; “creative explosion”, Pfeiffer 1983; Mithen 1998), such as the replacement/African Eve hypothesis, become redundant. Evolutionary logic simply demands that increasing size and complexity of the brain had to be in proportion to its benefits to the hominins concerned. After all, these increases involved considerable disadvantages beyond those that are readily apparent. More specifically, it is precisely those areas of the human brain that were most enlarged during the most recent period of evolution that are the ones most affected by the recently developed brain illnesses (Farley 1976; Damasio et al. 1990; Crow 1995, 2000, 2002; Cosmides and Tooby 1999; Hodgson 2003; Burns 2004, 2006; Keller and Miller 2006; Brüne and Brüne-Cohrs 2007; Keller 2008; Bednarik 2008a, 2011a; Helvenston and Bednarik 2011; cf. Ghika 2008). Bearing in mind that extant primates are largely free of the significant genetic burdens of present-day humans (Walker and Cork 1999; Olson and Varki 2003), it is more useful to interrogate the genetic record of the rise of these afflictions, and to ask the replacement advocates how they propose to explain these striking disadvantages of encephalization, or the most recent atrophy of the human brain.

They cannot account for the phenomenal rise of thousands of genetically based disorders and syndromes that has accompanied the most recent development of humans, which the domestication hypothesis accounts for perfectly (Bednarik 2008b, 2011a). It also places the rise of exograms in the Early Pleistocene, which the empirical evidence confirms, and it posits a ToM in the hominins of that time that is not fundamentally different from that of modern people.

A PRELIMINARY ETIOLOGY OF TOM

Ontogenic homology of contemporary humans provides a rough model for the development of ToM during human evolution because it is a vague recapitulation of the processes involved in that evolution. It implies that the skills of metarepresentation, recursion, and basic verbal language use need to be attributed to at least some of the earliest representatives of the genus *Homo*, if not to all of them (Bednarik 2001). *Homo erectus* managed to colonize not only cold climate regions, such as northern China; he also crossed the open sea in colonizing parties large enough to establish thriving island populations in numerous cases (Bednarik 2014c). The first achievement implies the controlled use of fire and probably of animal skins as clothing, as well as the construction of shelters. The first ability can be traced back at least 1.7 million years at one site, where a massive hearth of ash, charcoal, and calcined bone fragments was excavated in Oldowan-bearing strata, more than 30 m into Wonderwerk Cave, South Africa (Beaumont 2011; Beaumont and Bednarik 2013). The second capacity is amply demonstrated at three Indonesian islands, Flores (Sondaar et al. 1994; Bednarik 1995b, 2001, 2003, 2011a, 2014c; Brumm et al. 2010), Timor (Bednarik 1999), and Roti (Bednarik and Kuckenburger 1999). Colonizing seafaring during the Lower Paleolithic, in one case by *Homo erectus*, has also been suggested for five Mediterranean

islands: at Sardinia, or rather “Corsardinia” (Arca et al. 1982a, 1982b; Martini 1992; Bini et al. 1993; Sondaar et al. 1995; Ginesu et al. 2003); Crete (Faccini and Giusberti 1992; Mortensen 2008; Strasser et al. 2010, 2011); Gavdos (Kopaka et al. 1994–95; Kopaka and Matzanas 2009); Corfu (Cubuk 1976; Kourtessi-Philippaki 1999); and Euboea (Sarantea-Micha 1996; Sampson 2006). This evidence, in particular, provides a crucial benchmark, because it is capable of bestowing insights into the minimum technological, mental, and cognitive faculties of the Lower Paleolithic hominins concerned. Replicative experiments have provided ample empirical information about the absolute minimum requirements needed to accomplish the colonizing sea crossings that undeniably occurred up to a million years ago. For instance it would be absurd to think that these feats could have been accomplished without the ability to recursively communicate abstract concepts to conspecifics. They would also be entirely impossible without the faculty of well-developed autonoetic consciousness. Therefore the development of these faculties must predate one million years ago, and the same applies to language ability in general. This has long been evident from linguistics (Falk 1975, 1983, 1987, 2009; Bickerton 2010), but has been widely rejected by archaeology. Because it is therefore at odds with credible predictive outlines provided by the sciences, any archaeological explanation that cannot accommodate these fundamental insights must include clearly stated justifications. Most archaeologists believed only recently that Neanderthals possessed no language. This is only one of numerous examples when the frivolous archaeological claims concerning the humanity of ancient humans had to be corrected by one or more of the sciences, a pattern that is becoming all too common and has in fact characterized archaeology since the early 19th century (Bednarik 2013b).

Ignoring Pleistocene archaeology and the baseless arguments that discipline fields in reference to this subject, what can be said about the past development of what might be defined as “higher cognitive faculties” in hominins? These faculties define humanness today, but their existence poses the usual conundrum: science should not define phenomena describing human conditions by their effects, any more than medicine should not define diseases by their symptoms (Bednarik 2012). Science deals with cause and effect relationships, essentially by endeavoring to fathom the causes of observed effects. The only way to realistically review the etiology of modern human ToM or other higher cognitive functions is by addressing the hominin past, unconstrained by archaeological dogma.

It has been noted above that, at some time between five and eight million years ago, the human ancestors should have possessed the already well-developed ToM, consciousness and self-awareness of a chimpanzee, bonobo, or a 40-months-old modern human child. It has also been observed that since then their brains have continuously grown in volume, and that the high price of this enlargement demands that cognitive abilities must have developed adequately to justify that relentless encephalization.

Therefore the first fundamental observation is that, as a ballpark concept, the complexity of these abilities can be assumed to have risen correspondingly: it increased gradually, and not suddenly in some “big bang of consciousness” toward the end of the Pleistocene, as archaeology purports.

The second issue to be considered here is which of these abilities may be related to the development of human ToM? Did these abilities arise together, or did some forge ahead while others lagged behind? In order to consider these factors usefully, rather detailed information would be required from essentially two sources: from data about the cognitive abilities of late Pliocene and Early Pleistocene hominins safely inferable from archaeology; and pertinent

information that may be gleaned from their endocasts. Both these sources are highly unreliable: a discipline that cannot collectively determine the nature of some remains of a small human from Liang Bua Cave in Flores (Morwood et al. 2004), to decide whether it is of an impaired modern human, a dwarf *Homo erectus*, a relative of *H. georgicus* or *H. habilis*, an Asian australopithecine, or a gibbon, does not have much credibility. Nor does a discipline that believes in a pseudo-Biblical account of modern human origins based originally on a hoax (“Science is the belief in the ignorance of experts”; Feynman 1968). Since any investigation of the required details would involve humanities lacking scientific integrity it is perhaps judicious to abstain from speculations about the cognitive faculties of the hominins beyond one million years ago, until these disciplines can meet the expectations envisaged in the sciences. The picture is much clearer for the last one million years if archaeological dogma is ignored.

CONCLUSION

Theory of Mind, self-awareness, consciousness, technology and culture were all available to non-human species, although they were not developed to the integrated system of a self-reflective human brain that observes itself, generating volitional decisions through excitatory/inhibitory neural functions. In the absence of reliable information about the etiological history of hominin ToM from both archaeology and paleoanthropology, which have been captive to false beliefs for decades, the most judicious consideration of this issue is via ontogenic homology and biologically anchored reasoning. Linguistic contemplation implies a long duration of “reflective” language use, certainly well beyond one million years and quite possibly in the order of three times that long. This is confirmed by the demonstrated seafaring colonization events that extend at least one million years into the past, and which are considered impossible to accomplish without recursive language and autonoetic consciousness. Self-awareness must be attributed to all hominins, as traces of it are detectable even in extant chimpanzees, and the archaeologically late first occurrence of such material as beads and pendants is rather surprising. The Makapansgat cobble (Bednarik 1998) suggests apperceptive capability 2.5 to 3 million years ago in the hominins concerned, and a level of self-awareness well beyond that inherent in passing the mirror test (Gallup 1970; Mitchell 1993, 1997, 2002). In terms of creating a reasonable chronological framework, this is a most realistic proposition.

It follows from these considerations that, on the basis of the presently available empirical knowledge provided by the sciences (rather than the humanities), the ToM of the (unknown) human ancestors 5 to 8 million years ago should be expected to have been similar to that of a modern child of about forty months. The executive control over cognition unique to humans, together with metarepresentation and recursion, must have developed during the subsequent evolution of hominids and then hominins. *Homo erectus*, of the Early Pleistocene, can reasonably be credited with the cognitive development of a modern juvenile of about 8 to 12 years of age (Bednarik 2012). This could reasonably account for his ability of crossing the sea, and it suggests that substantially modern ToM was in place by a million years ago.

This model concurs with the expectations of cognitive and neuroscience, as well as with several sound archaeological insights. It clashes most severely with the predictions of

archaeology, especially those of recent decades, i.e., those deriving from the replacement hypothesis.

REFERENCES

- Allman, J. M., Watson, K. K., Tetreault, N. A., and Hakeem, A. Y. (2005). Intuition and autism: a possible role for Von Economo neurons. *Trends in Cognitive Sciences* 9(8), 367-373.
- Anati, E. (1981). The origins of art. *Museum* 33, 200-210.
- Anderson, E. (1949). *Introgressive hybridization*. New York: John Wiley and Sons.
- Arca, M., Martini, F., Pitzalis, G., Tuveri, C., and Ulzega, A. (1982). Il Paleolitico dell'Anglona (Sardegna Settentrionale). *Recherche* 1979-1980. *Quaderni* 12: 58.
- Arca, M., Martini, F., Pitzalis, G., Tuveri, C., and Ulzega, A. (1982). Il deposito Quaternario con industria del Paleolitico Inferiore di sa Padrosa-Pantallinu (Sassari). *Rivista di Scienze Preistoriche* 37: 31-53.
- Balter, M. (2007). A mind for sociability. *Science Now Daily News* July 27, p. 1.
- Barinaga, M. (1992). "African Eve" backers beat a retreat. *Science* 255, 686-687.
- Baron-Cohen, S. (1991). Precursors to a theory of mind: Understanding attention in others. In: A. Whiten (Ed.), *Natural theories of mind: Evolution, development and simulation of everyday mindreading* (pp. 233-251). Oxford: Basil Blackwell.
- Baron-Cohen, S. (1995). *Mindblindness: an essay of autism and theory of mind*. Cambridge, MA: MIT Press.
- Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Sciences* 6(6), 248-254.
- Baron-Cohen, S. (2006). Two new theories of autism: hyper-systemizing and assortative mating. *Archives of Disease in Childhood* 91, 2-5.
- Baron-Cohen, S., Jolliffe, T., Mortimore, C., and Robertson, M. (1997). Another advanced test of theory of mind: Evidence from very high functioning adults with autism or Asperger syndrome. *Journal of Child Psychology and Psychiatry* 38, 813-822.
- Baron-Cohen, S., Leslie, A. M. and Frith, U. (1985). Does the autistic child have a "theory of mind?" *Cognition* 21, 36-46.
- Beaumont, P. B. (2011). The edge: More on fire-making by about 1.7 million years ago at Wonderwerk Cave in South Africa. *Current Anthropology* 52 (4), 585-595.
- Beaumont, P. B. and Bednarik, R. G. (2013). Tracing the emergence of palaeoart in sub-Saharan Africa. *Rock Art Research* 30(1), 33-54.
- Bednarik, R. G. (1987). Engramme und Phosphene. *Zeitschrift für Ethnologie* 112(2): 223-235.
- Bednarik, R. G. (1990). On the cognitive development of hominids. *Man and Environment* 15(2): 1-7.
- Bednarik, R. G. (1992). On Lower Paleolithic cognitive development. In: S. Goldsmith, S. Garvie, D. Selin, and J. Smith (Eds.), *Ancient images, ancient thought: the archaeology of ideology* (pp. 427-435). Proceedings of the 23rd Annual Chacmool Conference, University of Calgary.

- Bednarik, R. G. (1995a). Concept-mediated marking in the Lower Palaeolithic. *Current Anthropology* 36, 605-634.
- Bednarik, R. G. (1995b). Wallace's barrier and the language barrier in archaeology. *Bulletin of the Archaeological Survey Association of Southern California* 20(3), 8-9, 13.
- Bednarik, R. G. (1998). The "australopithecine" cobble from Makapansgat, South Africa. *South African Archaeological Bulletin* 53, 4-8.
- Bednarik, R. G. (1999). Maritime navigation in the Lower and Middle Palaeolithic. *Comptes Rendus de l'Académie des Sciences Paris, Earth and Planetary Sciences* 328, 559-563.
- Bednarik, R. G. (2001). Replicating the first known sea travel by humans: the Lower Pleistocene crossing of Lombok Strait. *Human Evolution* 16(3-4): 229-242.
- Bednarik, R. G. (2003). Seafaring in the Pleistocene. *Cambridge Archaeological Journal* 13(1), 41-66.
- Bednarik, R. G. (2008a). The mythical Moderns. *Journal of World Prehistory* 21(2), 85-102.
- Bednarik, R. G. (2008b). The domestication of humans. *Anthropologie* 46(1), 1-17.
- Bednarik, R. G. (2011a). *The human condition*. New York: Springer.
- Bednarik, R. G. (2011b). Rendering humanities sustainable. *Humanities* 1(1): 64-71; <http://www.mdpi.com/2076-0787/1/1/64/>
- Bednarik, R. G. (2011c). Genetic drift in recent human evolution? In: K. V. Urbano (Ed.), *Advances in genetics research*, Volume 6 (pp. 109-160). New York: Nova Press.
- Bednarik, R. G. (2012). An aetiology of hominin behaviour. *Homo — Journal of Comparative Human Biology* 63, 319-335.
- Bednarik, R. G. (2013a). The origins of modern human behavior. In: R. G. Bednarik (Ed.), *The psychology of human behaviour* (pp. 1-58). New York: Nova Press.
- Bednarik, R. G. (2013b). *Creating the human past: an epistemology of Pleistocene archaeology*. Oxford: Archaeopress.
- Bednarik, R. G. (2013c). "African Eve": hoax or hypothesis? *Advances in Anthropology* 3(4), 216-228.
- Bednarik, R. G. (2014a). Exograms. *Rock Art Research* 31(1), 47-62.
- Bednarik, R. G. (2014b). Doing with less: hominin brain atrophy. *Homo — Journal of Comparative Human Biology*.
- Bednarik, R. G. (2014c). *The first mariners*. Research India Press, New Delhi.
- Bednarik, R. G. and Helvenston, P. A. (2012). The nexus between neurodegeneration and advanced cognitive abilities. *Anthropos* 107(2), 511-527.
- Bednarik, R. G. and Kuckenburger, M. (1999). *Nale Tasih: Eine Floßfahrt in die Steinzeit*. Thorbecke, Stuttgart.
- Behar, D. M., Vilems, R., Soodyall, H., Blue-Smith, J., Pereira, L., Metspalu, E., et al. (2008). The dawn of human matrilineal diversity. *American Journal of Human Genetics* 82, 1130-1140.
- Bibby, C. (1959). *T. H. Huxley: scientist, humanist and educator*. Horizon, New York.
- Bickerton, D. (2010). *Adam's tongue: how humans made language, how language made humans*. Hill and Wang, New York.
- Bini, C., Martini, F., Pitzalis, G., and Ulzega, A. (1993). Sa Coa de Sa Multa e Sa Pedrosa Pantallinu: due "Paleosuperfici" clactoniane in Sardegna. Atti della XXX Riunione Scientifica, "Paleosuperfici del Pleistocene e del primo Olicene in Italia, Processi di Formazione e Interpretazione", Venosa ed Isernia, 26-29 ottobre 1991 (pp. 179-197). Firenze: Istituto Italiano di Preistoria e Protostoria.

- Brasic, J. R. (2009a). Autism. *E Medicine Medscape*. Internet address: <http://emedicine.medscape.com/article/912781-print>.
- Brasic, J. R. (2009b). Asperger's syndrome. *E Medicine Medscape*. Internet address: <http://emedicine.medscape.com/article/912296-print>.
- Brasic, J. R. (2010). PET scanning in autism spectrum disorders. *E Medicine Medscape, Neurology*. Internet address: <http://emedicine.medscape.com/article/1155568-print>.
- Bräuer, G. (1984). Prä sapiens-hypothese oder Afro-europäische sapiens-Hypothese? *Zeitschrift für Morphologie und Anthropologie* 75, 1-25.
- Brookfield, J. F. Y. (1997). Importance of ancestral DNA ages. *Nature* 388, 134.
- Brumm, A., Jensen, G. M., van den Bergh, G. D., Morwood, M. J., Kurniawan, I., Aziz, F., and Storey, M. (2010). Hominins on Flores, Indonesia, by one million years ago. *Nature* 464, 748-752.
- Brüne, M. and Brüne-Cohrs, U. (2007). The costs of mental time travel. *Behavioral and Brain Sciences* 30(3), 317-318.
- Buchen, L. (2011). When geeks meet. *Nature* 479: 25-27.
- Burack, J. A., Charman, T., Yurmiya, N., and Zelazo, P. R. (Eds) (2009). *The development of autism: perspectives from theory and research*. London: Taylor and Francis/Routledge.
- Burns, J. K. (2004). An evolutionary theory of schizophrenia: cortical connectivity, metarepresentation, and the social brain. *Behavioral and Brain Sciences* 27(6), 831-855.
- Burns, J. K. (2006). Psychosis: a costly by-product of social brain evolution in *Homo sapiens*. *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 30(5), 797-814.
- Call, J. and Tomasello, M. (1998). Distinguishing intentional from accidental actions in orangutans (*Pongo pygmaeus*), chimpanzees (*Pan troglodytes*), and human children (*Homo sapiens*). *Journal of Comparative Psychology* 112, 192-206.
- Call, J. and Tomasello, M. (1999). A nonverbal false belief task: the performance of children and great apes. *Child Development* 70(2), 381-395.
- Campbell, M. C. and Tishkoff, S. A. (2010). The evolution of human genetic and phenotypic variation in Africa. *Current Biology* 20, R166-R173.
- Cann, R. (2013). Y weigh in again on modern humans. *Science* 341, 465-467.
- Cann, R. L., Stoneking, M. and Wilson, A. C. (1987). Mitochondrial DNA and human evolution. *Nature* 325, 31-36.
- Carrigan, D. and Hammer, M. F. (2006). Reconstructing human origins in the genomic era. *Nature Reviews Genetics* 7, 669-680.
- Carroll, N. (Ed.) (2000). *Theories of art today*. Madison, WI: University of Wisconsin Press.
- Carruthers, M. (1990). *The book of memory*. Cambridge: Cambridge University Press.
- Carruthers, M. (1998). *The craft of thought*. Cambridge: Cambridge University Press.
- Carruthers, P. and Smith, P. K. (Eds.) (1996). *Theories of theories of mind*. Cambridge: Cambridge University Press.
- Chiaroni, J., Underhill, P. A. and Cavalli-Sforza, L. L. (2009). Y-chromosome diversity, human expansion, drift, and cultural evolution. *Proceedings of the National Academy of Sciences of the US* 106, 20174-20179.
- Christian, K. M. and Thompson, R. F. (2005). Long-term storage of an associative memory trace in the cerebellum. *Behavioral Neuroscience* 119: 256-537.
- Convey, T. (2014). What is art? *Rock Art Research* 31(2), 142.
- Cosmides, L. and Tooby, J. (1999). Toward an evolutionary taxonomy of treatable conditions. *Journal of Abnormal Psychology* 108(3), 453-464.

- Crow, T. J. (1995). A Darwinian approach to the origins of psychosis. *British Journal of Psychiatry* 167(1), 12-25.
- Crow, T. J. (2000). Schizophrenia as the price that homo sapiens pays for language: a resolution of the central paradox in the origin of the species. *Brain Research Reviews* 31, 118-129.
- Crow, T. J. (2002). *The speciation of modern Homo sapiens*. Oxford: Oxford University Press.
- Csibra, G., Biro, S., Koos, O., and Gergely, G. (2003). One-year-old infants use teleological representations of actions productively. *Cognitive Science* 27(1), 111-133.
- Cubuk, G. A. (1976). Altpaläolithische Funde von den Mittelmeerterassen bei Nea Skala auf Kephallinia (Griechenland). *Archäologisches Korrespondenzblatt* 6: 175-181.
- Curnoe, D., Xueping, J., Herries, A. I. R., Kanning, B., Taçon, P. S. C., Zhende, B., Fink, D., et al. (2012). Human remains from the Pleistocene-Holocene transition of southwest China suggest a complex evolutionary history for East Asians. *PLOS ONE* 7, article ID e31918.
- Damasio, A. R., Tranel, D. and Damasio, H. (1990). Individuals with sociopathic behavior caused by frontal damage fail to respond autonomically to social stimuli. *Behavioral Brain Research* 41, 81-94.
- Danto, A. C. (1986). *The philosophical disenfranchisement of art*. New York: Columbia University Press.
- Danto, A. C. (1988). Artifact and art. In: S. Vogel (Ed.), exhibition catalogue for *ART/artifact* (pp. 18-32). New York: Center for African Art.
- Davies, S. (1991). *Definition of art*. Ithaca, NY: Cornell University Press.
- De Jaegher, H., Di Paolo, E. and Gallagher, S. (2010). Can social interaction constitute social cognition? *Trends in Cognitive Sciences* 14(10), 441-447.
- Dennett, D. C. (1987). Reprint of intentional systems in cognitive ethology: the Panglossian paradigm defended. *Behavioural and Brain Sciences* 6, 343-390.
- De Veer, M. W. and Van Den Bos, R. (1999). A critical review of methodology and interpretation of mirror self-recognition research in nonhuman primates. *Animal Behavior* 58, 459-468.
- Dielenberg, R. A. (2013). The comparative psychology of human uniqueness: a cognitive behavioral review. In: R. G. Bednarik (Ed.), *The psychology of human behaviour* (pp. 111-182). New York: Nova Press.
- Di Pellegrino, G., Fadiga, L., Fogassi, L., Gallese, V., and Rizzolatti, G. (1992). Understanding motor events: A neurophysiological study. *Experimental Brain Research* 91, 176-180.
- Donald, M. (1991). *Origins of the modern mind: three stages in the evolution of culture and cognition*. Cambridge, MA: Harvard University Press.
- Donald, M. (1993). On the evolution of representational capacities. *Behavioural and Brain Sciences* 16, 775-785.
- Donald, M. (2001). *A mind so rare: the evolution of human consciousness*. New York: W.W. Norton.
- DSM-5 (2013). *Autism spectrum disorder*. American Psychiatric Publishing. <http://www.dsm5.org/Documents/Autism%20Spectrum%20Disorder%20Fact%20Sheet.pdf>, retrieved 6 Aug. 2014.
- Dutton, D. (1993). Tribal art and artifact. *Journal of Aesthetics and Art Criticism*, 51, 13-21.

- Edmonds, C. A., Lillie, A. S. and Cavalli-Sforza, L. L. (2004). Mutations arising in the wave front of an expanding population. *Proceedings of the National Academy of Sciences of the US* 101, 975-979.
- Enard, W., Khaitovich, P., Klose, J., Heissig, F., Zöllner, S., Giavalisco, P., Nieselt-Struwe, K., Muchmore, E., Varki, A., Ravid, R., Doxiadis, G. M., Bontrop, R. E., and Pääbo, S. (2002). Intra- and interspecific variation in primate gene expression patterns. *Science* 296(5566), 340-343.
- Eswaran, V. (2002). A diffusion wave out of Africa. *Current Anthropology* 43, 749-774.
- Ewans, W. J. (1983). The role of models in the analysis of molecular genetic data, with particular reference to restriction fragment data. In: B. S. Weir (Ed.), *Statistical analysis of DNA sequence data* (pp. 45-73). New York: Marcel Dekker.
- Facchini, F. and Giusberti, G. (1992). *Homo sapiens sapiens* remains from the island of Crete. In: Bräuer G. and Smith F. H., (Eds.), *Continuity and replacement*. Rotterdam/Brookfield: A. A. Balkena; pp. 189-208.
- Fagundes, N. J. R., Ray, N., Beaumont, M., et al. (2007). Statistical evaluation of alternative models of human evolution. *Proceedings of the National Academy of Sciences of the US* 104, 17614-17619.
- Fairservice, W. A., Jr. (1975). *The threshold of civilization*. New York: Scribner.
- Falk, D. (1975). Comparative anatomy of the larynx in man and chimpanzee: implications for language in Neanderthal. *American Journal of Physical Anthropology* 43, 123-132.
- Falk, D. (1983). Cerebral cortices of east African early hominids. *Science* 221, 1072-1074.
- Falk, D. (1987). Hominid paleoneurology. *Annual Review of Anthropology* 16, 13-30.
- Falk, D. (2009). *Finding our tongues: mothers, infants and the origins of language*. Basic Books, New York.
- Farley, J. D. (1976). Phylogenetic adaptations and the genetics of psychosis. *Acta Psychiatry Scandinavia* 83(1), 173-192.
- Fernandes, V., Alshamali, F., Alves, M., Costa, M. D., Pereira, J. B., Silva, N. M., Cherni, L., Harich, N., Cerny, V., Soares, P., Richards, M. B., and Pereira, L. (2012). The Arabian cradle: mitochondrial relicts of the first steps along the southern route out of Africa. *American Journal of Human Genetics* 90, 347-355.
- Feynman, R. P. (1968). What is science? *The Physics Teacher* 7(6), 313-320.
- Fish, S. (2008). The uses of the humanities, Part 2. *The New York Times*, 13 January 2008.
- Forster, P. (2004). Ice Ages and the mitochondrial DNA chronology of human dispersals: a review. *Philosophical Transactions of Royal Society B* 359, 255-264.
- Forster, P., Torroni, A., Renfrew, C., and Rohl, A. (2001). Phylogenetic star contraction applied to Asian and Papuan mtDNA evolution. *Molecular Biology and Evolution* 18, 1864-1881.
- Francalacci, P., Morelli, L., Angius, A., Berutti, R., Reinier, F., Atzeni, R., et al. (2013). Low-pass DNA sequencing of 1200 Sardinians reconstructs European Y-chromosome phylogeny. *Science* 341, 565-569.
- Franco, F. and Butterworth, G. (1996). Pointing and social awareness: declaring and requesting in the second year. *Journal of Child Language* 23 (2), 307-336.
- Frith, U. (1989). *Autism: explaining the enigma*. Oxford: Blackwell.
- Frith, U. and Happé, F. G. E. (1994). Autism: Beyond "theory of mind". *Cognition* 50, 115-132.

- Gallagher, S. (2001). The practice of mind: theory, simulation, or primary interaction? *Journal of Consciousness Studies* 8(5-7), 83-107.
- Gallagher, S. and Hutto, D. (2008). Understanding others through primary interaction and narrative practice. In: T. Zlatev, T. Racine, C. Sinha, and E. Itkonen (Eds.), *The shared mind: perspectives on intersubjectivity* (pp. 17-38). Amsterdam: John Benjamins.
- Gallagher, H. L. and Frith, C. D. (2003). Functional imaging of "theory of mind". *Trends in Cognitive Science* 7, 77-83.
- Gallese, V. and Goldman, A. (1998). Mirror neurons and the simulation theory of mind-reading. *Trends in Cognitive Science* 2(12), 493-501.
- Gallup, G. G., Jr. (1970). Chimpanzees: self recognition. *Science* 167(3914), 86-87.
- Gallup, G. G., Jr. (1998). Self-awareness and the evolution of social intelligence. *Behavioral Processes* 42, 239-247.
- Gallup, G. G., Jr., Anderson, J. L., Shillito, D. P. (2002). The mirror test. In: M. Bekoff, C. Allen and G. M. Burghardt (Eds.), *The cognitive animal: empirical and theoretical perspectives on animal cognition* (pp. 325-333). Chicago: University of Chicago Press.
- Gardiner, J. M. (2001). Episodic memory and autonoetic consciousness: a first-person approach. *Philosophical Transactions of The Royal Society: Biological Sciences* 356(1413), 1351-1361.
- Ghika, J. (2008). Paleoneurology: neurodegenerative diseases are age-related diseases of specific brain regions recently developed by *Homo sapiens*. *Medical Hypotheses* 71(5), 788-801.
- Gibbons, A. (1998). Calibrating the mitochondrial clock. *Science* 279, 28-29.
- Ginesu, S., Sias, S. and Cordy, J. M. (2003). Morphological evolution of the Nurighe Cave (Logudoro, northern Sardinia, Italy) and the presence of man: first results. *Geografica Fisica e Dinamica Quaternaria* 26: 41-48.
- Goldman, A. (2005). Imitation, mind reading, and simulation. In: S. Hurley and N. Chater, *Perspectives on imitation II* (pp. 80-81). Cambridge, MA: MIT Press.
- Goody, J. 1977. *The domestication of the savage mind*. Cambridge: Cambridge University Press.
- Gopnik, A. (1988). Conceptual and semantic development as theory change. *Mind and Language* 3, 197-217.
- Gopnik, A. and Astington, J. W. (1988). Children's understanding of representational change and its relation to the understanding of false belief and the appearance-reality distinction. *Child Development* 59, 26-37.
- Gopnik, A. and Meltzoff, A. (1997). *Words, thoughts, and theories*. Cambridge, MA: MIT Press.
- Gopnik, A. and Schulz, L. (2004). Mechanisms of theory-formation in young children. *Trends in Cognitive Science* 8, 371-377.
- Gregory, R. L. (1970). *The intelligent eye*. London: Weidenfeld and Nicolson.
- Grinker, R. R. (2007). *Unstrange minds: remapping the world of autism*. New York: Basic Books.
- Handwerker, W. P. (1989). The origins and evolution of culture. *American Anthropologist* 91, 313-326.
- Happé, F. (1995). The role of age and verbal ability in the theory of mind task performance of subjects with autism. *Child Development* 66, 843-855.

- Happé, F. G. E. (1997). Central coherence and theory of mind in autism: Reading homographs in context. *British Journal of Developmental Psychology* 15, 1-12.
- Happé, F., Ehlers, S., Fletcher, P., Frith, U., Johansson, M., Gillberg, C., Dolan, R., Frackowiak, R., and Frith, C. (1996). Theory of mind in the brain: Evidence from a PET scan study of Asperger syndrome. *Neuroreport* 8, 197-201.
- Harding, L. (2005). History of modern man unravels as German scholar is exposed as fraud. *The Guardian*, February 19, 2005.
- Hare, B., Call, J., Agnetta, B., and Tomaselli, M. (2000). Chimpanzees know what conspecifics do and do not see. *Animal Behaviour* 59, 771-785.
- Harpending, H. C., Batzer, M. A., Gurven, M., Jorde, L. B., Rogers, A. R., and Sherry, S. T. (1998). Genetic traces of ancient demography. *Proceedings of the National Academy of Sciences of the US* 95, 1961-1967.
- Hartl, D. L. and Clark, A. G. (1997). *Principles of population genetics*. Sunderland: MA: Sinauer.
- Hayden, E. C. (2013). African genes tracked back. *Nature* 500, 514.
- Hellenthal, G., Auton, A. and Falush, D. (2008). Inferring human colonization history using a copying model. *PLOS Genetics* 4, article ID: e1000078.
- Helvenston, P. A. (2013). Differences between oral and literate cultures: what we can know about Upper Paleolithic minds. In: R. G. Bednarik (Ed.), *The psychology of human behaviour* (pp. 59-110). New York: Nova Press.
- Helvenston, P. A. and Bednarik, R. G. (2011). Evolutionary origins of brain disorders in *Homo sapiens sapiens*. *Brain Research Journal*, 3(2), 113-139.
- Henke, W. and Protsch, R. (1978). Die Paderborner Calvaria—ein diluvialer *Homo sapiens*. *Anthropologischer Anzeiger* 36, 85-108.
- Henn, B. M., Gignoux, C. R., Jobling, M., Granka, J. M., Macpherson, J. M., Kidd, et al. (2011). Hunter-gatherer genomic diversity suggests a southern African origin for modern humans. *Proceedings of the National Academy of Sciences of the US* 108, 5154-5162.
- Henneberg, M. (1988). Decrease of human skull size in the Holocene. *Human Biology* 60, 395-405.
- Henneberg, M. (1990). Brain size/body weight variability in *Homo sapiens*: consequences for interpreting hominid evolution. *HOMO — Journal of Comparative Human Biology* 39(3-4), 121-130.
- Henneberg, M. (2004). The rate of human morphological microevolution and taxonomic diversity of hominids. *Studies in Historical Anthropology* 4, 49-59.
- Henneberg, M. and Steyn, M. (1993). Trends in cranial capacity and cranial index in Subsaharan Africa during the Holocene. *American Journal of Human Biology* 5, 473-479.
- Hermelin, B. and O'Connor, N. (1970). *Psychological experiments with autistic children*. Oxford and New York: Pergamon Press.
- Heyes, C. M. (1998). Theory of mind in nonhuman primates. *Behavioral and Brain Sciences* 21(1), 101-134.
- Hobson, R. P. (1993). *Autism and the development of mind*. Erlbaum, Hove, UK.
- Hodgson, D. (2003). Seeing the “unseen:” fragmented clues and the implicit in Palaeolithic art. *Cambridge Archaeological Journal* 13, 97-106.
- Hofstadter, D. (2007). *I am a strange loop*. New York: Basic Books.
- Horowitz, A. (2003). Do humans ape? Or do apes human? Imitation and intention in humans and other animals. *Journal of Comparative Psychology* 17, 325-336.

- Hublin, J. J. (2011). African origin. *Nature* 476, 395.
- Hudjashov, G., Kivisild, T., Underhill, P. A., Endicott, P., Sanchez, J. J., Lin, A. A., Shen, P., Oefner, P., Renfrew, C., Villems, R., and Forster, P. (2007). Revealing the prehistoric settlement of Australia by Y-chromosome and mtDNA analysis. *Proceedings of the National Academy of Sciences of the US* 104, 8726-8730.
- Hughes, C., Soares-Boucaud, I., Hochmann, J., and Frith, U. (1997). Social behaviour in pervasive developmental disorders: effects of informant, group and 'theory-of-mind'. *European Child and Adolescent Psychiatry* 6 (4), 191-198.
- Iacoboni, M., Molnar-Szakacs, I., Gallese, V., Buccino, G., and Mazziotta, J. C. (2005). Grasping the intentions of others with one's own mirror neuron system. *PLoS Biology* 3(3), 529-535.
- Jacques, S. and Zelazo, P. D. (2005). Language and the development of cognitive flexibility: Implications for theory of mind. In: J. W. Astington and J. A. Baird (Eds.), *Why language matters for theory of mind* (pp. 144-162). Toronto: Oxford University Press.
- Jarrold, C., Butler, D. W., Coltington, E. M., and Jimenez, F. (2000). Linking theory of mind and central coherence bias in autism and the general population. *Developmental Psychology* 36, 126-138.
- Jellema, T., Baker, C. I., Wicker, B., and Perrett, D. I. (2000). Neural representation for the perception of the intentionality of actions. *Brain and Cognition (Special Issue: Cognitive Neuroscience of Actions)* 44(2), 280-302.
- Jobling, M. A., Hollox, E., Hurles, M., Tyler-Smith, C., and Kivisild, T. (2014). *Human evolutionary genetics* (2nd edn). New York: Garland Science.
- Jobling, M. A. and Tyler-Smith, C. (2003). The human Y-hromosome: an evolutionary marker comes of age. *Nature Reviews Genetics* 4, 598-612.
- Joffe, T. H. (1997). Social pressures have selected for an extended juvenile period in primates. *Journal of Human Evolution* 32, 593-605.
- Keenan, J. P., Falk, D. and Gallup, Jr, G. C. (2003). *The face in the mirror: the search for the origins of consciousness*. New York: Harper Collins Publishers.
- Keller, M. C. (2008). The evolutionary persistence of genes that increase mental disorders risk. *Current Directions in Psychological Science* 17(6), 395-399.
- Keller, M. C. and Miller, G. (2006). Resolving the paradox of common, harmful, heritable mental disorders: which evolutionary genetic models work best? *Behavioral and Brain Sciences* 29, 385-452.
- Kim, Y. S., Leventhal, B., Koh, Y.-J., Fombonne, E., Laska, E., Lim, E.-C., Chun, K.-A., Kim, S.-J., Kim, Y.-K., Lee, H., et al. (2011). Prevalence of autism. *The American Journal of Psychiatry*, 168, 904-12.
- Klein, R. G. and B. Edgar (2002). *The dawn of human culture: a bold new theory on what sparked the "big bang" of human consciousness*. Wiley and Sons, New York.
- Klyosov, A. A. (2014a). Reconsideration of the "out of Africa" concept as not having enough proof. *Advances in Anthropology* 4(1), 18-37.
- Klyosov, A. A. (2014b). Clarifying the "African Eve" concept. *Rock Art Research* 31(2), 146-148.
- Kopaka, K. and Matzanas, C. (2009). Palaeolithic industries from the island of Gavdos, near neighbour to Crete in Greece. *Antiquity* 83(321): <http://antiquity.ac.uk/antiquityNew/projgall/kopaka321/index.html#author>.

- Kopaka, K., Drossinou, P. and Christodoulakos, Y. (1994-95). Surface survey on Gavdos. *Kritiki Estia* 5: 242-244.
- Kourtessi-Philippaki, G. (1999). The Lower and Middle Palaeolithic in the Ionian islands: new finds. In: Bailey, G. N., Adam, E., Panagopoulou, E., Perlès, C., and Zachos, K. (Eds.), *The Palaeolithic archaeology of Greece and adjacent areas* (pp. 282-287). London: British School at Athens.
- Kuhn, T. S. (1962). *The structure of scientific revolutions* (1st edn., 2nd edn. 1970). Chicago: University of Chicago Press.
- Lashley, K. S. (1923a). The behavioristic interpretation of consciousness. *Psychological Review* 30, Part I: 237-272; Part II: 329-353.
- Lashley, K. S. (1923b). Temporal variation in the function of the *gyrus precentralis* in primates. *American Journal of Physiology* 65: 585-602.
- Lashley, K. S. (1924). The theory that synaptic resistance is reduced by the passage of the nerve impulse. *Psychological Review* 31: 369-375.
- Lashley, K. S. (1930). Brain mechanisms and intelligence. *Psychological Review* 37: 1-24.
- Lashley, K. S. (1932). *Studies in the dynamics of behavior*. Chicago: University of Chicago Press.
- Lashley, K. S. (1935). The mechanism of vision, Part 12: Nervous structures concerned in the acquisition and retention of habits based on reactions to light. *Comparative Psychology Monographs* 11: 43-79.
- Lashley, K. S. (1943). Studies of cerebral function in learning: loss of the maze habit after occipital lesions in blind rats. *Journal of Comparative Neurology* 79(3): 431-462.
- Lashley, K. S. (1950). In search of the engram. *Society of Experimental Biology, Symposium* 4: 454-482.
- Latour, B. (1993). *We have never been modern*. Cambridge, MA: Harvard University Press.
- Leslie, A. M. (1991). Theory of mind impairment in autism. In: A. Whiten (Ed.), *Natural theories of mind: evolution, development and simulation of everyday mindreading* (pp. 63-77). Oxford: Basil Blackwell.
- Leslie, A. M. (1994). Pretending and believing: issues in the theory of ToMM. *Cognition* 50, 211-238.
- Leslie, A. and Thaiss, L. (1992). Domain specificity in conceptual development. *Cognition* 43, 225-251.
- Li, H. and Durbin, R. (2011). Inference of human population history from individual whole genome sequences. *Nature* 475, 493-496.
- Lou, H. C., Luber, B., Crupain, M., Keenan, J. P., Nowak, M., Kjaer, T. W., Sackeim, H. A., and Lisanby, S. H. (2004). Parietal cortex and representation of the mental self. *Proceedings of the National Academy of Sciences of the US* 101 (2004): 6827-6832.
- Maddison, D. R. (1991). African origin of human MtDNA re-examined. *Systematic Zoology* 40, 355.
- Majumder, P. P. (2010). The human genetic history of south Asia. *Current Biology* 20, R184-R187.
- Martini, F. (1992). Early human settlement in Sardinia: the Palaeolithic industries. In: R. Tykot and T. Andrews (Eds.), *Sardinia in the Mediterranean: a footprint in the sea* (pp. 40-48). Sheffield: Sheffield Academic Press.

- Marvanová, M., Ménager, J., Bezard, E., Bontrop, R. E., Pradier, L., and Wong, G. (2003). Microarray analysis of nonhuman primates: validation of experimental models in neurological disorders. *The FASEB Journal* 17, 929-931.
- Mellars, P. (2011). The earliest modern humans in Europe. *Nature* 479, 483-485.
- Michael, J. (2012). Mirror systems and simulation: a neo-empiricist interpretation. *Phenomenology and the Cognitive Sciences* 11(4), 565-582.
- Michael, J., Christiansen, W. and Overgaard, S. (2013). Mindreading as social expertise. *Synthese*. DOI 10.1007/s11229-013-0295-z.
- Mitchell, R. W. (1993). Mental models of mirror-self-recognition: two theories. *New Ideas in Psychology* 11, 295-325.
- Mitchell, R. W. (1997). Kinesthetic-visual matching and the self-concept as explanations of mirror-self-recognition. *Journal for the Theory of Social Behaviour* 27, 18-39.
- Mitchell, R. W. (2002). Subjectivity and self-recognition in animals. In: M. R. Leary and J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 567-595). New York: Guilford Press.
- Mithen, S. (ed.) (1998). *Creativity in human evolution and prehistory*. Routledge, New York.
- Moorjani, P., Patterson, N., Hirschhorn, J. N., Keinan, A., Hao, L., Atzmon, G., Burns, E., Ostrer, H., Price, A. L., and Reich, D. (2011). The history of African gene flow into Southern Europeans, Levantines, and Jews. *PLOS Genetics* 7, article ID e1001373.
- Mortensen, P. (2008). Lower to Middle Palaeolithic artefacts from Loutró on the south coast of Crete. *Antiquity* 82(317); <http://www.antiquity.ac.uk/projgall/mortensen/>
- Morwood, M. J., Soejono, R. P., Roberts, R. G., Suktina, T., Turnkey, C. S. M., Westaway, K. E., et al. (2004). Archaeology and age of a new hominin from Flores in eastern Indonesia. *Nature* 431, 1087-1091.
- Newman-Norlund, R., van Shie, H., van Zuijlen, A., and Beckering, H. (2007). The mirror system is more active during complementary compared with imitative action. *Social Neuroscience* 10(7), 167-178.
- Oberman, L. M., Hubbard, E. M., McCleery, J. P., Altschuler, E. L., Ramachandran, V. S., and Pineda, J. A. (2005). EEG evidence for mirror neuron dysfunction in autism spectrum disorders. *Cognitive Brain Research* 24, 190-198.
- Oberman, L. M. and Ramachandran, V. S. (2007). The simulating social mind: the role of the mirror neuron system and simulation in the social and communicative deficits of autism spectrum disorders. *Psychological Bulletin* 133, 310-327.
- O'Connell, J. F., Hawkes, K., Jones, N. G. B. (1999). Grandmothering and the evolution of *Homo erectus*. *Journal of Human Evolution* 36, 461-485.
- Olson, M. V. and Varki, A. (2003). Sequencing the chimpanzee genome: insights into human evolution and disease. *Nature Reviews Genetics* 4, 20-28.
- Otoni, C., Primativo, G., Kashani, B. H., Achilli, A., Martinez-Labarga, C., Biondi, G., Torroni, A., and Rickards, O. (2010). Mitochondrial haplogroup H1 in north Africa: an early Holocene arrival from Iberia. *Plos ONE* 5, article ID e13378.
- Ozonoff, S. and Miller, J. N. (1995). Teaching theory of mind—a new approach in social skills training for individuals with autism. *Journal of Autism and Developmental Disorders* 25, 415-433.
- Paterson, T. (2004). Neanderthal man “never walked in northern Europe”. *The Telegraph*, August 22, 2004.

- Patin, E., Laval, G., Barreiro, L. B., Salas, A., Semino, O., Santachiara-Benerecetti, S., Kidd, K. K., et al. (2009). Inferring the demographic history of African farmers and Pygmy hunter-gatherers using a multi-locus resequencing data set. *PLOS Genetics* 5, 1-13.
- Pennisi, E. (1999). Genetic study shakes up Out of Africa theory. *Science* 283, 1828.
- Perner, J. and Garnham, W. A. (2001). Actions really do speak louder than words—but only implicitly. Young children's understanding of false belief in action. *British Journal of Developmental Psychology* 19(3), 413-432.
- Pfeiffer, J. E. (1983). *The creative explosion: an inquiry into the origins of art and religion*. Harper and Row, New York.
- Post, R. H. (1971). Possible cases of relaxed selection in civilized populations. *Humangenetik* 13, 253-284.
- Poznik, G. D., Henn, B. M., Yee, M. C., Sliwerska, E., Euskirchen, G. M., Lin, A. A., Snyder, M., Quintana-Murci, L., Kidd, J. M., Underhill, P. A., and Bustamante, C. D. (2013). Sequencing Y chromosomes resolves discrepancy in time to common ancestor of males versus females. *Science* 341, 562-565.
- Premack, D. G. and Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences* 1, 515-526.
- Preuss, T. M. (2000). What's human about the human brain. In: M. S. Gazzaniga (Ed.), *The new cognitive neurosciences* (pp. 1219-1234). Cambridge, MA: MIT Press.
- Protsch, R. R. R. (1973). The dating of Upper-Pleistocene Subsaharan fossil hominids and their place in human evolution: with morphological and archaeological implications. Unpubl. *PhD thesis*, University of California, Los Angeles.
- Protsch, R. (1975). The absolute dating of Upper Pleistocene sub-Saharan fossil hominids and their place in human evolution. *Journal of Human Evolution* 4, 297-322.
- Protsch, R. and Glowatzki, H. (1974). Das absolute Alter des paläolithischen Skeletts aus der Mittleren Klause bei Neuessing, Kreis Kelheim, Bayern. *Anthropologischer Anzeiger* 34, 140-144.
- Protsch, R. and Semmel, A. (1978). Zur Chronologie des Kelsterbach-Hominiden. *Eiszeitalter und Gegenwart* 28, 200-210.
- Rapacholi, B. M. and Gopnik, A. (1997). Early reasoning about desires. Evidence from 14- and 18-month-olds. *Developmental Psychology* 33(1), 12-21.
- Rehder, B. (2003). A causal-model theory of conceptual representation and categorization. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 29, 1141-1159.
- Rito, T., Richards, M. B., Fernandes, V., Alshamali, F., Cerny, V., Pereira, L., and Soares, P. (2013). The first modern human dispersals across Africa. *PLoS ONE* 8, article ID e80031.
- Rizzolatti, G., Fadiga, L., Gallese, V., and Fogassi, L. (1996). Premotor cortex and the recognition of motor actions. *Cognitive Brain Research* 3, 131-141.
- Rubinsztein, D. C., Amos, W., Leggo, J., Goodburn, S., Ramesar, R. S., Old, J., Dontrop, R., McMahon, R., Barton, D. E., and Ferguson-Smith, M. A. (1994). Mutational bias provides a model for the evolution of Huntington's disease and predicts a general increase in disease prevalence. *Nature Genetics* 7(7), 525-530.
- Sabbagh, M. A. and Moses L. J. (2006). Executive functioning and preschoolers' understanding of false beliefs, false photographs, and false signs. *Child Development* 77(4), 1034-1049.

- Sahoo, S., Singh, A., Himabindu, G., Banerjee, J., Sitalaximi, T., Gaikwad, S., Trivedi, R., Endicott, P., Kivisild, T., Metspalu, M., Villems, R., and Kashyap, V. K. (2006). A prehistory of Indian Y-chromosomes: evaluating demic diffusion scenarios. *Proceedings of the National Academy of Sciences of the US* 103, 843-848.
- Sample, I. (2013). Nobel winner declares boycott of top science journals. *The Guardian*, 10 December 2013; <http://www.theguardian.com/science/2013/dec/09/nobel-winner-2742-boycott-science-journals>, accessed 22 August 2014.
- Sampson, A. (2006). *The prehistory of the Aegean basin: Palaeolithic-Mesolithic-Neolithic*. Athens: Atrapos.
- Sarantea-Micha, E. (1996). Phaneromeni and Voleri, Nea Artaki in Euboea: Palaeolithic quarries and tool workshops. *Archaiol Kai Technes* 60: 43-47.
- Schulz, M. (2004). Die Regeln mache ich. *Der Spiegel* 34(18 August), 128-131.
- Searle, J. R. (1995). *The construction of social reality*. London: Allen Lane.
- Semendeferi, K., Armstrong, E., Schleicher, A., Zilles, K., and Van Hoesen, G. W. (2001). Prefrontal cortex in humans and apes: a comparative study of area 10. *American Journal of Physical Anthropology* 114, 224-241.
- Semon, R. (1904). *Die Mneme*. W. Leipzig: Engelmann.
- Semon, R. (1921). *The mneme*. London: George Allen and Unwin.
- Sherwood, C. C., Gordon, A. D., Allen, J. S., Phillips, K. A., Erwin, J. M., Hof, P. R., and Hopkins, W. D. (2011). Aging of the cerebral cortex differs between humans and chimpanzees. *Proceedings of the National Academy of Sciences of the US*, DOI: 10.1073/pnas.1016709108.
- Shi, W., Ayub, Q., Vermeulen, M., Shao, R. G., Zuniga, S., van der Gaag, K., de Knijff, P., Kayser, M., Xue, Y., and Tyler-Smith, C. (2010). A worldwide survey of human male demographic history based on Y-SNP and Y-STR data from the HGDP-CEPH populations. *Molecular Biology and Evolution* 27, 385-393.
- Shultz, S. and Dunbar, R. (2010). Encephalization is not a universal macroevolutionary phenomenon in mammals but is associated with sociality. *Proceedings of the National Academy of Sciences, US* 107(50), 21582-21586.
- Siegal, M. and Varley, R. (2002). Neural systems involved in "theory of mind." *Nature Reviews Neuroscience* 3(6), 463-471.
- Smith, F. H., Janković, I. and Karavanić, I. (2005). The assimilation model, modern human origins in Europe, and the extinction of Neandertals. *Quaternary International* 137, 7-19.
- Soares, P., Ermini, L., Thompson, N., Normina, M., Rito, T., Rohl, A., Salas, A., Oppenheimer, S., Macaulay, V., and Richards, M. B. (2009). Correcting for purifying selection: an improved human mitochondrial molecular clock. *American Journal of Human Genetics* 84, 740-759.
- Sondaar, P. Y., van den Bergh, G. D., Mubroto, B., Aziz, F., de Vos, J., and Batu, U. L. (1994). Middle Pleistocene faunal turnover and colonization of Flores (Indonesia) by *Homo erectus*. *Comptes Rendus de l'Académie des Sciences Paris* 319, 1255-1262.
- Sondaar, P. Y., Elburg, R., Klein Hofmeijer, G., Martini, F., Sanges, M., Spaan, A., and de Visser, H. (1995). The human colonization of Sardinia: a Late-Pleistocene human fossil from Corbeddu Cave. *Comptes Rendus de l'Académie des Sciences Paris* 320, 145-150.
- Stecker, R. (1997). *Artworks: definition, meaning, value*. University Park, PA: Pennsylvania State University Press.

- Steinmetz, J. E., Lavond, D. G., Ivkovich, D., Logan, C. G., and Thompson, R. F. (1992). Disruption of classical eyelid conditioning after cerebellar lesions: damage to a memory trace system or a simple performance deficit? *Journal of Neuroscience* 12: 4403-4426.
- Steinmetz, J. E., Logan, C. G., Rosen, D. J., Thompson, J. K., Lavond, D. G., and Thompson, R. F. (1987). Initial localization of the acoustic conditioned stimulus projection system to the cerebellum essential for classical eyelid conditioning. *Proceedings of the National Academy of the Sciences of the US* 84: 3531-3535.
- Steinmetz, J. E. and Thompson, R. F. (1991). Brain substrates of aversive classical conditioning. In: J. Madden (Ed.), *Neurobiology of learning, emotion and affect* (pp. 97-120). New York: Raven Press.
- Stewart, J. R. and Stringer, C. B. (2012). Human evolution out of Africa: the role of refugia and climate change. *Science* 335, 1317-1321.
- Stoneking, M. and Delfin, F. (2010). The human genetic history of east Asia: weaving a complex tapestry. *Current Biology* 20, R188-R193.
- Strasser, T. F., Panagopoulou, E., Runnels, C. N., Murray, P. M., Thompson, N., Karkanias, P., et al. (2010). Stone Age seafaring in the Mediterranean: evidence from the Plakias region for Lower Palaeolithic and Mesolithic habitation of Crete. *Hesperia* 79: 145-190.
- Strasser, T. F., Runnels, C., Wegmann, K., Panagopoulou, E., McCoy, F., DiGregorio, C., et al. (2011). Dating Palaeolithic sites in southwestern Crete, Greece. *Journal of Quaternary Science* 26(5): 553-560.
- Stringer, C. B. and Andrews, P. (1988). Genetic and fossil evidence for the origin of modern humans. *Science* 239, 1263-1268.
- Suddendorf, T. (1999). The rise of the metamind. In: M. C. Corballis and S. Lea (Eds.), *The descent of mind: psychological perception on hominid evolution* (pp. 218-260). London: Oxford University Press.
- Suddendorf, T. and Busby, J. (2003). Mental time travel in animals? *Trends in Cognitive Sciences* 7, 391-396.
- Tager-Flusberg, H. (2007). Evaluating the Theory-of-Mind hypothesis of autism. *Current Directions in Psychological Science* 16(6), 311-315.
- Templeton, A. R. (1993). The "Eve" hypothesis: a genetic critique and re-analysis. *American Anthropology* 95, 51-72.
- Templeton, A. R. (1994) "Eve": hypothesis compatibility versus hypothesis testing. *American Anthropologist* 96, 141-147.
- Templeton, A. R. (1996). Gene lineages and human evolution. *Science* 272, 1363.
- Templeton, A. (2002). Out of Africa again and again. *Nature* 416, 45-51.
- Templeton, A. (2005). Haplotype trees and modern human origins. *Yearbook of Physical Anthropology* 48, 33-59.
- Templeton, A. R. (2007) Perspective: genetics and recent human evolution. *Evolution* 61, 1507-1519.
- Templeton, A. R. (2010) Coherent and incoherent inference in phylogeography and human evolution. *Proceedings of the National Academy of Sciences of the US* 107, 6376-6381.
- Terberger, T. and Street, M. (2003). Jungpaläolithische Menschenreste im westlichen Mitteleuropa und ihr Kontext. In: J. M. Burdukiewicz, L. Fiedler, W.-D. Heinrich, A. Justus, and E. Brühl (Eds.), *Erkenntnisjäger: Kultur und Umwelt des frühen Menschen* (pp. 579-591). *Veröffentlichungen des Landesamtes für Archäologie Sachsen-Anhalt*, Vol. 57/2, Halle: Landesmuseum für Vorgeschichte.

- Thompson, J. R. (2012). The allegory of the hammer and the nail gun and other unstable orthodoxies of “modernity”: possible pitfalls of “behavioural modernity.” *AURA Newsletter* 29(2): 3-12.
- Thompson, J. R. (2014). Archaic modernity vs the high priesthood: on the nature of unstable archaeological/palaeoanthropological orthodoxies. *Rock Art Research* 31(2), 131-156.
- Thompson, R. F. (1967). *Foundations of physiological psychology*. New York: Harper and Row.
- Thompson, R. F. (1986). The neurobiology of learning and memory. *Science* 233: 941-947.
- Thompson, R. F. (1990). Neural mechanisms of classical conditioning in mammals. *Philosophical Transactions, Royal Society of London B* 329: 161-170.
- Thompson, R. F., Berger, T. W., Cegavske, C. F., Patterson, M. M., Roemer, R. A., Teyler, T. J., and Young, R. A. (1976). The search for the engram. *American Psychologist* 31: 209-227.
- Thomson, R., Pritchard, J. K., Shen, P., Oefner, P. J., and Feldman, M. (2000). Recent common ancestry of human Y chromosomes: Evidence from DNA sequence data. *Proceedings of the National Academy of Sciences of the US* 97, 7360-7365.
- Underhill, P. A., Shen, P., Lin, A. A., Jin, L., Passarino, G., Yang, W. H., Kauffman, E., et al. (2000). Y-chromosome sequence variation and the history of human populations. *Nature Genetics* 26, 358-361.
- Vernot, B. and Akey, J. M. (2014). Resurrecting surviving Neandertal lineages from modern human genomes. *Science* 343(6174), 1017-1021.
- Vigilant, L., Stoneking, M., Harpending, H., Hawkes, K., and Wilson, A. C. (1991). African populations and the evolution of human mitochondrial DNA. *Science* 253, 1503-1507.
- Walker, L. C. and Cork, L. C. (1999). The neurobiology of aging in nonhuman primates. In: R. D. Terry, R. Katzman, K. L. Bick, and S. S. Sisodia (Eds.), *Alzheimer's disease*, 2nd edn. (pp. 233-243). New York: Lippincott Williams and Wilkins.
- Ward, R. H., Frazier, B. L., Dew-Jager, K., and Pääbo, S. (1991). Extensive mitochondrial diversity within a single Amerindian tribe. *Proceedings of the National Academy of Sciences of the US* 88, 8720-8724.
- Watson, E., Bauer, K., Aman, R., Weiss, G., von Haeseler, A., and Pääbo, S. (1996). MtDNA sequence diversity in Africa. *The American Journal of Human Genetics* 59, 437-444.
- Wei, W., Ayub, Q., Xue, Y., and Tyler-Smith, C. (2013). A comparison of Y-chromosomal lineage dating using either resequencing or Y-SNP plus Y-STR genotyping. *Forensic Science International: Genetics* 7, 568-572.
- Weintraub, K. (2011). Autism counts. *Nature* 479, 22-24.
- Wellman, H. and Liu, D. (2004). Scaling theory of mind tasks. *Child Development* 75(2), 523-541.
- Wellman, H. and Wooley, J. (1990). From simple desires to ordinary beliefs: the early development of everyday psychology. *Cognition* 35(3), 245-275.
- Williams, J. H. G., Whiten, A., Suddendorf, T., and Perrett, D. I. (2001). Imitation, mirror neurons and autism. *Neuroscience and Biobehavioral Reviews* 25, 287-295.
- Wimmer, H. and Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition* 13, 103-128.
- Woodward, A. (1999). Infants' ability to distinguish between purposeful and non-purposeful behaviors. *Infant Behavior and Development* 22(2), 145-160.

- Xue, Y., Zerjal, T., Bao, W., Zhu, S., Lim, S. K., Shu, Q., Xu, J. J., Du, R. F., Fu, S. B., Li, P., Yang, H. M., and Tyler-Smith, C. (2005). Recent spread of a Y-chromosomal lineage in northern China and Mongolia. *American Journal of Human Genetics* 77, 1112-1116.
- Yotova, V., Lefebvre, J. F., Moreau, C., Gbeha, E., Hovhannesian, K., Bourgeois, S., et al. (2011). An X-linked haplotype of Neandertal origin is present among all non-African populations. *Molecular Biology and Evolution* 28, 1957-1962.
- Zaitchik, D. (1990). When representations conflict with reality: the preschooler's problem with false beliefs and "false" photographs. *Cognition* 35, 41-68.