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The mournful ape: Conflating expression and meaning in the mortuary behaviour of *Homo naledi*

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As an article in the last issue of the *South African Journal of Science*[1] highlighted, in the last few months we have seen a bonanza of early hominin material from the Cradle of Humankind – *Homo naledi* – presented to the world, courtesy of Lee Berger, John Hawks, Paul Dirks and the Rising Star science team. Firstly, there were papers on the taxonomy[2], and the geological and taphonomic[3] context, followed shortly afterwards by the detailed functional anatomy of the hands and feet of *H. naledi* in papers led by Tracy Kivell[4] and Will Harcourt-Smith[5], respectively. The media attention surrounding the fossils, and inferred mortuary behaviours, has been intense, but it has definitely put South African palaeoanthropology back on the world stage, and more importantly, encouraged the public to engage directly with the science and – via social media and exhibitions – with the scientists themselves.

The metrics for the two primary papers[2,3] have been nothing short of astonishing: 243 485 views and 25 435 downloads for the taxonomy paper, and 82 399 views and 9207 downloads for the context paper at the time of writing. In addition, there has been over 5500 downloads of the 3D surface models of the Dinaledi fossils, which allow users (both in academia and the public) to generate their own models of the fossils, provided they have a suitable 3D printer (Figure 1). This open-access public science has been a triumph in the democratisation and dissemination of data.[6] However, along with the media attention has come more than a fair degree of scientific and professional scrutiny (some as measured responses, some far from it) which has exposed some ugly truths at the heart of what we might like to think is a dispassionate and logical scientific debate.

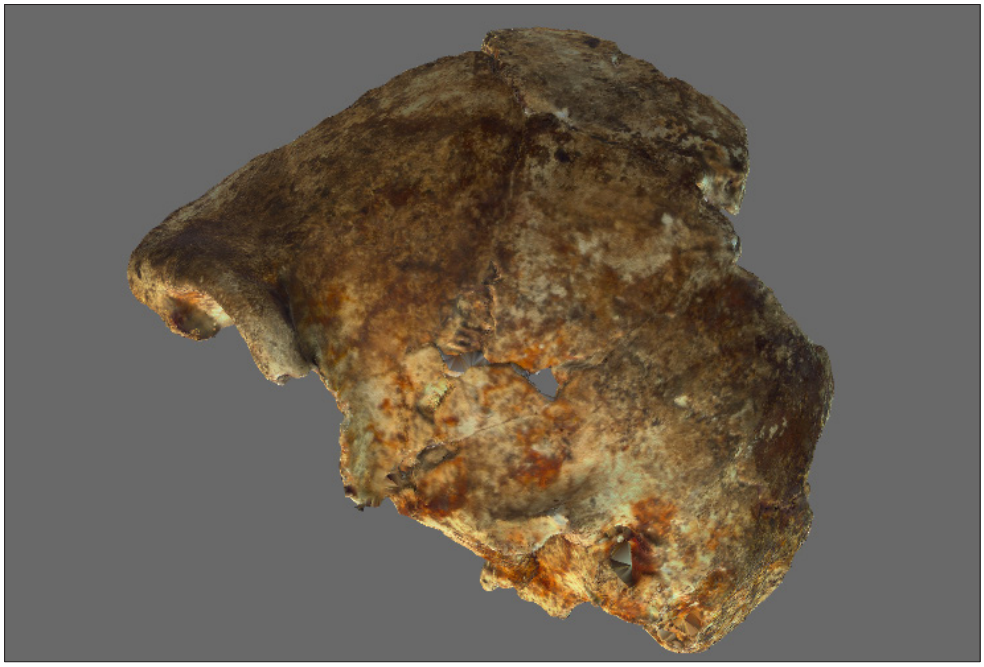

Photo: Patrick Randolph-Quinney.
Original specimen cc Evolutionary Studies Institute, University of the Witwatersrand

Figure 1: An example of 3D model sharing of the *Homo naledi* fossils. The figure shows a rendered surface scan of the U.W. 101-0396 (DH3) calvaria. The scan (3D Mesh, polygon file format) is free to download from *Morpho Source* (http://morphosource.org) and is displayed using *Microsoft 3D Builder*. The scan mesh is suitable for direct 3D printing.

First, the good scrutiny. The initial launch of the taxonomy and context papers was accompanied by a thoughtful and insightful commentary from Chris Stringer of the Natural History Museum in London. Stringer[7] highlights the issue of the (as yet) lack of radiometric dating from the site, and makes the important point that because *H. naledi* is currently only known from one site (as is also the case with *Australopithecus sediba*[8]), it is unclear whether or not the taxon was restricted to southern Africa. If *H. naledi* was more geographically widespread, its moderate body size may force palaeoanthropologists to re-examine other small-bodied fossils from across Africa, which have usually been attributed to a small form of *Homo erectus*.[7]

Other commentaries (all web based) followed from researchers such as Darren Curnoe (University of New South Wales) and Daniel Lieberman (Harvard University). Curnoe[9] states:

> *Reading the scientific article describing* Homo naledi *you realise that the work is detailed, rigorous and careful. It involved a large number of specialists covering a very wide set of physical features on the bones and teeth. The case for the new species is, in my opinion, detailed, compelling and praise worthy.*

Lieberman (interviewed by Allison Pohle[10] of Boston.com) was also broadly in support. He states:

> *The head of this thing is extremely like the* Homo erectus. *It has a brain that's a little larger than a chimpanzee, which is the smallest end of the range of brain sizes in the genus* Homo. *The shape of skull is* Homo erectus. *And its brow ridge, the shape of the face, and teeth, pretty much from the neck up, a lot looks like the* Homo erectus. *…From the neck down, there's a mixture of features….the foot was beautifully preserved and looks a lot like a human foot, except for the arch being a little flat. The upper body, arms and shoulders, look very primitive, like Lucy* [*Au. afarensis*]. *There was a beautifully preserved hand that was also very humanlike. The hands were humanlike in most regards except for the fingers and thumbs, and the shape of the wrist bones. The phalanges…are extremely curved, which you'd find in apes. It's an interesting mixture of stuff, some modern, some early* Homo, *and a few things you'd find in the* Australopithecus [sic]. *It's entirely reasonable for them to create a new species.*

Elsewhere science bloggers have described the *H. naledi* papers as a textbook example of how to do science.[11]

Now for the bad scrutiny. There were a number of negative commentaries, although it becomes abundantly clear that many of them are *ad hominem* attacks. The three primary nay-sayers to date have been Professors Christoph Zollikofer (University of Zurich), Jeffrey Schwartz (University of Pittsburgh) and Tim White (University of Berkeley). All three are senior scientists, and all three have profoundly negative views of the validity of *H. naledi* as a new and distinct species. Zollikofer, quoted in an interview with Johan von Mirbach[12], states:

> *The idea that this is a new genus is just another headline grabber. About 90% of this publication addresses the media and not the scientific community. I call this a 'media species', which is usually quite short-lived….My intuition says it is a primitive* Homo erectus. *But I'm just speculating, since nobody knows its exact biological age. Assuming that it is 2 million years old, you could say it is an early* Homo erectus*, but not a new genus.*

This statement gives pause for thought on two fronts: firstly, taxonomy should be divorced from chronology, and secondly, Berger and colleagues[2] do not name a new genus – *naledi* has been placed firmly within the existing genus *Homo*, thus joining a pantheon of taxa including manifestly primitive forms such as *H. habilis* and *H. rudolfensis*, evolutionary novelties such as *H. floresiensis*, and advanced (humanlike) morphs such as *H. ergaster, H. erectus, H. antecessor, H. heidelbergensis, H. neanderthalensis* and our own species, *H. sapiens*. Quite where the notion that *naledi* is representative of a 'new genus' comes from escapes me.

Writing for *Newsweek* on the day of the publication of the primary *eLife* papers[2,3], Jeffrey Schwartz[13] seems to suggest that the fossils should be placed in *Australopithecus*, and that several species are represented in the assemblage. He states:

> *Viewed from the side, two partial skulls are long and low, with a long gently sloping forehead that flows smoothly into the brow – nothing like us, or most specimens regarded as* Homo. *A third partial skull is very short and rounded, with a high-rising forehead that is distinguished from a distinct, well-defined brow by a shallow gutter – not like the other skulls, and not like us or most specimens regarded as* Homo. *The femur has a small head (the ball end that fits in the hip socket) that is connected to the shaft of the bone by a long neck, and, below the neck, is a 'bump' of bone that points backward. These features are seen in every australopith femur. In us, and all other living primates, the head of the femur is large and the neck short, and the 'bump' points inward. Further, the teeth are very similar to those from a nearby fossil site that has yielded various kinds of australopith. Even at this stage of their being publicized, the '*Homo naledi*' specimens reflect even greater diversity in the human fossil record than their discoverers will admit.*

In response, John Hawks highlights that *H. naledi* presents a *uniform* mix of primitive and derived traits, noting that every feature that is repeated in the sample is nearly identical in all individuals that preserve it. Hawks[14] states: '…It would be very strange to have a mix of different species where all seven proximal femora come from one species, while all of a dozen lower third premolars come from a different species.' One could also be a little less charitable, and suggest, given the rapidity with which the *Newsweek* article came out, that Professor Schwartz did not, perhaps, have sufficient time to fully absorb and assimilate the 35 pages of primary taxonomic description[2] and 26 pages of supplementary data and measurements before making his assessment.

Finally, Tim White has been the most prominent critic of both the taxonomy and the behavioural interpretation of *H. naledi.* White has challenged the primary nature of the deposit (he suggests it was mixed and disturbed), the care with which the fossils were recovered (he suggests that fresh breaks were caused by rushing the work, and by the excavators rather than the ingress of recreational cavers prior to the site being secured), and the specific taxonomy and composition of the assemblage (he attributes all to small-bodied *H. erectus*). This latter criticism may be considered somewhat ironic from a scientist who wrote (p. 291) that no one should publish on a fossil without seeing the original,[15] but who has not set foot in South Africa in a decade. Finally, White (along with Zollikofer) claim that the evidence for mortuary behaviours by the *naledi* hominins were specifically hyped for the press. In an interview with Glen Martin[16], White states, 'There is no evidence of burial rituals…the only evidence seems to be "We can't think of anything else". This is not evidence.'

I will leave it to others to address the criticism of the taxonomy and specific phylogenetic assessment of material from the Dinaledi Chamber, and instead concentrate on the issues raised about the inferred behaviour of *H. naledi* – deliberate body disposal. The case for this behaviour is based on geological, sedimentological, taphonomic and archaeological grounds; to contradict Professor White, what we present *is evidence,* and whilst we raise a number of alternative hypotheses to test against the physical data (hominin occupation of the cave, water transport of the remains, predator accumulation, mass fatality and death trap), the filter through which one assesses claims for each of these alternative scenarios simply does not fit the evidence at hand. In his commentary, Chris Stringer draws parallels between the depositional context of *H. naledi* and the 'sepulchral' pit from Sima de los Huesos (Atapuerca) in Spain, which provides evidence of at least 28 early Neanderthals who excavators suggest had been intentionally thrown into the pit, although it is worth noting that Sima does contain material from other large mammals, unlike the Dinaledi Chamber. There is general acceptance that Sima de los Huesos represents a charnel pit, for which large-brained archaic hominins (certainly more modern-looking than *H. naledi)* practised intentional disposal of the dead. Stringer highlights that such a mortuary behaviour in *H. naledi* is a surprisingly complex one for a hominin with a brain no bigger than that of *H. habilis* or a gorilla; others (myself included) would disagree.

The primatologist and professor of psychology at Emory University, Frans de Waal[17], writing in the *New York Times,* rightly takes Stringer to task for this assumption of linking brain size with complex social behaviour, and you may feel De Waal's frustration as he writes

> *…The problem is that we keep assuming that there is a point at which we became human. This is about as unlikely as there being a precise wavelength at which the color spectrum turns from orange into red. The typical proposition of how this happened*

> *is that of a mental breakthrough – a miraculous spark – that made us radically different. But if we have learned anything from more than 50 years of research on chimpanzees and other intelligent animals, it is that the wall between human and animal cognition is like a Swiss cheese. Apart from our language capacity, no uniqueness claim has survived unmodified for more than a decade since it was made. You name it – tool use, tool making, culture, food sharing, theory of mind, planning, empathy, inferential reasoning – it has all been observed in wild primates or, better yet, many of these capacities have been demonstrated in carefully controlled experiments.*
>
> *We know, for example, that apes plan ahead. They carry tools over long distances to places where they use them, sometimes up to five different sticks and twigs to raid a bee nest or probe for underground ants. In the lab, they fabricate tools in anticipation of future use. Animals think without words, as do we most of the time. Since they never stay in one place for long, they have no reason to cover or bury a corpse. Were they to live in a cave or settlement, however, they might notice that carrion attracts scavengers, some of which are formidable predators, like hyenas. It would absolutely not exceed the ape's mental capacity to solve this problem by either covering odorous corpses or moving them out of the way.*
>
> *The suggestion by some scholars that this requires belief in an afterlife is pure speculation. We simply don't know if* Homo naledi *buried corpses with care and concern or unceremoniously dumped them into a faraway cave to get rid of them. Apes appear to be deeply affected by the loss of others to the point of going totally silent, seeking comfort from bystanders and going into a funk during which they don't eat for days. They may not inter their dead, but they do seem to understand death's irreversibility. After having stared for a long time at a lifeless companion – sometimes grooming or trying to revive him or her – apes move on.*

Other researchers are more critical, but unfortunately seem fixated on the act of burial, on ritualistic symbol-laden interment, which we never suggest *H. naledi* as undertaking. This misunderstanding may come down to an inadvertent conflation of any form of mortuary behaviour with the notion of the burial act – they are categorically not the same. Curnoe[9] for instance, despite being happy with the taxonomic interpretation, comments: 'My 'nonsense-filter' also tells me that all the talk in the media about this new species *burying its dead and having human-like morality* [my emphasis], or that it dismantles one of the key pillars of human uniqueness, needs to be called out for what it truly is: absurd.' Views shared by Zollikofer who is quoted as saying[12]:

> *If you look more closely at the site where the skeletons were found, the cemetery theory becomes less probable. Think about it: according to the publication, there had never been direct access to the Dinaledi Chamber, where the bones were found. So our prehistoric human had to climb down there, squeeze through the narrow cave in complete darkness while dragging a corpse belonging to a member of its own species. From a purely practical standpoint, that makes no sense whatsoever.*

Well, archaeologists and primatologists would disagree with both Curnoe and Zollikofer, although specialists in palaeolithic burial have as yet not entered the fray…or perhaps they are winding up to address these issues through the correct medium – the peer-review process. Scientific discourse and peer-review is what drives the process of modern science, but being personally involved with the Dinaledi research has made me question the very nature of how the scientific community works, and in particular, how it fundamentally deals with evidence (ugly, inconvenient or otherwise) – the bedrock on which the modern scientific process is allegedly based.

Although I originally trained in archaeology and palaeoanthropology, and worked for many years in and around the sites of the Cradle of Humankind, the focus of my work in recent years has been forensic science, specifically anthropology and archaeology.[18] I am a specialist in the recovery and analysis of buried remains, burial environments (defined as the sedimentary and environmental context in which a body or bodies are contained post-mortem) and post-mortem processes.[19] I have recovered bodies from archaeological cemeteries, clandestine graves, homicides, fatal fires, and mass graves as the result of war crimes. My input into the Rising Star excavations was primarily as a forensic taphonomist and archaeologist.[3] As anyone with even a cursory interest in the forensic media circus which is 'real-life crime' or '*CSI*' will know, forensic science is deeply steeped in concepts of admissibility of evidence, and the application of basic sciences to the judicial or medico-legal process. In the USA, the admissibility of scientific evidence has been formalised through a number of legal case judgements, the most pertinent of which are those termed the Daubert Protocols or Daubert Standard.[20] In practice, Daubert is used by a trial judge to make an assessment of whether an expert's scientific evidence or testimony is based on scientifically valid reasoning or methodology and can properly be applied to the facts of the case.[21-23] Under Daubert, the factors considered in determining whether the science is valid are whether the hypothesis or technique in question (1) can be, and has been, tested; (2) has been subjected to peer review and publication; (3) has known or verifiable error rates; (4) has standards (professional or otherwise) controlling its operation; and (5) has attracted widespread acceptance within a relevant scientific community.[24]

So, does the science behind both the taxonomic and the context papers meet these definitions of admissibility? Of course it does. The science behind *H. naledi* is not controversial and is applied elsewhere in palaeoanthropology, evolutionary biology, geology, sedimentology, archaeology, etc., with widespread acceptance. Data are carefully collected (whether they be measurements of crania, teeth or femora, or elemental composition of cave sediments) and compared to existing standards and data sets. These data are subject to assessable error rates in terms of measurement error in data collection, or the effects of statistical sample size. Those undertaking the fieldwork and analyses are highly trained. And, most importantly, the work was peer reviewed before publication in a Thomson Reuters Web of Science accredited international journal. The evidence behind the science is sound – and presented in exceptional detail in the primary papers and supporting materials.[2,3] We present primary raw data, and *interpretations* of those data in such a way that scientists can use the published evidence to either accept the hypotheses presented or, if they so choose, re-analyse the data in a rigorous scientific fashion, and refute or (and this is the critical point) falsify our hypotheses. This process – observation, hypothesis, data collection, analysis and review, acceptance or rejection of hypothesis – is the cornerstone of how most modern science is conducted.

What critics perhaps fail to grasp is the difference between primary historical data (the physical evidence of the past – of which there is only one) and interpretation of intentionality or process in the past.[25] It is the creative tension between these two which basically defines the science of archaeology, particularly when it comes to understanding behavioural repertoires in hominins closely related to us.[26,27] Unfortunately this is complicated in species for which we have no clear modern analogue, falling as they are biologically somewhere between ape and human. To assist us in interpretation we triangulate data from a variety of disciplines – human archaeology, primate archaeology, ethology, evolutionary psychology, geology and taphonomy, to name a few.

Taphonomy is my area of primary interest, and an understanding of how we interpret the process of the introduction of bodies into the Dinaledi Chamber through taphonomic data is critically important. Because

of the confines of the Chamber, the Rising Star team applied forensic recovery and analytical techniques in order to extract the maximum amount of information about the formation of the assemblage, how the bodies had decomposed and skeletonised, and ultimately how they were introduced into the Dinaledi Chamber. As such, we adopted a multidisciplinary framework, bringing in a wide range of expertise in buried environments (more used to being applied to clandestine burials or forensic mass graves) to ensure that the most complete range of evidence was collected; the epistemological core of this is termed forensic taphonomy.[19] Whilst taphonomy can be considered the 'laws of burial',[28-33] forensic taphonomy[34] is perhaps unique in that the subject area marks a shift in the temporal nature of taphonomic studies, away from complex time-averaged assemblages accumulated over millennia, to shorter post-mortem timeframes spanning days to years, with the acknowledgment of humans as taphonomic agents and the emergence of the individual cadaver as the unit of analysis.[35] Much of the research is either derived from actual forensic casework, or applies neotaphonomy or actualistic taphonomy which concentrates on experimental work in the modern environment and applies its results to the past by analogy. This approach differs from 'classic' vertebrate taphonomy which is sometimes referred to as palaeotaphonomy[36]; this examines the context and content of depositional sites in great detail using temporo-spatial patterning, skeletal part representation and the pattern of skeletal damage as a means of interpreting formation processes. The neotaphonomic approach can be seen as primarily hypothetico-deductive in nature[19] and implicitly attempts to deal with issues of equifinality.[37] This is defined as reaching the same final state from different initial conditions and in different ways, without consideration of whether a system was open or closed. This is one of the great problems with taphonomic interpretation, in that whilst there is only one physical past, there may be multi-causative agents which produce that past, and as such can affect our reconstruction of an event or a taphonomic trace.[38-40]

To reiterate our interpretation based on physical evidence, the assemblage is unique by what it does not evidence – there is no evidence of peri-mortem breakage or trauma indicative of a fall or death trap as seen at sites such as Malapa[41], no carnivore modifications, no cut marks, no sub-aerial exposure or weathering indicative of death outside the cave, no evidence of water transportation of bodies or bones within the cave, and no evidence of burning or charring[3]. Despite an exhaustive search by a professional caving team and geologists, we failed to find any other plausible access points into the Dinaledi Chamber, and there is no evidence to suggest that an older, now sealed, entrance to the Chamber ever existed. Detailed surface mapping of the landscape overlying the cave system indicates that no large flowstone-filled fractures occur in the region above the Dinaledi Chamber. These findings, taken together with evidence that the Chamber in-fill was derived from in-situ weathering and from filtered exogenous clays and silts, indicates that there was not an easy or more accessible entrance from the surface into the Dinaledi Chamber at any time in the past (despite what some commentators choose to believe). No other animals found their way into the Dinaledi Chamber, indicating that it has always been a tortuous route. Hominins came into the Chamber as whole bodies, averaged over considerable time, and are not found distributed through the wider cave system as would be the case if they had wandered blindly into the labyrinth or been chased by predators. The accumulation of so many individuals in such an isolated specific locality, over a considerable period of time, suggests the route into the cave was intentional and deliberate. Following on from his comments on the taxonomy, Dan Lieberman suggests:

> *…It was a crazy deep cave, and getting in there wasn't easy. When they got in, there was nothing but the remains of this species. It's hard to imagine them getting there other than being intentionally deposited there. It smells to me like that's a form of burial, and it's a reasonable conjecture.*[10]

Again, Lieberman uses the word burial. This word is perhaps where part of the problem lies – with semantics – an entirely human problem, and one in which the meaning of 'burial' obviously causes confusion. Paul Pettitt[42] draws a very nice distinction with regard to mortuary behaviours in his excellent book *The Palaeolithic Origins of Human Burial*. He discusses the difference between non-human primate grief, suffering and loss as seen in the chimp communities of Gombe, Taï and Bossou, and Huntington and Metcalf's notion of the universality of human death. Huntington and Metcalf suggest that the diversity of cultural reactions to death and mortality is a measure of the universal impact of death – but that any reaction to it is not random; it is always meaningful and expressive. Pettitt draws the distinction that the chimpanzee reaction to death is certainly *expressive* (involving grooming, carrying, patting, vocalisations, etc.) but it is not *meaningful*. That then is the gulf between the mournful primate (expressive, even ritualistic at times) and the origins of complex mortuary behaviours (enriched with ritual *symbolism*, meaning and cognitive depth). Pettitt makes the point that mortuary practices form a wider set of transitions marked by ritual activity, but that how we contextualise them is important. Thus, there are a number of well-understood social concepts within our understanding of mortuary rituals, but these have differing physical expressions, functions and meanings. The most critical in the case of *H. naledi* is to differentiate among three most basic forms of mortuary practice: structured abandonment, funerary caching, and formal burial or inhumation. The former is the deliberate placement of a corpse at a certain point in the landscape, for simple functional reasons (protection from scavengers or predators). The second is structured deposition of a corpse, or parts of a corpse, in a chosen place, without modification of that environment, such as at the back of caves. Unlike structured abandonment, however, the place is given some 'meaning' beyond simple function. The third term is the creation of an artificial place for the purposes of containing a corpse, and involves at least three stages: excavation of an artificial pit or trench to serve as a grave, the interment of a body within the grave, and the covering of the body with the extracted sediment. Physically, and based on the contextual evidence, *H. naledi* may have practised funerary caching over multiple generations; we do not know where this behaviour fits on a scale from primate grief expression to symbolic meaning, but for palaeoanthropologists to dismiss the notion of a small-brained *naledi* showing a degree of social complexity in relation to mortality is arrogant and anthropocentric in the extreme.

None of the commentary and criticism in the media would lead me in any way to modify the working hypothesis of deliberate body disposal by *H. naledi.* Although research is ongoing on the assemblage and its context, no new data have come along to force us to reject our hypothesis. If at some point in the future such data do arise, then we will readdress the theory and, if appropriate, re-evaluate, rethink and raise new hypotheses which fit the data and present those to the scientific community through peer-reviewed publications. That process is how science works – it is provisional. But that provision is based on data and evidence…not belief. To reject a hypothesis because you simply do not like or do not believe the evidence presented to you is not science – it is pseudoscience at best and wilful ignorance at worst. It remains abundantly clear that many of the criticisms of the discovery and interpretation of *H. naledi* are not based on evidence; if they were, they would be published through the scientific peer-review process, and not through the popular media. They are either *ad hominem*, or perhaps caused by lack of appreciation or understanding of areas of science outside the comfort zone of the scientists concerned; I am not sure which I find the most depressing.

And with that, I leave you with closing remarks from Frans de Waal[17] – who views the discovery of *H. naledi* as an opportunity to re-contextualise our understanding of hominin behaviour back into the 'real' natural world, and for us not to view our own ancestral lineage as something unique and separate from our shared primate heritage. He closes his *New York Times* article with

> *…It is an odd coincidence that '*naledi*' is an anagram of 'denial'. We are trying way too hard to deny that we are modified apes. The discovery of these fossils is a major paleontological breakthrough. Why not seize this moment to overcome our anthropocentrism and recognize the fuzziness of the distinctions within our extended family? We are one rich collection of mosaics, not only genetically and anatomically, but also mentally.*

Well said.

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