

Homo naledi Probably Not Part of the Human Holobaramin Based on Baraminic Re-Analysis Including Postcranial Evidence

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Abstract

With postcranial data on morphological characteristics of *Homo naledi* available, a more precise baraminological analysis and classification is possible for this species. Opinions amongst creationists as well as evolutionists are divided as to whether *H. naledi* is a new species, basal to the group *Homo*, or whether it could be an already discovered member of the genus *Homo*, or even a species of ape, an australopithecine. With the inclusion of 37 postcranial morphological characters, this work attempts to reassess the baraminic classification of *H. naledi*. It is important that knowledge of morphology balances statistical consideration in order to provide a more holistic classification of species within a holobaramin. According to the results, no significant continuity exists between *H. naledi* and *Homo sapiens* and *Homo neanderthalensis*. However, a moderately positive correlation exists between *H. naledi* and *Australopithecus sediba*. Compared to previous baraminic analysis, *H. naledi* has shifted away from the *Homo* baramin more towards *A. sediba*, although final results still remain tentative. Furthermore, characteristics of the hand, upper limb, and feet show that these two species were similarly adapted to arboreal locomotion as well as a form of terrestrial bipedalism. Also, a partial variant of the BDIST software was devised to allow weighting of morphological characters.

Keywords: *Homo naledi*, *Australopithecus sediba*, *Homo sapiens*, *Homo neanderthalensis*, craniodental, postcranium, baraminology, holobaramin, monobaramin

Introduction

After the publication of the findings of *H. naledi* in 2015 (Stringer 2015), a few publications have been made as to its postcranial measurements. One paper has been published about the hand (Kivell et al. 2015) and another on the foot (Harcourt-Smith et al. 2015) of *H. naledi* in the journal *Nature*. Many evolutionists claim that *H. naledi* is an early form of the genus *Homo*, with transitional characteristics between australopithecines and early humans. Based on an earlier analysis of purely craniodental data (O'Micks 2016), it was deduced that *H. naledi*, even though a little distant from well-known humans, such as *H. sapiens* and *H. neanderthalensis*, was still within the human kind.

According to Wood's (2016) baraminological re-analysis and update of the *Homo* holobaramin based on 87 craniomandibular characteristics, *H. naledi* as well as other species from "early" *Homo*, such as *Homo habilis*, *Homo erectus*, and also *A. sediba* all fall into the *Homo* holobaramin. This is based on the view that modern humans should not be the basis for distinguishing humans from non-humans. Basically this means that since humankind encompassed much more variation in the past than what we see today, we should not reference everything with modern human, because this could create bias. In other words, should we compare only ancient variants of *Homo* to modern variants of the same holobaramin?

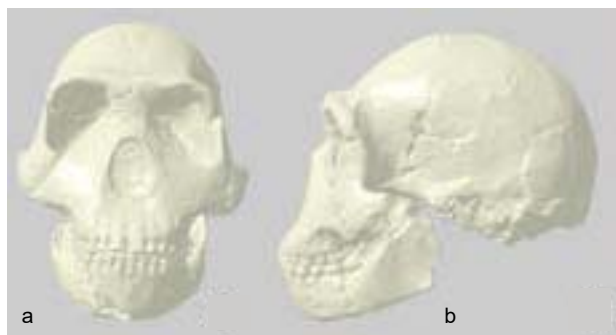
Peter Line (2015) explains that certain characteristics of *H. naledi* which are similar to australopithecines are within the range of variation of *H. erectus* and *H. neanderthalensis*. This is a view also espoused by Tim White, paleoanthropology professor at Berkeley, California. For example, the distally wide ribcage has been observed in some Neanderthal specimens (Hartley 2015). The high and lateral scapula on the thorax with little humeral torsion is also characteristic of *H. erectus* (Line 2015). The wrist and palms resemble those of modern humans, yet the curved fingers also resemble that of a *H. erectus* specimen, which might be due to vitamin D deficiency. These evidences might suggest that *H. naledi* might be human, if *H. erectus* is also truly human. However, we must ask ourselves how likely is it that if *H. naledi* truly is human, then why does it have so many australopithecine characteristics?

Other creationists oppose this view that *H. naledi* is human, but rather a species of ape. For example, according to David Menton (Mitchell 2015), the sloping face, the large mandibles, the small cranium, and the curved finger bones show that *H. naledi* is an ape and not human. David Menton lists five basic cranial morphological characteristics based on which humans can easily be distinguished from apes. These differences are (human vs. ape): large/small cranium, round/flat forehead, open/closed eye sockets when viewed from the side, vertical/sloped

face, presence/absence of protruding nasal bones (DeWitt, Habermehl, and Menton 2010). Indeed, what is interesting about one of the skull fragments of *H. naledi* found by the discoverers is that the mid-section of the face is missing, which has been reconstructed with plaster showing slightly jutting nasal bones, which is characteristic of modern humans, as opposed to a flat nose like what we see in apes. Since *H. naledi* has been thought by many evolutionary anthropologists to be the direct predecessor of humans, this could possibly be the reason they depicted *H. naledi* with supposed protruding nasal bones, which is characteristic of humans. However, since the nasal bones are missing, we cannot be sure what it really looked like. Indeed, if for example we examine the skull of *H. naledi* (figs. 1a and b) we can see that *H. naledi* shows australopithecine characteristics: sloped lower face, flat forehead, small cranial volume (estimated to be between 465cc and 560cc compared to 1100–1500cc for modern humans); furthermore, the orbits of the eyes are not plainly visible from the side.

Since this study takes postcranial characteristics of *H. naledi* into consideration, and since many of these postcranial characteristics resemble those of australopithecines (Wise 2016) (long curved fingers for climbing, flared pelvis, pyramidal ribcage, and small skull size, well outside the range of humans) I have chosen to reconsider the taxonomic categorization of *H. naledi*.

A total of 57 craniodental characteristics listed in Berger et al. (2010) formed the basis of my previous analysis. The majority of these are dental characteristics, which means that these types of characteristics were obviously over-represented, thereby possibly skewing the results. Therefore 30 measurements were analyzed which were taken from the hand of six species: 1) *H. naledi*, 2) *H. sapiens*, 3) *H. neanderthalensis*, 4) *Australopithecus afarensis*, 5) *A. africanus*, and 6) *A. sediba*, and six



Figs. 1a and b. 3D mesh image of the skull and mandible of *H. naledi*. Note that the middle section of the face is missing, and has been reconstructed, including the nasal bones. www.MorphoSource.org hosted by Duke University. (Credit: University of Witwatersrand and Dinaledi project.)

measurements taken from the foot of *H. naledi*, *H. sapiens*, and *A. afarensis* and *sediba*. I also added the five main cranial characteristics discussed by Dave Menton. Three other characteristics not analyzed in the previous study such as the australopithecine-like shoulder, the distally wide ribcage and the curled fingers have been analyzed here. In total this made 99 data points. An overview of these data points can be seen in Table 1.

Table 1. Overview of craniodental and postcranial characteristics of the six species studied in this analysis.

Major Anatomic Region/Subregion	Number of Characteristics
Craniodental	62
–cranium	18
–maxilla	21
–mandibles	23
Postcranial	37
–hands	29
–feet	6
–thorax	2
<i>Ribcage shape</i>	1
<i>Shoulder type</i>	1

The goal of this study in particular was to assess whether the taxonomical position of *H. naledi* would change based on new postcranial data added to the already known craniodental measurements. Although the same postcranial measurements are available for only a smaller number of species compared to the previous analysis (six versus 14), here the main question was whether *H. naledi* could possibly be reclassified based on more robust data or not.

While only six species were used on this analysis, this was due to the lack of postcranial data, which was not available for the other eight species (*P. aethiopicus*, *P. boisei*, *P. robustus*, *A. anamensis*, *H. erectus*, *H. habilis*, *H. rudolfensis*, and *H. heidelbergensis*) in the previous analysis of *H. naledi* (O'Micks 2016). Similarly, though postcranial exists for several outlier species (such as *G. gorilla*, *P. pygmaeus*, and *P. troglodytes*), these species didn't have any craniodental data in the Berger study. Therefore, the results presented in this study should be viewed as tentative, since after acquiring more data, gaps between different species might be filled in by adding new species.

Methods

The data matrix used in the previous study (O'Micks 2016) was augmented with data for the six species listed in the analysis (the original craniodental data originally came from Wood 1991). Twenty-eight measurements from Kivell et al. 2015 regarding hand measurements and six foot measurements

from Harcourt-Smith et al. 2015 were added to the matrix. The five cranial characteristics of Menton and the three other morphological characteristics were given a value of 1 or 2, meaning either present or not present, and/or if it resembled humans or australopithecines, or otherwise {1,2} if present in both forms in a given species. The data was transformed similarly to O'Micks 2016, except that a scaling factor of 1.999 was used instead of 3.999 in the equation used to transform the data points to integers between zero and two:

$$x'_{ij} = \text{int} \left(1.999 \cdot \frac{(x_{ij} - \min_{j=1..n} x_{i,j})}{(\max_{j=1..n} x_{i,j} - \min_{j=1..n} x_{i,j})} \right) + 1$$

This was done, since by using a lower scaling factor, closer distances, more significant correlations, and higher bootstrap values were obtained due to a lower variation in the integer values.

The data matrixes were then entered into the BDIST program at <http://www.coresci.org/bdist.html> (Robinson and Cavanaugh 1998; Wood 2005, 2008) to obtain baraminic distance correlations, correlation graphs, probabilities, and bootstrap values. A relevance cutoff of 0.95 was selected for both analyses. Eighty-three of the 99 characteristics were retained in the analysis. The data points were calculated in three-dimensional character space using multidimensional scaling (MDS), also available in the online program package by Wood (2008), and visualized using Kinemage software (available at <http://kinemage.biochem.duke.edu/software/mage.php>). Figs. 1a and b correspond to image M7300-8170 at the MorphoSpace website.

A partial version of the BDIST software was created by the author and was uploaded to GitHub at the following web address: https://github.com/jeanomicks/bdist_weighted. This version calculates baraminic distances based on weighting the individual characters in the data matrix used as input. An extra row at the bottom of the input matrix designates the weights for each character.

Results

Compared to the previous analysis (O'Micks 2016) of the taxonomic position of *H. naledi*, relationships between the six analyzed species changed quite a bit. Whereas previously *A. africanus* and *A. afarensis* are correlated with a value of 0.558, a baraminic distance of 0.531, and bootstrap value of 77%, these values now have significant values. The correlation value is now 0.93, the baraminic distance is 0.176, and the bootstrap value is now 91+%. In the previous study, *H. sapiens* and *H. neanderthalensis* had a correlation value of 0.535, a baraminic distance of 0.562, with a low bootstrap value of 57. These values are now more significant in that the correlation value is now 0.936,

the baraminic distance is 0.176, with a significant bootstrap value of 93+%. *A. sediba* and *H. naledi* only had a correlation value of 0.103, a baraminic distance of 0.667, and a bootstrap value of 98%. The correlation value is now 0.379, the baraminic distance is 0.353, with a bootstrap value of 98%. As a general trend we can see that the relationships between these three pairs of species all became more significant, albeit now the correlation between *A. sediba* and *H. naledi* is moderate.

In the present analysis, it is important to note how *H. naledi* relates to the other five species. Interestingly, it has a negative correlation of -0.359 and -0.526 with *A. afarensis* and *affricanus*, respectively. With *H. sapiens* and *H. neanderthalensis* the correlation values are 0.002 and 0.118, which are uninformative. The baraminic distances between *H. naledi* and the previous species is 0.569, 0.667, 0.51, and 0.49, with significant bootstrap values all of which are >90%.

Fig. 2 is a spatial depiction of the baraminic relationships between the six species based on the 3D MDS coordinates calculated by the BDIST program. Fig. 3 represents a stress graph, with a minimum stress value for two groups, with a minimum stress value of less than 0.055 at three dimensions. What can be seen is that the two *Homo* species cluster well together apart from *H. naledi* and *A. sediba* as well as *A. africanus* and *A. afarensis* forming somewhat loose clusters of species away from the two *Homo* species. Here the discontinuity between (*H. sapiens*+*H. neanderthalensis*) and (*Australopithecines*+*H.*

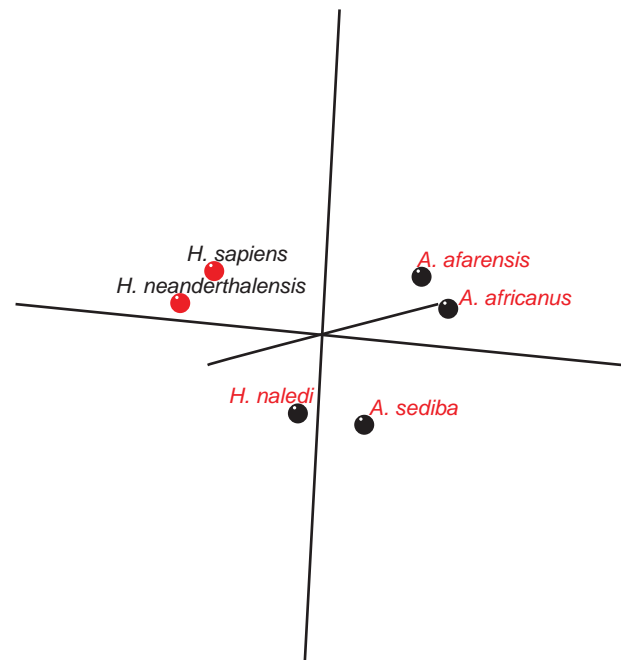


Fig. 2. Baraminic relationships according to 3D MDS coordinates. The coloring of the dots represents the different groups determined by the BDC results. Red: *H. sapiens*, *H. neanderthalensis*. Black: *A. africanus*, *A. afarensis*, *A. sediba*, *H. naledi*.

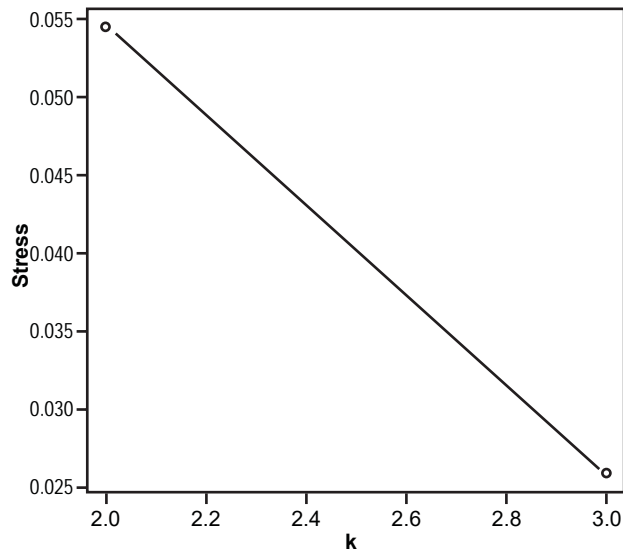


Fig. 3. Stress graph showing stress values at different dimensions. The minimum stress value is at three dimensions.

naledi) can be seen quite well.

A version of the BDIST program (Wood and Murray, 2003) was devised which assigns a weight between 0 and 1 to each character. Both the unweighted and the weighted distances and correlation values can be seen in Supplementary Excel File #1. As we can see, the distance between *H. naledi* and *A. sediba* dropped from 0.353 to 0.344, whereas the distance increased from 0.49 to 0.531 and from 0.507 to 0.542 between *H. naledi* and *H. neanderthalensis* and *H. sapiens*, respectively, if we assign weights of $42/57 \approx 0.74$ for each of the craniodental characteristics. This value was chosen so that both the 57 craniodental and the 42 postcranial characters would be represented with exactly equal total weight, in order to represent both craniodental and postcranial features equally.

It is also interesting to note that after taking postcranial characteristics into consideration, the baraminic distance between *H. naledi* and *A. sediba* dropped from the previous analysis from 0.667 to roughly half the value, 0.353 in the present study

and dropped even further to 0.344 when using the weighted version of the BDIST program. The baraminic distances between *H. naledi* and *H. neanderthalensis* and *H. sapiens* also dropped slightly, but increased again when the weighted version of BDIST was used. These results are summarized in Tables 2 and 3. What is also remarkable is that the baraminic distances also dropped between *H. naledi* and *A. afarensis* and *A. africanus*, and dropped even further when weighting was applied. This suggests that when taking further data into consideration, with proper weighting, *H. naledi* appears to be more australopithecine in nature.

The baraminic correlation increased between *H. naledi* and *A. sediba* when postcranial data was added to the character matrix, from 0.103 to 0.379, and even further when a weight of 0.74 was applied to the craniodental characteristics to 0.433. Correlation values also changed between *H. naledi* and *A. africanus*, from -0.649 to -0.359 (postcranial) to -0.126 (postcranial+weight=0.74). For *H. sapiens*, the trend was to change from 0.46 to 0.002 (postcranial) to 0.173 (postcranial+weight=0.74).

Discussion

By adding 36 new characteristics describing the hand and feet of six species as well as three other characteristics (table 1), as well as reducing the number of possible character states from five to three, a more robust analysis of *H. naledi* compared to the genus *Homo* and *Australopithecus* was made possible. This facilitated a more precise baraminic categorization of *H. naledi*, with generally higher correlation values and higher bootstrap values.

What we can see is that, as in the previous analysis of O'Micks (2016), *H. sapiens* and *H. neanderthalensis* belong to the same monobaramin, and *A. africanus* and *A. afarensis* belong in a separate monobaramin. However, the position of *A. sediba* and *H. naledi* have changed. *A. sediba* shows a moderately negative correlation to the members of the *Homo* monobaramin

Table 2. Changes in baraminic distances between *H. naledi* and the other five taxa analyzed in this study.

	<i>A. afarensis</i>	<i>A. africanus</i>	<i>A. sediba</i>	<i>H. neanderthalensis</i>	<i>H. sapiens</i>
Craniodental	0.969	0.938	0.667	0.531	0.594
Craniodental + Postcranial	0.667	0.569	0.353	0.471	0.510
Weighted Craniodental + Postcranial	0.625	0.509	0.344	0.507	0.542
Postcranial only (craniodental weight=0)	0.364	0.136	0.318	0.773	0.727

Table 3. Changes in correlation between *H. naledi* and the other five taxa analyzed in this study.

	<i>A. afarensis</i>	<i>A. africanus</i>	<i>A. sediba</i>	<i>H. neanderthalensis</i>	<i>H. sapiens</i>
Craniodental	-0.689	-0.649	0.103	0.634	0.460
Craniodental + postcranial	-0.526	-0.359	0.379	0.118	0.002
Weighted craniodental + postcranial	-0.338	-0.126	0.433	0.048	-0.173
Postcranial only (craniodental weight=0)	0.692	0.960	0.790	-0.858	-0.837

(−0.68 with *H. neanderthalensis*, and 0.739 with *H. sapiens*), while it shows a weak positive correlation with the two members of the *Australopithecus* monobaramin (0.288 with *A. afarensis*, and 0.366 with *A. africanus*). In contrast, *H. naledi* shows a moderate negative correlation to the members of the *Australopithecus* monobaramin (−0.526 with *A. afarensis*, and −0.359 with *A. africanus*), but shows neither continuity nor discontinuity with the members of the *Homo* monobaramin (correlation values of 0.118 with *H. neanderthalensis*, and 0.002 with *H. sapiens*). At the same time these two species show a moderate correlation with each other (0.379). This can be seen in the baraminic correlation matrix depicted in Fig. 4.

One of the main results of this analysis is that there is now a moderate correlation between *A. sediba* and *H. naledi* compared to previous results. A study by Dembo et al. (2016) assigning a date to the fossils also showed similar results. Interestingly, some of the results of Wood’s (2016) re-analysis of the human holobaramin also support this finding. In his analysis, there is a significant continuity between *H. naledi*, *A. sediba*, as well as *H. habilis* and *H. erectus*, which form a monobaramin within his proposed human holobaramin. In this paper he mentioned several cranial characteristics that *A. sediba* and *H. naledi* share with *Australopithecus*, but not with *Homo*, such as small cranial capacity (420–440 cc for

A. sediba; Berger et al. 2010; Carlson et al. 2011), marked development of the canine jugum, and a maxilla-alveolar index which is longer than it is wide, a lateral entoglenoid process, and an intermediate petrous orientation. Postcranially, *H. naledi* and *A. sediba* also share a number of characteristics, which will be discussed in the following sections.

The upper limbs and hand

The hand of *H. naledi* and *A. sediba* has long, curved fingers. The hand of *H. naledi* has some characteristics which are similar to the wrist and palm of modern humans and Neanderthals (Kivell et al. 2015). The mosaic nature of the hand of *H. naledi* has led some evolutionists to suggest that the curved fingers are retentions from an arboreal ancestor now being lost, but this is contradicted by the fact that its fingers are even more curved than some australopithecines. Furthermore, the upper limb and thorax of *H. naledi* also suggest that it was suited for arboreal locomotion. Kivell et al. (2015) also argue that the derived thumb and wrist features made *H. naledi* suitable for precision tool making and use; however, no tools were found in the Dinaledi chamber where *H. naledi* was found. Alternatively, *A. sediba* also shows anatomic upper limb features which, similarly to *H. naledi*, suggest arboreal locomotion. These include relatively high shoulders, pronounced clavicular conoid tubercles, high brachial index, moderately keeled ulnar trochlea, and the moderately curved manual phalanges (Churchill et al. 2013). Some characteristics possibly show signs of tool use, such as a human-like palmar pad with a mobile proximal pulp, and a derived abductor digiti minimi (ADM) (Kivell et al. 2011).

The thorax

The ribcage of *H. naledi* is distally wide, which is a very common characteristic of australopithecines. The thorax of *A. sediba* also follows this basic pattern, although besides the narrow upper thorax, its pelvis and lower thorax is also narrow (Schmid et al. 2013; Williams et al. 2013). This transformation of the funnel-shaped thorax of australopithecines towards the barrel-shaped thorax of humans is viewed by evolutionists as a transition between arboreal climbing/suspension and terrestrial bipedalism. However, the supposed stem species of all hominins, *Ardipithecus ramidus*, has also been argued to have a derived, barrel-shaped thorax like humans (Lovejoy et al. 2009), meaning that there is no clear evolutionary trajectory here.

The feet

The foot of both *H. naledi* and *A. sediba* show modern human-like characteristics. For *H. naledi*

	<i>Australopithecus afarensis</i>	<i>Australopithecus africanus</i>	<i>Australopithecus sediba</i>	<i>Homo naledi</i>	<i>Homo neanderthalensis</i>	<i>Homo sapiens</i>
<i>Australopithecus afarensis</i>						
<i>Australopithecus africanus</i>						
<i>Australopithecus sediba</i>						
<i>Homo naledi</i>						
<i>Homo neanderthalensis</i>						
<i>Homo sapiens</i>						

Fig. 4. Baraminic distance correlation matrix for three *Australopithecus* species and three *Homo* species. Dark gray boxes show that two species are significantly positively correlated (interpreted as evidence of continuity, that they belong to the same baramin). Light gray boxes show that two species are significantly negatively correlated (interpreted as evidence of discontinuity, that they belong to different baramins, or of distant positions within an array of taxa connected by continuity and hence cobaraminic).

these include an adducted hallux, an elongated tarsus, a derived ankle, and calcaneocuboid joints. However, the proximal pedal phalanges are curved, which is more characteristic of australopithecines (Harcourt-Smith et al. 2015). In *A. sediba*, terrestrial bipedality is achieved by hyperpronation, based on its arched foot, long plantar ligaments, enlarged talar head (DeSilva et al. 2013; Zipfel et al. 2011). Furthermore, we should also add that human-like feet also occur in embryonic form in chimpanzee and gorilla. According to Coon (1954), “The embryo of a chimpanzee at one stage has a foot resembling that of man in that its great toe points forward for walking rather than backward for grasping. Only as it approaches its birth does its foot acquire the appearance of a hand. At no stage of its development does the human foot resemble that on an adult ape.”

The age of the fossils

The *H. naledi* fossils were found very near to the surface of the ground suggesting that the fossils are quite young—*H. naledi* could definitely not be the predecessor of modern humans if it is seemingly so recent. *H. naledi* has not yet been assigned a date for about three years now. According to a recent estimate involving Bayesian inferences based on phylogenetic trees, the supposed evolutionary age of *H. naledi* has been estimated to be 912ka (Dembo et al. 2016). In comparison, *H. erectus* fossils have been dated at 1.5Ma (Zaim et al. 2011), yet *H. naledi* is thought to be basal to the genus *Homo*, thereby preceding *H. erectus*.

Analysis using weights for specified characters

Besides statistical analysis it is apparent that knowledge of important and less important morphological characters also carries weight in order to give a more holistic description of a given species. I suggest that further baraminological distance algorithms could assign weights to different characters in relation to their importance if warranted. That is why a weighted version of the BDIST software was devised as a part of this study. For example, a human baramin analysis would be skewed if for example, more than one half of all characters described only dental features. As we see in the Berger et al. (2010) study, characters such as “maxilloalveolar length” and “maxilloalveolar breadth” might not bring so much new information to the character matrix, or for example “symphysis area” could already be determined partially by “symphysis height” and “symphysis width” so as to be redundant.

Therefore, in order to get a picture of how baraminic distances and correlations can change according to weighting certain characters, the weighted version of the BDIST program (bdist_weighted.pl) was run

on the character matrix with weights ranging from 0.1 to 1.0 in intervals of 0.1 for the 57 craniodental characters. The program accepts the relevance cutoff as a parameter, therefore each of the weight values were combined with relevance cutoff values of 0.75, 0.8, 0.85, 0.9, and 0.95 for five species, *A. africanus*, *A. afarensis*, *A. sediba*, *H. neanderthalensis*, and *H. sapiens*. The 50 distance and correlation values were displayed for each of the five species (Figs. 5a–e; Figs. 6a–e). The distance and correlation values are available in Supplementary Excel File #2.

What we can see as a general trend is that as the weights for the craniodental characters decreased, so the baraminic distance between *H. naledi* and the three australopithecine species decreased. At a relevance cutoff of 0.95 and a weight of 0.1, this distance decreased to 0.25, 0.426, and 0.325 between *H. naledi* and *A. africanus*, *A. afarensis*, and *A. sediba*, respectively. In contrast, the baraminic distance increased between *H. naledi* and *H. neanderthalensis* and *H. sapiens* to 0.715 and 0.683 at these identical parameter values.

As for the correlation values we see that at a relevance cutoff of 0.95 and a weight of 0.1, the correlation between *H. naledi* and *A. africanus*, *A. afarensis*, and *A. sediba* was 0.858, 0.563, and 0.737, respectively, which are all moderate or even strong correlations. In contrast, the baraminic correlation dropped between *H. naledi* and *H. neanderthalensis* and *H. sapiens* to -0.78 and -0.781 at these identical parameter values.

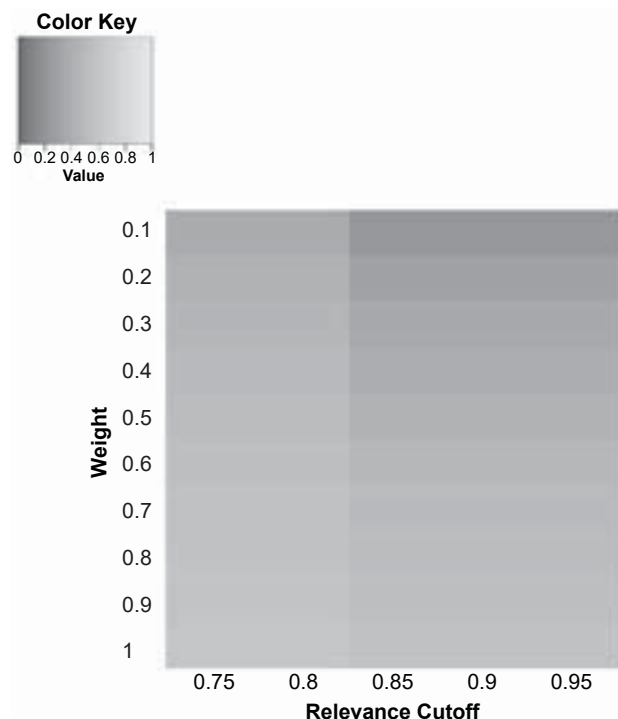


Fig. 5a. Baraminic distance between *H. naledi* and *A. africanus* according to relevance cutoff and weighting of craniodental features.

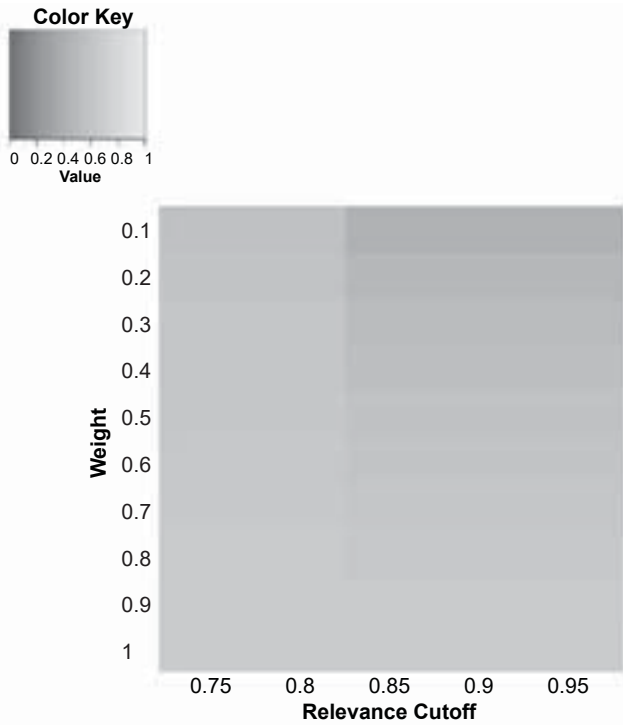


Fig. 5b. Baraminic distance between *H. naledi* and *A. afarensis* according to relevance cutoff and weighting of craniodental features.

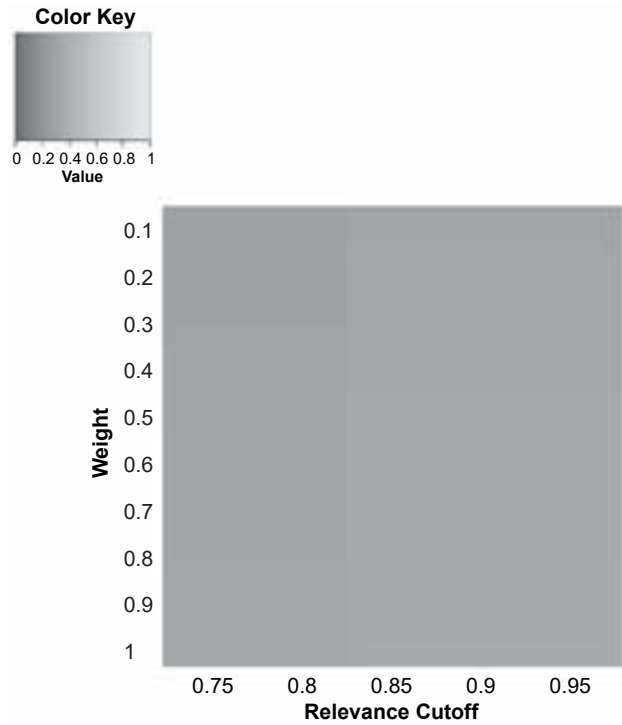


Fig. 5c. Baraminic distance between *H. naledi* and *A. sediba* according to relevance cutoff and weighting of craniodental features.

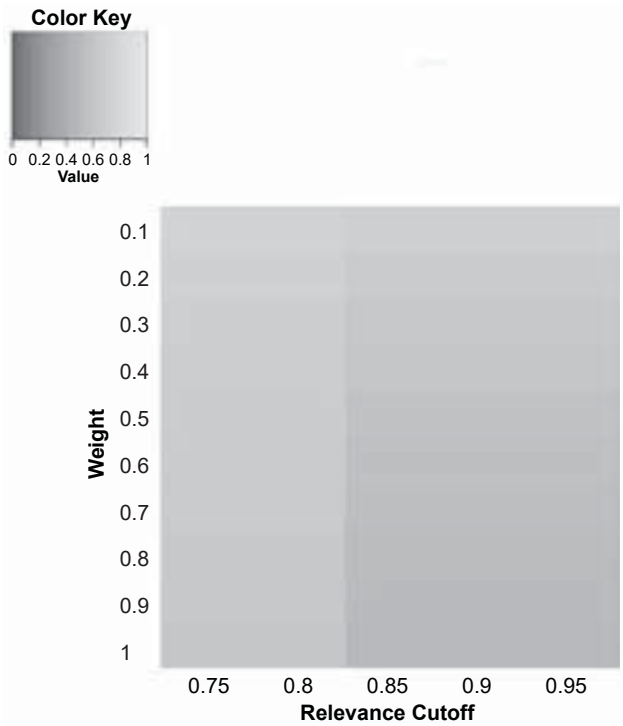


Fig. 5d. Baraminic distance between *H. naledi* and *H. neanderthalensis* according to relevance cutoff and weighting of craniodental features.

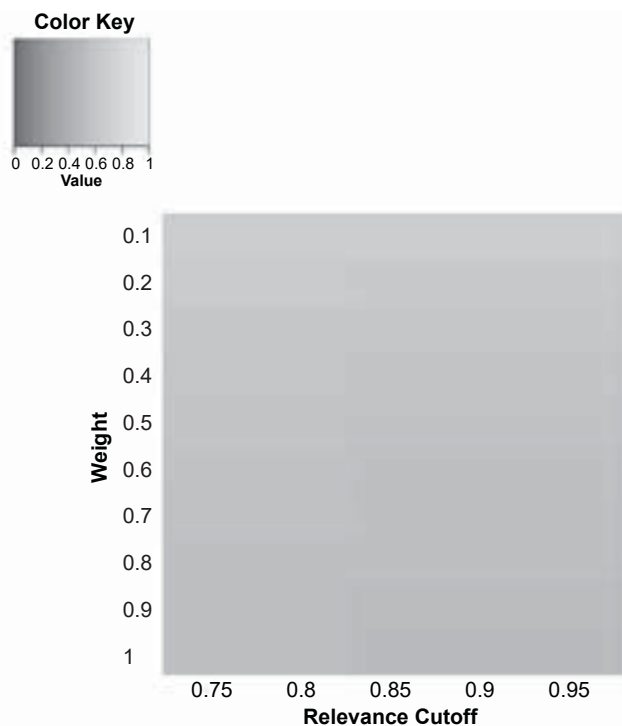


Fig. 5e. Baraminic distance between *H. naledi* and *H. sapiens* according to relevance cutoff and weighting of craniodental features.

Lowering the weight value for craniodental characters to 0.1 might seem drastic, yet as mentioned above, craniodental characters might indeed be overrepresented compared to postcranial characters (62 versus 37), and also redundant. A

smaller character weight for craniodental characters could be warranted, however, since the skull makes up a smaller region of the body as a whole. Postcranial characters were also measured mainly for the hand and the foot (35 of 37 characters), which means that

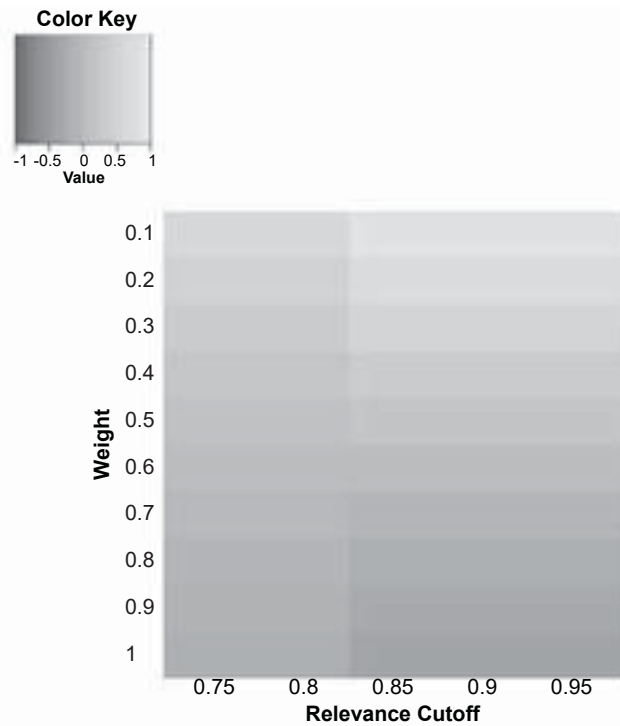


Fig. 6a. Baraminic correlation between *H. naledi* and *A. africanus* according to relevance cutoff and weighting of craniodental features.

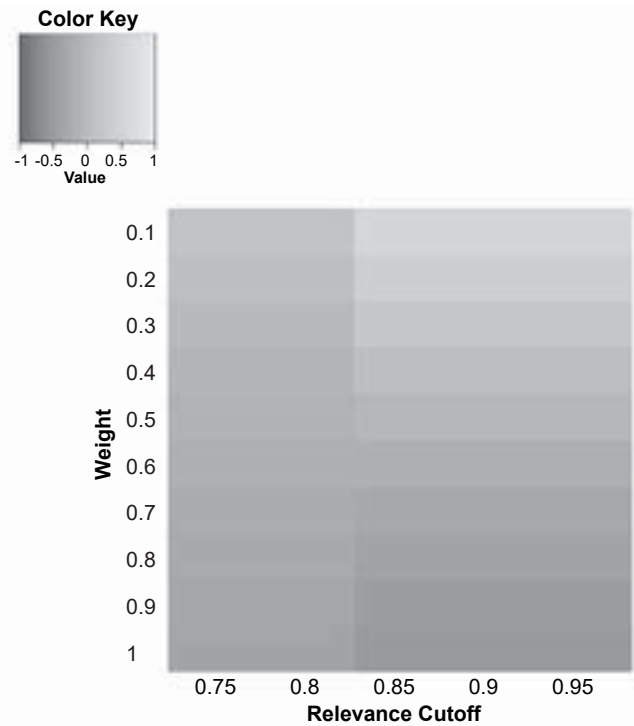


Fig. 6b. Baraminic correlation between *H. naledi* and *A. afarensis* according to relevance cutoff and weighting of craniodental features.

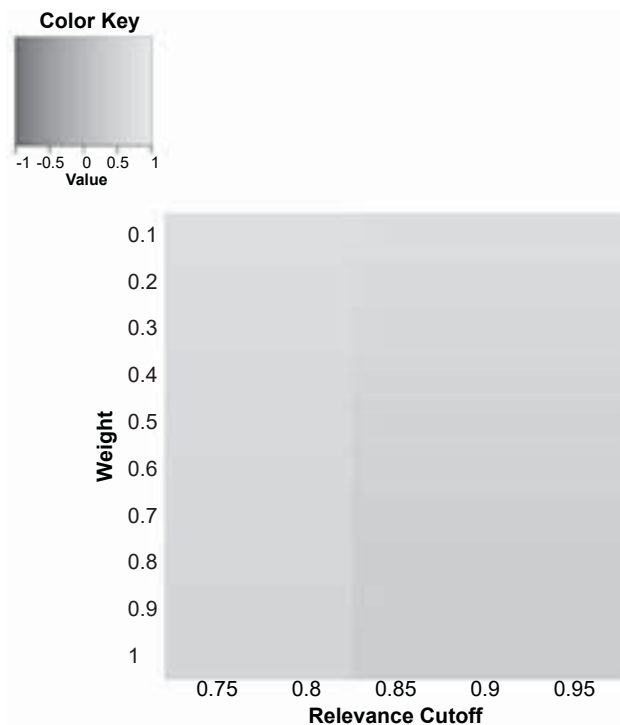


Fig. 6c. Baraminic correlation between *H. naledi* and *A. sediba* according to relevance cutoff and weighting of craniodental features.

though present, postcranial measurements were still underrepresented. However, by lowering the weight value we were still able to show a lower distance between *H. naledi* and the three *Australopithecus* species, and a higher distance between it and the genus *Homo*. Furthermore, this way there was a

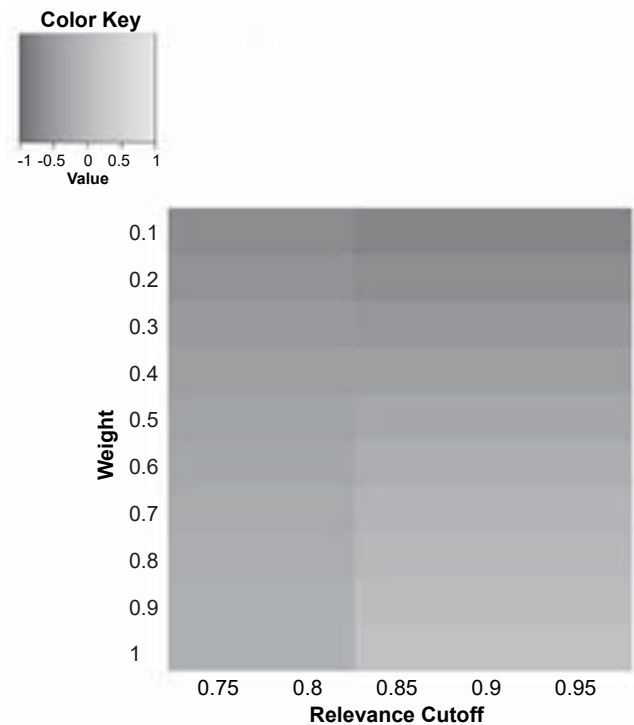


Fig. 6d. Baraminic correlation between *H. naledi* and *H. neanderthalensis* according to relevance cutoff and weighting of craniodental features.

moderate to strong positive correlation between *H. naledi* and the three *Australopithecus* species, and a moderately negative correlation between it and the genus *Homo*, showing that *H. naledi* segregates away from *Homo* towards the *Australopithecus* holobaramin.

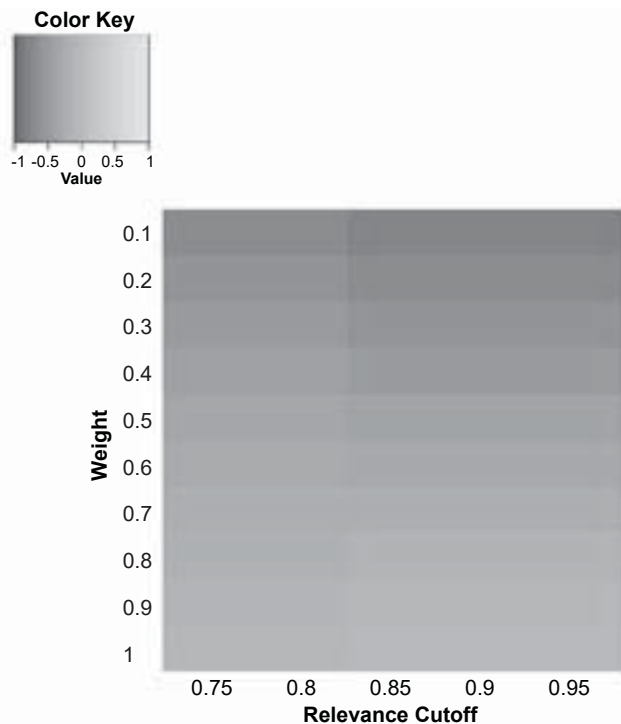


Fig. 6e. Baraminic correlation between *H. naledi* and *H. sapiens* according to relevance cutoff and weighting of craniodental features.

Conclusion

Based on this baraminological analysis, by adding postcranial data to the earlier character matrix, we can see that *H. naledi* groups away from the *Homo* genus, and more towards *A. sediba*. Whatever robust continuities it had with *Homo* in the previous analysis are now gone, yet its connections to the *Australopithecus* baramin have not yet been well established.

It is also interesting that both *H. naledi* and *A. sediba* were discovered in South Africa by Lee Berger, seven years apart. Similarities between these two species in the structure of the upper limb, thorax, and feet suggest that they might be similar, if not the same species of australopithecine. The australopithecine nature of *H. naledi* is also suggested by its mixed modes of locomotion, “derived” for terrestrial bipedality as well as elongated phalanges in the hand suited for arboreal locomotion (Harcourt-Smith 2016).

These evidences suggest that *H. naledi* might indeed not be part of the *Homo* holobaramin, but could rather be a member of the *Australopithecus* baramin, possibly a relative of *A. sediba*.

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Supplementary Files

- Supplementary Table 1. Combined data set from Tables 1 and 2 from Berger et al. (2015), Kivell et al. (2015) and Harcourt-Smith et al. (2015), 0.95 cutoff.
- Supplementary Table 2. Correlation matrix *A. africanus*, *A. afarensis*, *A. sediba*, *H. neanderthalensis*, *H. sapiens*.