Supplementary information

A juvenile early hominin skeleton from Dikika, Ethiopia

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S1. Dental dimensions and sex of DIK-1-1

S2. Facial profile

S3. Brain EV estimates

S4. Brain EV growth (absolute, relative)

S5. Hyoid

S6. Scapula

S7. Semicircular canal size (absolute, relative)

References

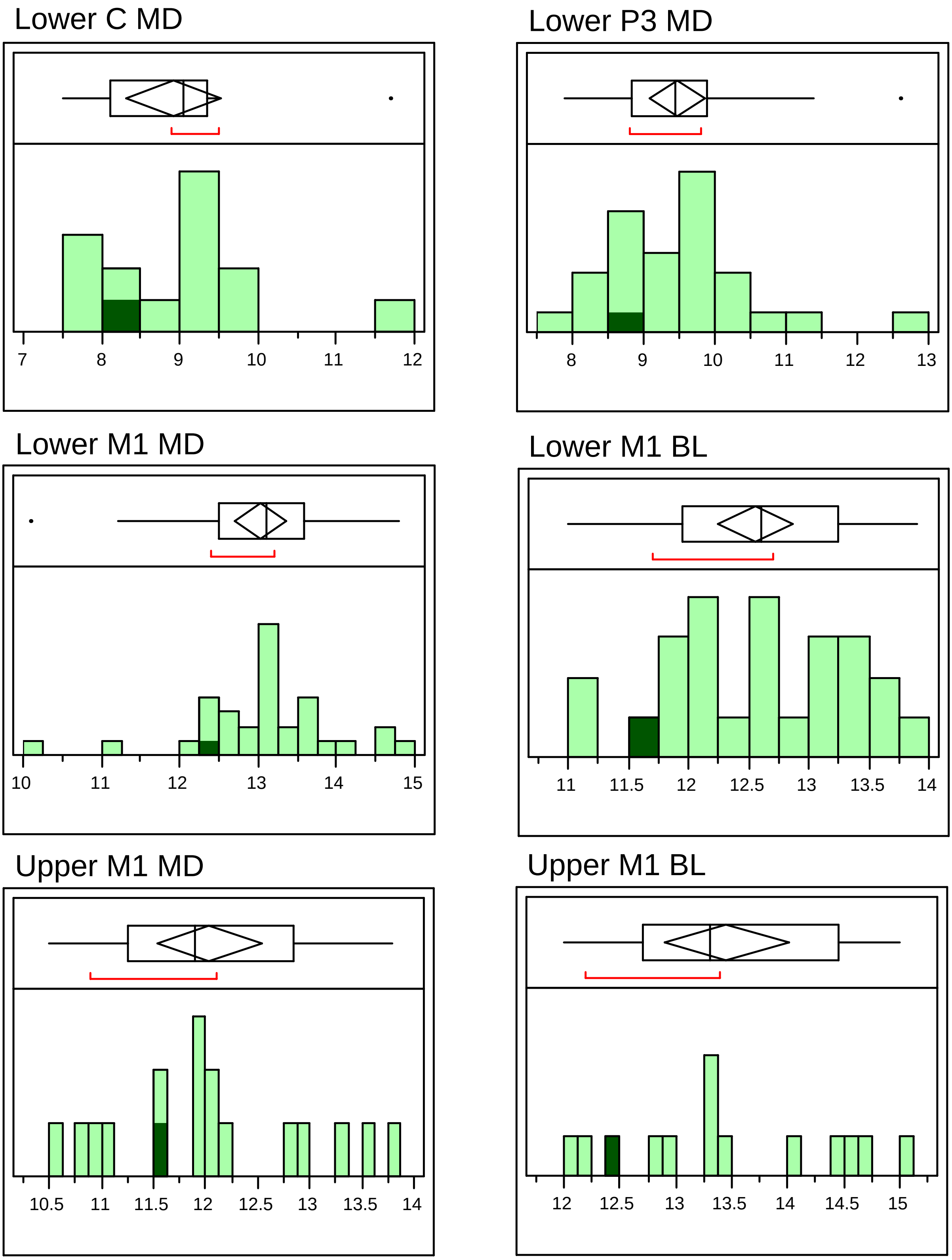
Bivariate analyses used

- Rank correlation (PAST v1.40; http://folk.uio.no/ohammer/past/)
- Test for allometry, i.e. whether the slope of the double log regression is significantly different from 1 (PAST v1.40; http://folk.uio.no/ohammer/past/).
- RMA regression for each species, logged values in case of allometric relationship (calculated in Ms Excel 2003).
- RMA regression of comparative species to predict values for DIK-1-1, and when its actual values are known it is assessed whether they fall within the 95% confidence intervals of the predicted values (calculated in Ms Excel 2003).
- If two variables are not correlated comparisons are made by t-test (calculated in Ms Excel 2003).

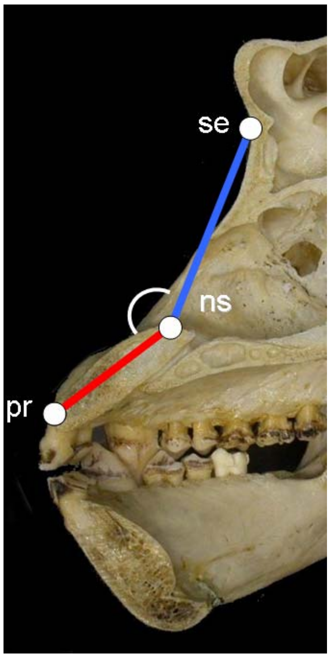
Statistical significance indicated as: ns: not significant, x: $P<0.05$, xx: $P<0.01$, xxx: $P<0.001$.

S1. DENTAL DIMENSIONS AND SEX OF DIK-1-1

Dimensions of fully formed permanent teeth of DIK-1-1 (dark green) compared with *Australopithecus afarensis* from Hadar, Laetoli and Maka[1]. The box-and-whisker plot shows the median, the upper and lower quartiles (box), the range, the mean and two standard deviations (diamond), and the location of the most dense half of the distribution (red bracket). DIK-1-1 is most likely female given that its dental size is consistently in the lower half of the distribution, and close to confirmed female individuals such as A.L. 417-1[1]



S2. FACIAL PROFILE ANGLE (se – ns – pr)

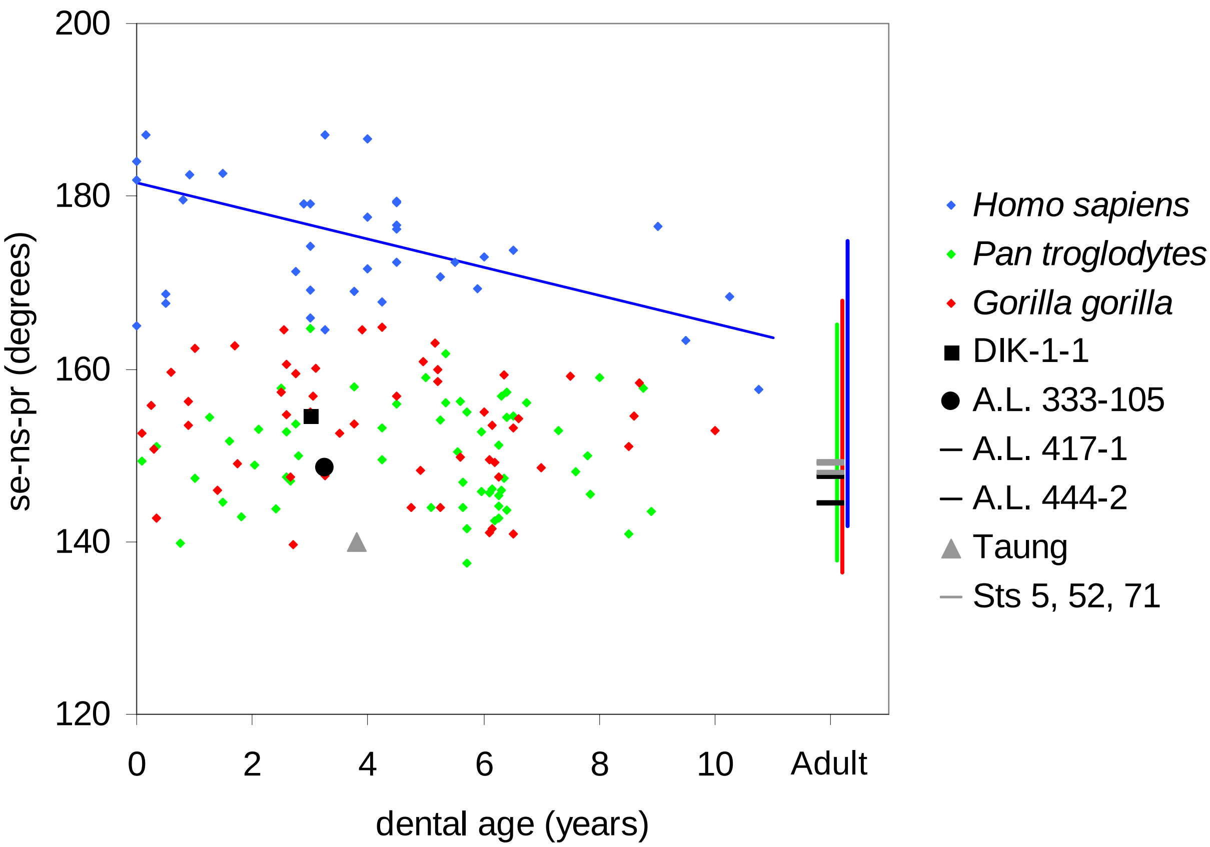


Comparative sample

Homo sapiens: 43 juveniles (neonate – 17 years; Bosma collection[2], UCL Anatomy, United Kingdom), 48 adults[3].
Pan troglodytes: 67 juveniles (neonate – subadult[4], 65 adults[3]).
Gorilla gorilla: 56 juveniles (neonate – subadult[4], 56 adults[3]).

Method

The angle in the midsagittal plane of sellion (se) to nasospinale (ns) to prosthion (pr) was measured from radiographs, lateral digital photographs[3], or 3D CT data sets.



Conclusion: with age the angle quantifying the craniofacial profile does not change in *Pan* and *Gorilla*, but reduces in *Homo* (r_{rank} -0.512xxx; RMA slope -1.643; intercept -0.965). The angle in DIK-1-1 and other juvenile and adult *Australopithecus* specimens fall within the range of intraspecific variation of both *Pan* and *Gorilla*, and establishing whether a specific ontogenetic trend is present is not possible with the limited number of fossil specimens.

S3. ESTIMATING ENDOCRANIAL VOLUME (EV)

Method

For an ontogenetic cross-sectional series of *Pan troglodytes* and *Gorilla gorilla* crania the RMA regression was calculated between the EV and the product of the maximum endocranial breadth and the midsagittal endocranial arc from foramen caecum to opisthion. The EV was measured by seed method (source: Ashton archive, HYMS, United Kingdom; R. McCarthy, pers. comm.), the breadth was measured from basal radiographs, and the arc from lateral radiographs[4]. The crania are housed in the Natural History Museum, London, and the Powell Cotton Museum, Birchington (United Kingdom). The RMA regression equations of both species were used to estimate the EV of DIK-1-1. Neither its endocranial breadth (85 mm), nor its mid-sagittal arc length (196 mm) are thought to be affected by the deformation of its occipital region.

log[Endocranial breadth . arc] (x in mm^2) against log[EV] (y in cm^3)

	Pan troglodytes		*Gorilla gorilla*		Combined
Sample size	54		27		
Age range	0 – 17 years		1 – 17 years		
r_{rank}	0.723	xxx	0.932	xxx	
RMA slope, +/- 95%	1.229	0.222	1.335	0.224	
RMA intercept	-2.677		-3.111		
	log	raw	log	raw	raw
DIK-1-1, x observed	4.22	16660	4.22	16660	
DIK-1-1, y predicted	2.51	326	2.53	335	330
SE of y predicted	0.04		0.02		
-95%	2.44	275	2.48	300	275
+95%	2.59	386	2.57	375	386
Taung x	4.29	19522	4.29	19522	
y predicted	2.60	396	2.62	414	405
SE of y predicted	0.04		0.02		
-95%	2.52	334	2.57	374	334
+95%	2.67	469	2.66	458	469
y observed		405		405	405

The combined estimated EV of DIK-1-1 is 330 cm^3, with a 95% confidence interval of 275-386 cm^3. Volume measurements of the preserved endocast from a CT data set (voxel size 0.29x0.29x0.50mm) give a minimum of 235 ml. The relatively minor occipital deformation represents well under 100 cm^3 in volume reduction, and the original EV of DIK-1-1 is therefore assumed to have been in the lower half of the estimated range, or 275-330 cm^3.

The regression equations were tested for Taung, and the combined predicted EV is identical to the reconstructed EV of 405 cm^3 (ref. 5).

S4. ENDOCRANIAL VOLUME (EV)

Comparative sample

Homo sapiens: 145 juveniles (0 – 13 years); Bosma collection[2] (J. Richtmeier, K. Mowbray et al., pers. comm.), Faculty of Medicine, Strasbourg[6], and Musée de l'Homme, Paris[7]

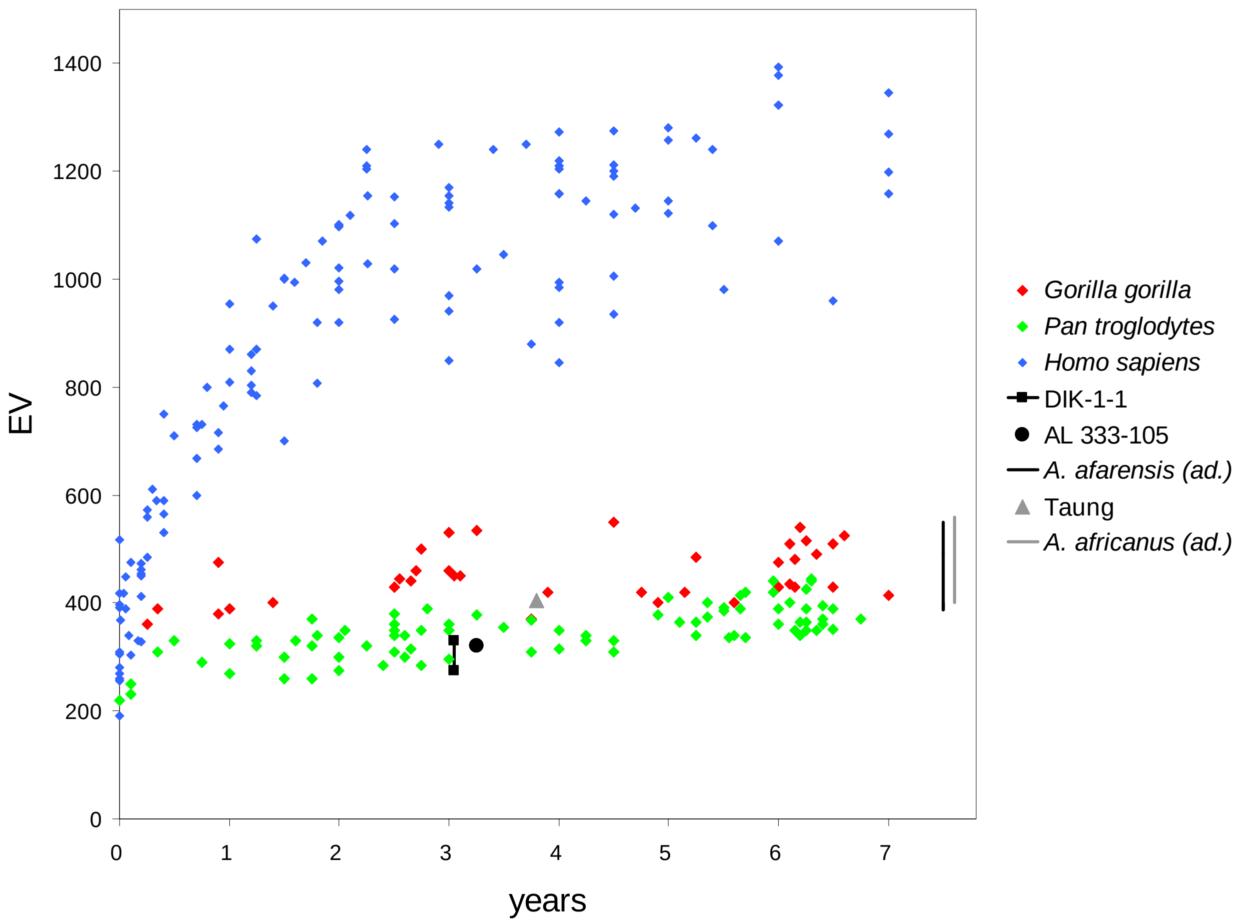
Pan troglodytes: 108 juveniles (0 – 10 years), Natural History Museum, London[4], Powell Cotton Museum, Birchington[4], Peabody Museum, Harvard (D. Lieberman, pers. comm.), Dept. of Anatomy, UCL (this study; ref 8).

Gorilla gorilla: 40 juveniles (0 – 9 years) Natural History Museum, London[4]; Powell Cotton Museum, Birchington[4], United Kingdom.

Australopithecus afarensis: A.L. 162-28, A.L. 288-1, A.L. 333-45, A.L. 333-105, A.L. 444-2 (ref. 9).

Australopithecus africanus: Taung[5, 10]; Sts 5, 19, 60, 71; Stw 505; MLD37/38 (ref. 9).

S4a) Absolute EV (cm^3) against age

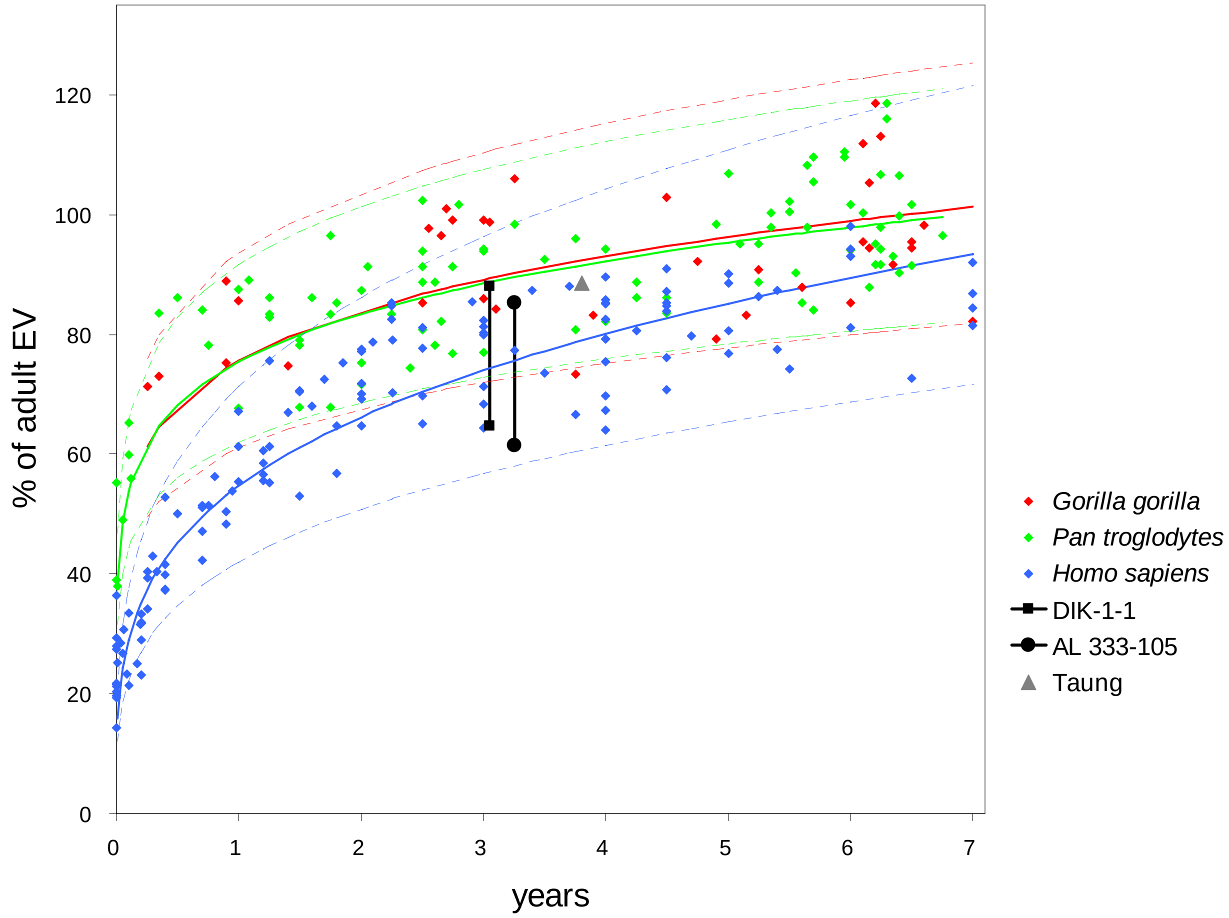


Conclusion: DIK-1-1 and A.L. 333-105 fall in the lower half of the equivalent juvenile *P. troglodytes* EV range, whereas adult *A. afarensis* EV values (range 375 – 550 cm^3) are somewhat higher than adult *P. troglodytes* (range 282 – 500 cm^3, ref. 11).

S4b) Proportional EV (% of mean adult EV) against age

	dental age (y)	EV (cm^3)	mean adult EV (cm^3)	% completed
DIK-1-1	3.0	275-330	375-425 (female)	65-88
A.L. 333-105	3.2	320	375 (female) - 521 (male)	61-85
Taung	3.8	405	457 (both)	89

Separate male and female mean adult EVs of African apes[11] were used when sex of juvenile is known. Mean adult EVs of modern humans are from the closest available population (Strasbourg[12], Paris[13]) or a worldwide estimate (Bosma[14]).



NB: RMA (solid lines) and 95% confidence intervals (dashed lines) are given for the extant species.

Conclusion: After about 1.5 years of age the proportional EV of humans and African apes greatly overlap. The estimated range for DIK-1-1 and A.L. 333-105 overlaps with both, but fall below the average trend for African apes, and more centred over the average human trend.

S5. HYOID

Comparative sample

Homo sapiens: 3 juveniles, 1, 2 and 4 years old, 63 adults (Spitalfields, Abingdon, Natural History Museum, United Kingdom

Pan troglodytes: 22 juveniles (neonatal - subadult), 44 adults (Powell Cotton Museum, United Kingdom). After ref. 15 and Clegg (pers. Comm.).

Gorilla gorilla: 19 juveniles (neonatal - subadult), 25 adults (Powell Cotton Museum, United Kingdom). After ref. 15 and Clegg (pers. Comm.).

Hyoid body measurements[16, 17]

Breadth (maximum transverse diameter, MTD)
Height (maximum medial height, MMH)
Depth (depth of posterior surface, DPS)

Results

S5a. Hyoid body breadth (x) - height (y), in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	44		51		66	
r_{rank}	0.642	xxx	0.540	xxx	0.529	xxx
Allometry / Isometry	I		A		A	
RMA slope, +/- 95%	0.619	0.141	0.744	0.153	0.738	0.142
RMA intercept	-1.837		0.039		0.018	
	raw		log	raw	log	raw
DIK-1-1, x observed	11.7		1.1	11.7	1.1	11.7
DIK-1-1, y predicted	5.4		0.8	6.8	0.8	6.4
SE of y predicted	2.26		0.07		0.05	
-95%	0.8		0.7	4.9	0.7	5.1
+95%	9.9		1.0	9.4	0.9	7.9
DIK-1-1, y observed	7.7			7.7		7.7
In predicted range?	Y			Y		Y

Conclusion: hyoid body breadth and height are correlated in all three species; DIK-1-1 not significantly different from all three.

S5b. Hyoid body breadth (x) - posterior depth (y), in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	44		51		66	
r_{rank}	0.646	xxx	-0.118	ns	0.183	X
Allometry / Isometry	I		na		A	
RMA slope, +/- 95%	0.490	0.119			1.996	0.480
RMA intercept	-0.877				-2.429	
	raw				log	Raw
DIK-1-1, x observed	11.7				1.1	11.7
DIK-1-1, y predicted	4.8				-0.3	0.5
SE of y predicted	1.91				0.16	
-95%	1.0				-0.6	0.2
+95%	8.7				0.0	1.0
DIK-1-1, y observed	4.7					4.7
In predicted range?	Y					N
t-test			DPS/MTD x100			
N			51			
Mean			37			
SD			15.6			
Dik-1-1			40			
Ts			0.185	ns		

Conclusion: hyoid body breadth and depth are correlated in *Gorilla* and *Homo*; DIK-1-1 is not significantly different from *Gorilla* and *Pan*, but has a deeper body than *Homo*.

S5c. Hyoid body height (x) - posterior depth (y), in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	44		51		66	
r_{rank}	0.763	xxx	0.402	xx	0.344	xx
Allometry / Isometry	I		I		A	
RMA slope, +/- 95%	0.792	0.169	0.810	0.214	2.706	0.635
RMA intercept	0.578		-1.290		-2.478	
	raw		raw		log	raw
DIK-1-1, x observed	7.7		7.7		0.9	7.7
DIK-1-1, y predicted	6.7		4.9		-0.1	0.8
SE of y predicted	1.63		1.56		0.15	
-95%	3.4		1.8		-0.4	0.4
+95%	10.0		8.1		0.2	1.6
DIK-1-1, y observed	4.7		4.7			4.7
In predicted range?	Y		Y			N

Conclusion: hyoid body height and depth are correlated in all three species; DIK-1-1 is not significantly different from *Gorilla* and *Pan*, but has a deeper body than *Homo* (see graph, fig. 4a).

S6. SCAPULA

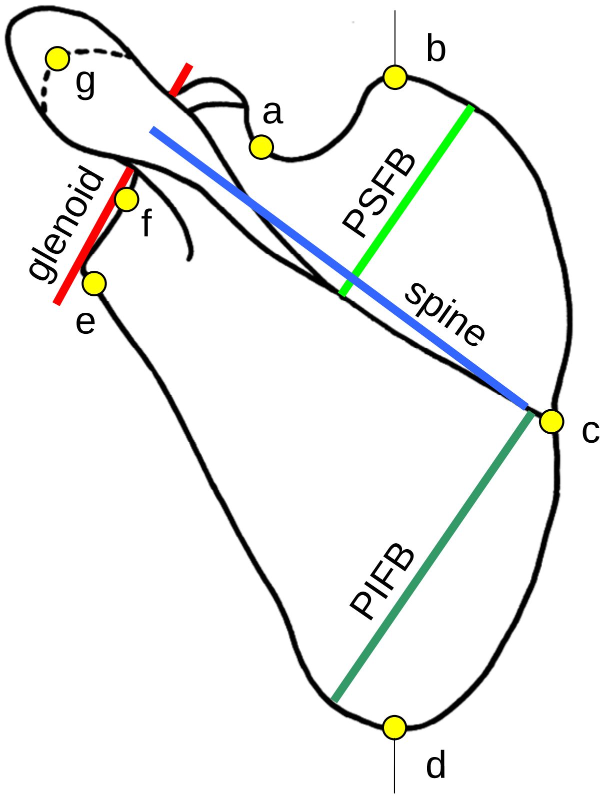
Comparative sample

Homo sapiens: 36 juveniles (neonatal - subadult), 10 adults (Spitalfields, Natural History Museum, and Dept of Anatomy, UCL; United Kingdom)

Pan troglodytes: 48 juveniles (infant - subadult), 10 adults (Powell Cotton Museum, United Kingdom)

Gorilla gorilla: 43 juveniles (infant - subadult), 11 adults (Powell Cotton Museum, United Kingdom)

Scapula measurements:



Glenoid fossa size: square root (fossa length x breadth) in millimetres; as proxy for overall body size[18]. The value for DIK-1-1 is 14.4 mm, and for similarly aged, 3 year old *H. sapiens*, *P. troglodytes* and *G. gorilla* the average values are 13.5, 15.3 and 20.0 mm, respectively.

Glenoid angle to medial scapular border (b-d). Values are positive for fossa facing superiorly, negative for fossa facing inferiorly)

Spinal angle to medial scapular border (b-d). Values give the angle opening superiorly.

Supraspinous fossa breadth (b-c).

Infraspinous fossa breadth (d-c).

Perpendicular infraspinous fossa breadth

Perpendicular supraspinous fossa breadth (PSFB), relative to the spinal orientation

Perpendicular infraspinous fossa breadth (PIFB.), relative to the spinal orientation

Landmarks a to g define linear measurements used in the multivariate analysis (S6f). Definition follows ref 19, except ‘f’, which is position on the middle of the dorsal glenoid margin.

Notes

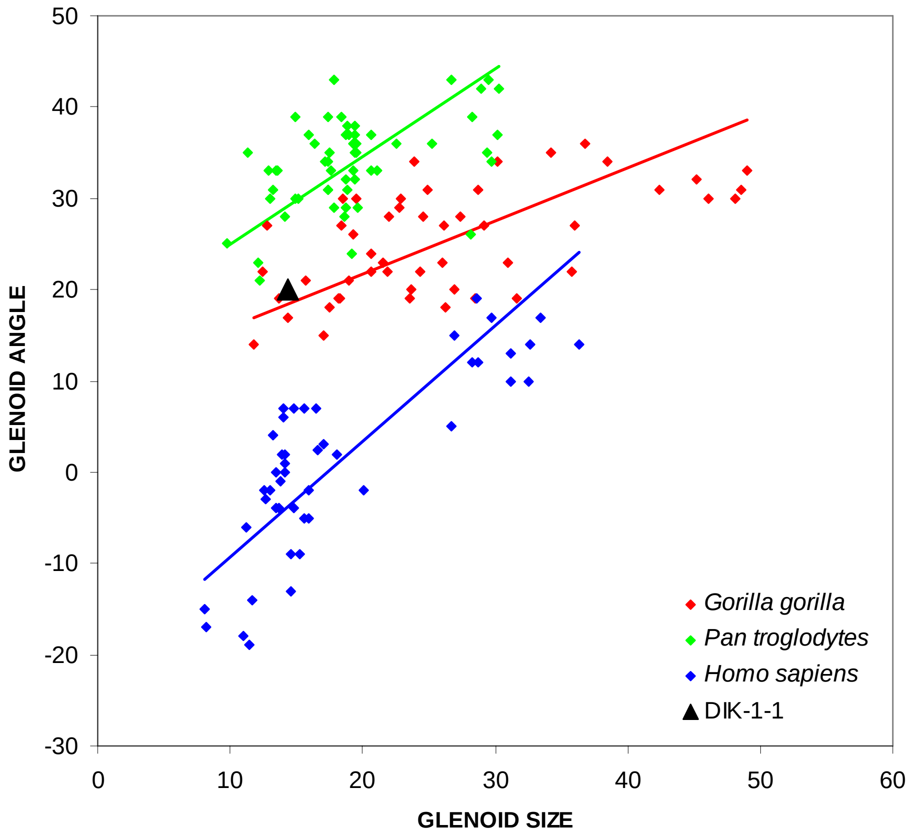
1. Point d of the right scapula is damaged, but on the left side this area is well-preserved and could be used to reconstruct accurately its position.
2. Fossa breadths are measured in two ways, along the medial border (b-c-d) and perpendicular to the spine, because each quantifies different aspects of scapular shape.
3. Conclusions given below are identical when the geometric mean of the main scapula dimensions, or the morphological length (c-f) is used as body size proxy instead of glenoid fossa size.
4. The angle of the glenoid fossa and spine are given relative to the medial border as it describes the line of attachment of the serratus and rhomboid muscles, and appears to represent a neutral orientation parallel with the vertebral column. Previous studies of the *A. afarensis* scapula measured the glenoid fossa angle relative to the ventral bar[18,20]. This angle cannot be taken here, as the ventral surface is not visible. On the other hand, the angle to the lateral (axillary) border[21] could be measured.

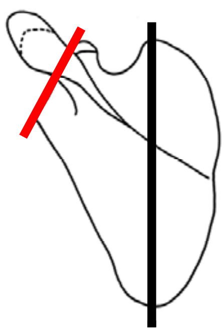
Results

S6a. Glenoid angle to medial border (y) in degrees against glenoid fossa size (x) in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	50		57		46	
r_{rank}	0.575	xxx	0.453	xxx	0.775	xxx
Allometry / Isometry	n/a		n/a		n/a	
RMA slope, +/- 95%	0.584	0.138	0.958	0.226	1.266	0.229
RMA intercept	9.978		15.476		-22.034	
	raw		raw		raw	
DIK-1-1, x observed	14		14		14	
DIK-1-1, y predicted	18		29		-4	
SE of y predicted	4.90		4.43		6.00	
-95%	9		20		-16	
+95%	28		38		8	
DIK-1-1, y observed	20		20		20	
In predicted range?	Y		Y		N	

Conclusion: in all three species the glenoid fossa rotates facing more superiorly with age. DIK-1-1 is most similar to *Gorilla*, and not significantly different from *Pan*, but has a more superiorly facing glenoid fossa than *Homo*.
NB: The glenoid fossa angle relative to the lateral (axillary) border[21] is 118 degrees in DIK-1-1, which is within the range of adult apes (101-124 degrees), and well outside that of humans (128-147 degrees)[21].

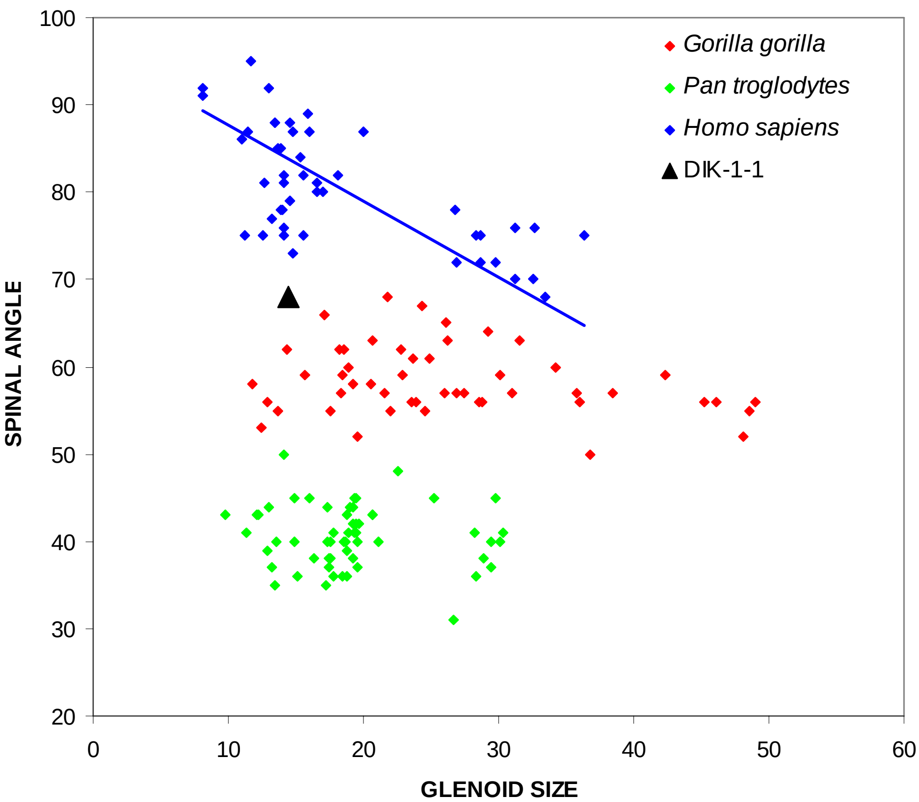


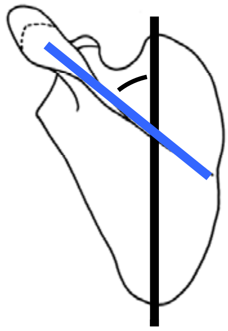


S6b. Spinal angle to medial border (y) in degrees against glenoid fossa size (x) in millimetres.

	Gorilla gorilla	*Pan troglodytes*	*Homo sapiens*
Sample size	50	57	46
r_{rank}	-0.256 ns	0.018 ns	-0.627 xxx
Allometry / Isometry	n/a	n/a	n/a
RMA slope, +/- 95%			-0.869 0.197
RMA intercept			96.367
			raw
DIK-1-1, x observed			14
DIK-1-1, y predicted			84
SE of y predicted			5.14
-95%			73
+95%			94
DIK-1-1, y observed			68
In predicted range?			N
t-test			
n	50	57	
mean	58.4	40.6	
SD	3.9	3.5	
Dik-1-1	68	68	
ts	2.44 x	7.68 xxx	

Conclusion: spinal orientation does not change with age in *Gorilla* and *Pan*, but becomes more inclined in *Homo*. In DIK-1-1 it is more inclined than in *Homo*, and less inclined than in *Pan*. It equals the minimum inclination found in the *Gorilla* sample (68 degrees), but is nevertheless statistically different from that species' mean.

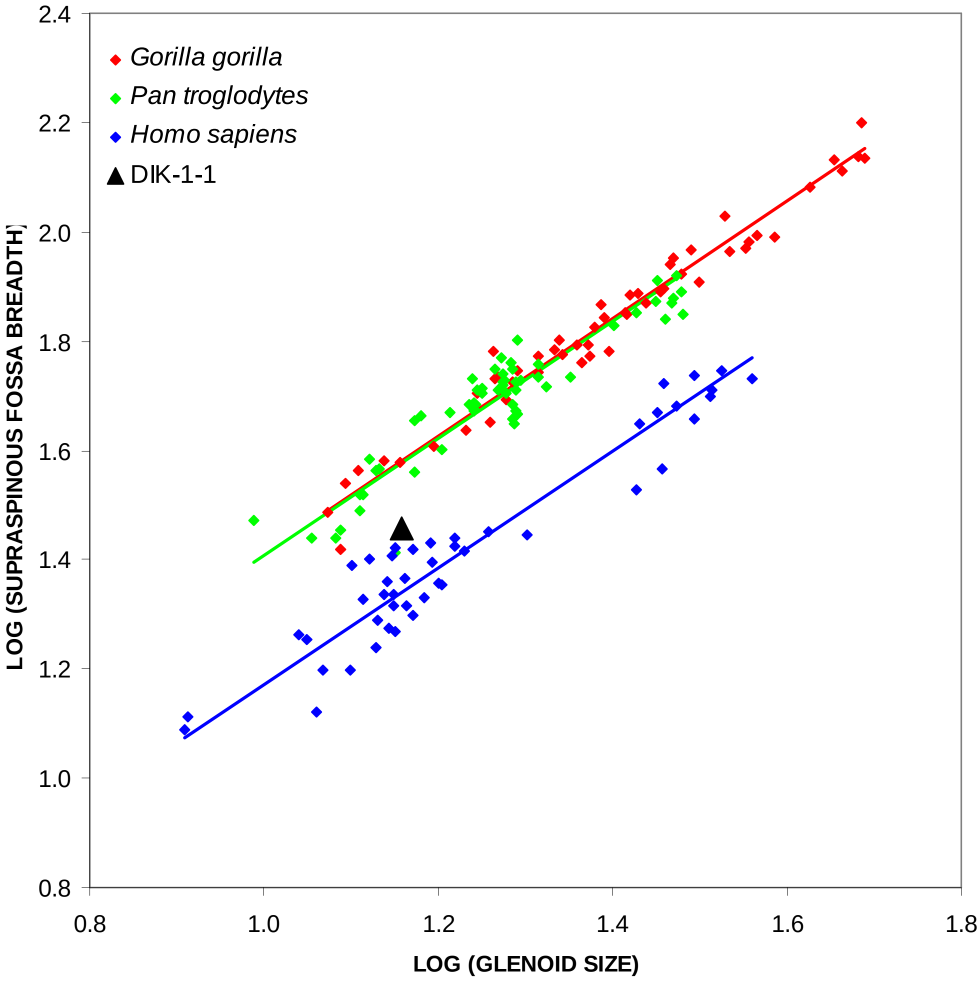


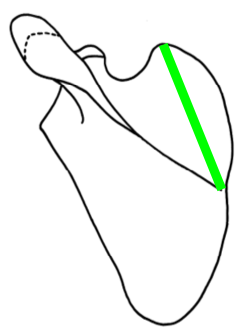


S6c. Supraspinous fossa breadth (y) against glenoid fossa size (x) in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	54		58		46	
r_{rank}	0.979	xxx	0.855	xxx	0.902	xxx
Allometry / Isometry	A		I		I	
RMA slope, +/- 95%	1.075	0.054	2.686	0.242	1.637	0.130
RMA intercept	0.336		-0.120		-1.574	
	log	raw	raw		raw	
DIK-1-1, x observed	1.16	14	14		14	
DIK-1-1, y predicted	1.58	38	39		22	
SE of y predicted	0.032		4.8		3.4	
-95%	1.52	33	29		15	
95%	1.65	44	48		29	
DIK-1-1, y observed		29	29		29	
In predicted range?		N	Y		Y	

Conclusion: - Supraspinous fossa breadth of DIK-1-1, is intermediate between the wider fossa of African apes, and the narrower fossa of *Homo*, but only the difference from *Gorilla* is statistically significant.

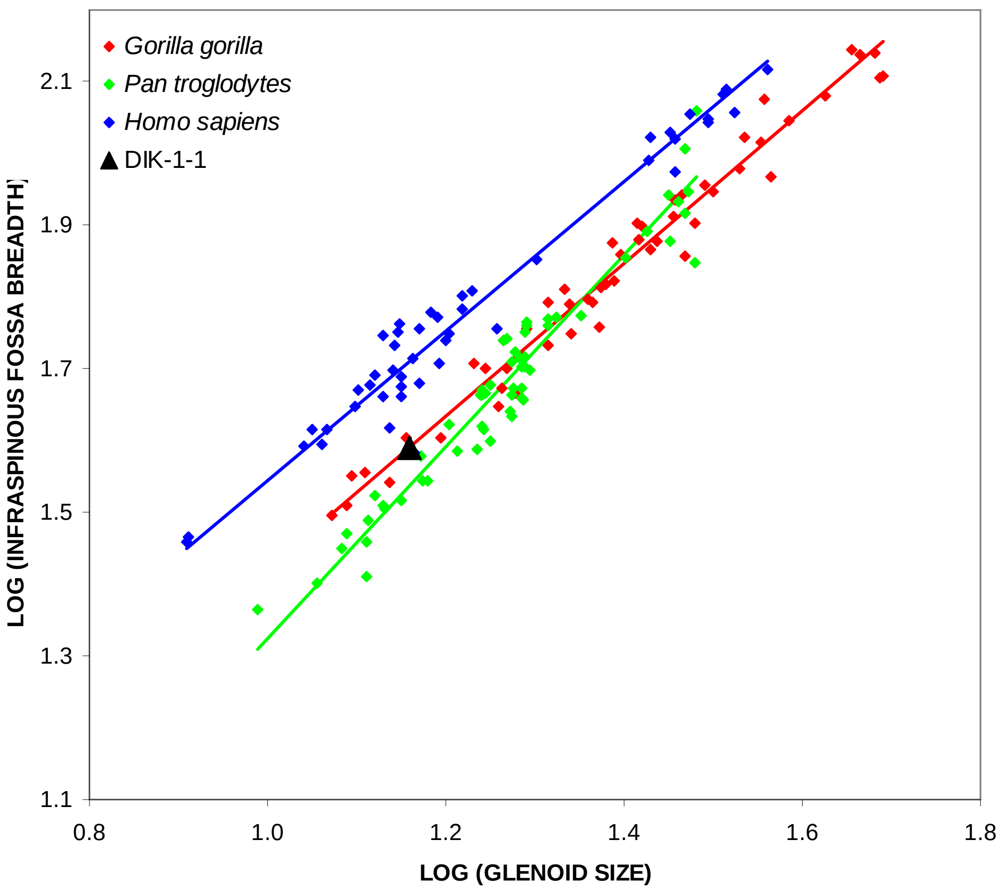




S6d. Infraspinous fossa breadth (y) against glenoid fossa size (x) in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	54		58		46	
r_{rank}	0.982	xxx	0.949	xxx	0.916	xxx
Allometry / Isometry	A		A		I	
RMA slope, +/- 95%	1.065	0.051	1.337	0.087	3.717	0.183
RMA intercept	0.355		-0.013		-2.111	
	log	raw	log	raw	raw	
DIK-1-1, x observed	1.16	14	1.16	14	14	
DIK-1-1, y predicted	1.59	39	1.54	34	51	
SE of y predicted	0.030		0.038		4.8	
-95%	1.53	34	1.46	29	42	
95%	1.65	45	1.61	41	61	
DIK-1-1, y observed		39		39	39	
In predicted range?		Y		Y	N	

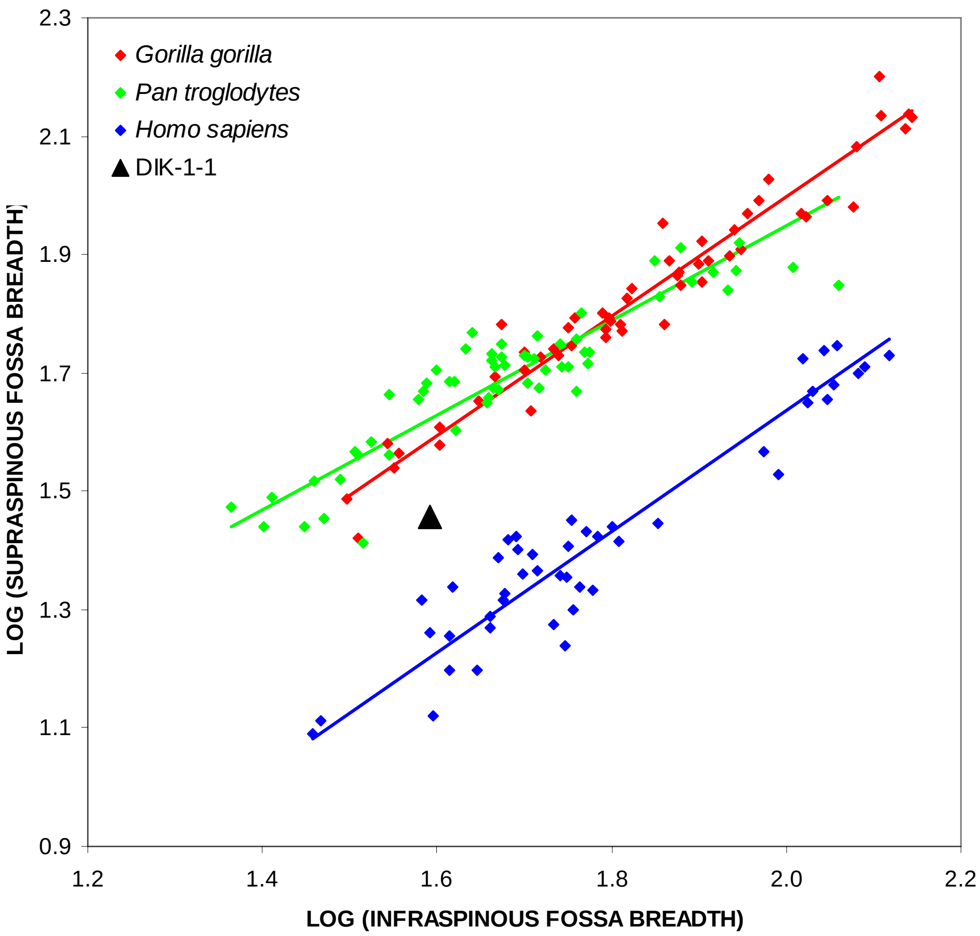
Conclusion: - Infraspinous fossa breadth of DIK-1-1 is similar to that of the African apes, and significantly narrower than in *Homo*.

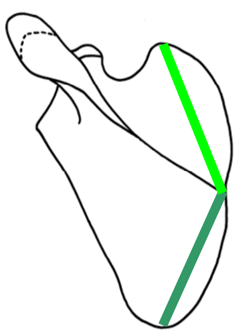


S6e. Supraspinous fossa breadth (y) against infraspinous fossa breadth (x) in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	54		58		46	
r_{rank}	0.969	xxx	0.867	xxx	0.876	xxx
Allometry / Isometry	I		A		I	
RMA slope, +/- 95%	1.014	0.077	0.800	0.089	0.440	0.038
RMA intercept	-1.749		0.349		-0.644	
	raw		log	raw	raw	
DIK-1-1, x observed	39		1.59	39	39	
DIK-1-1, y predicted	38		1.62	42	17	
SE of y predicted	8.3		0.052		3.7	
-95%	21		1.52	33	9	
95%	54		1.73	53	24	
DIK-1-1, y observed	29			29	29	
In predicted range?	Y			N	N	

Conclusion: - Realtive to infraspinous breadth the supraspinous breadth of DIK-1-1 is intermediate between the wider fossa of African apes, and the narrower fossa of *Homo*, but the difference from *Gorilla* is not statistically significant

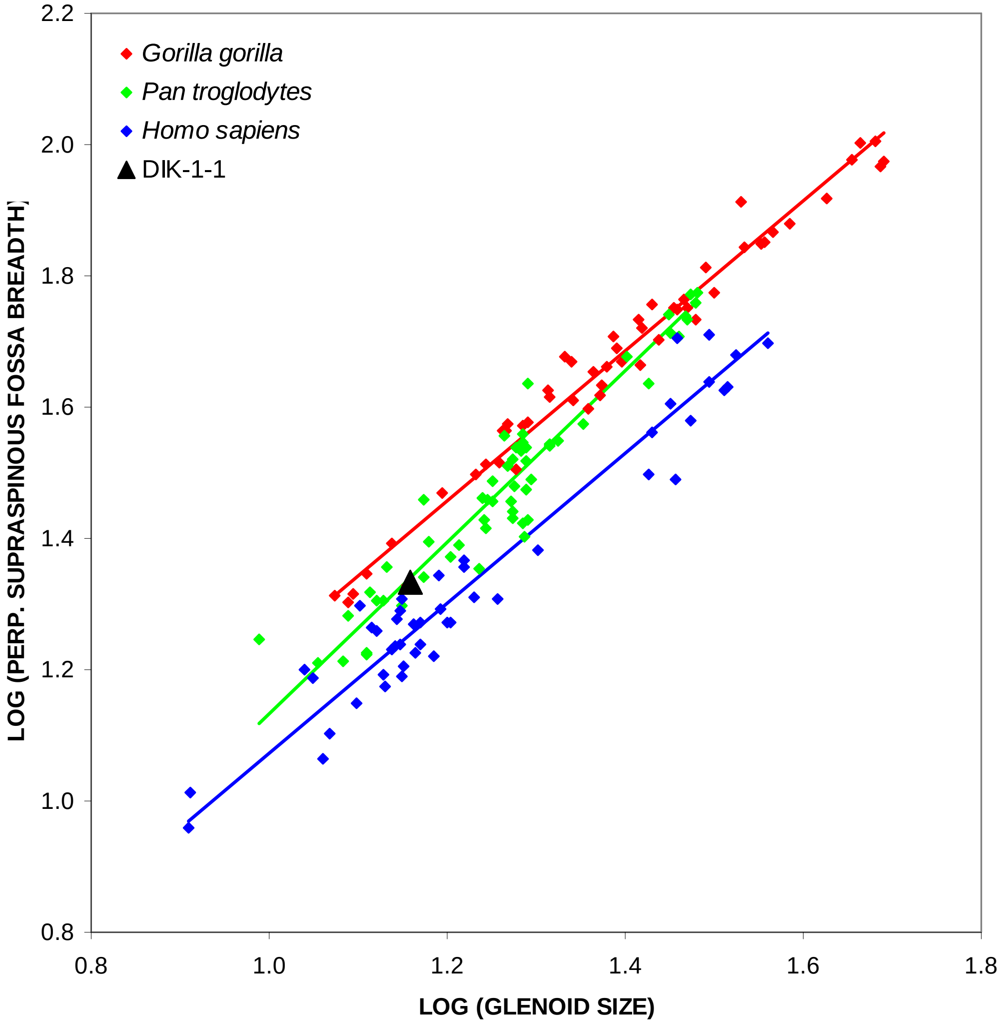


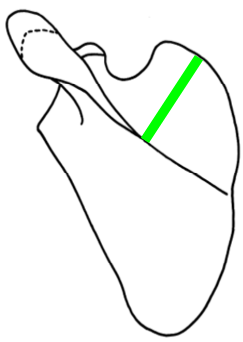


S6f. Perpendicular supraspinous fossa breadth (y) against glenoid fossa size (x) in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	54		58		46	
r_{rank}	0.979	xxx	0.904	xxx	0.899	xxx
Allometry / Isometry	A		A		A	
RMA slope, +/- 95%	1.141	0.053	1.305	0.107	1.140	0.088
RMA intercept	0.089		-0.172		-0.068	
	log	raw	log	raw	log	raw
DIK-1-1, x observed	1.16	14	1.16	14	1.16	14
DIK-1-1, y predicted	1.41	26	1.34	22	1.25	18
SE of y predicted	0.03		0.05		0.05	
-95%	1.35	22	1.25	18	1.15	14
+95%	1.47	30	1.43	27	1.35	23
DIK-1-1, y observed		22		22		22
In predicted range?		Y		Y		Y

Conclusion: Perpendicular supraspinous fossa breadth of DIK-1-1 is most similar to that of *Pan*, but is not significantly different from the generally somewhat narrower fossa in *Homo*, and wider fossa in *Gorilla*.

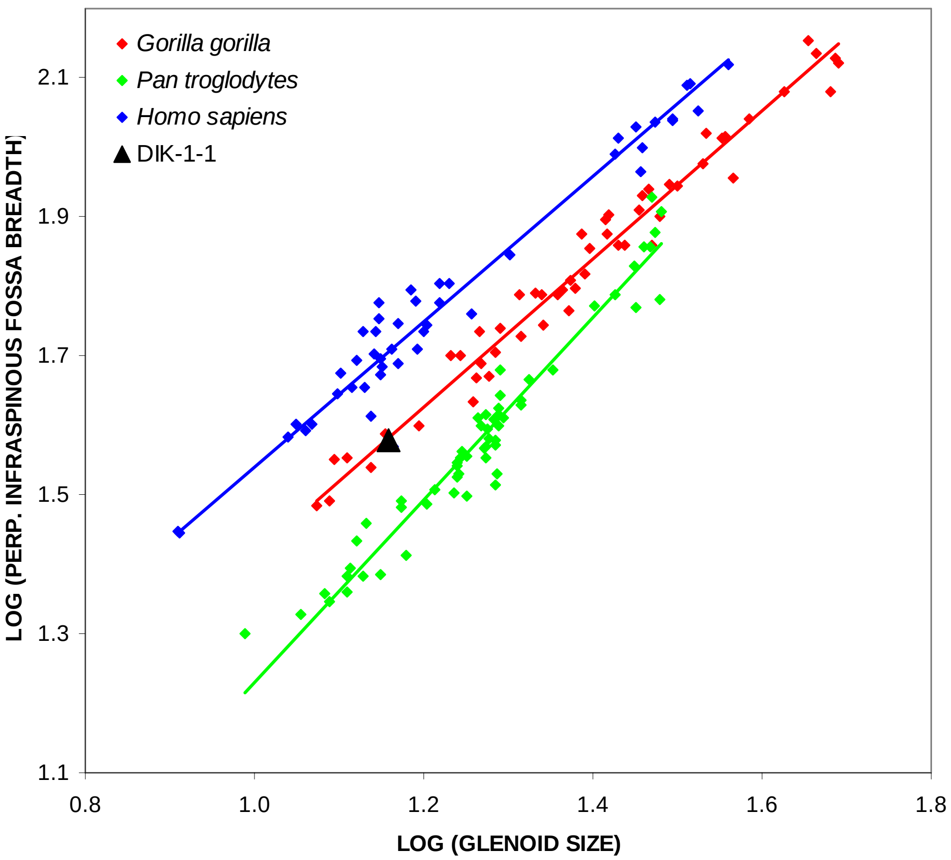


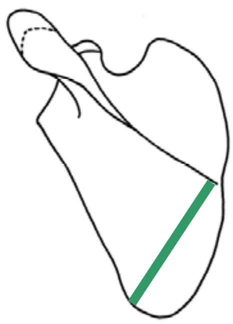


S6g. Perpendicular infraspinous fossa breadth (y) against glenoid fossa size (x) in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	54		58		46	
r_{rank}	0.982	xxx	0.957	xxx	0.921	xxx
Allometry / Isometry	A		A		I	
RMA slope, +/- 95%	1.067	0.050	1.316	0.083	3.681	0.193
RMA intercept	0.347		-0.087		-1.883	
	log	raw	log	raw	raw	
DIK-1-1, x observed	1.16	14	1.16	14	14	
DIK-1-1, y predicted	1.58	38	1.44	27	51	
SE of y predicted	0.03		0.04		5.1	
-95%	1.52	33	1.36	23	41	
+95%	1.64	44	1.51	32	61	
DIK-1-1, y observed		38		38	38	
In predicted range?		Y		N	N	

Conclusion: Perpendicular infraspinous fossa breadth of DIK-1-1 is most similar to that of *Gorilla*, and significantly wider than in *Pan*, and narrower than in *Homo*.

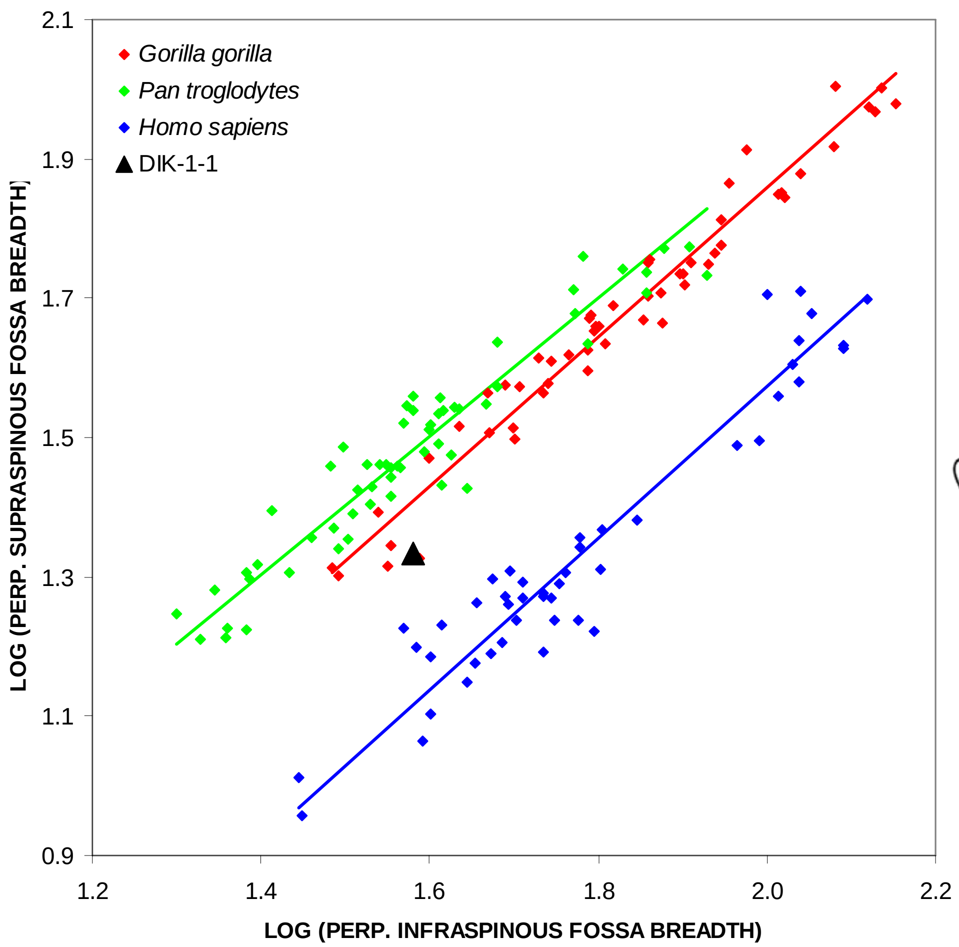


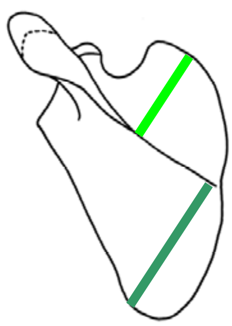


S6h. Perpendicular supraspinous fossa breadth (y) against perpendicular infraspinous fossa breadth (x) in millimetres.

	Gorilla gorilla		*Pan troglodytes*		*Homo sapiens*	
Sample size	54		58		46	
r_{rank}	0.982	xxx	0.922	xxx	0.900	xxx
Allometry / Isometry	A		I		I	
RMA slope, +/- 95%	1.069	0.059	0.754	0.062	0.415	0.038
RMA intercept	-0.282		1.662		-3.274	
	log	raw	raw		raw	
DIK-1-1, x observed	1.58		38		38	
DIK-1-1, y predicted	1.41	26	30		12	
SE of y predicted	0.04		3.6		3.6	
-95%	1.33	21	23		5	
95%	1.48	30	38		20	
DIK-1-1, y observed		22	22		22	
In predicted range?		Y	N		N	

Conclusion: Compared with the perpendicular infraspinous fossa breadth DIK-1-1 has a narrower perpendicular supraspinous fossa than most *Gorilla* specimens, but it is not significantly different from this species. However, it is relatively wider than in *Homo*, and relatively narrower than in *Pan*.





S6i. DIK-1-1 scapula morphology compared to apes and humans using a multivariate approach.

Method
Principal components analysis of scapular measurements. The first principal component has little discrimination and appears to represent size variation in the sample. The second and third principal components separate the three comparative taxa (see main text). All linear measurements were log transformed, and the analysis was conducted on the correlation matrix using the prcomp function in the R statistical package (v. 2.0).
Variables
SSFB: Supraspinous fossa breadth; TOT: Total breadth; SSFL: Supraspinous fossa length; ISFB: Infraspinous fossa bredth; MOLP: Morphological length; SPL: Spinal length; ISFL: Infraspinous fossa length; PSSFB: Perpendicicular supraspinous fossa breadth; PISFB: Perpendicular infraspinous fossa breadth; PTOB: Perpendicular total breadth; GFL: Glenoid fossa length; GFB: Glenoid fossa breadth.

	Gorilla gorrilla	*Homo sapiens*	*Pan troglodytes*
Sample Size	54	46	58
Variables and Weightings	PCA1	PCA2	PCA3
SSFB	0.9047	-0.4069	-0.1004
TOTB	0.9962	-0.0020	0.0326
SSFL	0.9823	-0.1455	-0.0063
ISFB	0.9012	0.4218	0.0368
MOL	0.9912	-0.0839	-0.0194
SPL	0.9927	-0.0625	0.0421
ISFL	0.9739	-0.1406	0.1564
PSSFB	0.9703	-0.1635	-0.1405
PISFB	0.8329	0.5377	-0.1144
GFL	0.9813	0.0864	0.0144
GFB	0.9887	0.0415	0.0747
Proportion of Variance	0.9160	0.0655	0.0070
Cumulative Proportions	0.9160	0.9815	0.9885

Conclusions
The DIK-1-1 specimen clearly falls within the *Gorrilla* cluster in the PCA ordination plot showing that its shape is more similar to this taxon than to either *Pan* or *Homo* (see figure 4b in main text).

S7. The absolute and relative arc size of the semicircular canals.

Method

The semicircular canals of both inner ears of DIK-1-1 were visualised combining CT scans in the transverse and sagittal plane (voxelsize 0.1 x 0.1 x 0.5mm). The canal arc measurements were taken from planar reformatted images showing the full extent of each canal, using Voxblast 3.1 (Vaytek, USA). The arc size of each canal is quantified by the radius of curvature (R), defined as half the average of the arc height and width, measured to the centre of the canal lumen[22].

Absolute arc size (mm)	n	ASC-R mean	- SD	PSC-R mean	- SD	LSC-R mean	- SD
Homo sapiens	53	3.2	0.24	3.1	0.30	2.3	0.21
Pan troglodytes	7	2.7	0.20	2.8	0.24	2.4	0.24
Pan paniscus	6	2.6	0.19	2.5	0.16	2.4	0.18
Australopithecus africanus	4	2.4	0.26	2.6	0.19	2.2	0.17
DIK-1-1	1	2.6	-	2.6	-	2.2	-

Relative arc size (%)	n	ASC %R	PSC %R	LSC %R
Homo sapiens	53	37	37	26
Pan troglodytes	7	34	35	31
Pan paniscus	6	34	34	32
Australopithecus africanus	4	34	36	30
DIK-1-1	1	35	35	30

The mean and standard deviation (SD) of the absolute radius size of the anterior, posterior and lateral semicircular canals (ASC-R, PSC-R, LSC-R respectively) are given in millimeters (n: sample size). The relative sizes of the canals are given in percentages (sum of the three canals is 100%). Data for *Australopithecus africanus* (Taung, Sts 5, Sts 19, MLD 37/38) and extant species are taken from ref. 22. The canal radii of DIK-1-1 are based on all three canals on the left, and the posterior and lateral canal on the right.

Conclusion:

Both in absolute and relative arc size the semicircular canals of DIK-1-1 are not significantly different from the *A. africanus* sample. Both *Australopithecus* species are more similar to the extant great apes, than to modern humans. The latter are characterised by the derived feature of arc enlargement of the anterior and posterior canals[22].

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