

Supplementary Materials for The evolution of modern human brain shape

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The PDF file includes:

- fig. S1. Landmark set used in this study.
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- fig. S3. Average endocranial shapes of *H. erectus*, Neandertals, and present-day humans that the bgPCA is based on.
- fig. S4. Visualization of surface area expansion associated with shape changes.
- fig. S5. bgPCA of endocranial form.
- fig. S6. Allometric relationships within archaic *Homo* representatives shown as a series of predicted shapes according to the regression on size.
- Legends for movies S1 to S6

Other Supplementary Material for this manuscript includes the following: (available at advances.sciencemag.org/cgi/content/full/4/1/eaao5961/DC1)

- movie S1 (.mp4 format). Brain shape evolution in *H. sapiens* (lateral view).
- movie S2 (.mp4 format). Brain shape evolution in *H. sapiens* (occipital view).
- movie S3 (.mp4 format). Brain shape evolution in *H. sapiens* (inferior view).
- movie S4 (.mp4 format). Brain shape allometry in archaic *Homo* representatives (lateral view).
- movie S5 (.mp4 format). Brain shape allometry in archaic *Homo* representatives (occipital view).
- movie S6 (.mp4 format). Brain shape allometry in archaic *Homo* representatives (inferior view).

SUPPLEMENTARY MATERIALS

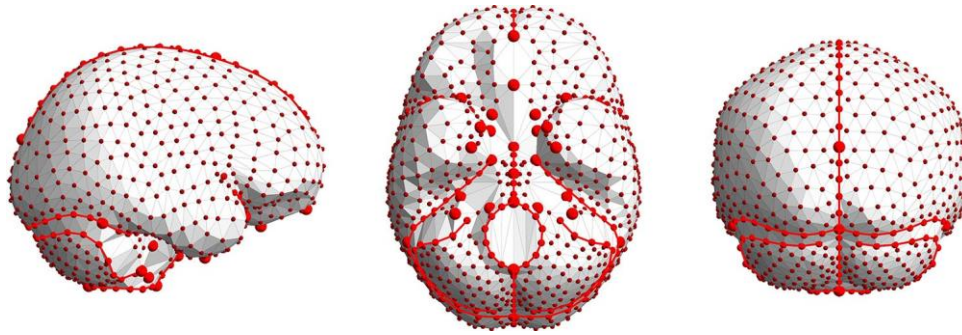


fig. S1. Landmark set used in this study. Anatomical landmarks are shown as large red spheres, semilandmarks on curves are connected with lines and all 935 landmarks and sliding semilandmarks on curves and the surface are used to visualize a triangulated endocranial surface. Lateral view (left), inferior view (middle), occipital view (right).

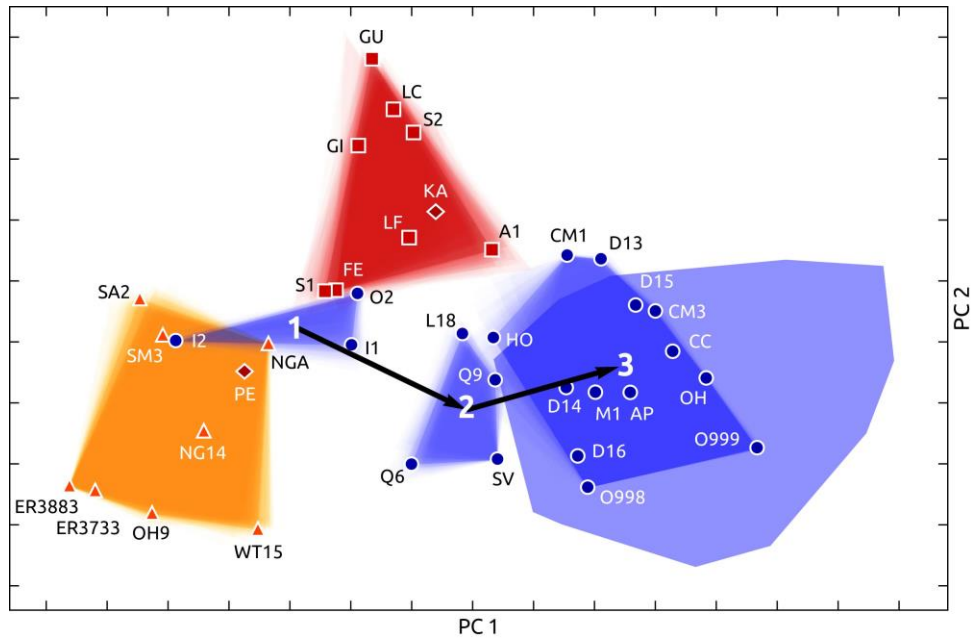


fig. S2. bgPCA of endocranial shape. *H. erectus*: triangles and orange convex hull (ER3733: KNM-ER 3733, ER3883: KNM-ER 3883, OH9: OH 9, WT15: KNM-WT 15000, NG14: Ngandong 14, SM3: Sambungmacan 3, NGA: Ngawi, SA2: Sangiran 2), Neandertals: squares and red convex hull (FE: Feldhofer 1, LF: La Ferrassie 1, LC: La Chapelle aux Saints, GI: Gibraltar, GU: Guattari, S1: Spy 1, S2: Spy 2, A1: Amud 1), *H. heidelbergensis/rhodesiensis*: darkred diamonds (KA: Kabwe, PE: Petralona), present-day humans: light blue convex hull, fossil *H. sapiens*: circles and convex hulls for geologic age groups 1–3 (I1: Jebel Irhoud 1, I2: Jebel Irhoud 2, O2: Omo 2, L18: L.H. 18, Q6: Qafzeh 6, Q9: Qafzeh 9, SV: Skhul V, HO: Hofmeyr, CM1: Cro Magnon 1, CM3: Cro Magnon 3, AP: Abri Pataud, M1: Mlacc 1, D13-D16: Dolní Věstonice 13-16, O998: Oberkassel 1, O999: Oberkassel 2, OH: Ohalo II H2, CC: Combe Capelle). Evolutionary globularization can also be visualized in a two-step process as shape changes from geologic age group 1 to 2 and 2 to 3 (arrows).

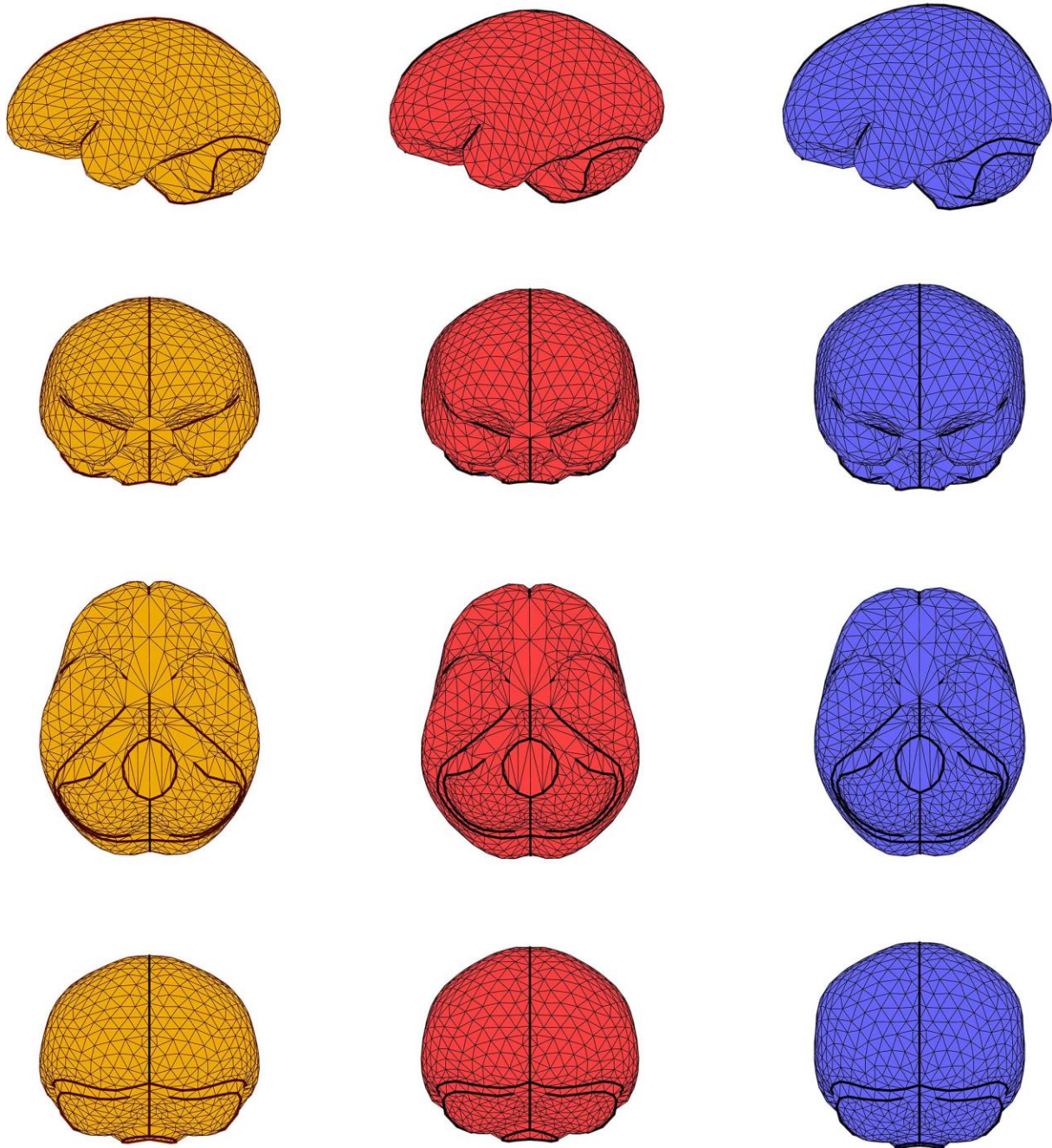


fig. S3. Average endocranial shapes of *H. erectus* (orange), Neandertals (red), and present-day humans (blue) that the bgPCA is based on. From top to bottom: lateral, frontal, inferior, occipital and superior view.

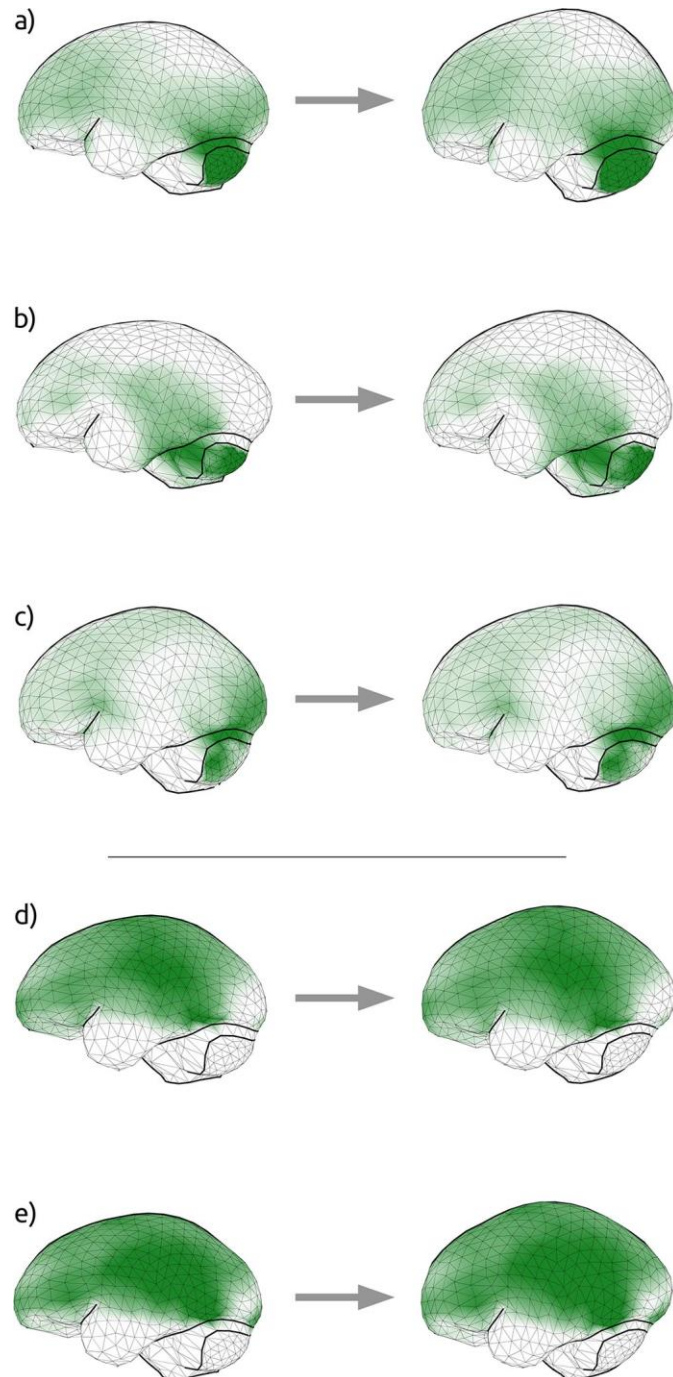


fig. S4. Visualization of surface area expansion associated with shape changes. Regions with local surface area increase to over 118 % appear in dark green. **(a)** from geologically older to younger *H. sapiens* individuals according to the regression on geologic age, **(b)** from geologic age group 1 to 2, **(c)** from geologic age group 2 to 3, **(d)** from geologically older to younger archaic *Homo* individuals, **(e)** from smaller to larger archaic *Homo* individuals.

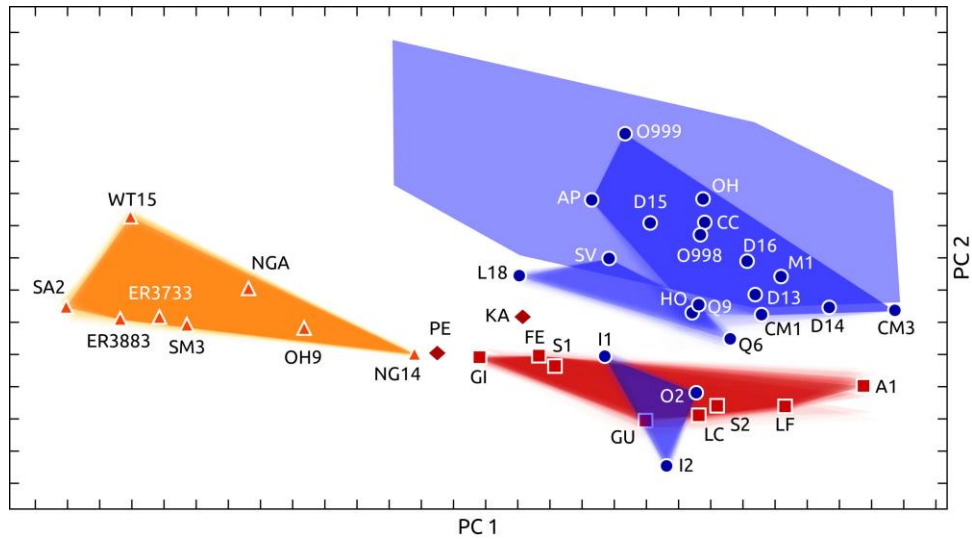


fig. S5. bgPCA of endocranial form. *H. erectus*: triangles and orange convex hull (ER3733: KNM-ER 3733, ER3883: KNM-ER 3883, OH9: OH 9, WT15: KNM-WT 15000, NG14: Ngandong 14, SM3: Sambungmacan 3, NGA: Ngawi, SA2: Sangiran 2), Neandertals: squares and red convex hull (FE: Feldhofer 1, LF: La Ferrassie 1, LC: La Chapelle aux Saints, GI: Gibraltar, GU: Guattari, S1: Spy 1, S2: Spy 2, A1: Amud 1), *H. heidelbergensis/rhodesiensis*: darkred diamonds (KA: Kabwe, PE: Petralona), present-day humans: light blue convex hull, fossil *H. sapiens*: circles and convex hulls for geologic age groups 1–3 (I1: Jebel Irhoud 1, I2: Jebel Irhoud 2, O2: Omo 2, L18: L.H. 18, Q6: Qafzeh 6, Q9: Qafzeh 9, SV: Skhul V, HO: Hofmeyr, CM1: Cro Magnon 1, CM3: Cro Magnon 3, AP: Abri Pataud, M1: Mlacc 1, D13-D16: Dolní Věstonice 13-16, O998: Oberkassel 1, O999: Oberkassel 2, OH: Ohalo II H2, CC: Combe Capelle).

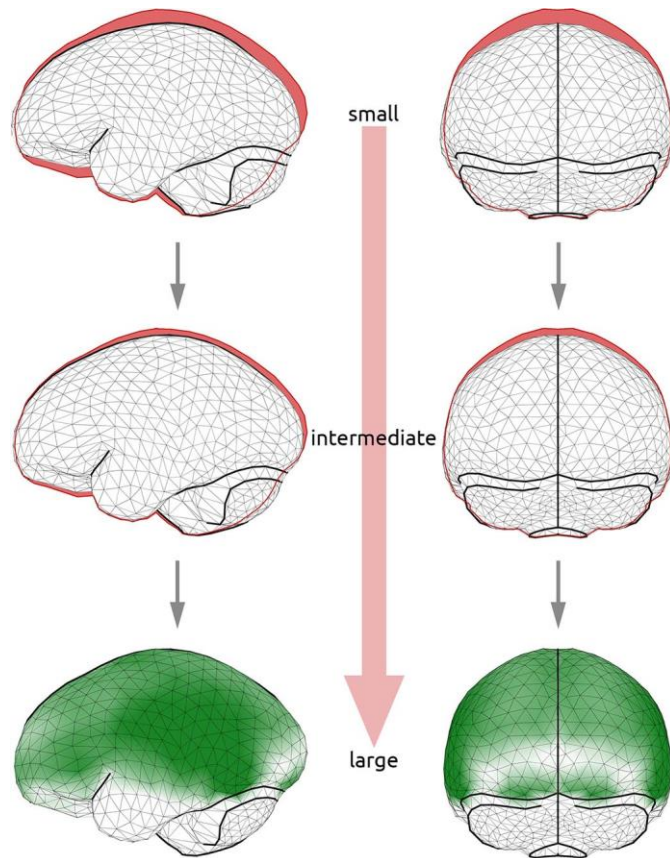


fig. S6. Allometric relationships within archaic *Homo* representatives shown as a series of predicted shapes according to the regression on size at minimal (top), intermediate (middle) and maximal size of the sample (bottom and red area in top and middle). Color-coding in green (bottom) illustrates regions with surface size increase associated with this shape changes. Lateral (left) and occipital (right) views. See also movies S4-S6 and fig. S4.

movie S1. Brain shape evolution in *H. sapiens*. Visualization of the shape regression on geologic age from the oldest to the youngest age of *H. sapiens* fossils (lateral view).

movie S2. Brain shape evolution in *H. sapiens*. Visualization of the shape regression on geologic age from the oldest to the youngest age of *H. sapiens* fossils (occipital view).

movie S3. Brain shape evolution in *H. sapiens*. Visualization of the shape regression on geologic age from the oldest to the youngest age of *H. sapiens* fossils (inferior view).

movie S4. Brain shape allometry in archaic *Homo* representatives. Visualization of the shape regression on size from the smallest to the largest archaic *Homo* fossil of our sample (lateral view).

movie S5. Brain shape allometry in archaic *Homo* representatives. Visualization of the shape regression on size from the smallest to the largest archaic *Homo* fossil of our sample (occipital view).

movie S6. Brain shape allometry in archaic *Homo* representatives. Visualization of the shape regression on size from the smallest to the largest archaic *Homo* fossil of our sample (inferior view).