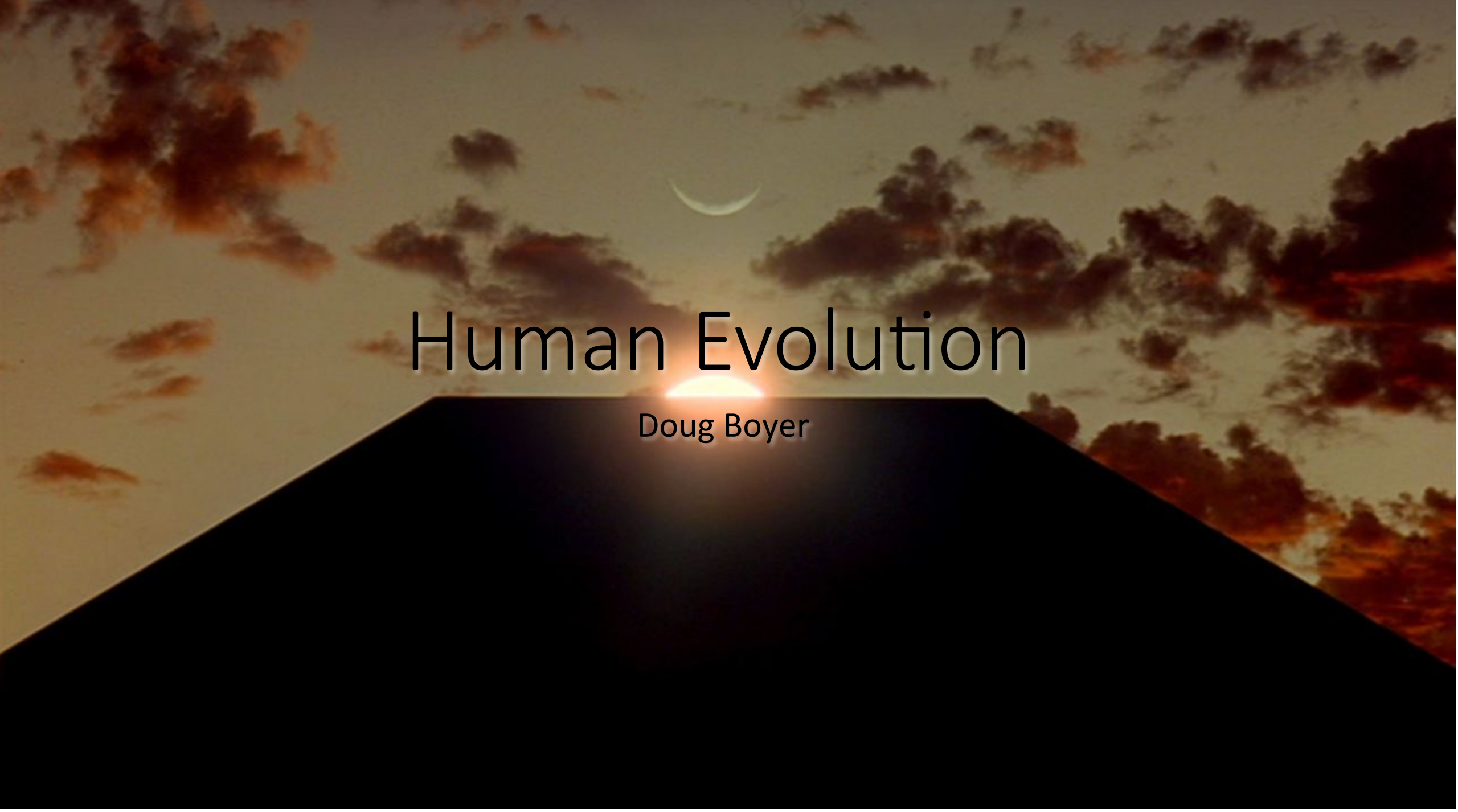

Human Evolution
Doug Boyer

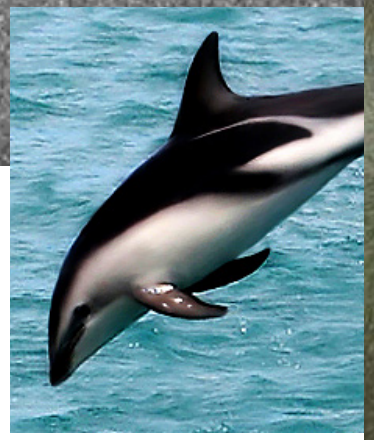
- Overview
- Major themes
- Basic facts
- MorphoSource


Overview - our origin story as
told by science

Overview – our origin story as told by science

Human Classification

- First life (first appearing 3,800mya)
  - Chordates (first appearing 542mya)
    - Mammals (first appearing 180mya)
      - Primates (first appearing 55mya)
        - Anthropoids (first appearing 45mya)
          - Hominoidea (first appearing 30mya)
            - Hominidae (first appearing 15mya)
              - Homininae (first appearing 12mya)
                - Hominini (first appearing 7mya)
                - *Homo* (first appearing 2.8mya)
                - *Homo sapiens* (first appearing 0.2mya)



Overview – our origin story as told by science

Time and Place of Human Origins

- A “hominin” is an animal closer to humans than any ape.
- First “hominins” are from Africa appearing about 6mya.
- This matches up with DNA evidence indicating that apes and humans split by 6-7mya.

Overview – our origin story as told by science

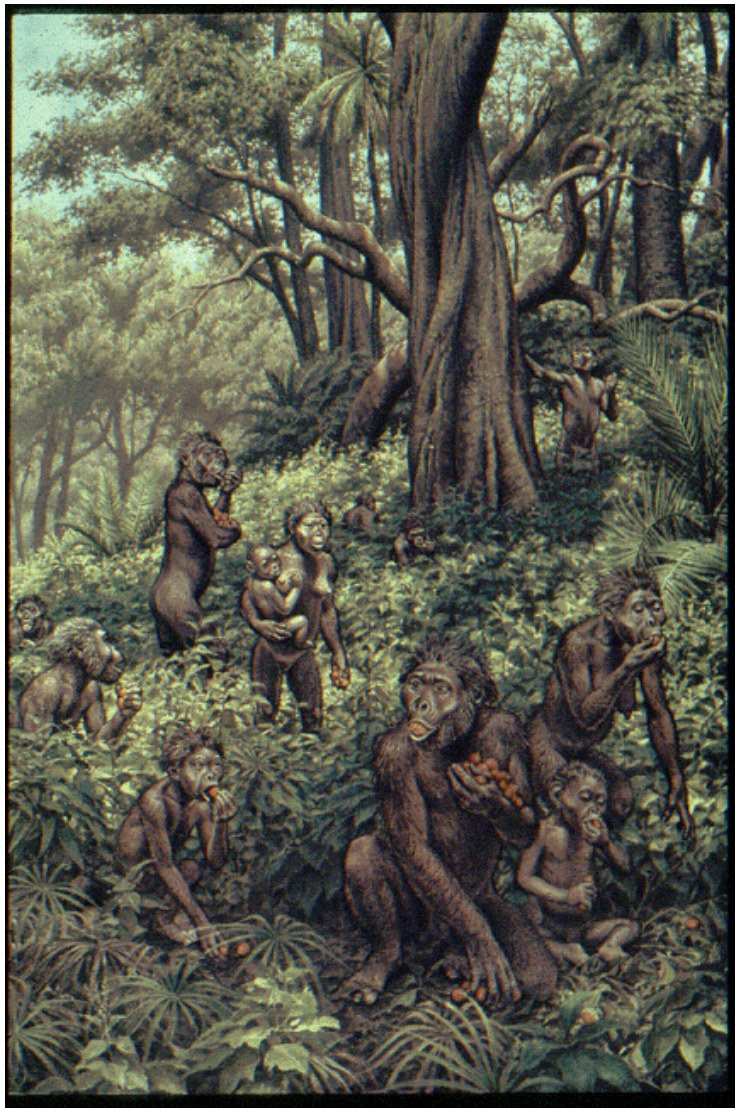
How long has Africa been the 'cradle' of human-kind?

- Monkey & Apes since 30 mya
- some apes leave Africa, at 16 mya.
- In Europe, significant changes
- European descendents returned to Africa at 8-9 mya

Overview – our origin story as told by science

What happened next?

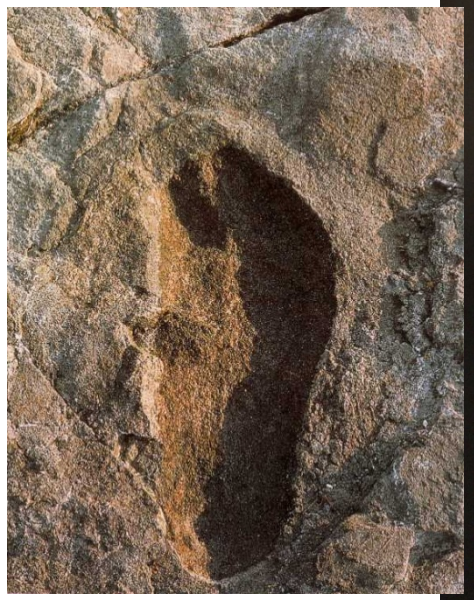
- Apes that returned to Africa had adapted to forests while in Europe.
- Their bodies were poorly proportioned for quadrupedal walking.
- When some species began to inhabit the spreading Savanna, bipedalism was used.
- By 4.2 mya fully capable bipedal hominin's had evolved.
- Over the next 1 million years a number of different species evolved, only one gave rise to living humans.



Overview – our origin story as told by science

What did early hominins look like?

- Upright posture
- Human-like hand & foot proportions
- Chimp-like curvature of their digits
- Big teeth with thick enamel
- Pronounced dimorphism
- Brains just a bit bigger...



Overview – our origin story as told by science

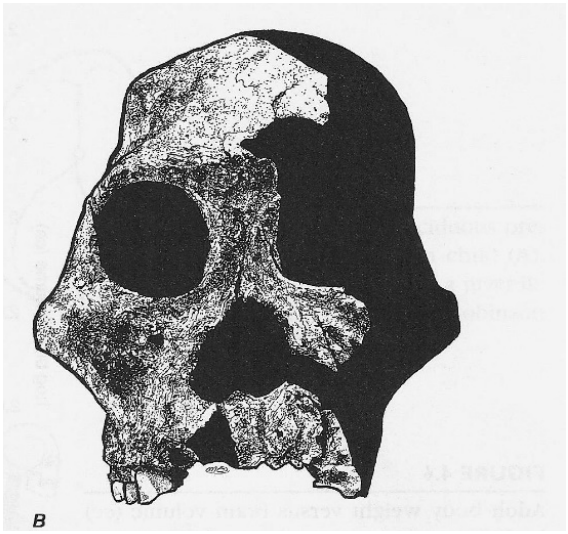
Why good were these features?

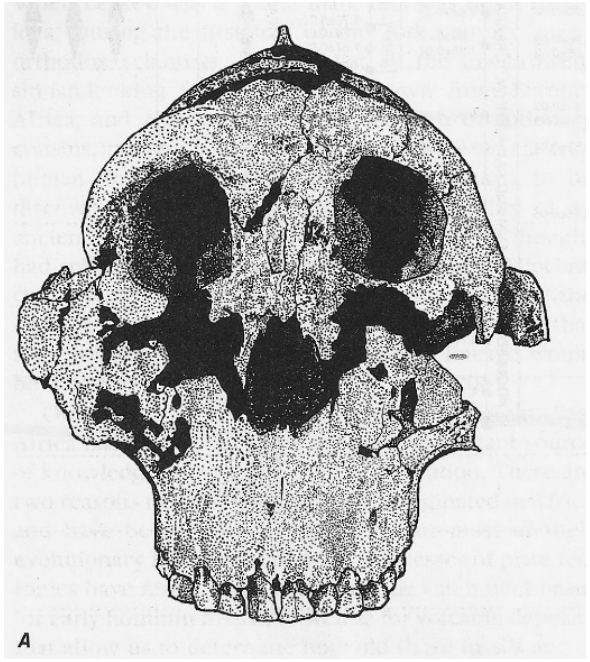
- foraging while traveling
- better for manipulation of small objects
- a diet of gritty material (dirty tubers) or large amounts of fibrous material (like grass)
- greater reliance on extractive foraging

Overview – our origin story as told by science

Between 4.2 and 1.7 mya some species became more extreme

- Around 2 mya some super-robust hominin species show up.
- This speaks to increasing specialization to a niche that other hominins were also filling.

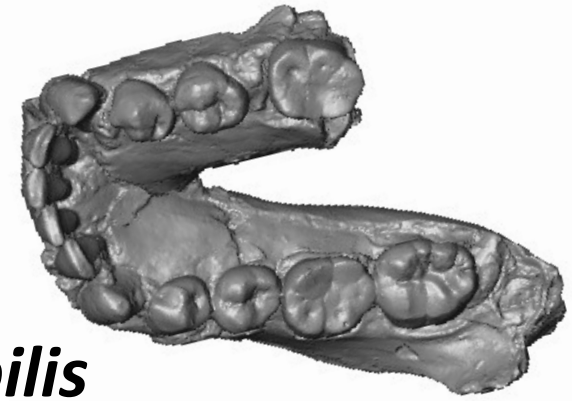




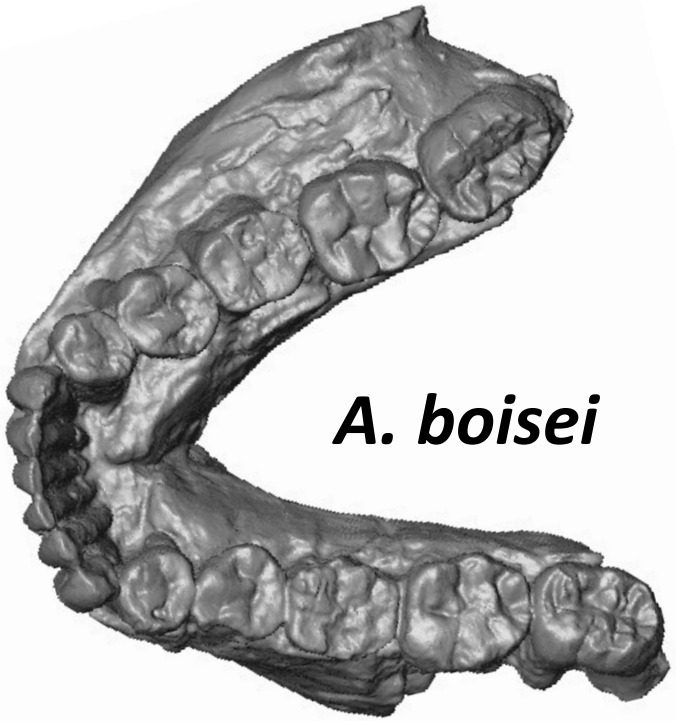
Overview – our origin story as told by science

“There’s more than one way to skin a cat”

- Around the same time we see increasing proliferation of stone tools.
- Another hominin now with smaller teeth also becomes more frequently recovered.



Homo habilis

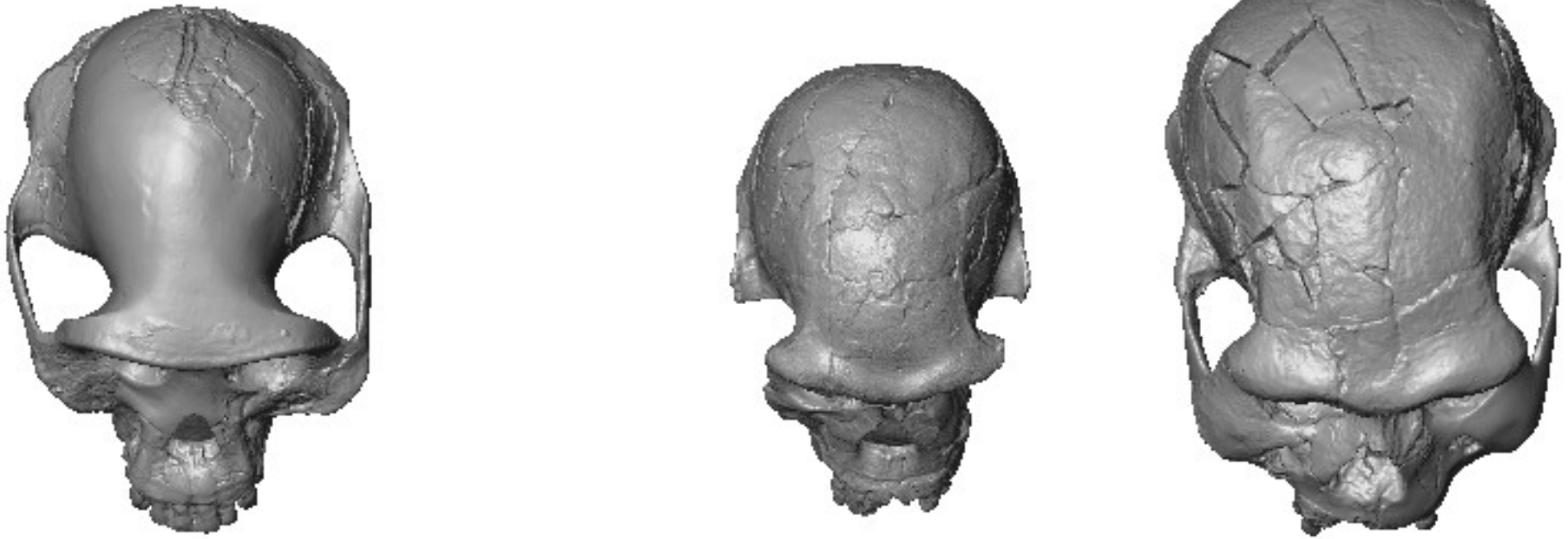


A. boisei

Overview – our origin story as told by science

A bunch of *Homo* species

- All had bigger brains than the Australopiths.
- *Homo habilis* and *Homo rudolfensis* were smallish.
- *Homo erectus* was large… it is our most direct ancestor.

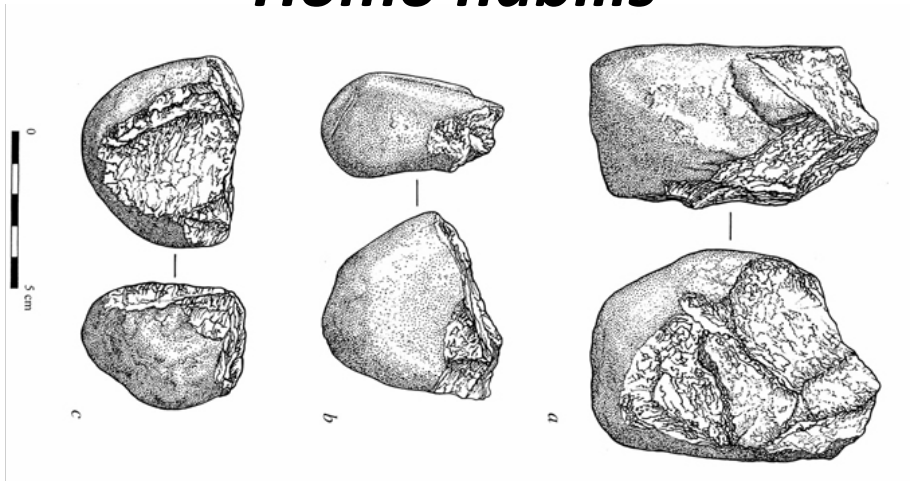


Overview

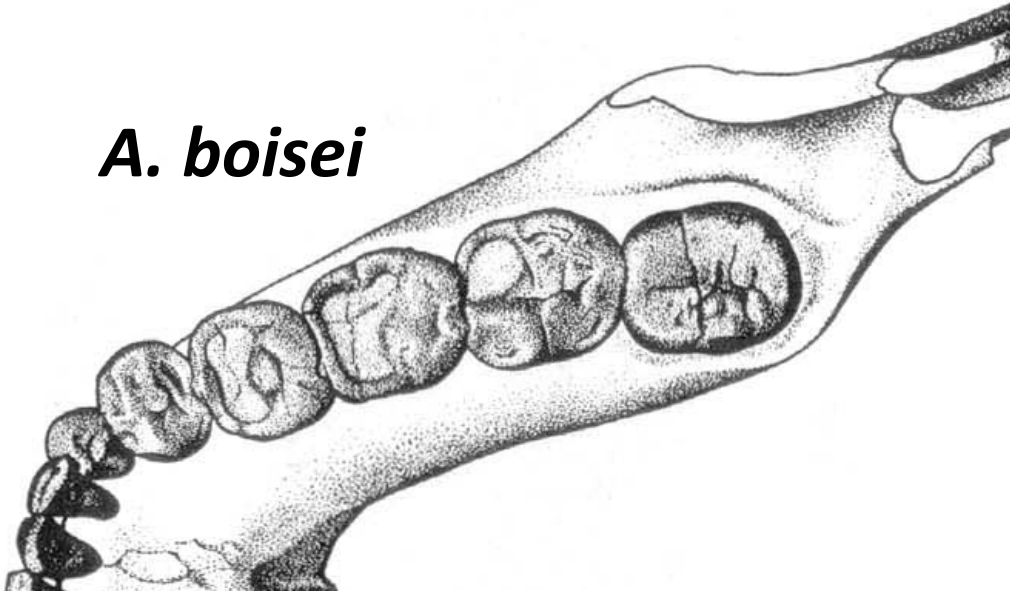
Why small teeth & big brains

- Homo was relying more on tools it made, rather than tools that grew out of its head (teeth) for food processing.
- More effective tool use required more complex thinking and larger brains.

Homo habilis



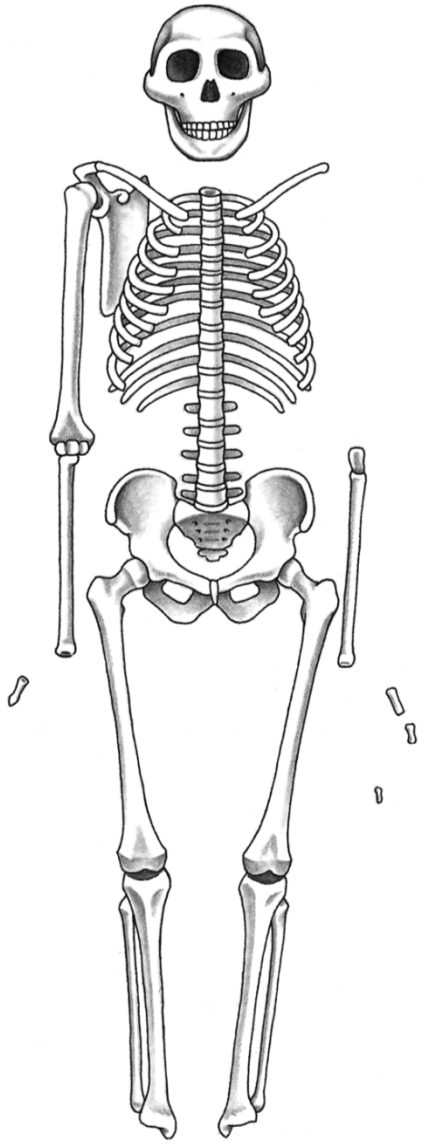
A. boisei



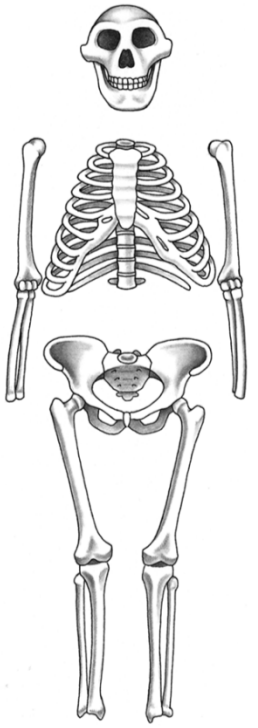
Overview

Only *Homo erectus* survived beyond 1.4mya

- *Homo erectus* left Africa and reduced its extinction susceptibility with wider geographic range.
- Its larger body size and possibly different proportions may have provided some ‘super powers’ that led to a completely different niche.



H. erectus
KNM-WT 15000
(307)



A. afarensis
A.L. 288-1
"Lucy"
(320)

Overview

What were the 'super powers' of *Homo erectus*?

- With a larger body size and slender build it was probably exceptionally heat tolerant (like modern humans)
- In addition its long legs and heat tolerance probably allowed it to keep moving at a faster pace than other savanna animals during the heat of the day.
- These two traits – heat tolerance & endurance – were pivotal

Overview

What good is heat tolerance and endurance to *Homo erectus*?

- It could be active in the hottest part of the day with safety from powerful predators like lions.
- It could capture prey animals who flag in the heat (persistence hunting).

Overview

What else happened when *Homo* became a hunter?

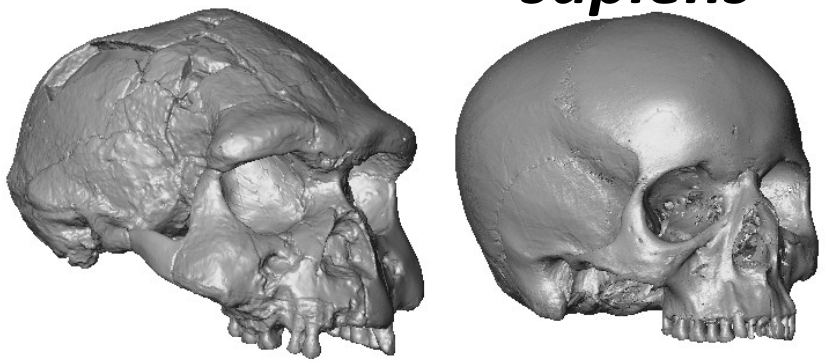
- Higher demands for energy demanded even more efficient hunting.
- Safety from predation allowed longer lifespan and potential for longer juvenile learning periods.
- Since ultimate intelligence and hunting skill is linked to lifespan those individuals who took longer to grow up and lived longer survived better and also had bigger brains.
- So brain size continued to increase in *Homo erectus.*
- The demands for more efficient hunting led to more complex and efficient tools.
- Demands on the teeth lessened and food energy increased with discovery of fire and cooking at around 1.1mya.

Overview

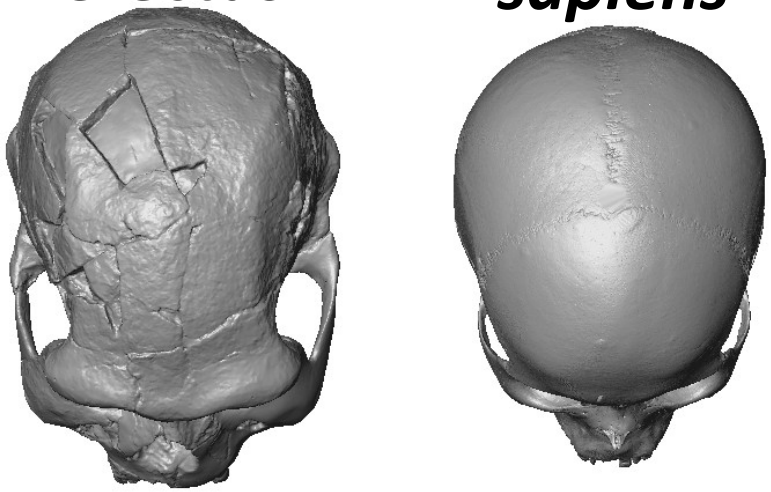
***Homo erectus* had spread across the globe by 1 mya… mean while in Africa**

- More dramatic changes continued and by 600,000 years ago a slightly different hominin with a fully modern-sized brain, large nose appeared and spreadout of Africa again.
- *Homo heidelbergensis* was the largest hominin yet -- larger than us.
- Living up north began to change it…

erectus ***sapiens***



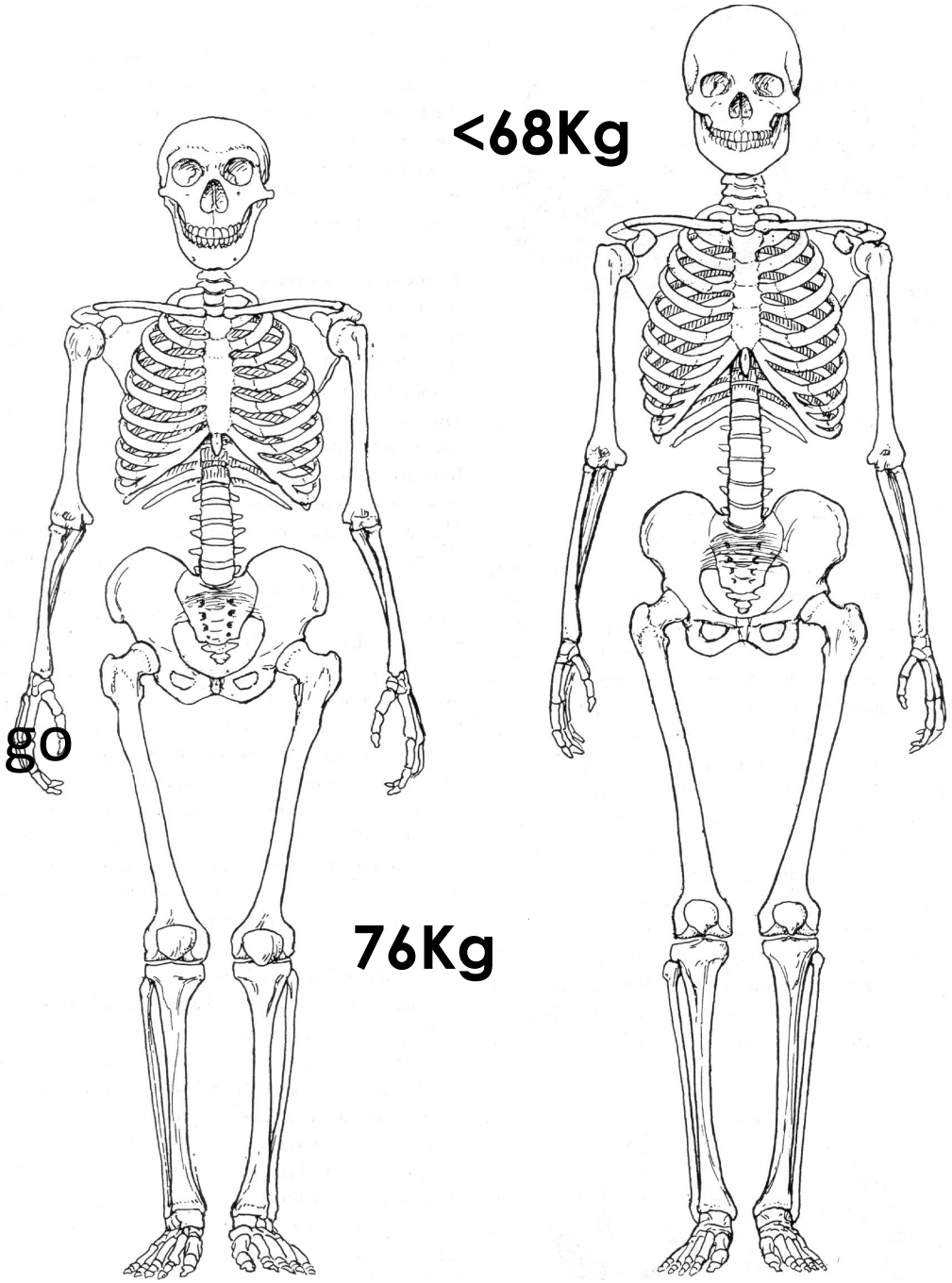
erectus ***sapiens***



Overview

Homo neanderthalensis

- Robust, barrel-chested, shorted limbed
- Possible ‘pre-neanderthals at 300,000-220,000 years ago
- Definitive specimens until 120,000 years ago
- Associated with first new development in stone tools by 300,000
- Probably an obligate carnivore
- Shorter juvenile period than modern humans



Overview

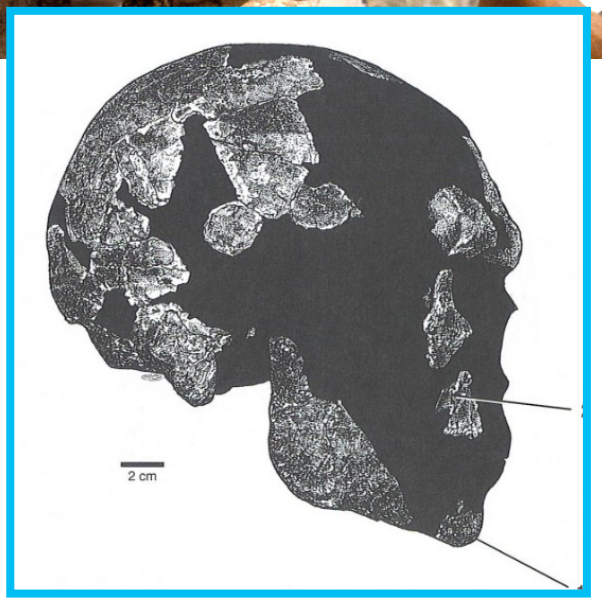
Homo neanderthalensis

- Robust, barrel-chested, shorted limbed
- Possible ‘pre-neanderthals at 300,000-220,000 years ago
- Definitive specimens until 120,000 years ago
- Associated with first new development in stone tools by 300,000
- Probably an obligate carnivore
- Shorter juvenile period than modern humans

Overview

Homo sapiens

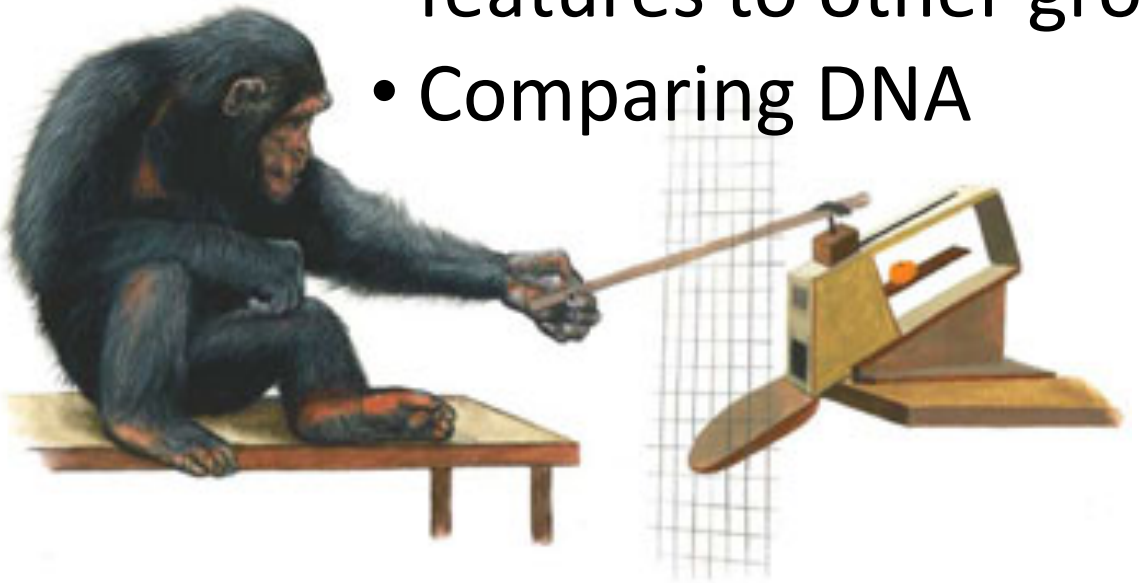
- Back in Africa…
- Ethiopia and Kenya yield earliest fossils at ~195,000 years old
- By 110,000 years ago modern humans are in middle east.
- By 100,000 years ago we have evidence of asthetic appreciation in Southern Africa.
- BY 30,000 years ago we invade Europe, introduce new stone tool cultures and push Neanderthals to extinction.

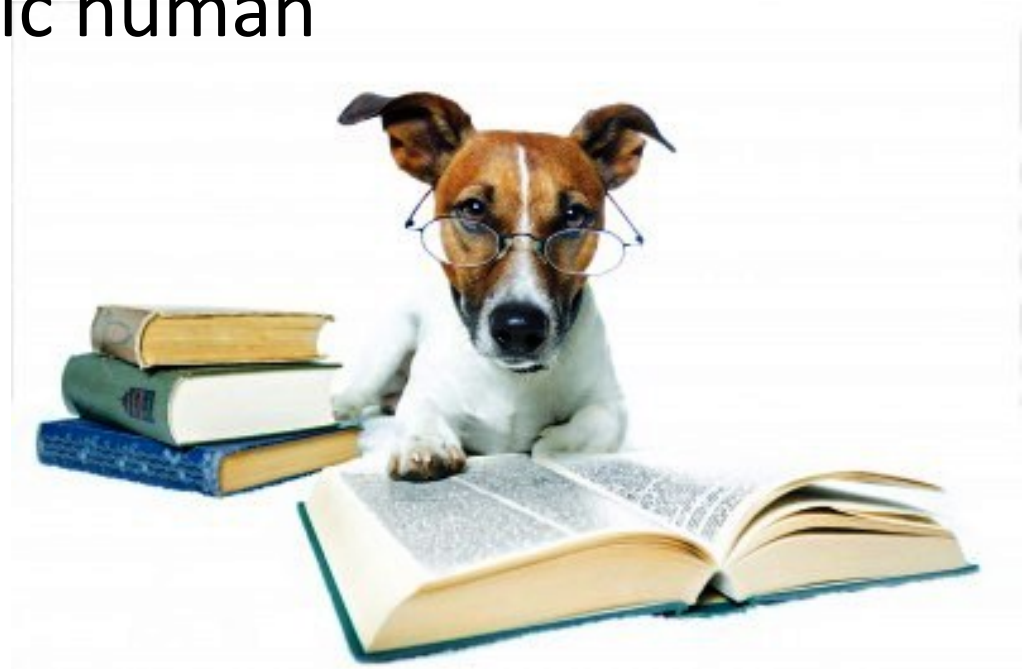


Major Themes

Connection to rest of the tree of life (no monoliths)

- Overview major groups of mammals and defining features
- Comparing and contrasting basic human features to other groups
- Comparing DNA





Major Themes

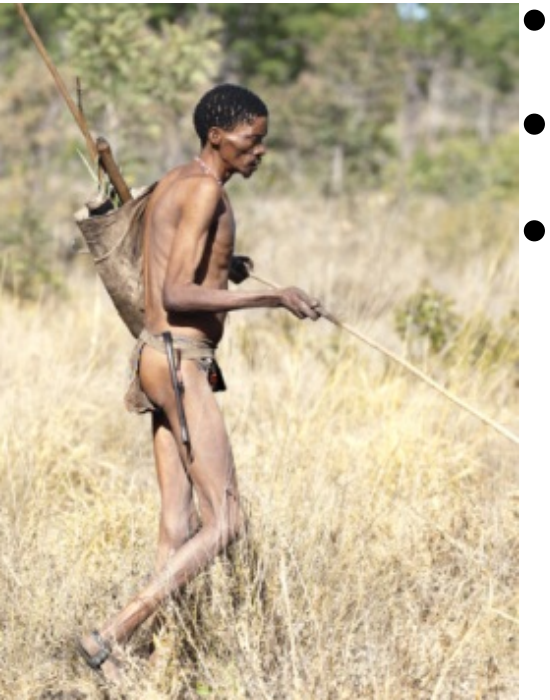
Environmental impact on our species over time

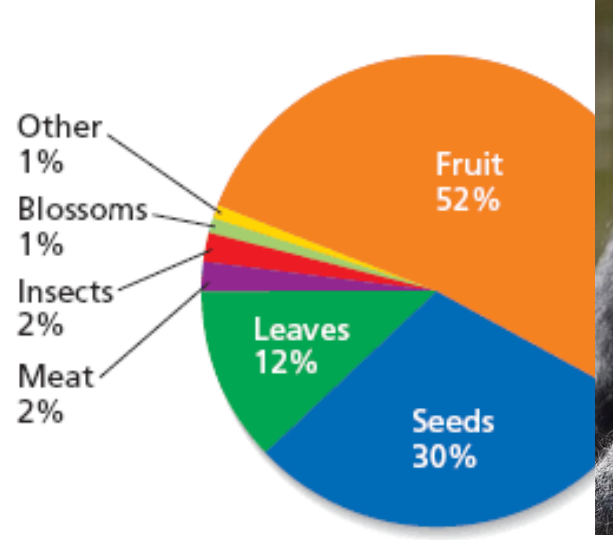
- Map changes in climate against changes in form (cooling and aridity with bipedalism, tooth size, tool types, brain size, body form).
- Compare changes hominins and their contemporaries (late Miocene and early Pleistocene changes in diet, and tooth form).

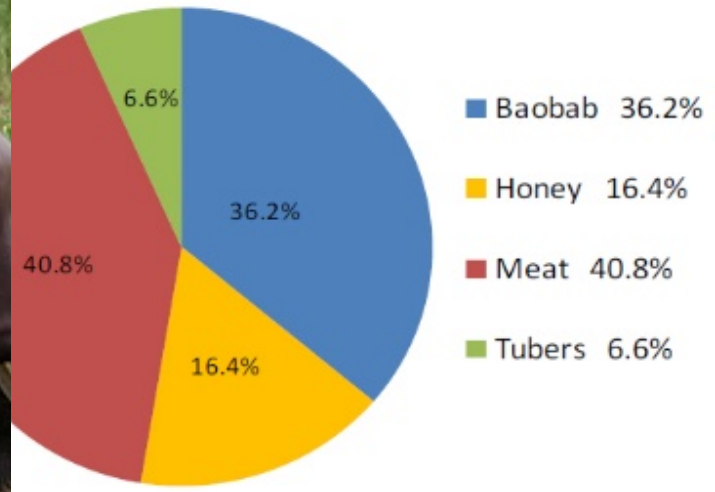
Major Themes

Understanding human species, society and health

- Comparison to…
- other animals
- apes
- traditional societies
- By analysis of archaeological record







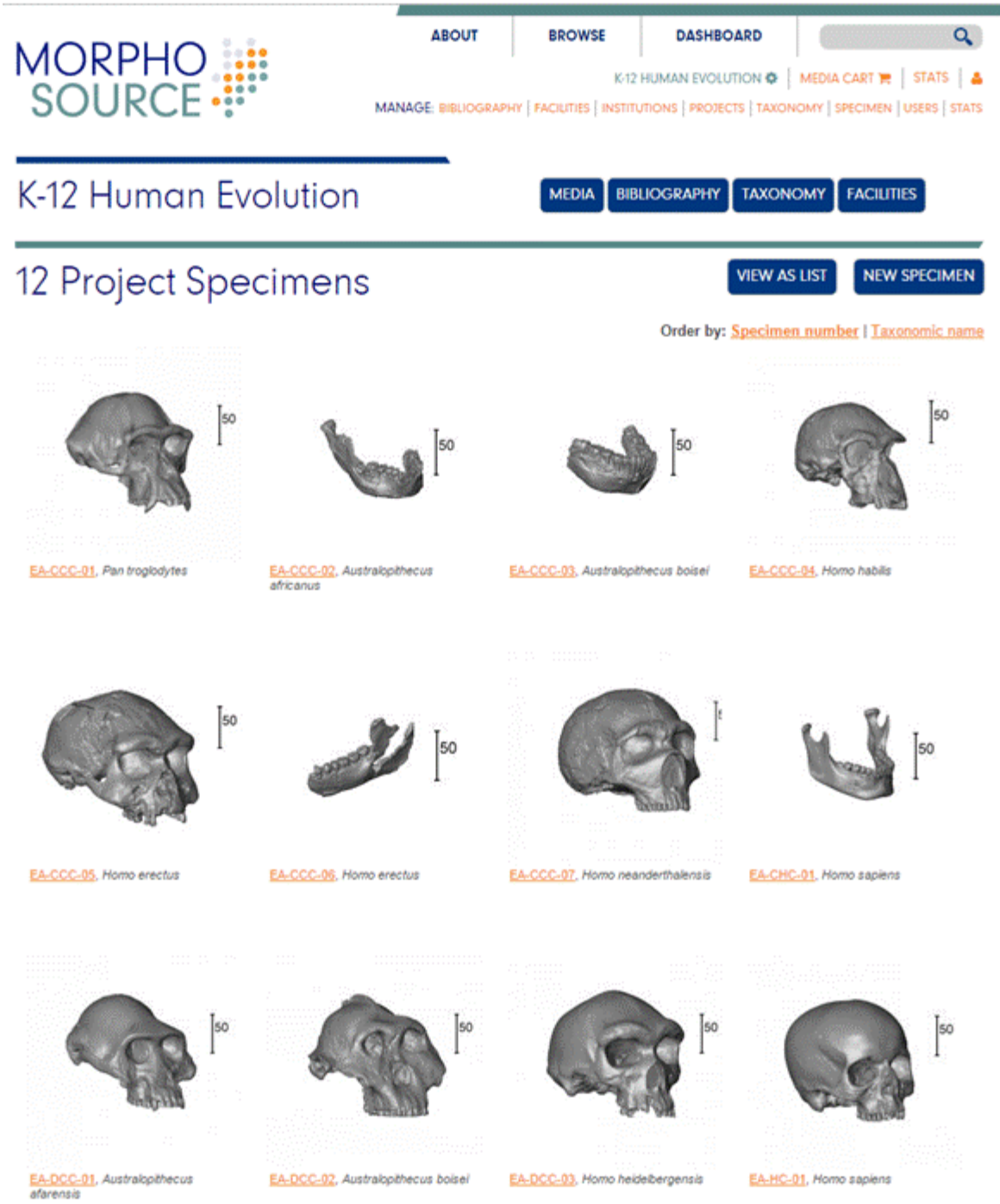
Basic Facts & Concepts

- Big picture time scale
- Taxonomy
- Diversity of human fossils, their time period, geography and physical traits
- Comparative anatomy & its correlation to ecology and function

MorphoSource Resources

Models

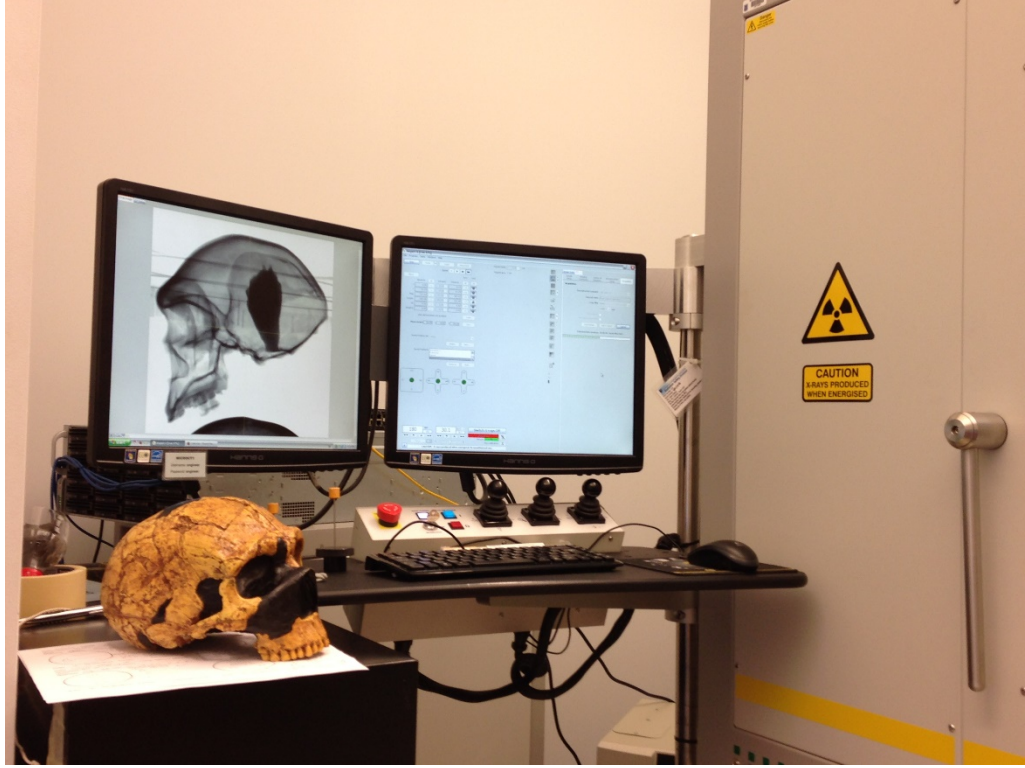
- Scans of casts from Duke Univ. anthropology collection
- Open in Meshlab
- Species name
- Age
- Locality
- Collector
- Collection year

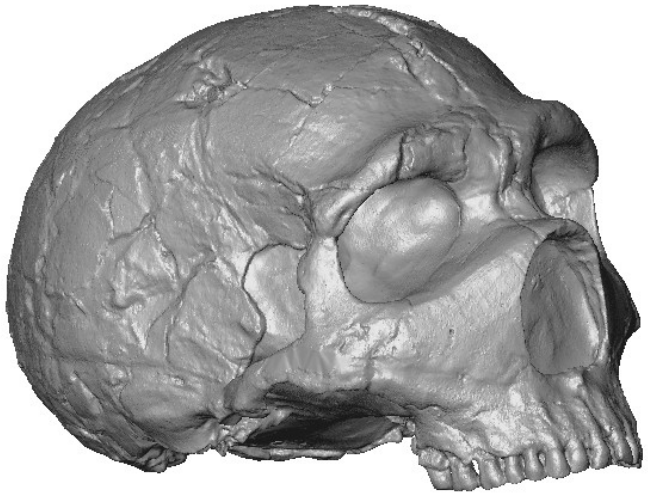


MorphoSource Resources

Basic features of the skull

- Brain size (cognition)
- Tooth size (diet)
- Canine size, shape (social structure)
- Tooth proportions (diet – foraging strategies – *Paranthropus* v. *Homo*)
- Face shape, prognathism
- Foramen magnum position (bipedalism)
- Mandible shape (chin)





MorphoSource Resources

Basic features of the skeleton

- Hand proportions (knuckle-walking, manual dexterity)
- Foot morphology (bipedalism)
- Pelvis form (bipedalism, obstetrics)
- Hindlimbs (joint size, length, knee shape)
- Vertebral column (lumbar lordosis and associated features)
- Shoulders (scapula form)