

GVZ 2023 18 April

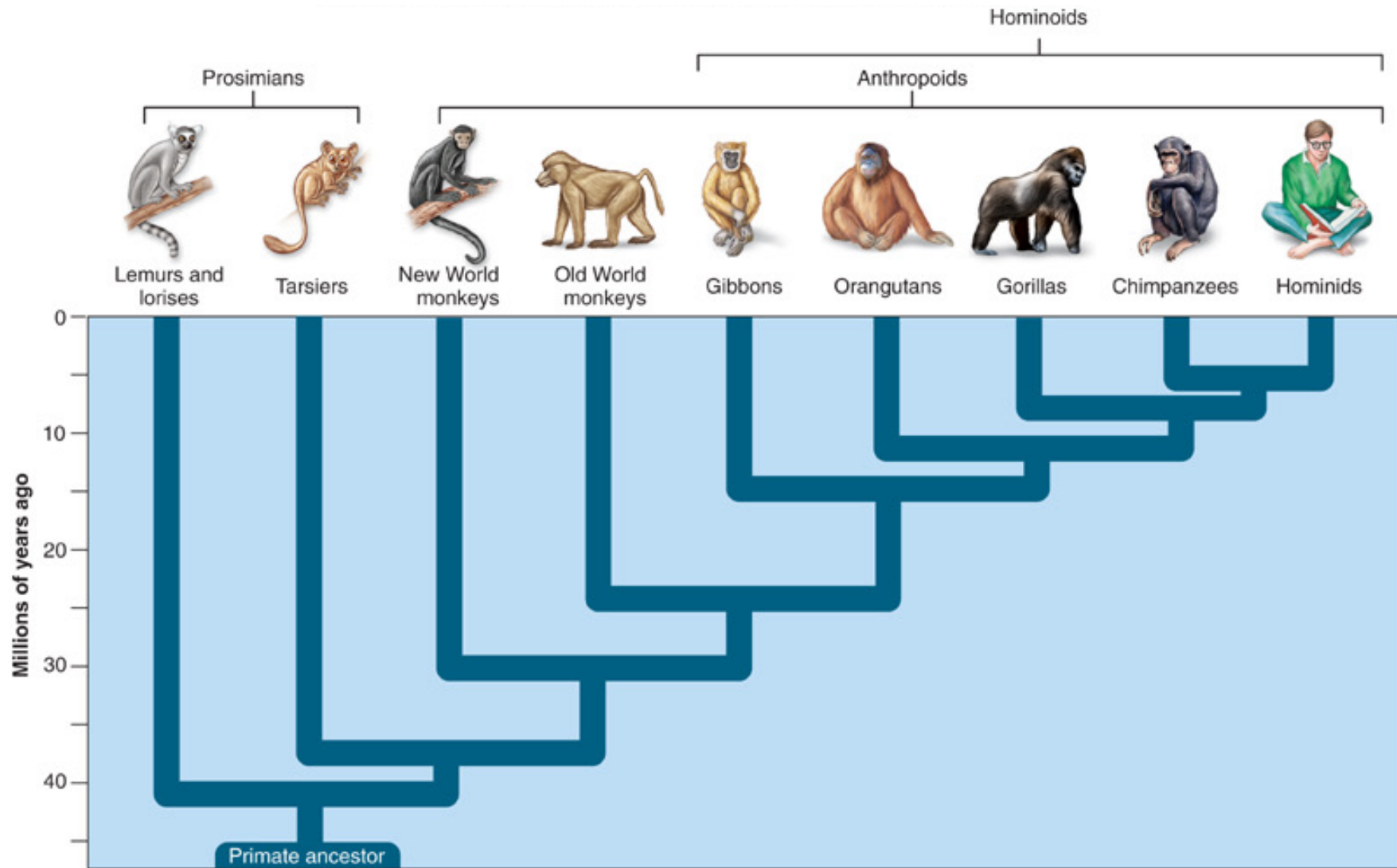
- Primates
- Human evolution



Primate synapomorphies

- Free moving shoulder and elbow joints
 - Arboreal locomotion
- Hindlimb-dominated locomotion
- Five functional digits on hands/feet
 - Opposable thumb and big toe
- Claws modified into nails
- Reduced olfactory, increased vision
 - Smaller snout
 - Large orbits
 - Binocular vision
- Large brain
- Small litter, long gestation, long period of parental care





Lemurs, pottos, lorises: **Strepsirrhini**

Anthropoids, tarsiers: **Haplorhini**

Strepsirrhini

- Lemurs: Madagascar
- Lorises: SE Asia, India
- Potto, Galagos: Africa
- Small, arboreal, diurnal (lemurs) or nocturnal (others)



Tarsiiformes

- Part of Haplorhini
- Southeast Asia islands
- Small, nocturnal, arboreal, carnivorous
- Elongate fingers, hindlimbs (tarsus)
- Large eyes



Simiiformes (Anthropoidea)

- Larger size
 - Body size and brain size increased
- Change of diet
 - Insectivorous to frugivorous/folivorous
- Change in activity
 - Nocturnal to diurnal
- Locomotion
 - From leaping and clinging to running and brachiating
- Includes monkeys and Hominoids



- Platyrrhini

- New World monkeys
 - flat face, lateral nostrils
 - prehensile tail (some)
 - frequent monogamy, male parental care
 - 3 premolars
 - structure of digits



- Cercopithecoidea (part of Catarrhini)

- Old World monkeys
 - downward nose, nostrils
 - polygamous
 - 2 premolars
 - structure of digits





Ethanol, Fruit Ripening, and the Historical Origins of Human Alcoholism in Primate Frugivory¹

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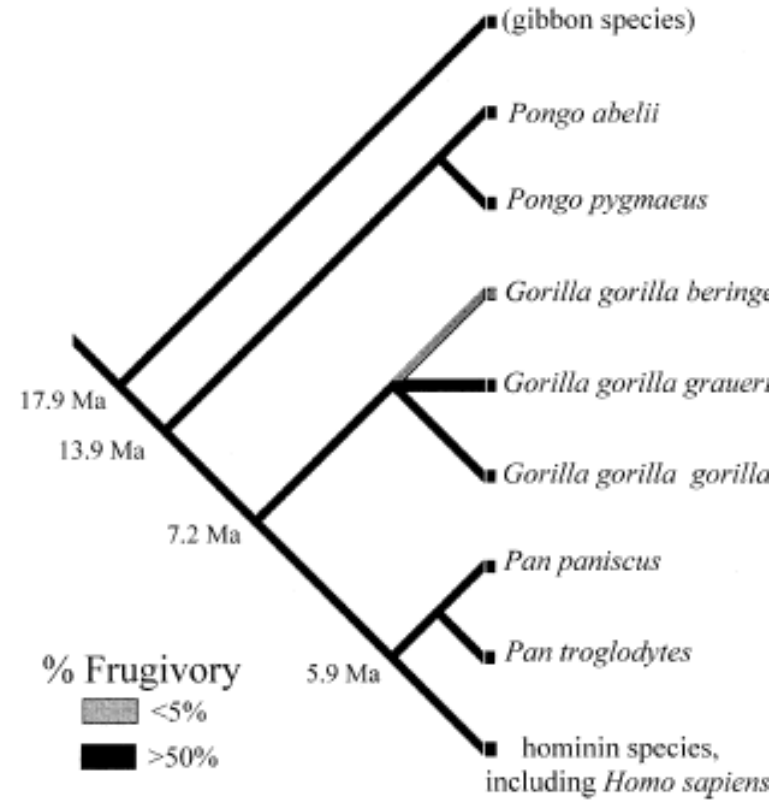
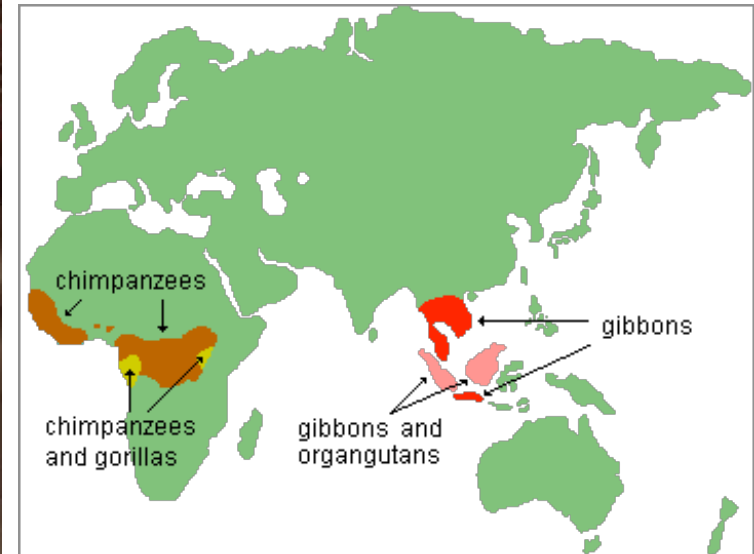


FIG. 3. Divergence and extent of frugivory for extant hominoids.

Hominoidea

- Gibbons
- Orangutans
- Chimpanzees
- Humans
- Gorillas



Hominoidea:
Human evolution



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Humans (*Homo*)

- Diverged from other great apes ~4-8 Mya
- Three synapomorphies
 - Bipedal stance
 - S-shaped curvature of vertebrae
 - Pelvic modifications
 - changes in leg bones
 - Flattened feet, unopposable big toe
 - Large brains
 - Linked to locomotion and hand manipulation
 - Speech and Language
 - larynx shifted back, use of tongue



DNA comparison



98%
similar

↔



86%
similar

↔



(Not exclusively) Human traits

- Language
- Tool use
- Handedness
- "Intelligence"
- Thanatopsis
- Cooking and fire use
- Dancing



(Not exclusively) Human traits

- Language



The Meanings of Chimpanzee Gestures

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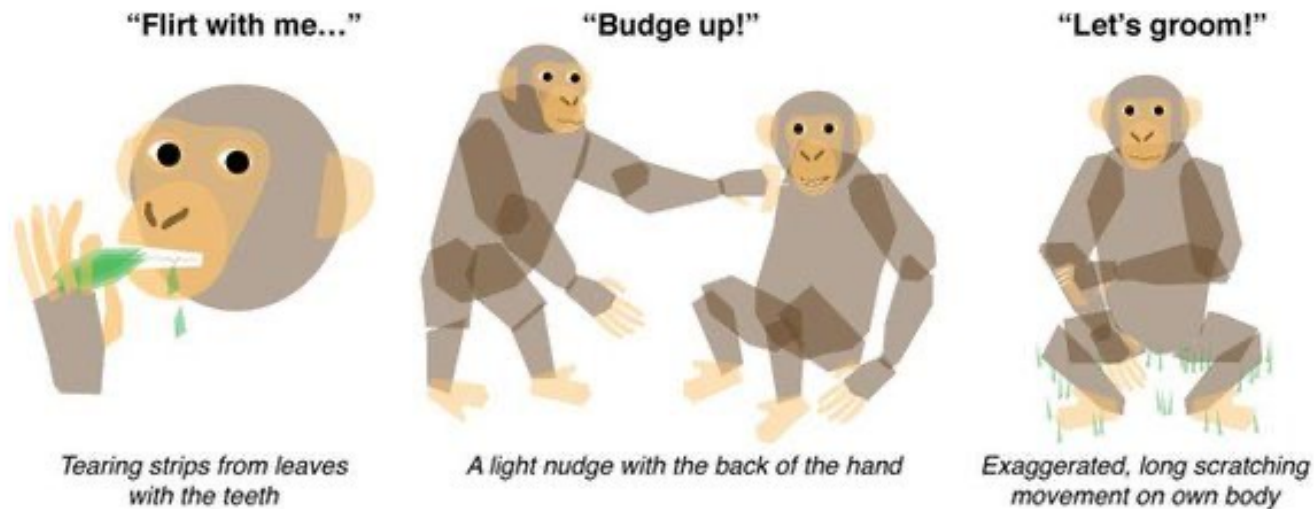


Table 2. Primary or Secondary Gesture Meanings, Excluding Play

Apparently Satisfactory Outcome	N ₁ (Primary)	N ₁₊₂ (Primary or Secondary)	N ₁₊₂₊₃ (Primary, Secondary, or Tertiary)
“Stop that”	9	16	20
“Move away”	7	13	14
“Contact”	4	7	10
“Acquire object”	4	5	8
“Follow me”	3	6	10
“Move closer”	3	6	8
“Sexual attention” (to male)	3	5	7
“Climb on me”	2	4	6
“Initiate grooming”	1	3	4
“Sexual attention” (to female)	1	2	2
“Reposition body”	1	2	2
“Attend to specific location”	1	1	1
“Travel with me” (adult)	0	2	2
“Climb on you” ^a	0	0	1
“Travel with me” (infant) ^a	0	0	0

The apparently satisfactory outcome (ASO, as defined in [Table S1](#); see [Table S3](#) for data) listed in order of the number of gesture types (N) to which they are associated as the primary, then secondary, or tertiary ASO for each gesture type.

^aThese two ASOs were recorded only as the tertiary or even less frequent outcome of a gesture type, as used by the community as a whole. However, their use was necessarily limited to young infant signalers; evidently they would be more prominently represented in a study of infant gesturing.

(Not exclusively) Human traits

- Tool use





Is primate tool use special? Chimpanzee and New Caledonian crow compared

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Table 1. Summary of chimpanzee (*Pan troglodytes*) and new Caledonian crow (*Corvus moneduloides*) compared on five aspects of tool-use (from [25]). (First number before comma is types seen in nature, second is for captivity.)

species	components of elementary technology ($n = 5$)	modes of tool use ($n = 22$)	modes of tool making ($n = 4$)	functions of tool use ($n = 7$) ^a	modes of associative technology ($n = 5$)
chimpanzee	5,5	20,22	4,4	6,6	5,5
New Caledonian crow	5,4	4,4	3,3	2,2	0,2

^aShumaker *et al.*'s criteria for 'symbolize' are operationally problematic, but chimpanzee fantasy play seems to meet them.

(Not exclusively) Human traits

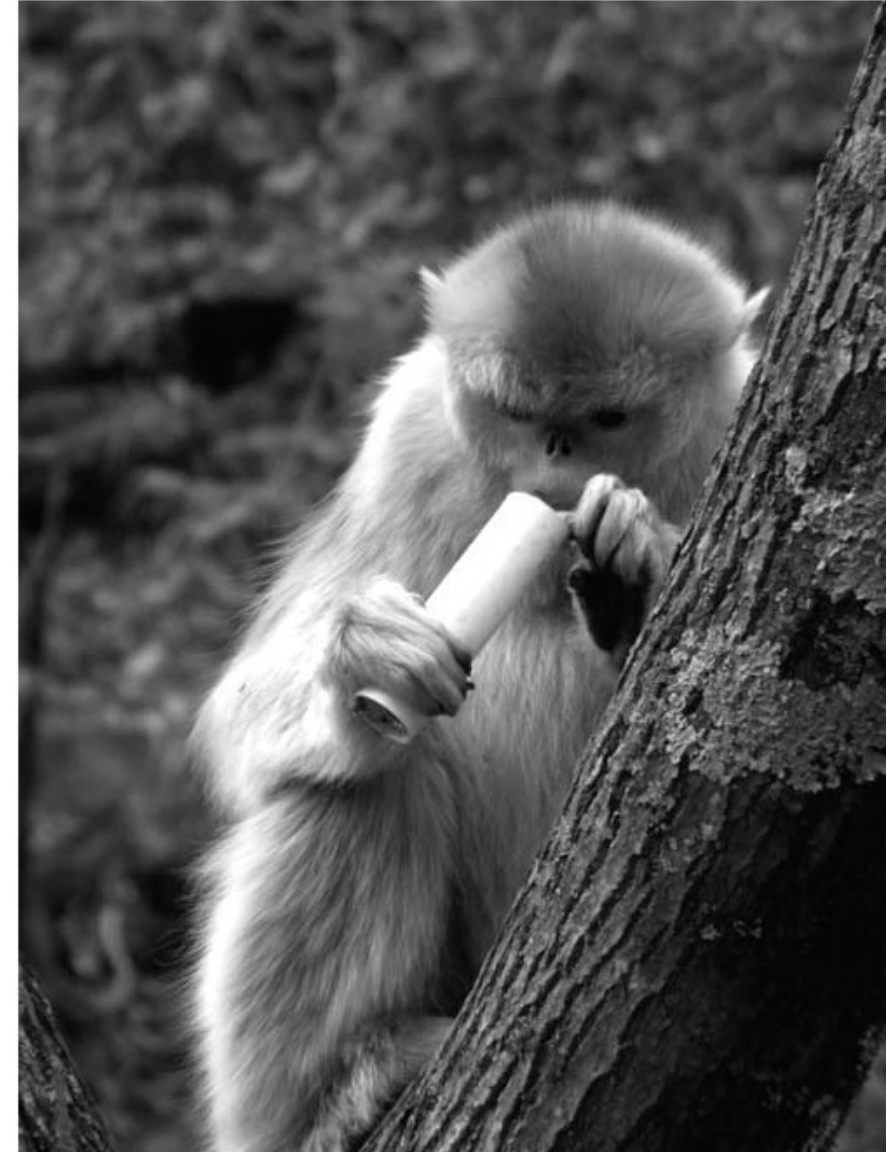
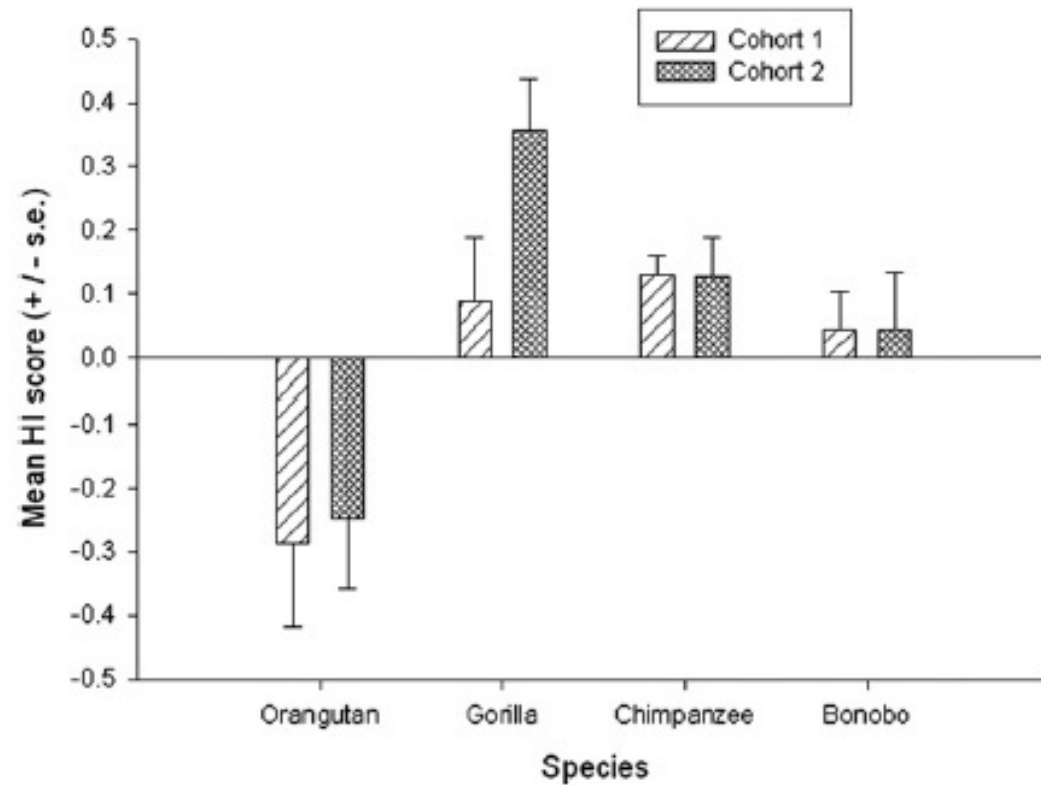
- Handedness





Hand preferences for coordinated bimanual actions in 777 great apes: Implications for the evolution of handedness in Hominins

William D. Hopkins^{a,b,c,*}, Kimberley A. Phillips^d, Amanda Bania^e, Sarah E. Calcutt^f, Molly Gardner^g,
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(Not exclusively) Human traits

- "Intelligence"



Why are there so many explanations for primate brain evolution?

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Table 1. Comparison of the main hypotheses for brain evolution against the five key explanatory criteria.

criteria	hypothesis can explain ^a					
	instrumental	MIH	CIH	VIH	SH	SBH
(i) primates have larger brains than other animals	X	✓	X	(✓)	(✓)	✓
(ii) quantitative variation in primate brain size	✓	(✓)	X	X	X	✓
(iii) brain size correlates with group size in primates	X	X	X	X	X	✓
(iv) primate sociality is complex (bonded)	X	X	X	X	(✓)	✓
(v) pairbonded non-primates have large brains	X	X	X	X	✓	✓
(vi) some primates are more innovative technically	✓	X	✓	X	X	✓

^a✓, the hypothesis provides an explanation for the phenomenon indicated; X, hypothesis is unable to account for the phenomenon. Parentheses indicate cases where the evidence is arguable.

(Not exclusively) Human traits

- Thanatopsis



(Not exclusively) Human traits

- Cooking and fire use



Cognitive capacities for cooking in chimpanzees

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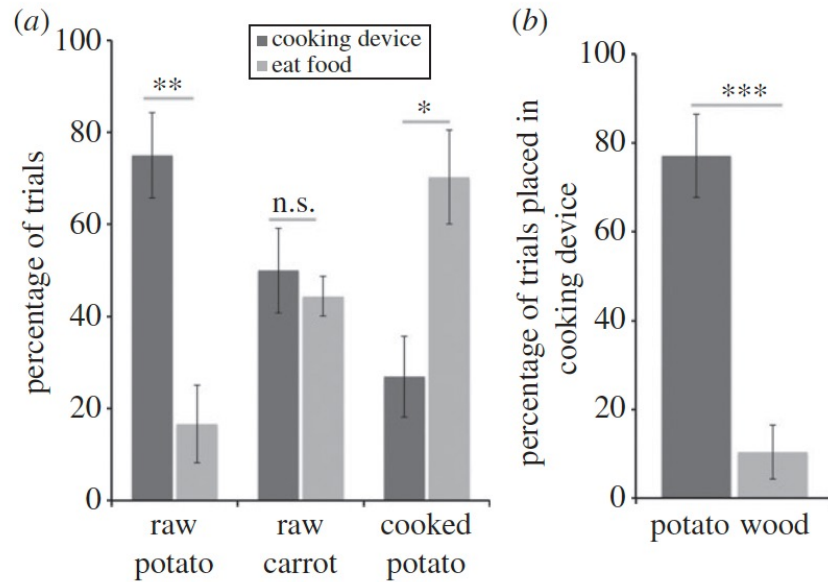
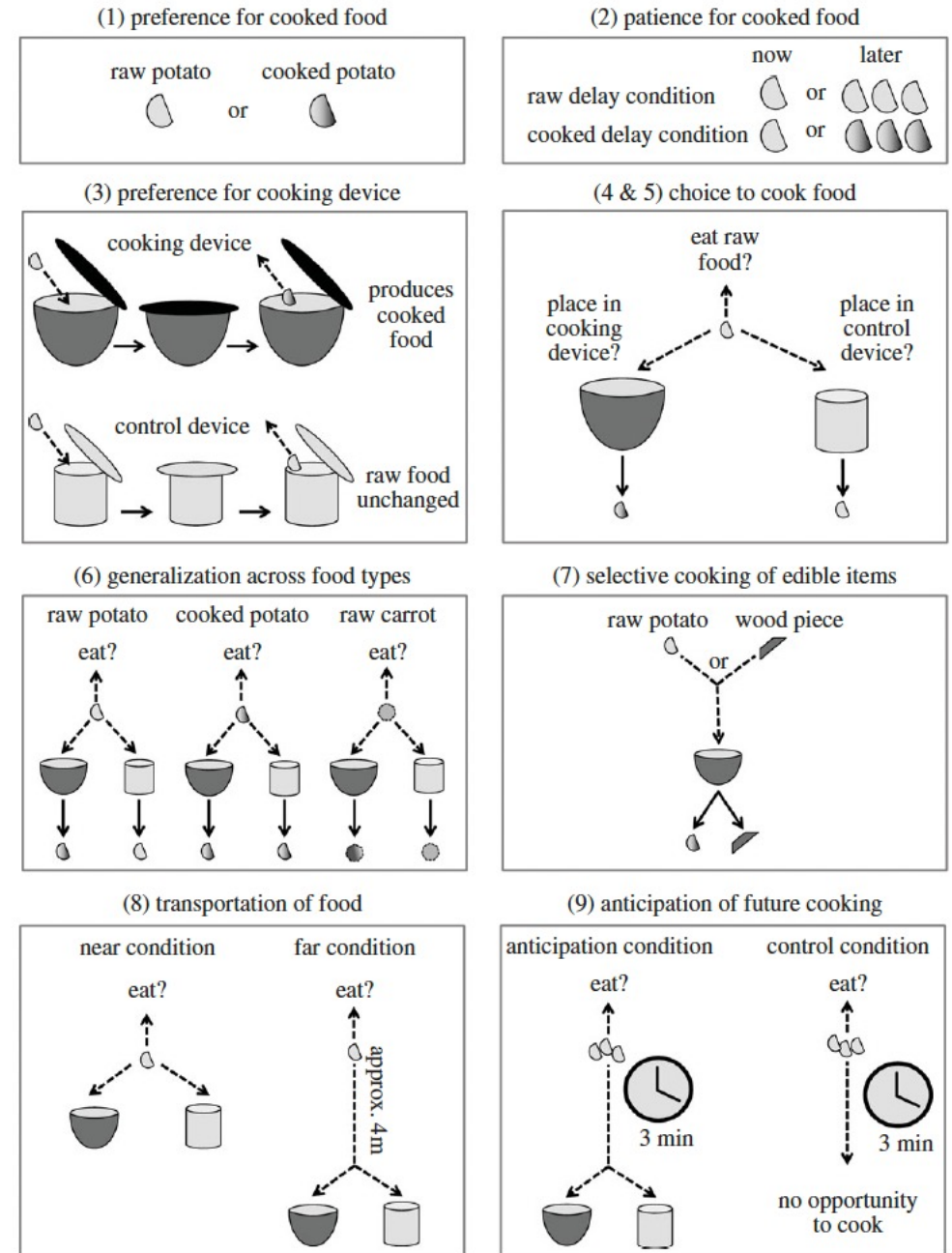


Figure 3. Comprehension of cooking transformation. (a) Percentage of trials where chimpanzees chose to eat versus cook raw potato, pre-cooked potato and novel raw carrot (experiment 6). (b) Percentage of trials where chimpanzees chose to place raw potato in the cooking device compared with an inedible item (experiment 7). Error bars indicate s.e.; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.



(Not exclusively) Human traits



- Dancing

Rhythmic swaying induced by sound in chimpanzees (*Pan troglodytes*)

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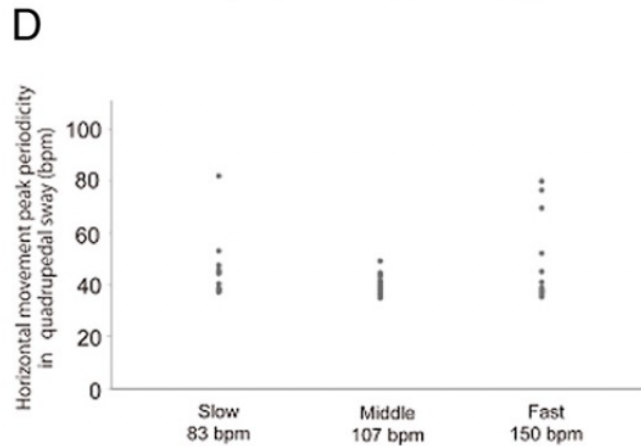
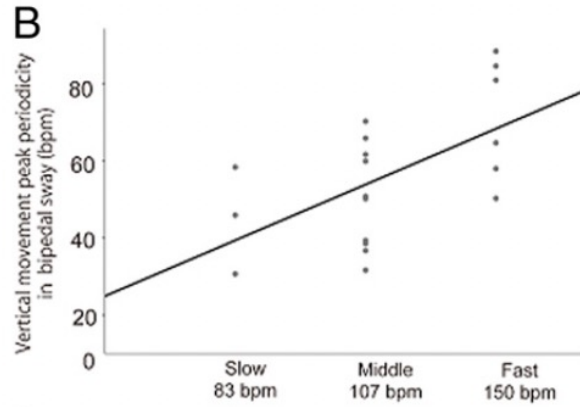
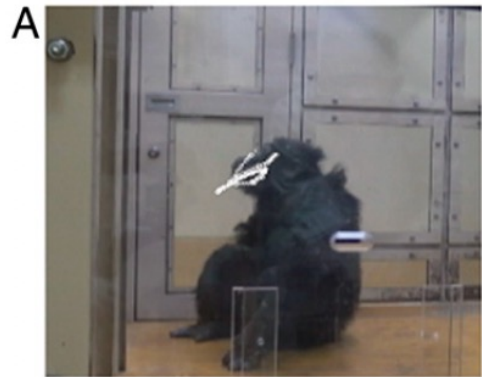


Table 1. Percentage of rhythmic movement observed

	Whole body movement			Partial body movement			Combination of whole body and partial body
	Bipedal sway	Quadrupedal sway	Hanging sway	Hand clapping	Knocking/banging	Foot tapping	
Akira (M)	75.28	22.08	0.31	0	1.07	0	0.81
Ayumu (M)	62.99	9.7	25.37	0	0.62	0	1.32
Gon (M)	6.84	52.11	0	8.07	32.32	0	0.66
Cleo (F)	64.26	28.14	0	5.85	1.74	0	0
Ai (F)	46.89	0	3.5	0	0	49.62	0
Pal (F)	1.6	8.13	11.23	55.83	12.15	0	0
Chloe (F)	0	0	100	0	0	0	0

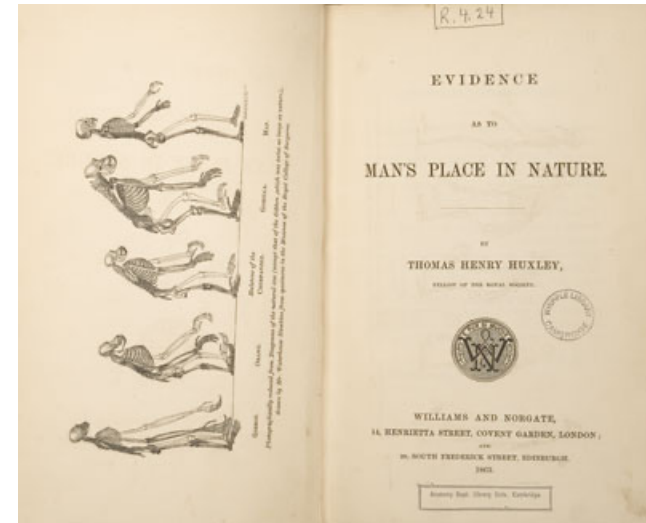
Bipedal sway, swaying in an upright, 2-legged stance; Quadrupedal sway, swaying while standing on all fours; Hanging sway, swaying when hanging from ceiling bars; Hand clapping, clapping the hands; Knocking/banging, knocking or banging a panel with the hands; Foot tapping, tapping the foot. F, female; M, male.

Evolution of humans



Great moments in the study of human evolution: Texts

- GL LeClerq 1749 *Histoire Naturelle*
 - discusses (but rejects) human-ape link
- Others suggested relationship (Chambers, Lamarck) or classified humans as primates (Linnaeus)
- TH Huxley 1863 *Evidence as to Man's Place in Nature*
 - Compelling anatomical arguments
- C Darwin 1871
 - *The Descent of Man*
 - Focus on sexual selection



Huxley 1863

- "Without question... [man's] early stages of development... far nearer the apes, than apes are to the dog"
- "Is man so different from any of these apes that he must form an order by himself?"
- "It is quite certain that the ape which most nearly approaches man is either the Chimpanzee, or the Gorilla..."
- "Thus, whatever system of organs be studied, the comparison of their modifications in the ape series leads to one and the same result—that the structural differences which separate Man from the Gorilla and the Chimpanzee are not so great as those which separate the Gorilla from the lower apes...But if man be separated by no greater structural barrier from the brutes than they are from each other—then it seems to follow that... there would be no rational ground for doubting that man might have originated... by the gradual modification of a man-like ape"
- "At the present moment there is but one hypothesis which has any scientific existence—that propounded by Mr. Darwin"

Great moments in the study of human evolution: Discoveries

- 1856 *Homo neanderthalensis*
- 1891 *Homo erectus*
- 1924 *Australopithecus africanus*
- 1938 *Paranthropus robustus*
- 1974 *Australopithecus afarensis*
- 1992/2009 *Ardipithecus ramidus*

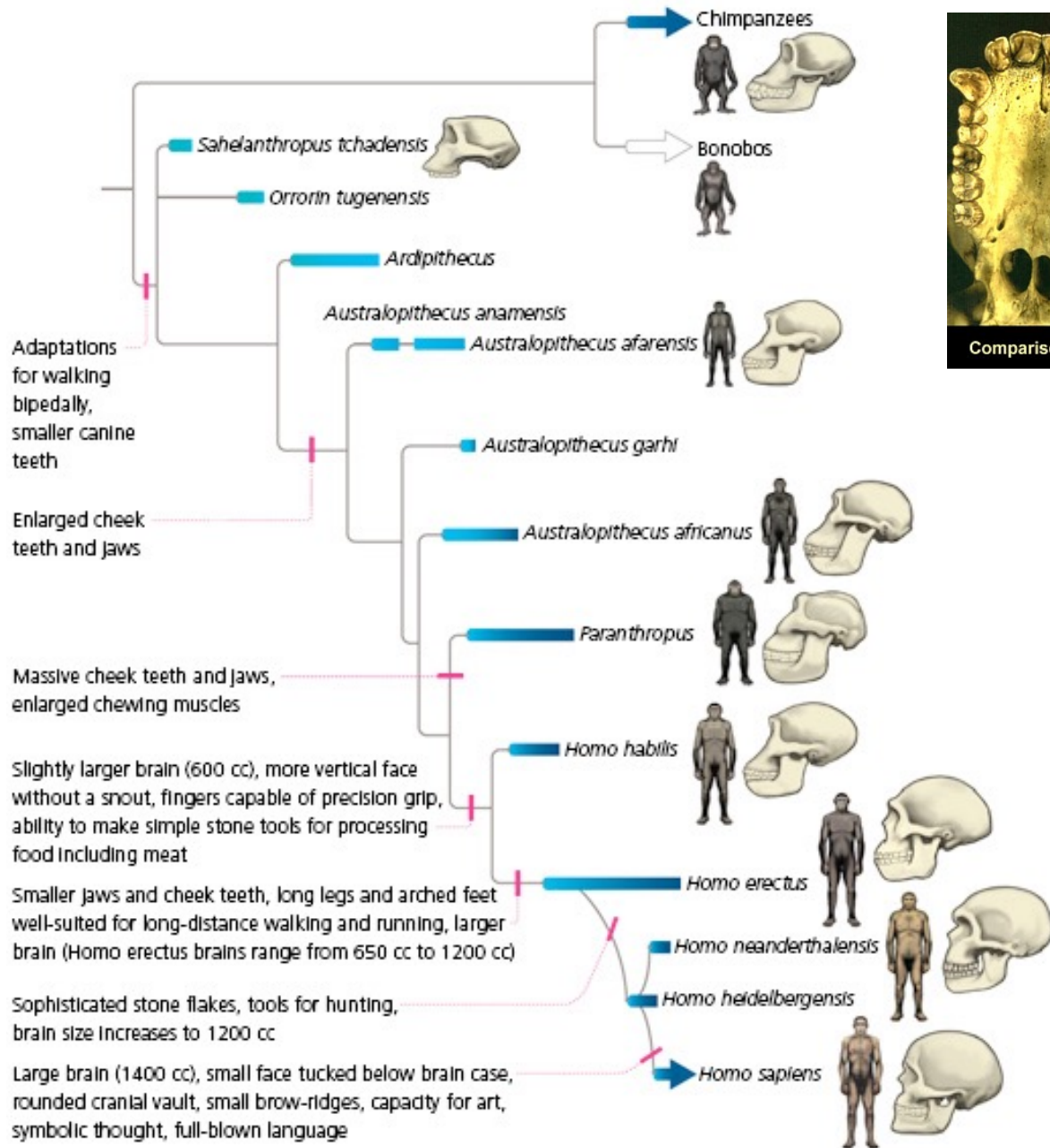


Great moments in the study of human evolution: Discoveries



<https://www.youtube.com/watch?v=yD3AZ8t8zK0>



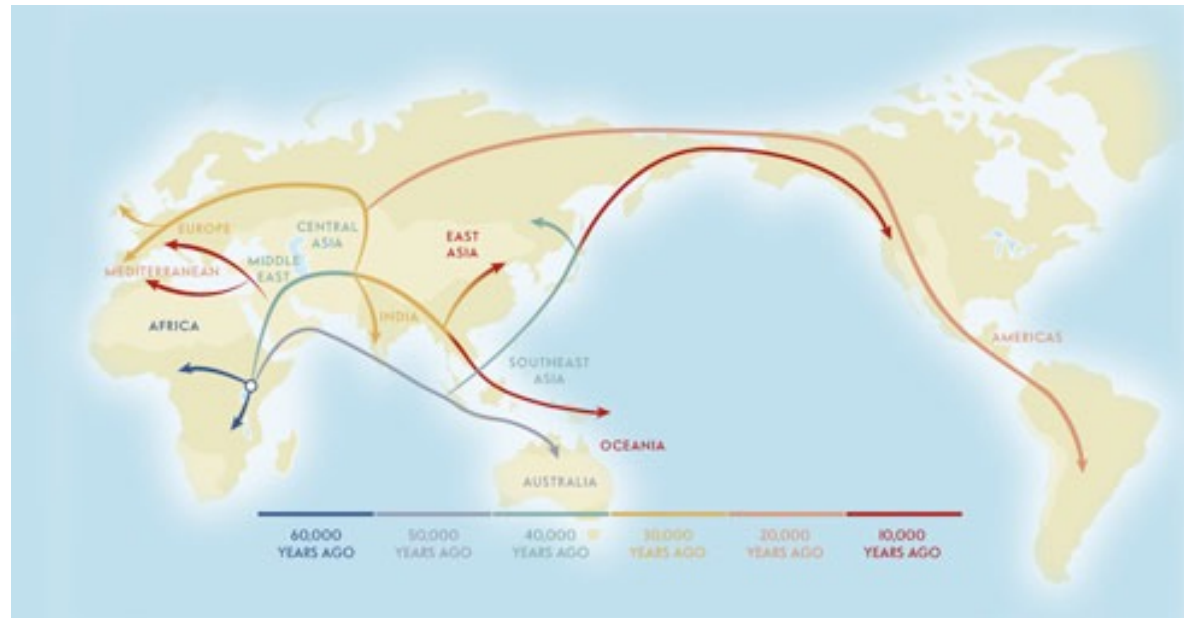


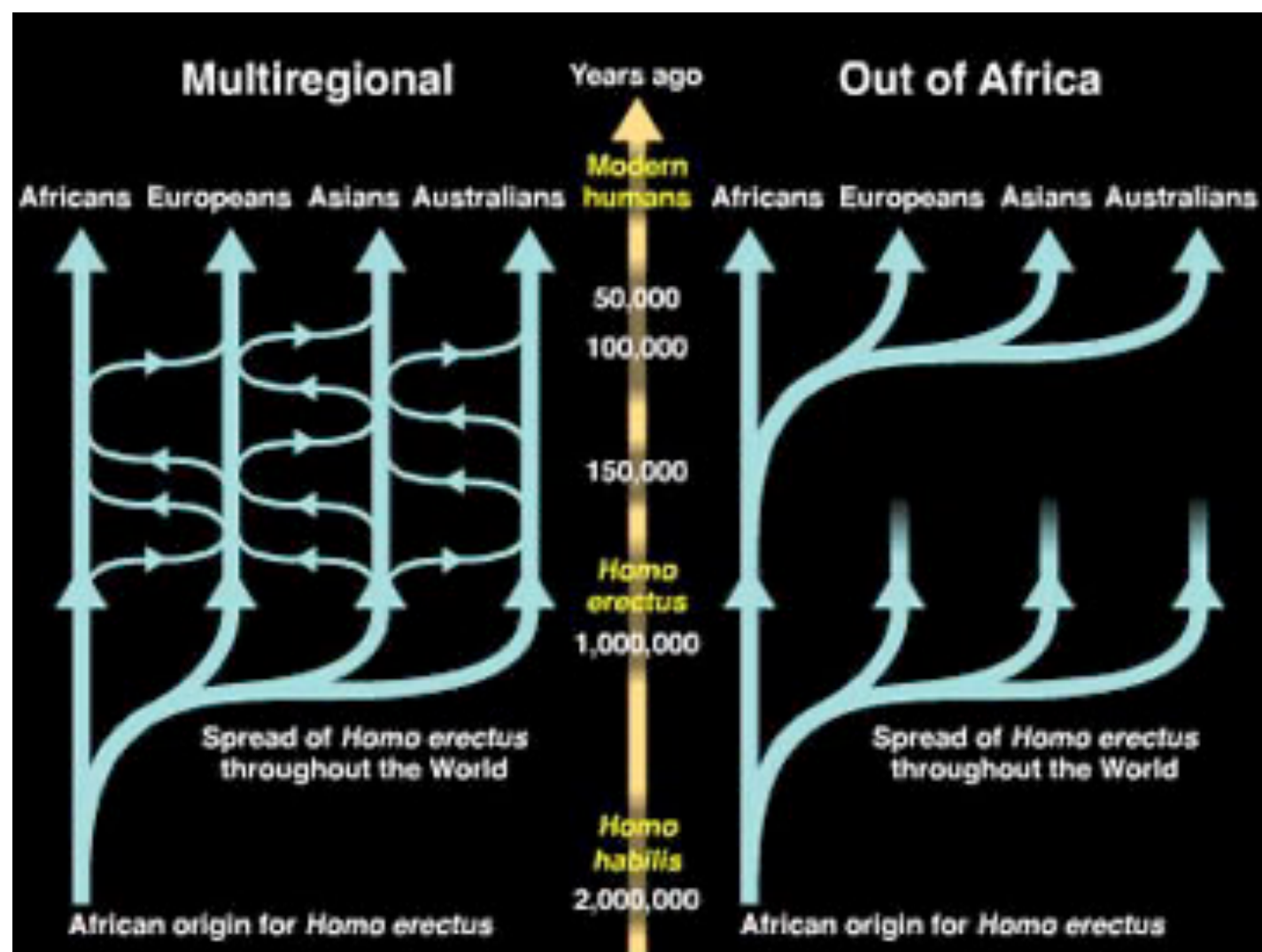
Hypotheses of Human Evolution

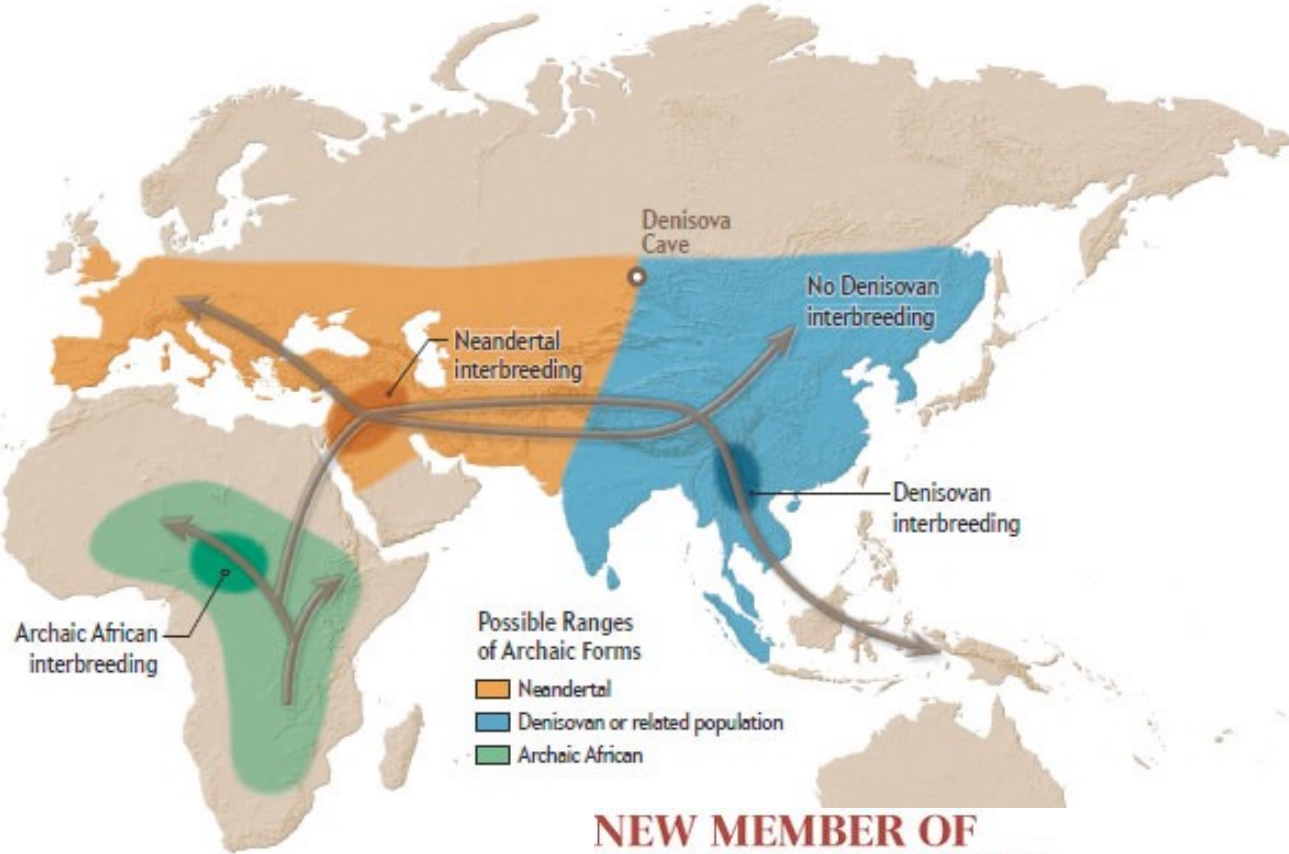
- Multiregional (Milford Wolpoff 1988)
 1. Origin in Africa
 2. *Homo* dispersal to other continents 2 mya
 3. Worldwide species evolves to modern *Homo sapiens*
H. erectus = *H. sapiens* = *H. neanderthalensis*

Hypotheses of human evolution

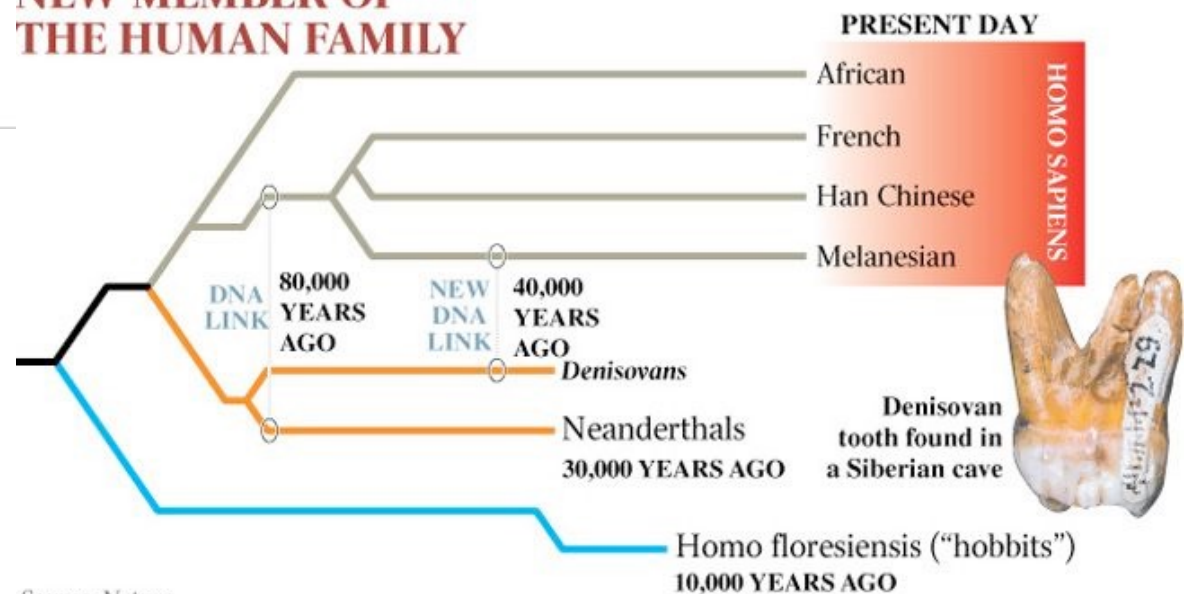
- "Out of Africa"/Recent African Origin
 1. Origin in Africa
 2. *H. erectus* (1.9 mya) and *H. neanderthalensis* (400K ya) migrate to Europe, Asia
 3. *H. sapiens* leaves Africa 60K ya, colonizes world, outcompetes other forms







NEW MEMBER OF THE HUMAN FAMILY





SIMPSONS
HAPPY

Mammals Reading

- Berkeley, Edinburgh museums; Pough et al.
- Rowe [definition, diagnosis]
- Rowe and Gauthier [mammal names]
- Tattersal [human origins]
- Danneman and Racimo [introgression]
- Hobaiter and Byrne [communication], McGrew [tool use], Hopkins [handedness], Goncalves [thanatopsis], Warnekin [cooking], Hattori [music]