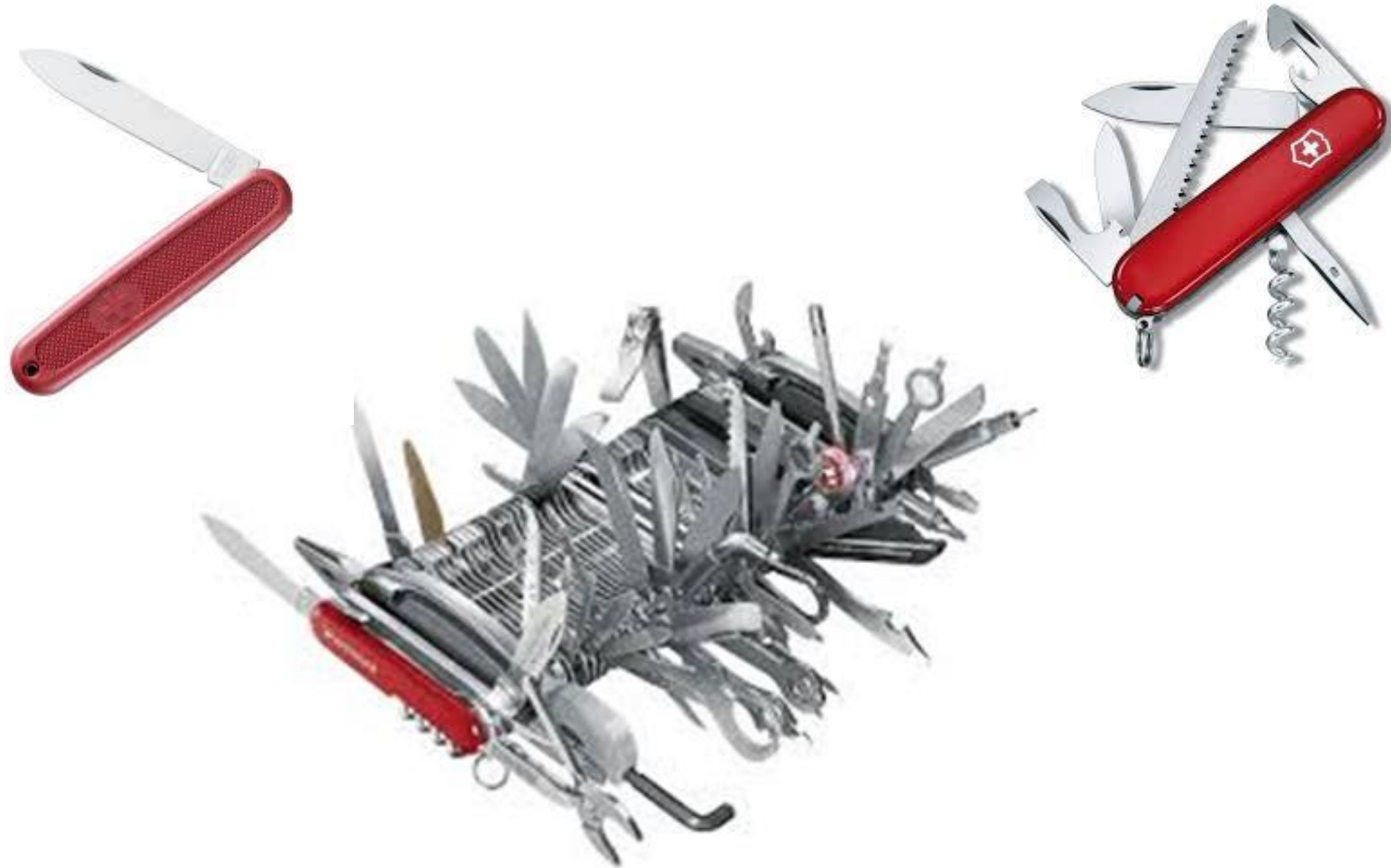
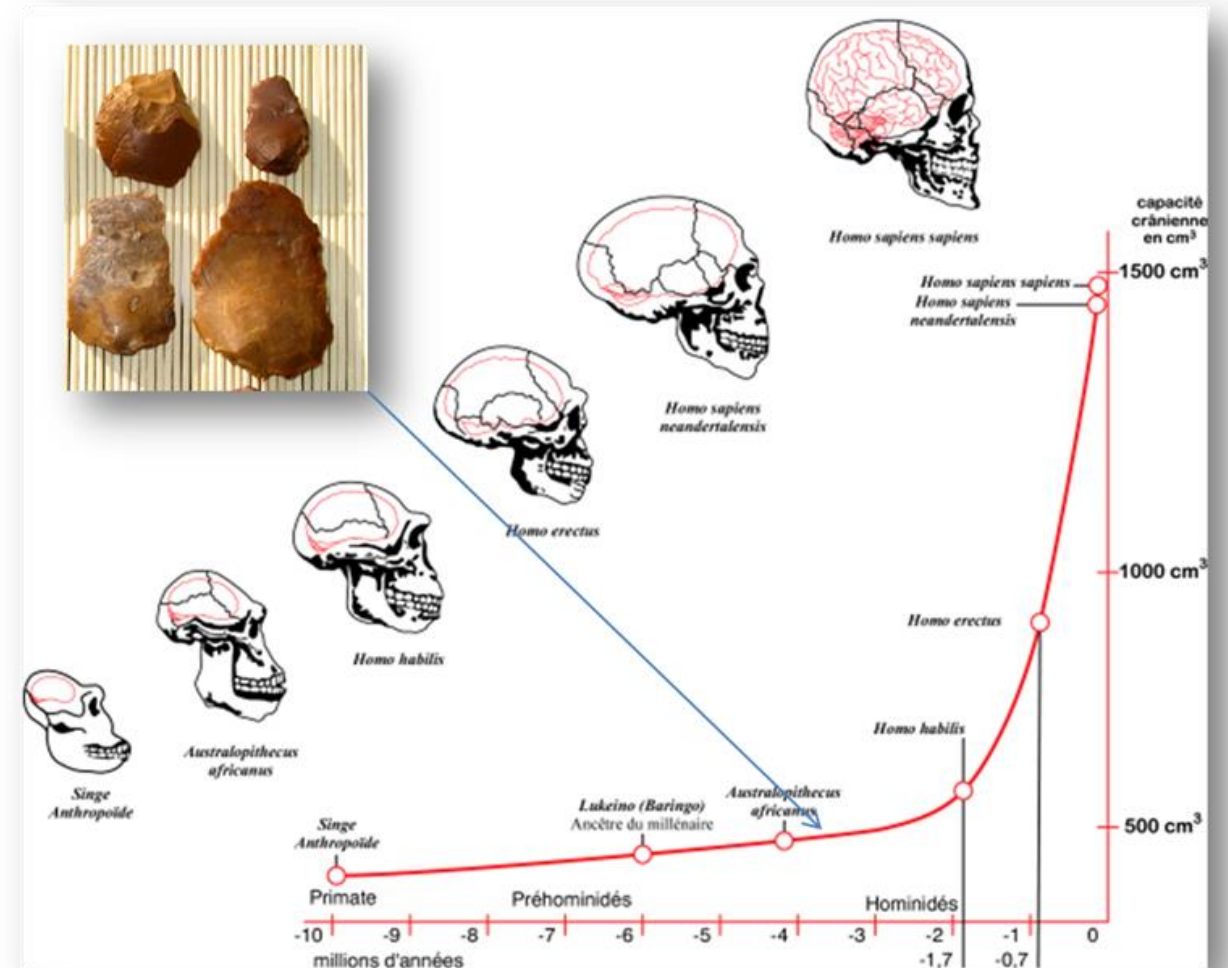


Lecture 1. Culture and cultural transmission



Culture and human evolution

- Humans became dependent on material culture before most of the biological, genetic changes that made us human took place



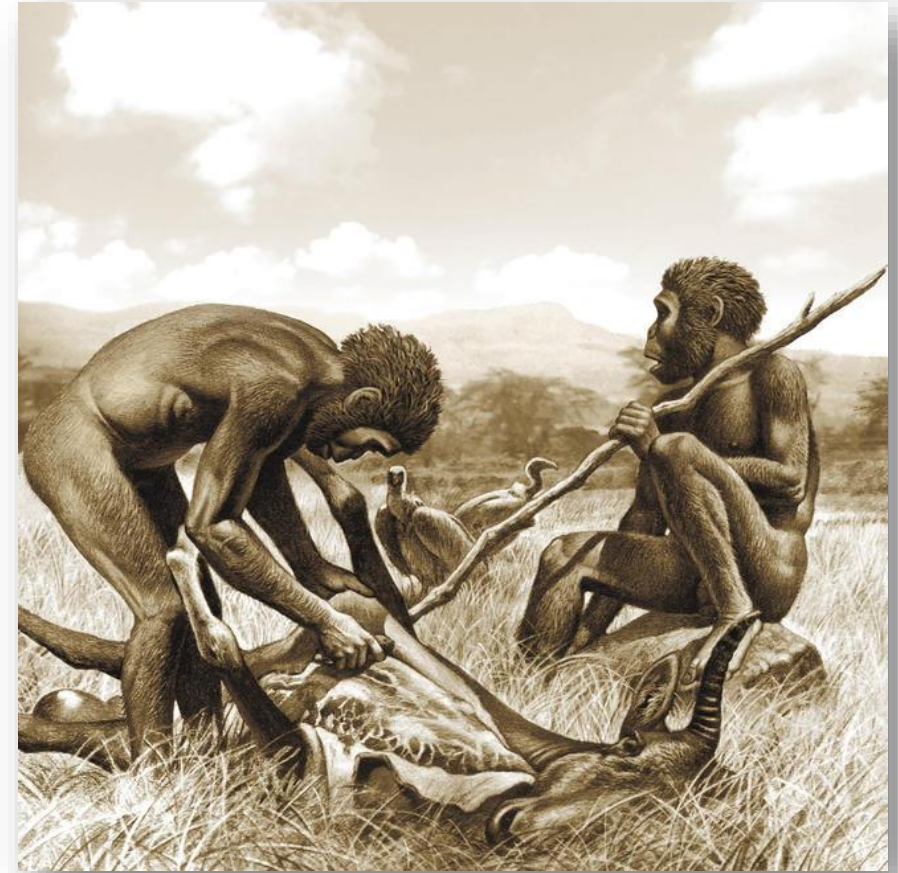
Cultural mediation

- Significant cultural mediation of hominin life style started a long time ago
 - and may define the genus *Homo*
- ‘core-flake-hammerstone technology (Oldowan) temporally persistent beginning ~2.0Ma’
- ‘acquisition of large animal tissues by hunting and butchery’
- ‘tool-edge wear consistent with processing underground tubers and roots’
- “Increasing cultural mediation...through technology and social factors...would be essential to buffer against fluctuating climatic conditions’ (Anton et al 2014)



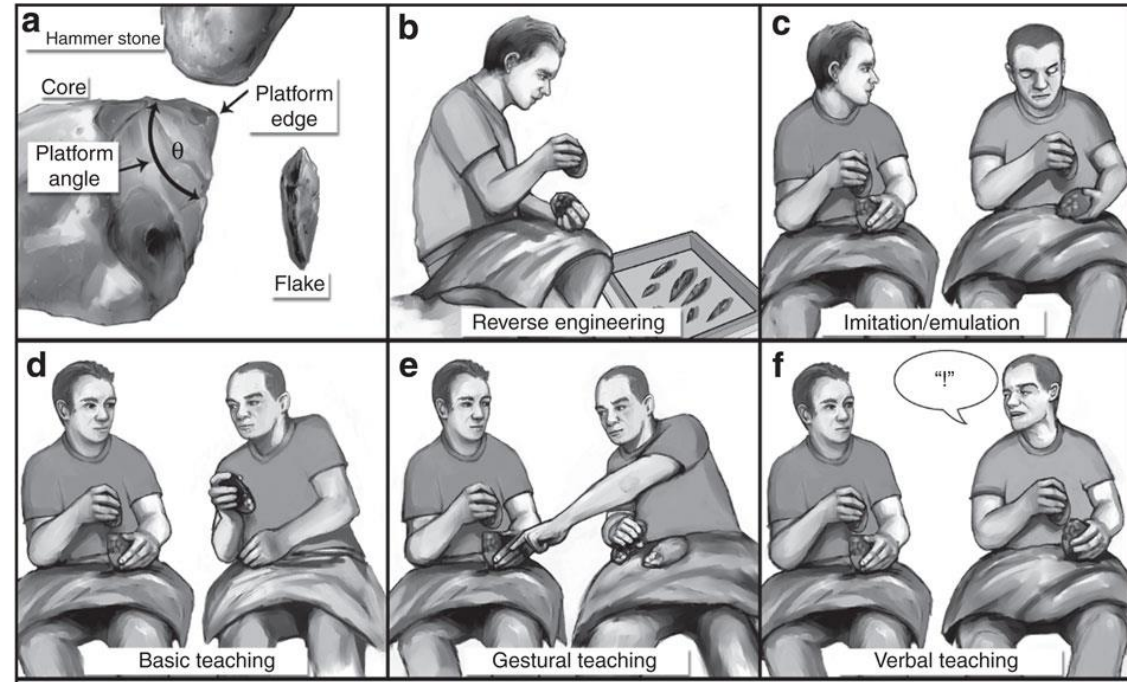
The technological hypothesis

- From ~3.2 Mya (at least), humans became more dependent on stone tools
 - meat extraction
 - gathering of energy-rich tubers/roots
- ‘Technological Hypothesis’: language evolved due to tool-making
 - teaching aid
 - first as gesture (tool-making is a manual skill)
 - later as speech (more complex lithic industries)



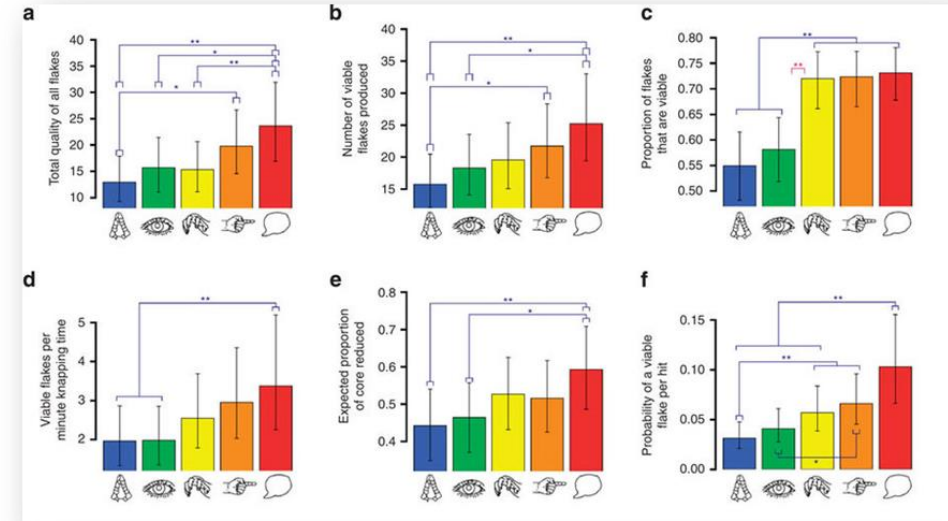
Transmission of tool-making skills

- Morgan et al. (2015) compared efficiency of transmission of Oldowan stone tool-making skills (Mode 1, ~2.5 Mya) under five treatments
 - reverse engineering (asocial learning)
 - imitation
 - basic teaching
 - gestural teaching
 - verbal teaching (‘full language’)



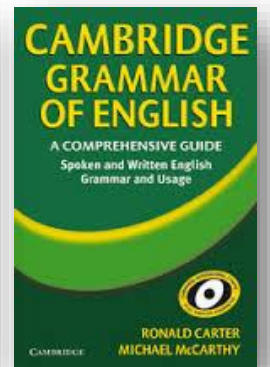
Tool-making skills required language

- Social transmission of Oldowan technology is enhanced by teaching and especially by language
- *Gestural* language would be enough for Oldowan transmission
- Speech may have emerged as a more *general* medium of transmission of cultural information



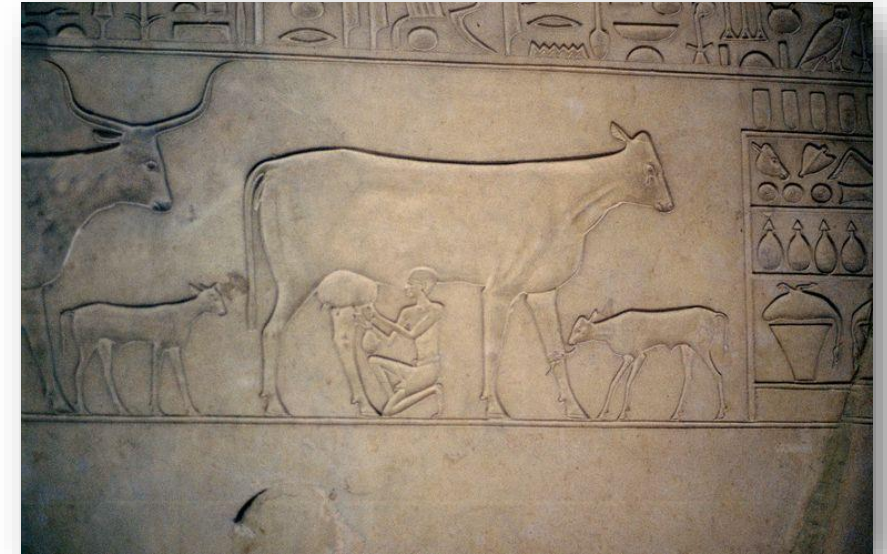
Grammaticalisation: languages evolve too

- Language may have evolved to facilitate cultural transmission, but it may have evolved as another aspect of cumulative culture (Tomasello)
 - a communication technology



Gene-culture co-evolution

- So cultural and cognitive evolution affect each other
- Gene-culture co-evolution explains recent processes
 - lactase persistence
- It may also explain how certain cognitive features of humans evolved
 - they may have evolved to allow the acquisition, creation and transmission of culture
- If this is the case, certain cognitive abilities are both ‘genetic’ and ‘learned’



Imitation and over-imitation

- Over-imitation has been widely seen as a unique human trait
 - cognitive predisposition required for cultural acquisition absent in other species
- Classic example: babies were claimed to imitate facial gestures, sounds, tongue protrusion



Imitation and over-imitation

- However, after 40 years, no study has managed to replicate the original results!
 - only tongue protrusion
- Then a recent study has shown that tongue protrusion is not an example of imitation, but a general response to arousal
- Therefore, imitation is both learned and an evolved ability beyond what is observed in other species
 - Example: the ability to learn 30,000 words is genetic, but not the 30,000 words themselves (we have to learn them)!
- Increase in human cultural repertoire:
 - pressure on learning abilities
 - increase in cultural learning

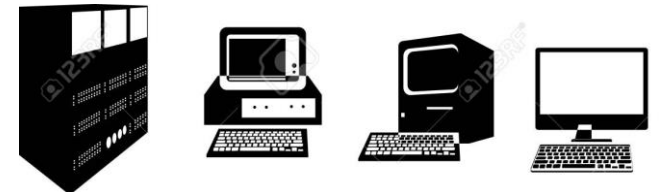
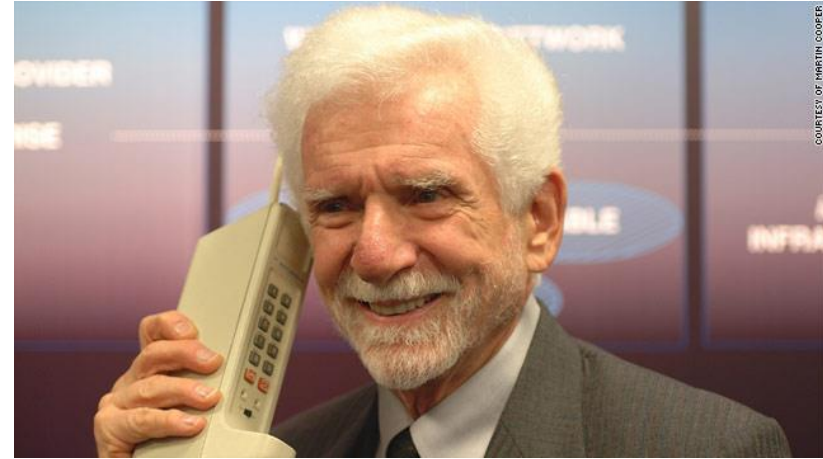


Cognitive abilities behind cultural transmission

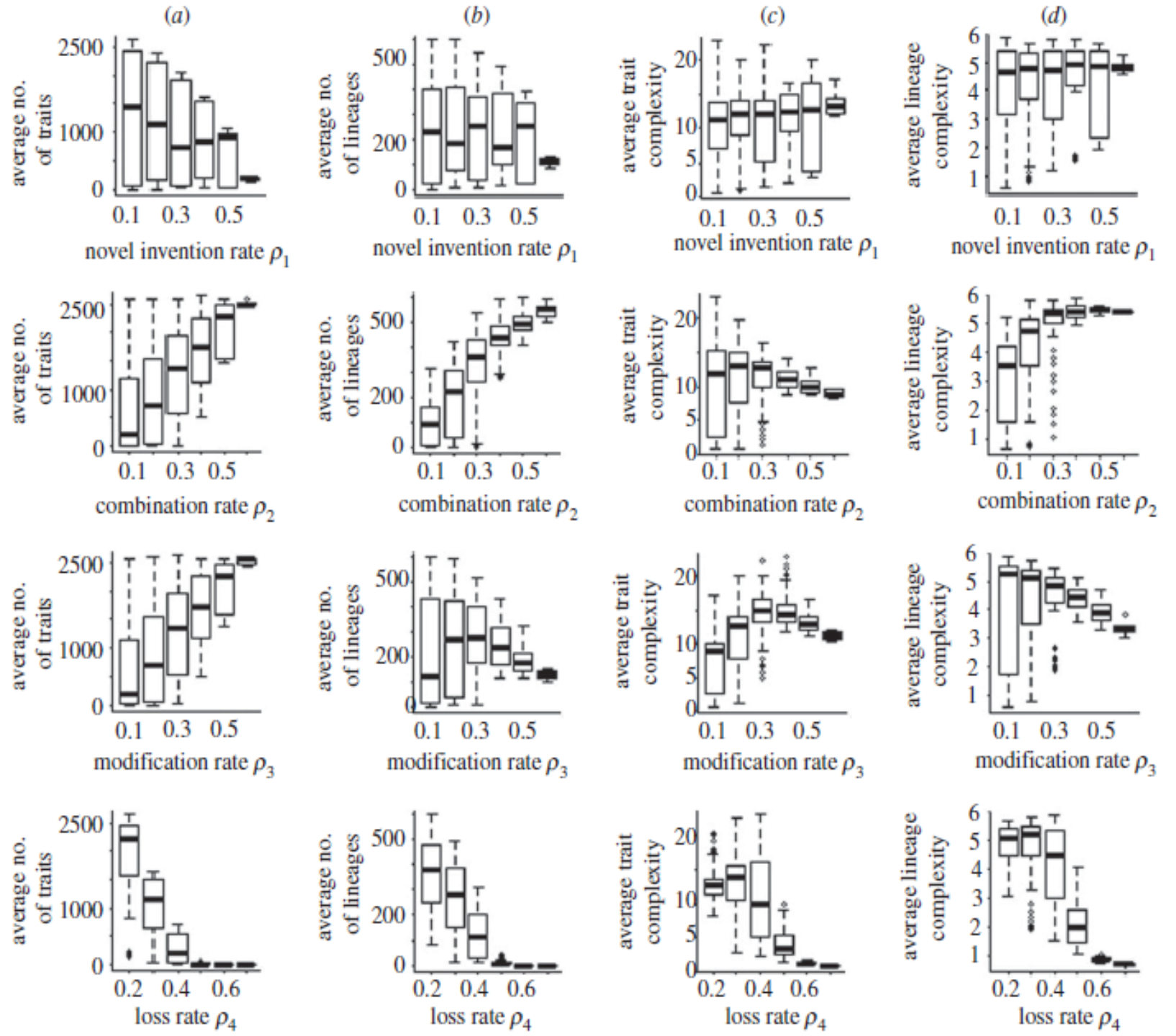
- The ability to learn and transmit culture is only one of the cognitive abilities required for the evolution of cumulative culture
- Lewis and Laland (2012) simulated the dependence of cultural evolution on various cognitive abilities

Cognitive abilities behind cultural transmission

- **(1) Innovation:**
generation of entirely new traits
- **(2) Modification:**
gradual refinement of existing traits
- **(3) recombination:**
bringing together two established traits to generate a new trait
- **(4) transmission fidelity:** ability to avoid cultural loss or deterioration



- **Innovation** was the least important factor
- **Modification** and **recombination** were important
- **Fidelity** had the strongest effect



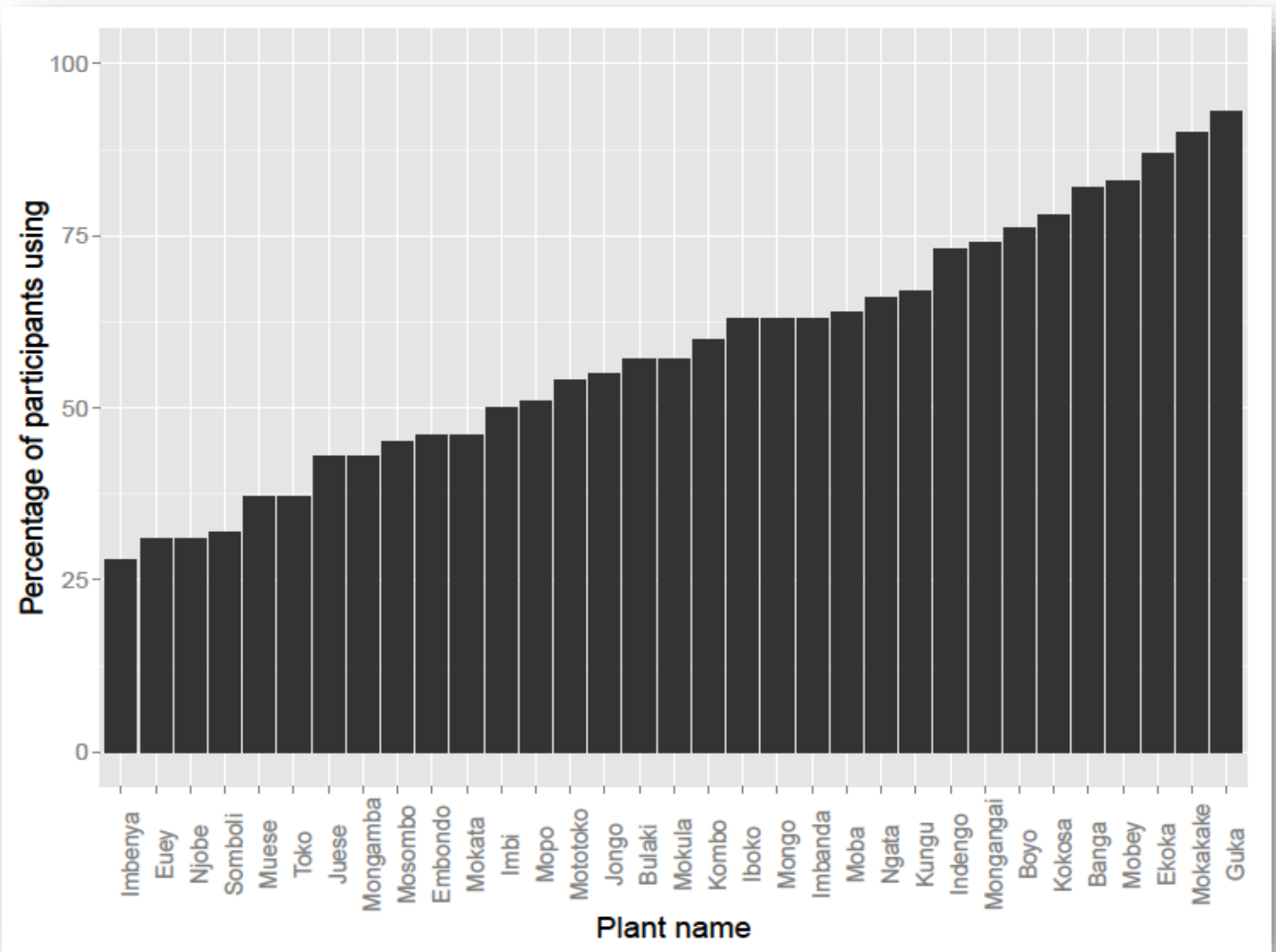
Cultural knowledge

- Studies have placed too much emphasis on individual abilities
- Cultural information must be transmitted across social networks
- In fact, cultural information is stored by social networks
- Social networks have a superior ‘memory’ to individual brains



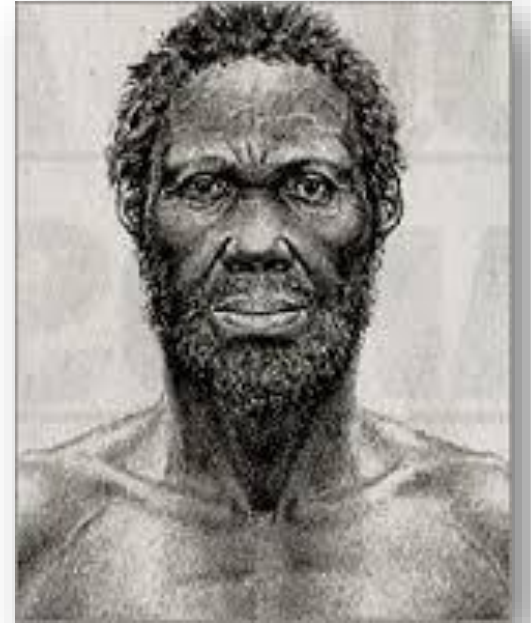
Plant medicinal knowledge

- Salali et al 2016: 35 plants with medicinal and other uses
- No plant was known by all 200 BaYaka (average ~60%)



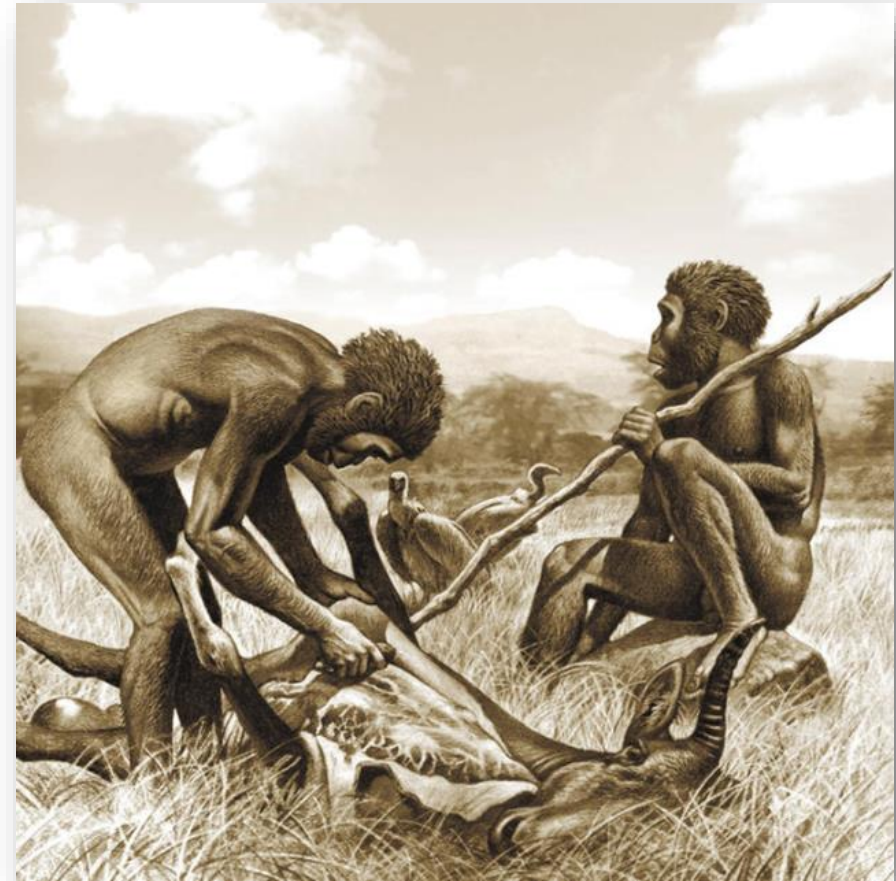
Dual inheritance system

- Gene-culture co-evolution results in a ‘dual inheritance system’
 - phenotypes transmitted both genetically and culturally
- Cultural component of the human dual system has increased faster than the genetic component
 - most changes probably related to gene-culture co-evolution
- Outcome: human evolution increasingly and gradually reflecting cultural evolution



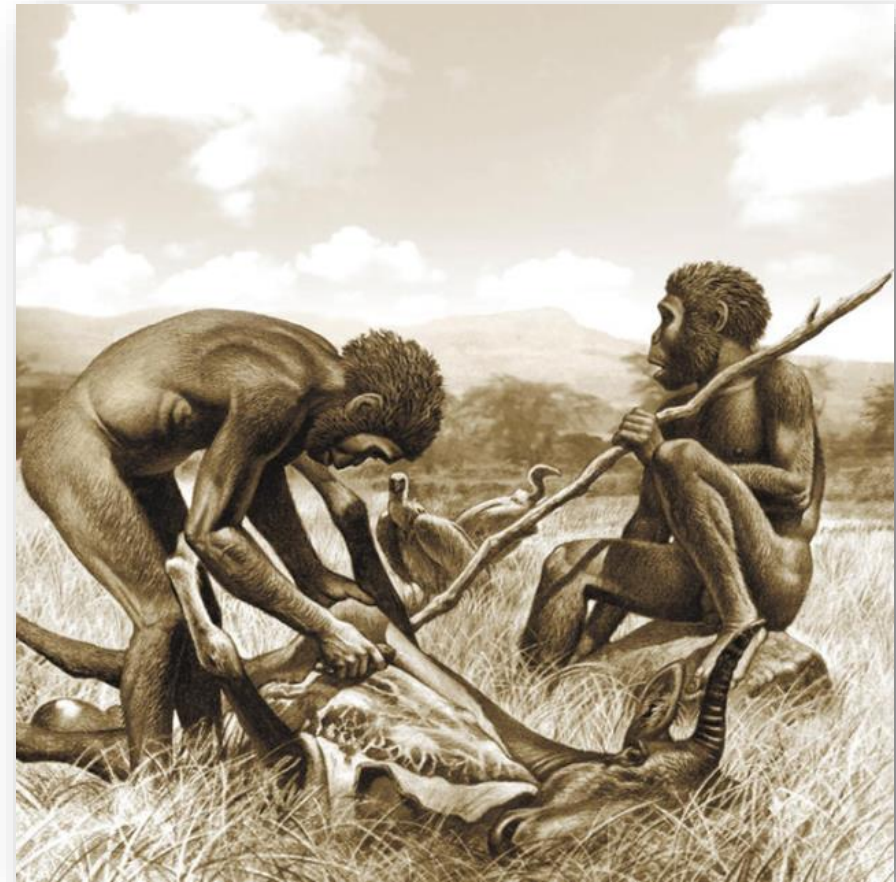
Cumulative culture and biology

- Therefore understanding cultural evolution and transmission is central to an understanding of the most distinctive human traits



Module aims

- Introduce a few methods to study of cultural transmission
- Define basic features of social networks
- Simulate effects of social structure/social networks on cultural transmission



Readings

- Anton et al 2014. Evolution of early Homo: An integrated biological perspective. *Science*
- Heyes C 2016. Imitation: not in our genes. *Current Biology*
- Lewis and Laland 2012. Transmission fidelity is the key to the build-up of cumulative culture. *Phil Transactions R Soc London*
- Morgan et al 2015. Experimental evidence for the co-evolution of hominin tool-making teaching and language. *Nature Communications*
- Salali et al. 2016. Knowledge-sharing networks in hunter-gatherers and the evolution of cumulative culture. *Current Biology*
- Tomasello M. 2008. *Origins of Human Communication*.

Textbooks

- Luke, Douglas. *A User's Guide to Network Analysis in R*.
- Crawley, Michael. *The R Book*, 2nd Edition.
- Sayama, Hiroki. *Introduction to the Modeling and Analysis of Complex Systems*, Open SUNY Textbooks.
<http://bingweb.binghamton.edu/~sayama/textbook/>