

CULTURE



BIOM 225 Introduction to Anthropogeny
November 19, 2020

Lecture 8
Pascal Gagneux

How many of you still know how to make twine or a rope? or use such twine to make a net?
This is an example of how cultural knowledge can erode.....

Animal Material Culture



spider nets



termite nests fungal gardens



weaver ants



octopus gimmickry



bower birds



weaver birds



megapode incubators



great barrier reef



beaver dams

Examples of animal material and tool use, many of these examples do not include learnt behaviors.

Animal cultural transmission



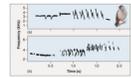
meerkats: hunting



cheetahs: hunting



vervets: correction of alarm calls



song birds: song dialects
(e.g. white crowned sparrow)



corvids: tool use in
New Caledonian crows



dolphins: tool use

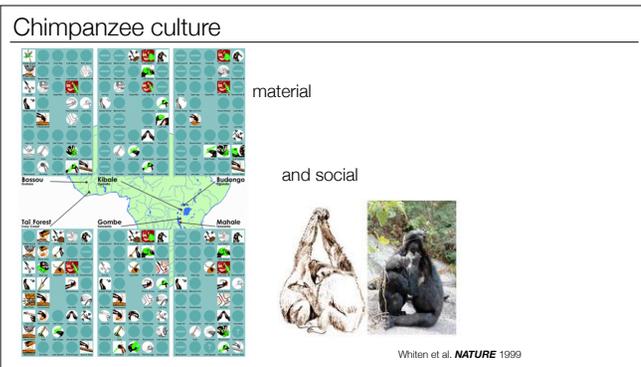


orcas: hunting and vocalization

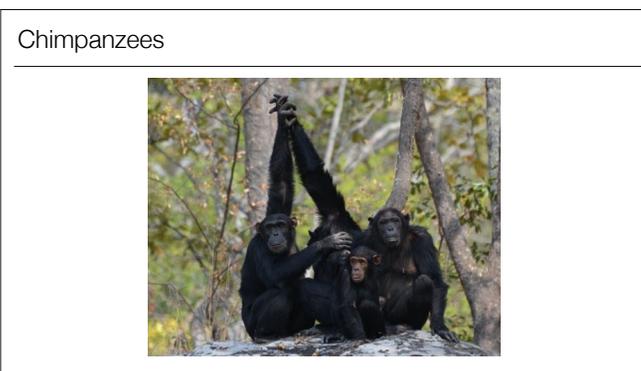


chimpanzees: tool use and hunting

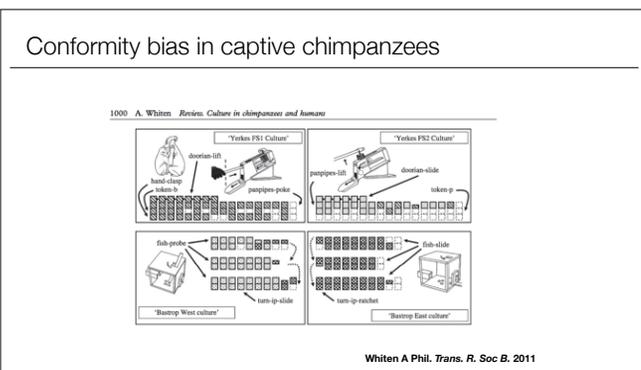
Animals actively teaching, very few examples if any from apes



Behaviors are arranged in the 5times 8 arrays to cluster those behaviors customary or habitual at each site, with clusters for westerly sites on the left of the array and clusters for easterly sites on the right. The secondary Mahale site (K) is omitted. Colour icons, customary; circular icons, habitual; monochrome icons, present; clear, absent; horizontal bar, absent with ecological explanation; question mark, answer uncertain.

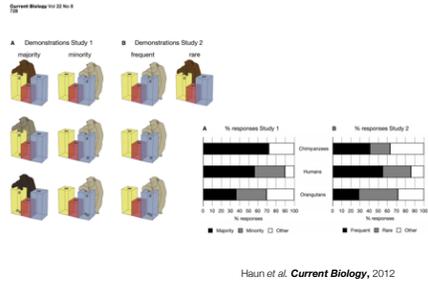


Savannah chimpanzees in Issa Valley, Tanzania, 5 years later, fully habituated and not afraid of human observers anymore.



Spread of experimentally seeded, multiple traditions generating four chimpanzee 'cultures'. At each pair of locations, alternative techniques were experimentally seeded in a single individual and spread locally. Each column represents a single chimpanzee, with hatching corresponding to the alternative techniques seeded in the leftmost individual in each case. At Yerkes, row 1 ¼ lift versus slide methods to open door in 'doorian fruit', run as a diffusion chain; row 2 ¼ poke versus lift panpipes techniques spread in an open (unconstrained) diffusion; row 3 ¼ bucket versus pipe posting option for tokens in an open diffusion [19]; row 4 ¼ hand-clasp grooming, which arose and spread spontaneously in only Yerkes FS1 community. At Bastrop, row 1 ¼ fish-probe versus fish-slide techniques; row 2 ¼ turn-ip-slide versus turn-ip-ratchet techniques, used to extract food from two different devices; each technique spread to a second group (middle) and then a third (bottom).

Normative transmission in Chimpanzees



Haun et al. *Current Biology*, 2012

Structure of Peer Demonstrations in Study 1 and Study 2(A) Demonstrations of different response options in study 1. One option is demonstrated by three different individuals, once each (majority). One option is demonstrated by one individual three times (minority). One option is never demonstrated. The real boxes were opaque, not transparent as indicated here. Every observer saw these two types of demonstrations by conspecific peers in counterbalanced order. (B) Demonstrations of different response options in study 2. One option is demonstrated by one individual three times (frequent). A second option is demonstrated by one individual once (rare). One option is never demonstrated. The real boxes were opaque, not transparent as indicated here. Every observer saw two demonstrations by conspecific peers in counterbalanced order. Figure 2. Percent Responses following Different Demonstrations in Study 1 and Study 2 (A) Percentage of given responses in either of the three response categories (majority, minority, or other), separately for the three tested great ape species in study 1.(B) Percentage of given responses in either of the three response categories(frequent, rare, or other), separately for the three tested great ape species in study 2.

Apes have culture but do not know it

Jourdain Hypothesis :
 "Par ma foi il y a plus de quarante ans que je dis de la prose sans qu'on s'en doute rien, et je vous suis le plus oblige du monde de m'avoir appris cela."
 M. Jourdain, *Le Bourgeois Gentilhomme*, Acte II, scène 4, Molière (1670).
 [By my faith! For more than forty years I have been speaking prose without knowing anything about it, and I am much obliged to you for having taught me that." M. Jourdain, *The Middle-class Gentleman*, Act II, scene 4, Molière (1670) *The Gutenberg Project*, translation by Philip Dwight Jones].



Table 2 | Summary of the different stages of representations involved in the cultural process and their presence in humans and great apes, according to current knowledge.

Representational stage	Species	Humans: Spoken	Non human great apes
Primary sampled mental representation		Present	Present (e.g., spatial memory; see Jourdain et al., 2013).
Re-representations		Present	Present at the conceptual level but experiments needed to explore the conceptual level (Gruber and Santos, 2007; Ruiz and Santos, 2016).
- Categorization		Present	Partially present (Minton, 2000; Hobaiter et al., 2016) but experiments needed to confirm their extent.
- Representation of techniques		Present	Understanding of different models (Epperson et al., 2011) group identity present but no group-mindedness (Gruber and Zuberhöfer, 2012; Tomasello et al., 2008).
- Representation of practitioners		Present	Absent (Call and Tomasello, 2008).
Metarepresentation of cultural beliefs		Present	

Lack of Metarepresentation of cultural beliefs

Gruber et al. 2015 *Frontiers in Psychology*

Mental state attribution! The highest stage of metarepresentational process, in our context, is to appreciate that members of another group may harbor beliefs that are different from one's own group, that is, to compare 'how things ought to be' (Figure Figure3C3C). Here, cognition goes beyond simple re-representations, which could sustain all previous aspects of cultural knowledge, i.e., categorisation, representation of techniques, and representation of models. In effect, the metarepresentational processes must become 'representations of representations as representations', that is metarepresentations. In humans, this type of metarepresentation probably underlies complex mental state attribution, intentional teaching and belief-based imitation, the human 'theory of mind' (Tomasello et al., 2005 and comments; Meltzoff, 2007). The ability to mentally represent and compare own and others' knowledge may refine the categorisation of partners as 'same' or 'other.' Such reasoning, if associated with feelings of group identity, appears to be an ingredient for the emergence of social norms. Humans have an urge to conform to the behavior of others, but to perceive group behavior as normative and recognize deviation, it is also necessary to mentally represent the group norm, 'the way things ought to be.' Humans tend to become aggressive toward non-followers, while positive reinforcement also plays a role, for instance, in the case of the 'chameleon effect,' when individuals engaged in an interaction unintentionally match each other's behaviors (Chartrand and Bargh, 1999). How this effect connects to norms, however, remains to our knowledge to be investigated. The theory of mind of great apes, in contrast, appears to be more limited and unable to take into account others' false beliefs, suggesting that their metarepresentational abilities are equally limited (Call and Tomasello, 2008).

Conformism and Norm

Swiss Meta-representation of cultural beliefs

1. We have always done it like this.
2. We have never done it like this.
3. If you do it differently, then anyone could do so.



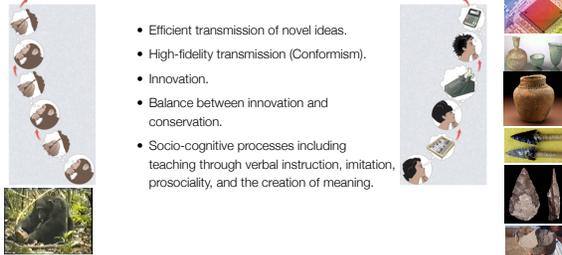
The origin of ratcheting culture



Kurzban & Barrett Science 2012

The evolution of the paper clip is sometimes used to illustrate this principle

The origin of ratcheting culture



Kurzban & Barrett Science 2012

Building on others' ideas, tinkering and innovating while also conforming to a certain degree. Language does wonders to sharing ideas. From Oldowan stone tool, to Acheulean hand axe, to hafted arrow points, pottery, glass, microchips and photovoltaic panels, all different uses of silicate minerals!

CULTURE (Indo-European)



from cultura: growing, cultivating (Neolithic)

Looking up the word for culture in a small sample of different language families reveals: different views of culture and reflexiveness of human cultures.

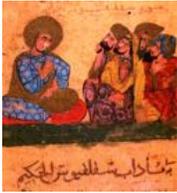
Utamaduni (Bantu)

Πολιτισμός



from مدينة (Madina) Arabic for "city", Urbanity, Culture

ثقافة (Afro-Asiatic) thaqafa



etymology from: instructing, teaching, educating

Paleolithic Culture

no writing system

no farming

no currency / market economy

no towns

YET all profoundly cultural!

文化 (Sinotibetan) wén huà



The intricate patterns of 2,500-year-old tattoos - some from the body of a Siberian 'princess' preserved in the permafrost - have been revealed in Russia. The remarkable body art includes mythological creatures and experts say the elaborate drawings were a sign of age and status for the ancient nomadic Pazyryk people, described in the 5th century BC by the Greek historian Herodotus. But scientist Natalia Polosmak - who discovered the remains of ice-clad 'Princess Ukok' high in the Altai Mountains - is also struck about how little has changed in more than two millennia.

Sanskrit (Indo-european)



from संस्कृति Sanskrit saṃskṛta 'composed, elaborated,' from saṃ 'together' + kr 'make' + the past participle ending -ta

Elaborated, composed

Teko (Tupi-Guarani, South Amazon)



custom, mode of being

Custom, mode of being.
Cultural anthropologists would insist that human culture is a system for the creation of meaning.

Contrasting European Views on the Past



Thomas Hobbes 1588- 1676

"No arts; no letters; no society; and which is worst of all, continual fear, and danger of violent death: and the life of man, solitary, poor, nasty, brutish and short."



Jean Jacques Rousseau 1712-1778

"Civilization is a hopeless race to discover remedies for the evils it produces."

"Nature made me happy and good, and if I am otherwise, it is society's fault."

Eurocentrism including among intellectual giants



David Hume 1711-1776

"I am apt to suspect the Negroes, and in general all other species of men to be naturally inferior to the whites. There never was any civilized nation of any other complexion than white, nor even any individual eminent in action or speculation."



Immanuel Kant 1724-1804

Die Menschheit ist in ihrer größten Vollkommenheit in der Rasse der Weißen. Die gelben Indianer haben schon ein geringeres Talent. Die Neger sind weit tiefer, und am tiefsten steht ein Teil der amerikanischen Völkerschaften. [...] Die Neger von Afrika haben von der Natur kein Gefühl, welches über das Lappische steigt.

Humanity exists in its highest perfection in the White Race. The yellow Indians already have a lower talent. Negroes are far lower, and lowest are the peoples of America. [...] The Negroes of Africa have by nature no feeling that rises above the trifling.

Ethical Giants too: Albert Schweitzer



- Material progress much faster than mental progress.

"I have given my life to try to alleviate the sufferings of Africa. There is something that all white men who have lived here like I must learn and know: that these individuals are a sub-race. They have neither the intellectual, mental, or emotional abilities to equate or to share equally with white men in any function of our civilization. I have given my life to try to bring them the advantages which our civilization must offer, but I have become well aware that we must retain this status: the superior and they the inferior. For whenever a white man seeks to live among them as their equals they will either destroy him or devour him. And they will destroy all of his work. Let white men from anywhere in the world, who would come to Africa, remember that you must continually retain this status; you the master and they the inferior like children that you would help or teach. Never fraternise with them as equals. Never accept them as your social equals or they will devour you. They will destroy you." - Dr. Albert Schweitzer, winner of the 1952 Nobel Prize for peace, in his 1961 book, From African Notebook.

Ernesto "Che" Guevara



Guevara's 1952 diary:

"The blacks, those magnificent examples of the African race who have maintained their racial purity thanks to their lack of an affinity with bathing, have seen their territory invaded by a new kind of slave: the Portuguese."

"The black is indolent and a dreamer; spending his meager wage on frivolity or drink; the European has a tradition of work and saving, which has pursued him as far as this corner of America and drives him to advance himself, even independently of his own individual aspirations."

Laurent Kabila and son Joseph



Che was wrong! Kabila overthrew Mobutu and became the president of DRC. His son Joseph also became president.

中國 China: sees itself as the "middle country"

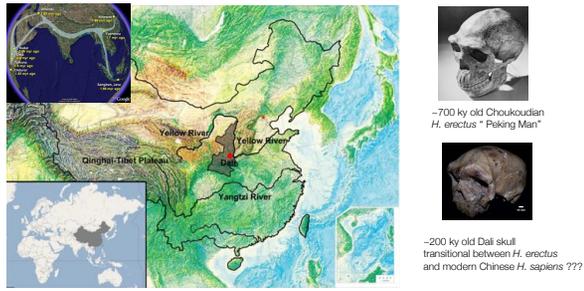
Ethnocentrism not restricted to Europe



Zheng He 鄭和 1371-1433



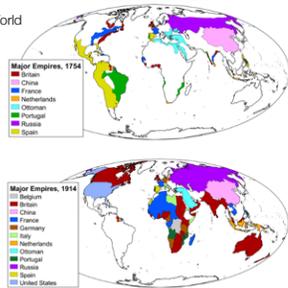
We can't be from Africa!



The view that Chinese people cannot possibly be descending from recently out of Africa populations is still rather popular in China.

Smaller boats, but drive to explore, convert and conquer

European Conquest of the World



Top: Colonialism in 1754. China remained the richest country on Earth, but had not conquered an overseas colonial empire. Major European powers concentrated on establishing colonies in the Americas (some of the most valuable of which, in the Caribbean, are too small to be shown here) and trading posts in Africa and Asia. based on a map by Wikimedia/Andrei nacu
 Below: Colonialism in 1914. This map shows the world's major empires on the eve of World War I. The focus of European colonialism has shifted to the Eastern Hemisphere, and neo-European United States has become a colonial power in its own right, seizing some of declining Spain's possessions. After the war, much of the Ottoman Empire's territory was divided up among Britain and France, while Germany lost its overseas possessions to the victorious nations. China's power was severely weakened by the ongoing fall of the Qing Dynasty. based on a map by Wikimedia/Andrei nacu

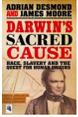
Ethnography vs "Anthropogeny"

Adolf Bastian vs Ernst Haeckel



German ethnographers who experience the "psychic unity of man", having spent decades living in far away societies, strongly disagreed with Haeckel's racial hierarchy, causing many of them to refuse notions of evolution.

Darwinian Abolitionism vs Evolutionary Racism



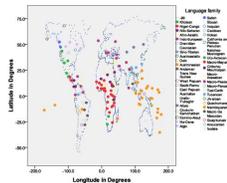
Ethnography Socio-Cultural Anthropology

- Observing other societies
- Living in other societies
- Looking for patterns
- Quest for universals
- Quest for violations of universals

Ironically, in Britain, many Darwinian evolutionists strongly opposed slavery.

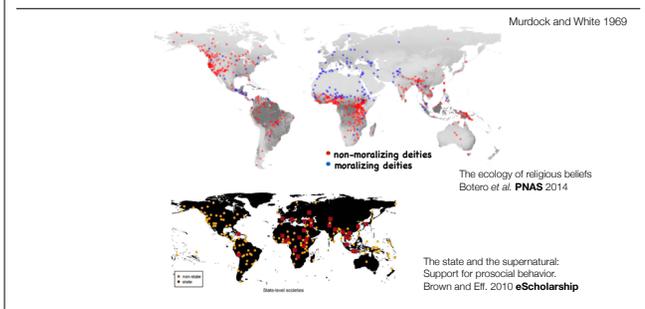
SCCS - Standard Cross-Cultural Sample: 186 cultures

Murdock and White 1969



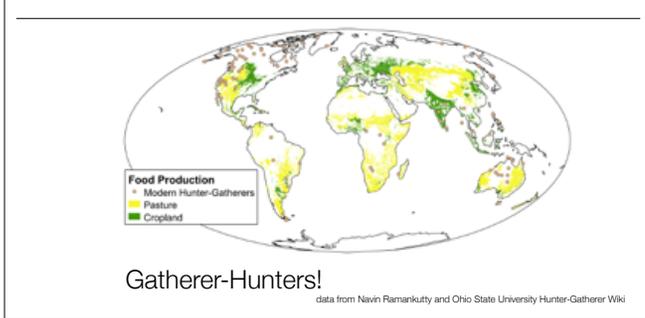
A classic collection of ethnographic data widely used in cross-cultural comparisons.

SCCS - Standard Cross-Cultural Sample: 186 cultures



Top: Global distribution of societies that exhibit beliefs in moralizing high gods (blue) or not (i.e., atheism or beliefs in nonmoralizing deities or spirits in red). The underlying map depicts the mean values of net primary productivity (i.e., the net balance of monthly consumption relative to production of carbon dioxide by living plants) in gray scale. Darker localities reflect places with greater potential for overall plant growth. Cross-cultural research entails a particular statistical problem, known as Galton's problem: tests of functional relationships (for example, a test of the hypothesis that societies with pronounced male dominance are more warlike) can be confounded because the sample of cultures are not independent. Traits can be associated not only because they are functionally related, but because they were transmitted together either through cross-cultural borrowing or through descent from a common cultural ancestor. George Peter Murdock attempted to tackle Galton's problem by developing a sample of cultures relatively independent from each other—i.e., with relatively weak phylogenetic and cultural diffusion relationships. Murdock began with the twelve hundred or so peoples in his Ethnographic Atlas (Murdock, 1967), dividing them into roughly 200 "sampling provinces" of closely related cultures. Murdock and Douglas R. White chose one particularly well-documented culture from each sampling province to create the Standard Cross-Cultural Sample (SCCS) (Murdock and White, 1969). The number of cultures is large and varied enough to provide a sound basis for statistical analysis; the sample includes 186 cultures, ranging from contemporary hunter gatherers (e.g., the Mbuti), to early historic states (e.g., the Romans), to contemporary industrial peoples (e.g., the Russians) (Silverman & Messinger 1997; Mace & Pagel 1994).

Living Foragers and their Plight



Modern agriculture and hunter-gatherers. Map shows area used for major agricultural and pastoral production in 2000, and locations of societies that have depended on hunting and gathering for a significant portion of their food in the modern era. data from Navin Ramankutty and Ohio State University Hunter-Gatherer Wiki

Last Living Hunter Gatherers/Foragers



Study of pre-agricultural societies - value to Anthropogeny?

- What is left from pre-neolithic times?
- Living Foraging Societies as models?
- PRO: Natural fertility, minimal material culture, strongly reflect ecological conditions.
- CONTRA: marginalized ecologically, influenced by pastoralist or agricultural neighbors, oppressed by neighbors and possibly secondarily hunter-gatherer.

Human relations area files
<http://hraf.yale.edu/>

Egalitarian Levelling Mechanisms

- 1. Mobility and flexibility
- 2. Access to means of coercion
- 3. Access to food and resources
- 4. Sharing
- 5. Sanctions on the accumulation of personal possessions
- 6. The transmission of possessions between people
- 7. Leadership and decision-making

James Woodburn, *Man* 1982

Minimum Cultural Kit for "Human Modernity"?

- fire
- home base
- cordage
- containers
- carrying slings?
- projectile weapons
- floating device?

technical aspects of the winning modern human App!

The techno-cultural niche:

A second inheritance system - Cultural universals of technology



Shelter

Containers



Control of Fire

Cooking



Tool making

Lever



Weapons

Tying material



Twining/weaving

Brown, Donald (1991). *Human Universals*. Philadelphia: Temple University Press.

"Nothing in biology makes sense, except in the light of evolution."

(Theodosius Dobzhansky)
American Biology Teacher, 1983,35(3):125-129



"Human evolution cannot be understood as a purely biological process, nor can it be adequately described as a history of culture. It is the interaction of biology and culture.

There exists a feedback between biological and cultural processes".

(Theodosius Dobzhansky)
Mankind Evolving, p. 18, 1962

Cultural Universals of Language and Cognition:

Language employed to manipulate others
Language employed to misinform or mislead
Language is translatable
Abstraction in speech and thought
Antonyms, synonyms
Logical notions of "and," "not," "opposite,"
"equivalent," "part/whole," "general/particular"

Binary cognitive distinctions
Color terms: black, white

Classification of: age, behavioral propensities,
body parts, colors, fauna, flora, inner states,
kin, sex, space, tools, weather conditions

Continua (ordering as cognitive pattern)

Discrepancies between speech, thought,
and action

Figurative speech, metaphors
Symbolism, symbolic speech
Synesthetic metaphors

Tabooed utterances
Special speech for special occasions
Prestige from proficient use of language
(e.g. poetry)
Planning
Units of time

Brown, Donald (1991). *Human Universals*. Philadelphia: Temple University Press.

Cultural Universals of Society:

Personal names	Conflict
Family or household	Cooperative labor
Generally Male Dominated	Gender roles Males on average travel greater distances over lifetime
Males Generally More Overtly Violent than Females	Marriage
Kin groups	Husband older than wife on average
Peer groups not based on family	Copulation normally conducted in privacy
Actors under self-control distinguished from those not under control	Incest prevention or avoidance, incest between mother and son unthinkable or tabooed
Affection expressed and felt	Collective decision making
Age grades	Etiquette
Age statuses	Inheritance rules
Age terms	Generosity admired, gift giving
Law: rights and obligations, rules of membership	Redress of wrongs, sanctions
Moral sentiments	Sexual jealousy
Distinguishing right and wrong, good and bad	Sexual violence
Promise/oath	Shame
Prestige inequalities	Territoriality
Statuses and roles, Leaders/De facto oligarchy	Triangular awareness (assessing relationships among the self and two other people)
Property	Some forms of proscribed violence
Coalitions	Visiting
Collective identities	Trade

Brown, Donald (1991). Human Universals. Philadelphia: Temple University Press.

Cultural Universals of Myth, Ritual and Aesthetics:

Magical thinking	Childbirth customs
Use of magic to increase life and win love	Rites of passage
Beliefs about death	Music, rhythm, dance
Beliefs about disease	Play
Beliefs about fortune and misfortune	Toys, playthings
Divination	Death rituals, mourning
Attempts to control weather	Feasting
Dream interpretation	Body adornment
Beliefs and narratives	Hairstyles
Proverbs, sayings	Art
Poetry/rhetorics	
Healing practices, medicine	

Brown, Donald (1991). Human Universals. Philadelphia: Temple University Press.

Post-Modernism

PREMODERN MODERN POSTMODERN



"Because God put it there and that's the way it's always been." "Onwards and upwards with reasonable progress!" "Strength is all that counts! It's the only way to survive!"

Martin Heidegger
1889-1976



Jacques Derrida
1930-2004



"there is no out-of-context" (il n'y a pas de hors-texte)

- Impossibility of objectively studying humans or their societies.
- The exercise is a way of oppressing others.
- All narratives are equally true if they are lived.
- Anthropologists need to be advocates for the oppressed.
- Emphasis on including the opinions of the people being studied.
- A sense of relativism for the practices of other cultures.
- Rejection of science.
- Rejection of grand, universal schemes or theories which explain other cultures.

Cultural Relativism

Prince Pyotr Alexeyevich Kropotkin
Mutualism, Reciprocal Altruism

MUTUAL AID
A FACTOR OF EVOLUTION

BY
P. KROPOTKIN

NEW YORK
MCCLEND PUBLISHERS & CO.
1909



Shinji Imanishi
Sociality Matters



Just as Victorian imperialism influenced Darwinian ideas, Russian anarchism and Japanese collectivism strongly influenced thinkers like Kropotkin and Imanishi.

Babakiuaria



<https://www.youtube.com/watch?v=UoUMpGMCe8>

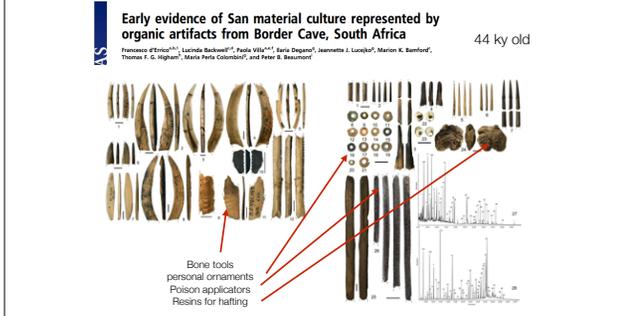
Culture Kit of behaviorally modern human



Fossilisable Hardware

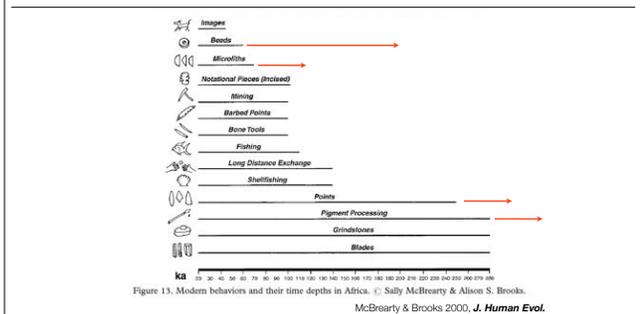
D'Errico and Stringer *Proc R Soc* 2012

Organic Artifacts from S Africa



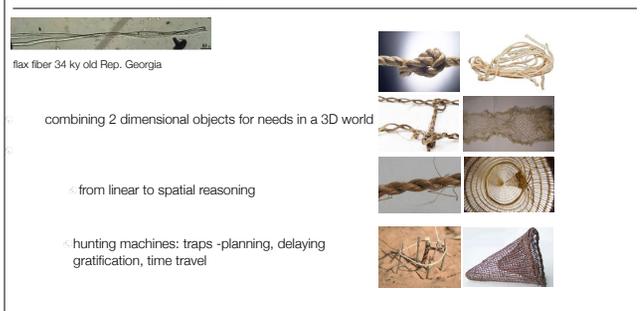
Bone awls and points (1–7), OES beads (8–21), *N. kraussianus* beads (22 and 23), lump of organic material bound with vegetal fibers (24), digging stick (25), poison applicator (26), and gas chromatograms of the lipid fraction extracted from the residue from one end of the poison applicator (27) and from the lump of organic material (28). (Scale bars: 1 cm.)

Behavioral Innovations of the Middle Stone Age



Smooth transition into behaviorally modern humans, or revolution?

Fiber Technology: plant fibers and animal fibers



Fiber Technology: Mexican fan palm fibers for rope



Washingtonia spec.
Mexican Fan Palm



Phormium spec.
New Zealand Flax

Fibers can be twisted into strands and strand can be twisted together in opposite directions, causing the twist to remain permanent. additional fibers can be spliced into the nascent cord allowing the production of long ropes.....

Body Art (Karo tribe, Omo Valley, Ethiopia)



Body art in the Omo Valley of lowland Ethiopia. natural pigments from different color earth (red and yellow ochre and kaolin clay) are used in combination with flowers and other vegetation to create stunning body art in males and females, adults and children.

Origins of Symbolic Capacity?



Symbolic "Transition"



El castillo Cave, N. Spain 40 ky



Abris du castanet, S. France 38 ky



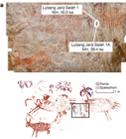
- Shared Symbols for social niches



Hohle Fels, Germany 38 ky



carved shell, Java, 540 ky!!!



Lubang Jerji Saleh, Borneo -40 kya.

El Castillo cave N Spain 40 kya hands

Abris du Castanet S France 38 kya

Hohle Fels Venus, Germany 38 kya

540,000-Year-Old Shell Carvings May Be Human Ancestor's Oldest Art Live Science - December 3, 2014

The ancient, big-bodied relatives of modern-day humans not only ate freshwater shellfish, but engraved their shells and used them as tools, a new study finds. Researchers in Java, Indonesia, discovered engravings on a shell that dates to between 540,000 and 430,000 years ago. The ancient artwork could be the oldest known geometric carving made by a human ancestor, the researchers said. It's unclear what the engraving - a series of slashes and an "M"-shaped zigzag - means, but it could indicate that *Homo erectus*, the ancestor of modern humans, may have been smarter than was previously thought.

Our bodies as canvas: Ochre body paint



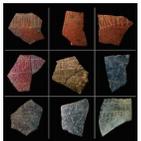
Himba women using ochre and milk fat



Blombos Cave ochre and palette
100 cya



Blombos Cave ochre 70 cya



Diepkloof Rock Shelter, Western Cape, South Africa, dated to 60,000 BP.



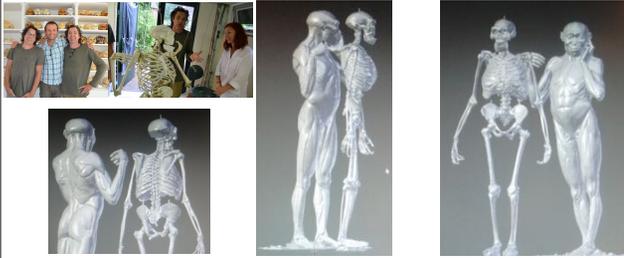
Evidence that 100,000 years ago humans were using ochre to paint and paint themselves, likely in very similar ways than present day Himba people of Namibia.

Engraved ostrich egg shells stained with various pigments date back to 60 kya, A panel of mineral pigments used by the Koumeyaay Tribe in San Diego County.



UC San Diego graduate students producing "primordial art" using mollusc shell, suspension of ochre and two pieces of hollow reed to create an "air brush".

Paleo reconstruction art



Kennis brother working on Java woman, 1.6 millions year old homo erectus.



Why and why not?



Why are Lascaux-type cave paintings not found all over Africa or the Americas?

Projectile weapons



Spears
Schöningen Germany
270 ky old



Arrow heads
Sibudu Cave, S Africa,
64 ky old

- cognitive demands of hunting with spears, atlatls, sling shots and bows and arrows?
- exaptation for positional relations in syntax?
- symmetrical projectile points?
- balance, aim and timing?
- conditioning in massively delayed gratification: laborious manufacture of weapons for the incertitude of catching prey.
- spear, atlatl, bow and arrow, slings, blow gun

Niche Construction

- social niche: language, kinship, tribe, alliances
- belief/value systems, religion
- technology/culture: fire for landscape modification
- technology/ culture: fire for cooking
- technology: weapons for hunting and social competition.
- technology/culture: symbolic creation for social cohesion, mental niche e.g. numbers, concepts.
- technology/culture: weapons, shelter, clothing, shoes, boats - survival kits for any ecology

CULTURE: the hominid ecological niche? Loring Brace

CULTURE: the hominid ecological niche? Loring Brace

The Cultural Niche

- non-biological inheritance system
- rapidly evolving
- human biology has become embedded in culture

A selection of cultural packages

- Mbuti pygmies: fire, huts, dogs, projectile weapons, hunting nets, music, drugs, rituals, taboos, patrilineal and sister exchange common, mostly monogamous
- Khoisan: fire, huts, carrying slings, projectile weapons, arrow poison, containers, rituals taboos
- Penan: fire, huts, blow gun, arrow poison, music, hunting traps, rituals, taboos
- Polynesians: fire, huts, outrigger canoes, crops, domestic animals (chicken, pig, rat and dog), navigation, rituals, taboos (and tattoos)
- Inuit: fire (oil fire), snow huts, clothing, eye protection, projectile weapons for marine hunting, kayaks, dogs, sleds, rituals, taboos.



Cultural Convergence

- e.g. Axial Age: 800 to 200 BCE three distinct region:
- Yellow River, Yangtze, Ganges, Middle East: religious traditions with unprecedented emphasis on self-discipline, asceticism and otherworldly moralizing doctrines
- Shift from short term to longterm strategies?



Adaptive cultural norms

- cooking
- gift giving
- kinship alliances / social networks
- incest taboos
- shared belief systems
- leveling of opportunities (e.g. monogamy)
- ethnocentrism /parochialism
- slavery
- cast systems
- domestication
- farming
- exploration / curiosity
- respect of authority?
- traditions

Maladaptive cultural norms

- Colostrum taboos
- Baby formula
- Unilateral breast feeding in Tanka Women
- Infants sleeping alone
- Human sacrifice
- Genital mutilation
- Foot binding in China, body modifications?
- Lead-based cosmetics in Japan
- Sweetened Soda
- Sati (widow burning) in India
- Male dominance / chauvinism
- Human sacrifice / witchcraft / homeopathy / psychoanalysis
- Prestige bias
- Hygiene hypothesis?
- Suicide, seppuku?
- Endogamy?

Loss of Innovation? – Cultural (drift) attrition?

- Tasmania fishing technology, boomerang complex tools, bone tools, sewed clothes
- Polynesia (bow and arrow?), pottery
- Lascaux in the Americas?
- Australia bow and arrow (though woomera/atlatl retained)
- Dorset Inuit, Bow and Arrow
- California: fish hook

Culture-Driven Evolution

- Tool manufacture
- Tool use
- Projectile tool use
- Language
- Fire and Cooking
- Clothing
- Property and Inheritance
- Fairness

Baldwin Effect

a mechanism for specific selection for general learning ability

"fixation of learnt behavior"

"plasticity to rigidity"

James Mark Baldwin suggested that an organism's ability to learn new behaviors (e.g. to acclimatise to a new stressor) will affect its reproductive success and will therefore have an effect on the genetic makeup of its species through natural selection.

Like other systems for the inheritance of acquired variation, culture can play an active role in evolution through what is known as the Baldwin effect. Systems for phenotypic flexibility, if they are adaptive, will generate phenotypes that tolerate small environmental changes and small genetic departures from current optima.

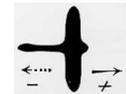
Boyd and Richardson 2010 **PNAS**

Baldwin Effect

evolutionary basis of psychological traits



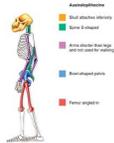
ostrich calluses on heel and sternum



instinctive fear of predator, Niko Tinbergen



James Mark Baldwin



bipedality



throwing



human language development

Fire



Genetic Assimilation
Conrad Waddington, 1957

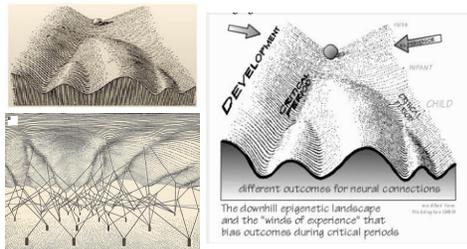


Drosophila embryos were exposed to ether, producing a bithorax-like phenotype. Flies which developed halteres with wing-like characteristics were chosen for breeding for 20 generations, by which point the phenotype could be seen without ether treatment.

The classic example of genetic assimilation was a 1953 experiment by C. H. Waddington, in which *Drosophila* embryos were exposed to ether, producing a bithorax-like phenotype (a homeotic change). Flies which developed halteres with wing-like characteristics were chosen for breeding for 20 generations, by which point the phenotype could be seen without ether treatment.

Developmental Canalization, Waddington, 1957

developmental trajectory represented by rolling ball



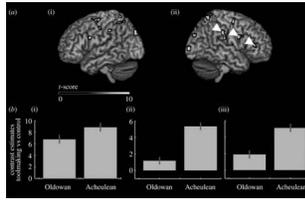
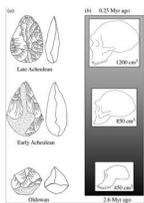
Waddington's 'developmental landscape'. (a) The developmental trajectory of the organism, represented by the rolling ball, is determined by a landscape representing the developmental dynamics of the organism. (b) The shape of this landscape is determined by genes, here represented by pegs pulling the landscape into shape via strings, and by epistatic interactions between genes, here represented by connections between strings. From Waddington (1957: 36).

Genetic Assimilation - Badlwin effect

- bipedal locomotion
- manual dexterity
- language acquisition
- prosociality
- menstruation (spontaneous decidualization)
- belief in the supernatural?
- fire (pyromania)?
- fear or defiance of authority?
- other?

Stone tools and language

shared neuronal basis?



PET scans of stone tool makers injected radioactive Fluor sugar

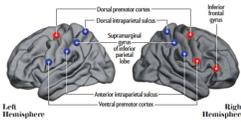
Stout et al. *Philos Trans R Soc Lond B Biol Sci*, 2008

Experimental archeology

Dietrich Stout

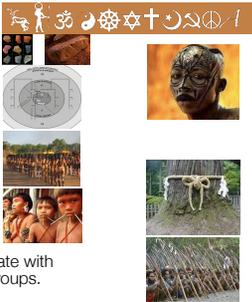
An Expansion of Brainpower

Scanning techniques reveal how more of the brain gets used as toolmaking becomes more sophisticated. Imaging distinguished areas activated when a modern toolmaker crafted an implement reminiscent of simple Oldowan tools (2.6 million to 1.6 million years ago) compared with regions active when making Acheulean hand axes (500,000 to 200,000 years ago). Blue dots denote brain regions utilized when chipping both Oldowan and Acheulean tools; red ones fit up as well when knapping an Acheulean hand ax.



The socio-cultural niche

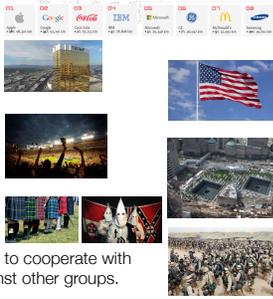
- ☞ Shared Symbols
- ☞ Personal Names
- ☞ Kinship Terms
- ☞ Tribes
- ☞ Shared Rituals
- ☞ Dance & Music
- ☞ Sacred Spaces
- ☞ Group Identity
- ☞ Increased capacity to cooperate with and compete against other groups.



socio-cultural winning App: no personal names, no language, no reputation!

The modern socio-cultural niche:

- Shared Symbols
- Personal Names
- Kinship Terms
- Tribes
- Shared Rituals
- Sacred Spaces
- Group Identity
- Increased capacity to cooperate with and compete against other groups.

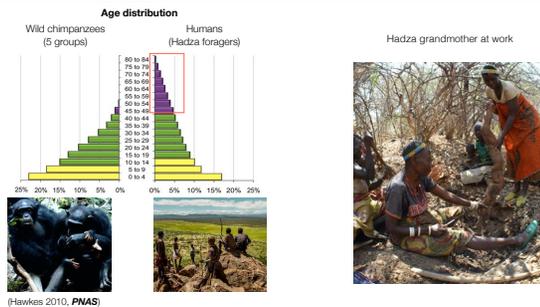


Many modern technologies rely heavily on reputation: AirBnB, UBER, Ebay...

Reputation

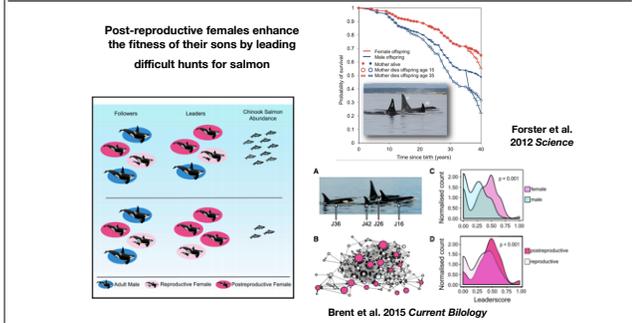
- language, personal names, and cultural values
 - cooperation with non-kin, third party punishment
 - awareness of ones reputation changes the game!
 - Cooperation becomes much more than reciprocal altruism or kin selection!

Aging and survival



Humans populations have many individuals who survive long after the period of reproduction. In Most other animals, when reproduction ceases, most individuals tend to die. Due to the bias favoring female survival , many more older females survive. Up to 25% of living adults in a given social group can be post-reproductive females. The grandmother hypothesis proposes that these females benefit their younger relatives buy provisioning children with food, care and knowledge.

Cultural Transmission by Orca Grandmothers



Postreproductively Aged Female Killer Whales Lead Group Movement (A) A postreproductively aged female, J16, leads her adult son and two adult daughters. (Photo credit: Dave Ellifrit, Center for Whale Research.) (B) In this example leadership network (year 2003), arrows point toward leaders. Age increases with node size. Dark pink nodes represent postreproductively aged females, light pink nodes represent reproductively aged and juvenile females, and blue nodes represent males. (C) Distribution of “leader score” values by sex, normalized to have the same area and smoothed using kernel density estimates. Leader score values are used for visualization only and were calculated as number of times an individual led a group movement in a year/the total number of times they were seen. Statistical results are based on permutation-based binomial regression models in which the dependent variable was the number of times a whale was a leader in a given year relative to the number of times they were a follower. Adult females were significantly more likely to lead compared to adult males ($N = 48$ females, 24 males, 419 whale years), controlling for the impact of age on leadership. (D) Distribution of leader scores in adult females. Postreproductively aged females (35+ years of age) were significantly more likely to lead compared to reproductively aged females (12–34 years of age) ($N = 23$ postreproductive females, 32 reproductive females, 307 whale years).

New genes for old minds



CD33 (Siglec 3) and other genetic variants for cognitive maintenance selected late in life.



- Contributions of older adults via cultural transmission to younger kin in group or wider social network (tribe) result in selection after reproductive period.

Gene	Associated disease	SNP	Derived allele	AF	AF	AF	AF	AF	AF	Reference
CD33	LOAD	r3585646	A	0.21	0.20	0.48	0.19	0.21	0.12	12
		rs1248179	T	0.21	0.20	0.48	0.19	0.21	0.12	26, 28
		r3585646	T	0.21	0.20	0.48	0.19	0.21	0.12	31
ADG	LOAD, Cardiovascular disease	r3585646	T	0.21	0.20	0.48	0.19	0.21	0.12	31
ADG	Sodium retention, sodium sensitive hypertension	rs202298	A	0.20	0.19	0.36	0.15	0.20	0.12	44, 45
ADG	Hypertension	r3585646	A	0.20	0.19	0.36	0.15	0.20	0.12	46
CD33	Type 2 diabetes	rs1248179	T	0.21	0.20	0.48	0.19	0.21	0.12	47, 76
CD33	Type 2 diabetes	r3585646	C	0.20	0.19	0.36	0.15	0.20	0.12	47, 77
CD33	Cardiovascular disease	rs1248179	T	0.21	0.20	0.48	0.19	0.21	0.12	48
CD33	Cardiovascular disease	r3585646	C	0.20	0.19	0.36	0.15	0.20	0.12	48
CD33	Myocardial infarction and ischemic stroke	rs1248179	T	0.21	0.20	0.48	0.19	0.21	0.12	49
CD33	Myocardial infarction and ischemic stroke	r3585646	C	0.20	0.19	0.36	0.15	0.20	0.12	49
CD33	Myocardial infarction and hypertension	rs1248179	T	0.21	0.20	0.48	0.19	0.21	0.12	50
CD33	Myocardial infarction and hypertension	r3585646	C	0.20	0.19	0.36	0.15	0.20	0.12	50
CD33	Alzheimer's	rs1248179	T	0.21	0.20	0.48	0.19	0.21	0.12	51
CD33	Alzheimer's	r3585646	C	0.20	0.19	0.36	0.15	0.20	0.12	51

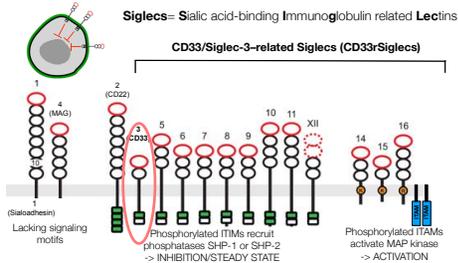
AF, African; AM, American; AN, East Asian; EA, European; SA, South Asian.
 *Allele frequencies are from the 1000 Genomes Project.
 †SNP ID identifier.

Schwarz et al. *PNAS* 2015

Making oneself useful while old? The benefit of older wise minds to younger related members of the tribe.

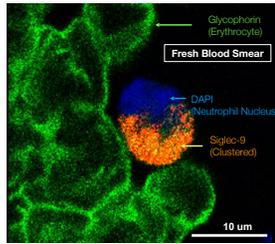
Human Siglecs: fine-tuning immune responses

“Brakes” on immune cells:



Immune cells carry “brakes” self and non-self sensing innate molecules that can tune down unnecessary inflammation.

“Self-Associated Molecular Patterns” (SAMPs) for Siglec-9 are widespread!



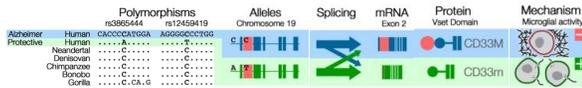
Lizcano, A. et al. Erythrocyte sialoglycoproteins engage Siglec-9 on neutrophils to suppress activation. *Blood*, 2017.

Fresh blood smear of human blood with red blood cells (erythrocytes) stained for the glycoprotein glycophorin (with a green fluorescent antibody). A white blood cell (neutrophil) is stained with DAPI (blue stain for chromatin, red blood cells have no chromatin left in them) and with a yellow fluorescent antibody against the SIGLEC-9 protein, an innate silica acid sensing receptor that signals the immune cell to “relax” when it engages sialic acids on the surface off neighboring cells.....

Cognitive maintenance?



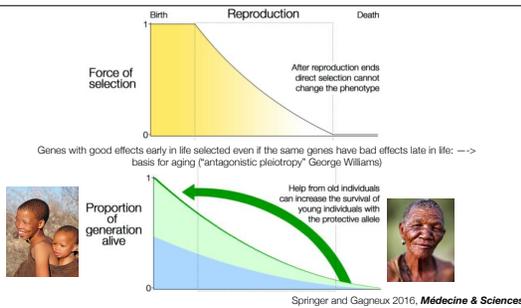
Different blend of splice variants leads to increased microglia activity, resulting in better amyloid beta clearance → less plaque accumulation.



Schwarz et al. *PNAS*, 2015
Springer and Gagneux *Médecine & Sciences*, 2016

Two point mutations in DNA are associated with different mix of proteins (splice variants, one with and the other without the outermost domain of Siglec-3), resulting in protection from Late onset Alzheimers disease. The splice variant lacking the sialic acid-binding outermost domain, does inhibit microglia resulting in higher microglia activity (cleaning up amyloid beta plaques).

Culture Can Change the Selective Landscape



The altered human age pyramid allows for unexpected selection late in life, mediated by help provided by elders to younger group members. Genetic variants that protect the aging mind can be selected by their effects on younger relatives, an example of kin-selection in action.

Derived Human Growth Schedule



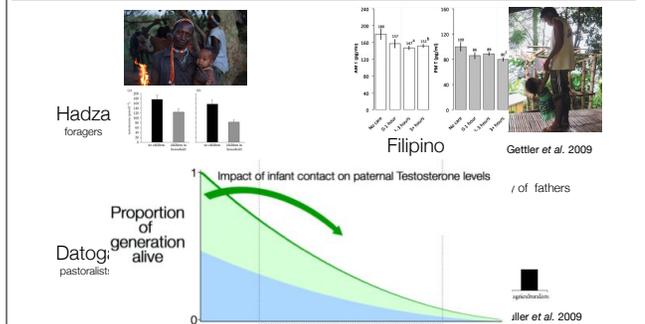
- Delay allows increased transmission of behavior and concepts.
- Human minds are effective copying devices and idea generators.
- Language is one of the major target of imitation and idea transmission.
- Delayed development: biological assimilation of culture?
- Paradoxically shorter Inter-birth-Interval than apes.

Minds as copying machines and idea generators

Humans over-imitate, focusing as much on the way than on the goal, chimps go for the goal.

Ratcheting culture.

Paternal testosterone and child care



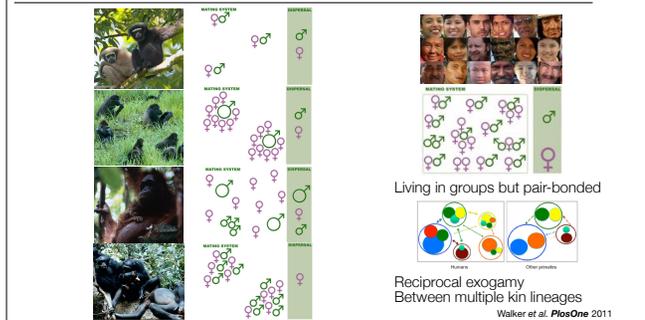
Brian Wood, Frank Marlow

Chirs Kuzawa

Exposure of males in their prime to infants reduce their testosterone level!

Less aggression and much less reason to fight (as no possession/cattle)

Mating Systems



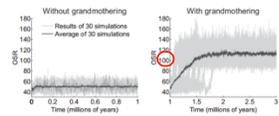
We are the only primate that lives in groups but forms strong pair bonds Combined with names and kinship terms, this allows the large social networks of tribes, even when the groups are small hunter gatherers. Cooperation by pair-bonded male and female in raising young and provisioning for “family” and group.

Decreased intra-group aggression by leveling reproductive opportunities for males? Reproductive pairs within small groups, within very large social networks! Lessening of sexual conflict?

Grandfathers: wise teachers or reproductive competitors?

Surviving older men form new competition

Operational sex ratio (OSR): number of men capable of competing for the fertilization any given egg ovulated.



Mate guarding leading to pair bonding? (Coxworth *et al.* *PNAS* 2015)
Female choice for male body guard? (Smuts, *Human Nature* 1992)

Extending the grandmother hypothesis to mate guarding and pair-bonding. Operational sex ratio (males to female that could breed) increases dramatically with more elderly surviving adults. This could massively increase competition for younger females and result in younger males pair-bonding to guard females against attention of older males.

Modeling effect of grandmother/grandfather survival on operational sex ratio: Time evolutions of ASRs and OSRs with and without grandmothering. (A) ASRs of 30 simulations over 1 million y without grandmothering. Each simulation is shown in light gray. The average of the 30 simulations is shown in black and ends at an ASR of 0.77. The ending point of the simulation shown in medium gray serves as the starting point for the 30 new simulations with grandmothering shown in B. (B) ASRs of 30 simulations over 2 million y with grandmothering. Each simulation is shown in gray. The average of the 30 simulations, in black, ends at an ASR of 1.56. (C) OSRs of 30 simulations over 1 million y without grandmothering. Colors as in A. The average of the 30 simulations ends at an OSR of 50. (D) OSRs of 30 simulations over 2 million y with grandmothering. Colors as in B. The average ends at an OSR of 111.

Operational sex ratio in four foraging people



Table 2. Demographic parameters for human hunter-gatherers

Population	Male age: 20-65 years	Female age: 20-40 years	Birth interval: year	Male paternity: days/year	Female fecundable: days per cycle	Cycles to conception: ASR MSF	OSR MSF
Dobe !Kung (26, 27)	0.593	0.407	4.17	365	6	4	1.46
Ache Hiwari (28)	0.652	0.348	2.44	365	6	4	1.87
Hiwi (29)	0.618	0.382	3.70	365	6	4	1.62
Hadza (30)	0.616	0.384	3.23	365	6	4	1.66

Coxworth *et al.* *PNAS* 2015

Assuming stationary populations, the mortality curve mirrors the age structure. To model age structures we used probability of survival to each age in the published life tables, summing the calculated number of survivors for men and women to each of the fertile ages, then dividing the sum for each sex by their combined total to get the fraction fertile adults by sex (columns 2 and 3). We included men from 20 and 65 years based on reported age ranges of fertilities from the ethnographers and those reported by Tuljapurkar *et al.* Women from 20 to 40 years are included based on average ages of first and last birth.

Marriage Ceremonies

anchoring pair-bonding in social networks and conventions



Traditional Telugu wedding in Hyderabad, India

Marriage tend to be major social affairs, highly publicized, subject to strong cultural norms, involving display of status and wealth, exchange of goods or money (dowry or bride price) and anchoring a couple in a complex mesh of social relationships, debts, gratitude etc. Cheat and you face not just your partner, but an entire clan behind him or her.....

Merci grand-maman!

Sambucus nigra: source
of sialic acid binding
lectin protein SNA



Julie Sumi, 1905-1998

Summary

- Human mind is made for and by culture
- Humans are biologically cultural e.g. language
- Humans are culturally biological e.g. cooking
- Cultures are subject to their own dynamic evolution.
- Cultures can generate highly adaptive tool kits.
- Cultures can generate highly maladaptive behaviors.
- We are only beginning to appreciate how deep the interactions between culture and biology are for our species.