STICERD Morishima public lecture

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The Secret of Our Success

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LSE events

Hashtag for Twitter users: **#LSEHenrich**

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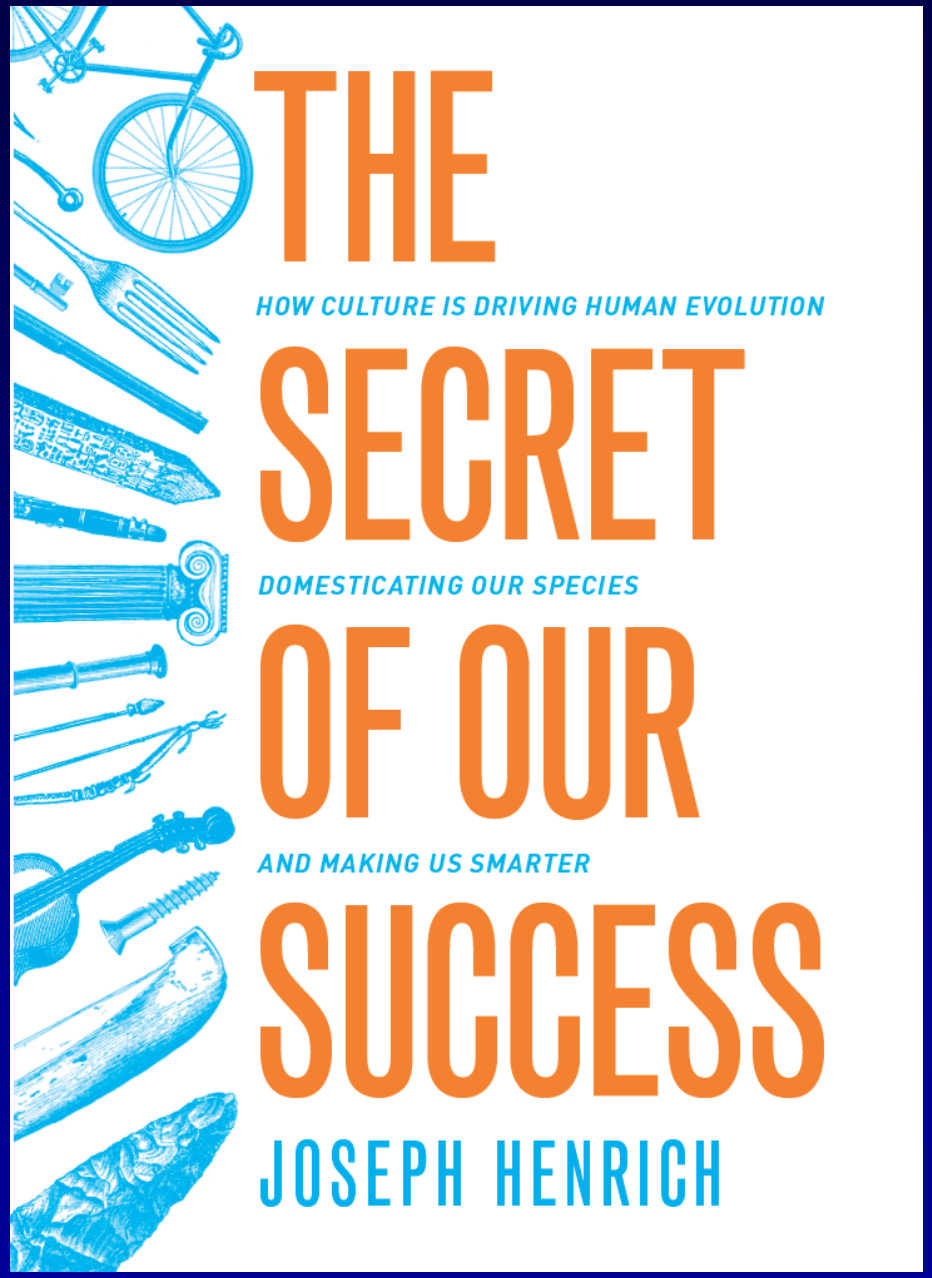
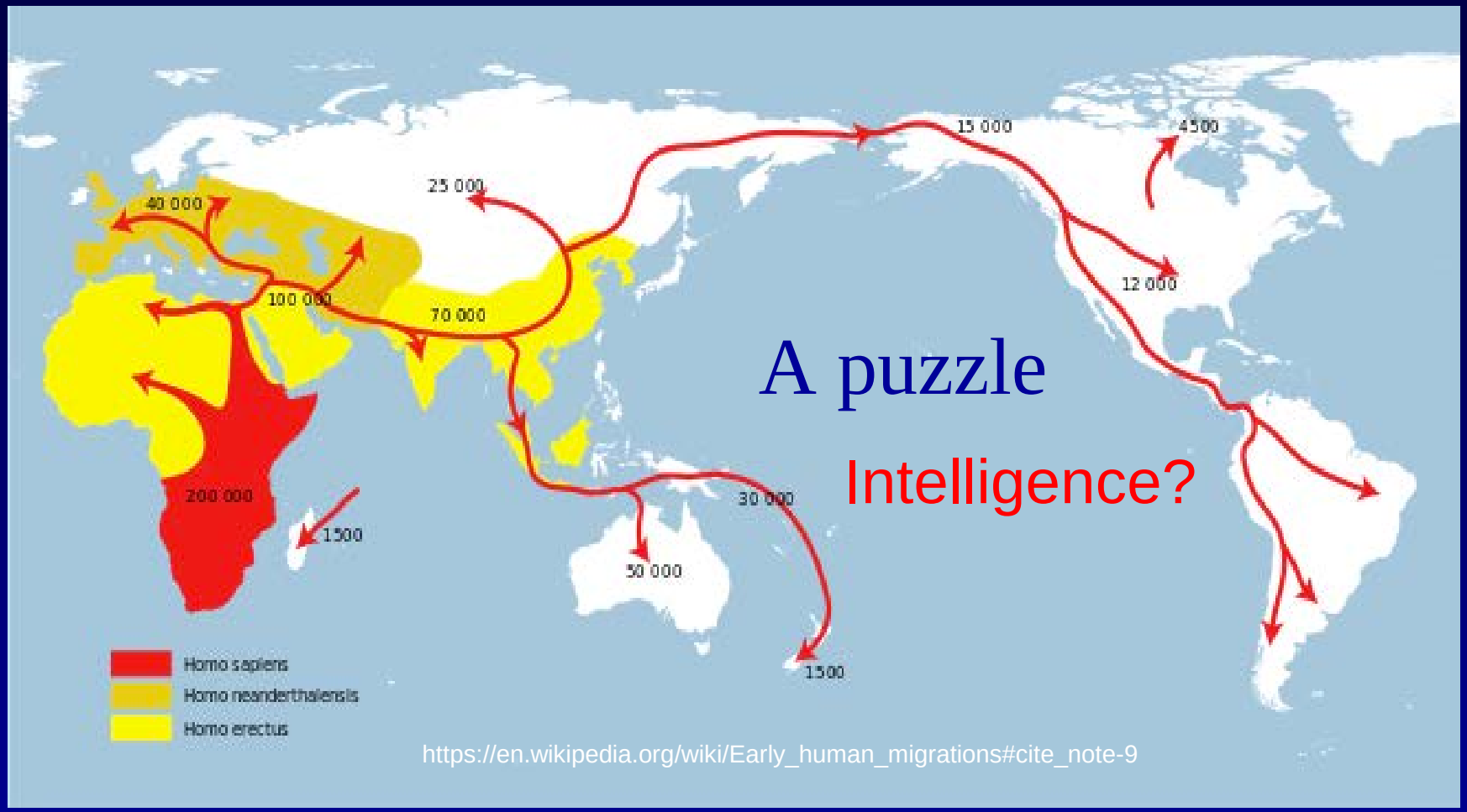

THE
HOW CULTURE IS DRIVING HUMAN EVOLUTION
SECRET
DOMESTICATING OUR SPECIES
OF OUR
AND MAKING US SMARTER
SUCCESS
JOSEPH HENRICH



- Immense diversity of habitats
- Few environment-specific genetic adaptations
- How did we do it?

Lost European Explorers

1860 CE

- Burke & Wills Expedition
- Trapped along Coopers Creek
- Couldn't fish or hunt
- Able to survive on fish from locals, and **nardoo**
- Observed locals processing an aquatic fern. Bread ☺
- Nardoo: indigestible & toxic.
- Thiaminase→B1 depletion

Aboriginal Processing

- Grind, leach, heat and use mussel shell spoon
- Grind, leach, bake in ash

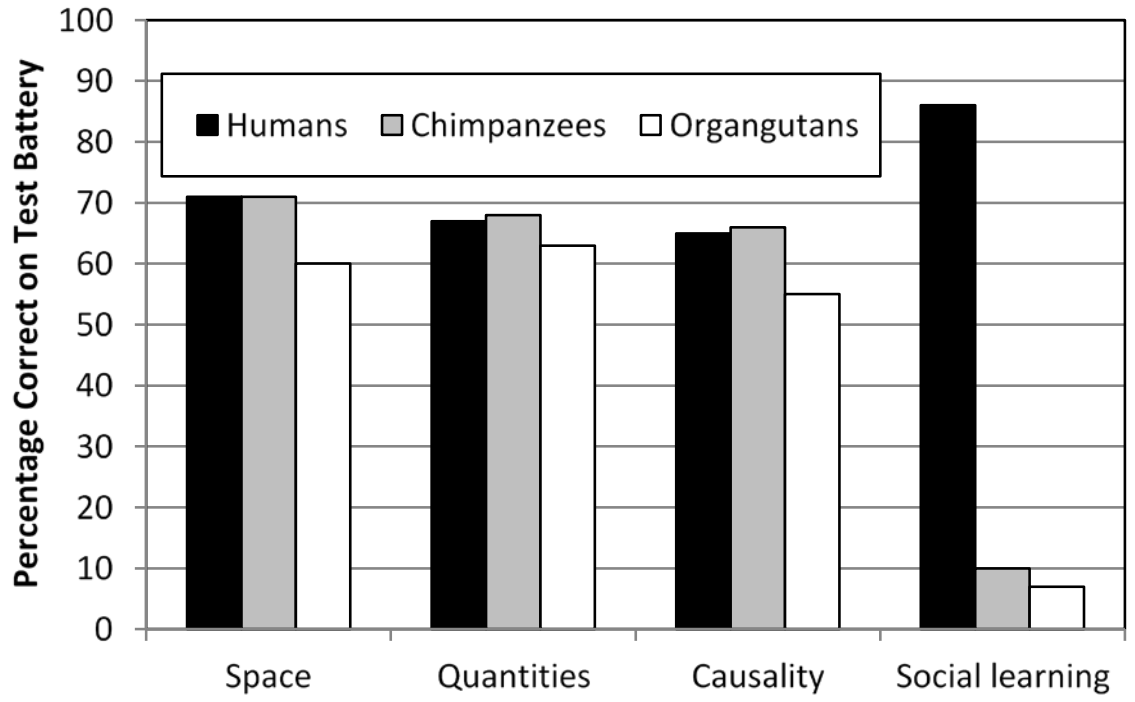
It’s not our intelligence

- Burke and Wills could not survive as hunter-gatherers
  - Aboriginals survived in Australia for 60K as hunter-gatherers
  - No modules fired up, no instincts kicked in, and no general intelligence bailed them out.
  - Couldn’t find water or identify edible plants
  - Couldn’t hunt effectively, make traps, spears or fishing hooks
  - Any local adolescent can do all of these things. What was missing?

Brain
680g

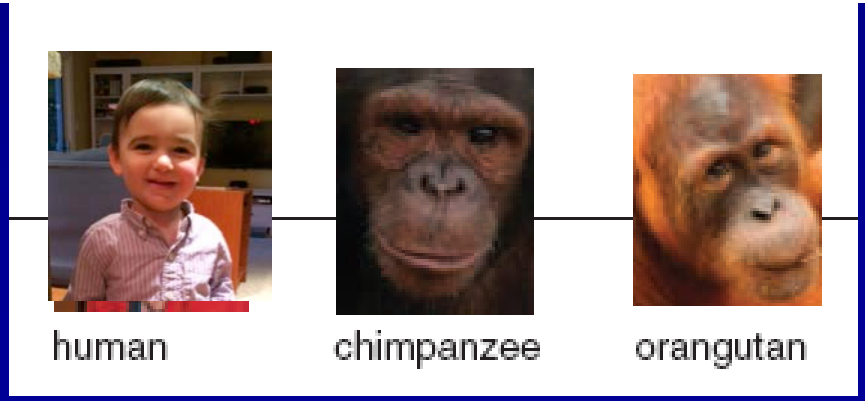
Relative success of humans not explained by “intelligence” relative to other apes

Figure 3.1: Performance on four sets of cognitive test with chimpanzees, orangutans and toddlers (data from Herrmann et. al. 2007)



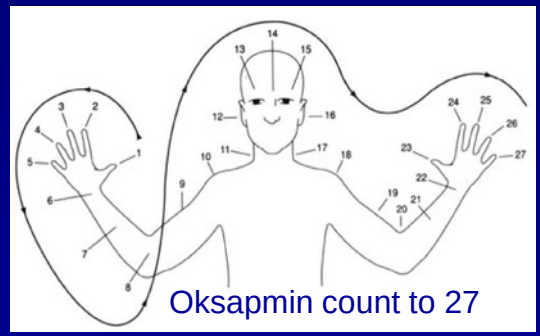
Also
Working Memory
Strategic thinking

We humans get much smarter from 2.5 to 25. Apes do not



Wait, why do we seem so smart?

- We culturally inherit cognitive solutions to many problems (it's the software, not the hardware)
- Tools—we socially learn affordances (screws, springs, levers, pulleys, etc.)
  - Wheel concept
  - Elastically stored energy
  - Compressed air
- Numbers systems
- Spatial cognition—3 coordinate systems
- Words—70,000 words in your vocabulary (other languages ~3-5000)

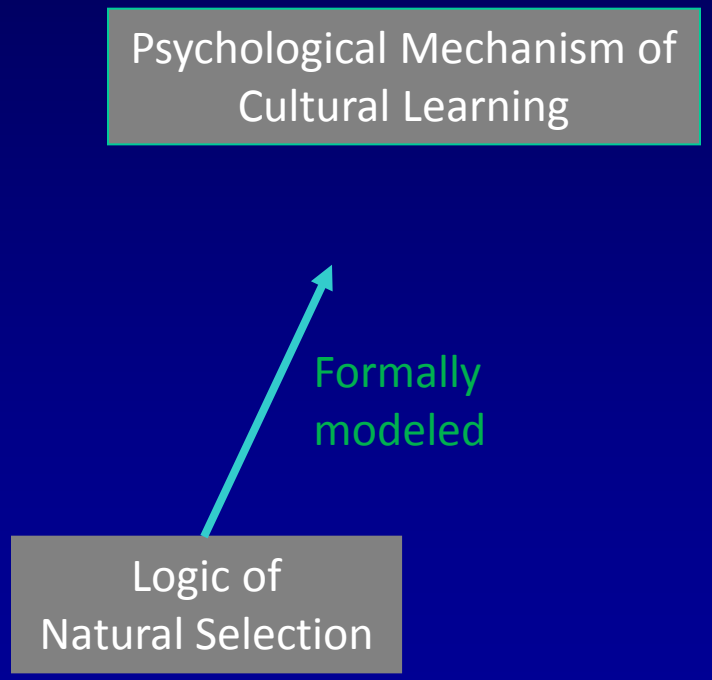


How "smart"?

The secret of our success

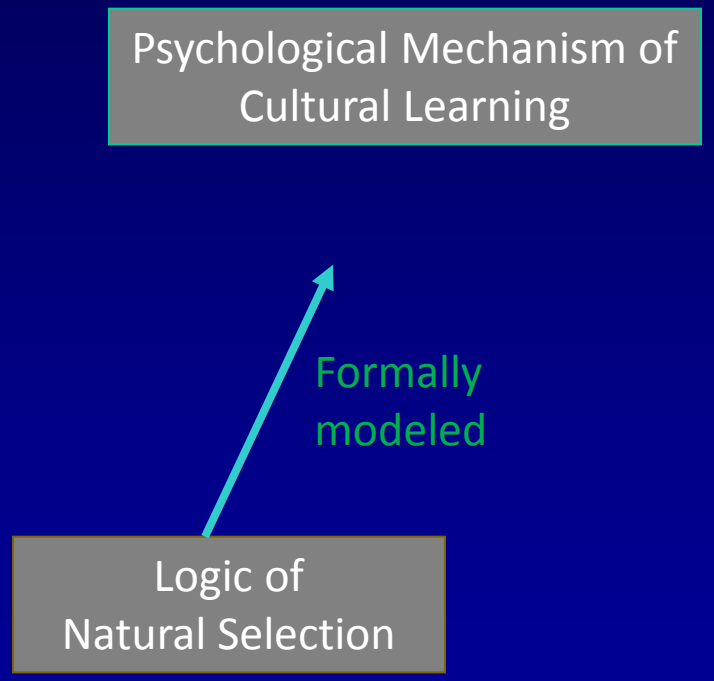
- It’s not our intelligence.
- Culture: we depend on cumulative bodies of cultural information—*cultural adaptations*.
  - High fidelity cultural transmission—good copiers
  - Sociality
- Collective Brains: innovation and accumulation is socio-cultural process.
  - Larger, more interconnected populations generate more complex tools, more sophisticated technologies and larger toolkits
- Cultural Brain Hypothesis—cultural evolution drove (and drives) genetic evolution

How might natural selection have shaped our cognition to best exploit the socially-available information



- Suppose you enter a novel environment (young or migrant).
- How do you figure out what to eat?
  - Individual learning—costly
  - Cultural learning
    - Focus on food choices of older, healthy, and successful people.

How might natural selection have shaped our cognition to best exploit the socially- available information



- Model-based mechanisms: from whom to learn?
- Content-based mechanisms
  - Food, fire, artifacts
  - Norms, social groups
  - Living kinds (danger info)

Model-based Selective Cultural Learning

- What cues should learners use to assess who in is most likely to possess information useful/adaptive to the learner.
  - Skill/competence
  - Success
  - Prestige (cues of attention, deference)
  - Health (positive affect)
  - Age—older children and older people
  - Self-similarity: sex and ethnicity/dialect

Aggregate to select preferred models

Evidence for model-based cultural learning

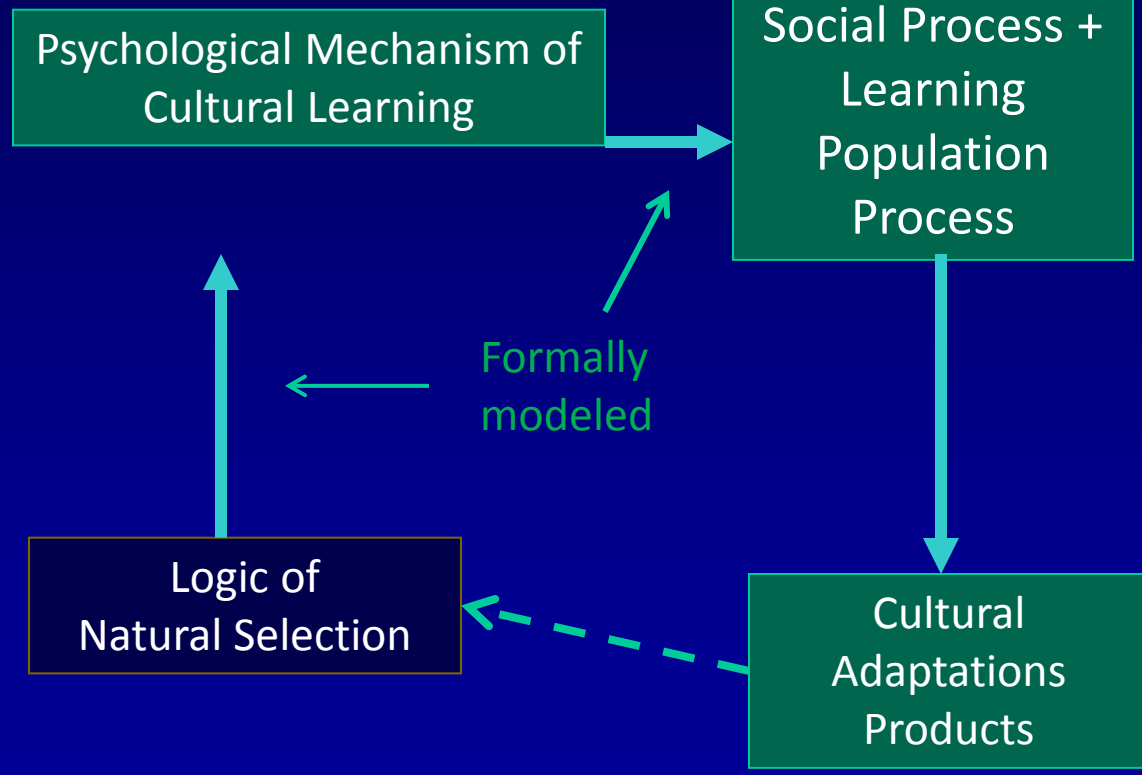
- Substantial experimental evidence that children and adults use these cues (and some infant work).
  - Skill, competence, reliability
  - Success
  - Age, health and affect
  - Sex, ethnicity (dialect)
  - Prestige-use other's opinions to guide attention and learning
    - Attention
    - Sociolinguistic cues
    - Ethology (body posture)

Vast array of domains:

- Food preferences
- Mate choice
- Technological adoptions
- Word meaning, dialect
- Economic strategies
- Suicide
- Beliefs (e.g., invisible agents)
- Cognitive strategies
- Reputational content
- Social motivations (fairness & punishment)

Reliably develops relatively early, occurs automatically and often remains unconscious. Increases under incentives.

Cultural Adaptations: If individuals learning from the most successful & healthy (etc.), then *over generations populations* can converge on locally adaptive repertoires

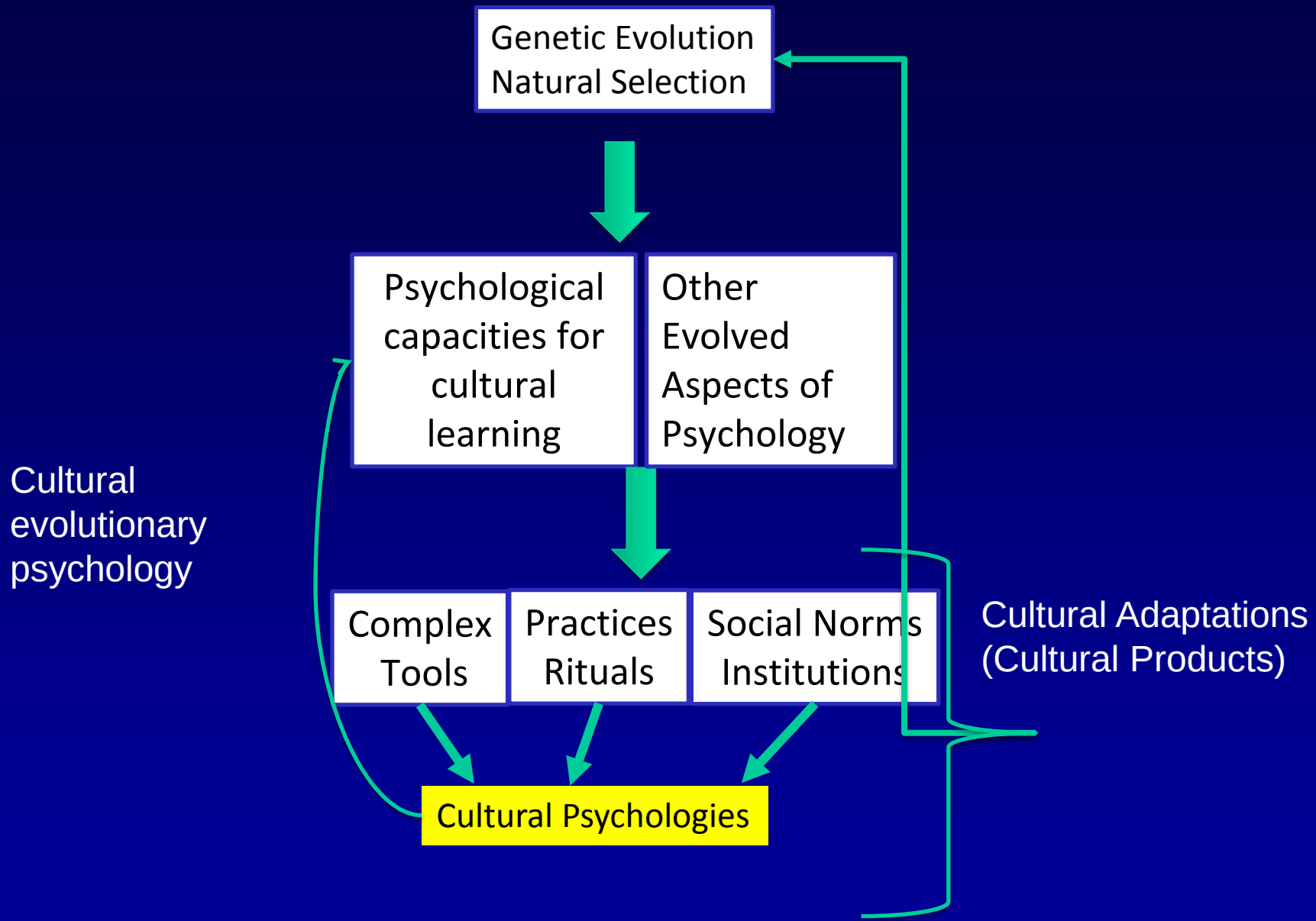


Cultural Products
Tools, technologies
Dietary repertoires
Food processing techniques
Ritual practices
Ecological knowledge
Medical knowledge
Communicative systems

Permits theorizing of
(1) Sociality effects
(2) Adaptive lags
(3) Maladaptations

Cultural Adaptations

- Cultural evolution often operates outside of conscious awareness
- Cultural adaptations emerge without actors' understanding causality or costs and benefits
- Appear "rational" (appear "designed")
- Procedures and subgoals are transmitted.
- Causal understandings are often backed out, post-hoc
  - Boomerangs, many medicines
- Sometimes causal understandings are wrong.
- Sometimes NOT understanding the causality is crucial

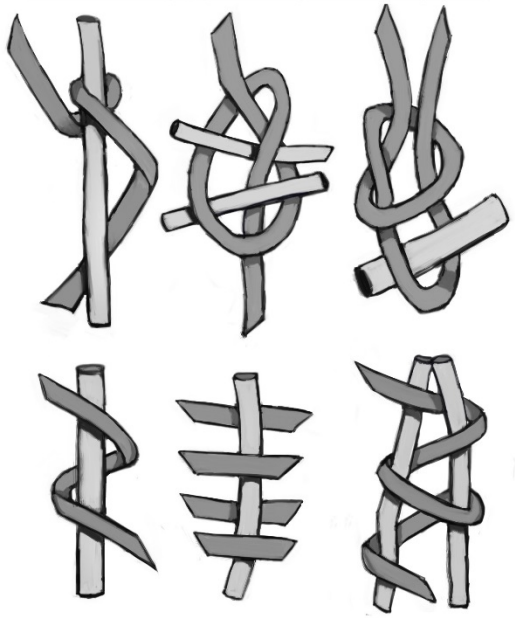

Genetic Evolution
Natural Selection
Psychological capacities for cultural learning
Other Evolved Aspects of Psychology
Complex Tools
Practices Rituals
Social Norms Institutions
Cultural Psychologies
Cultural evolutionary psychology
Cultural Adaptations (Cultural Products)

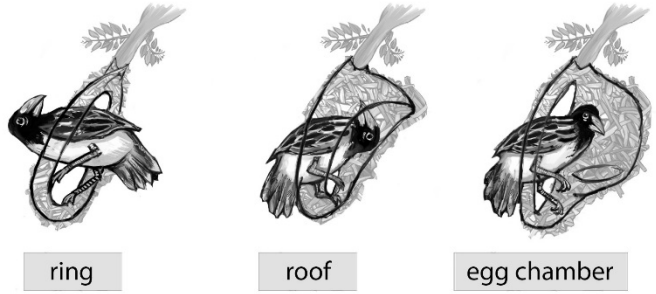
Point

“Natural selection is the only known causal process capable of producing complex functional organic mechanisms”
(Buss, Haselton, Shackelford, et al. 1998)

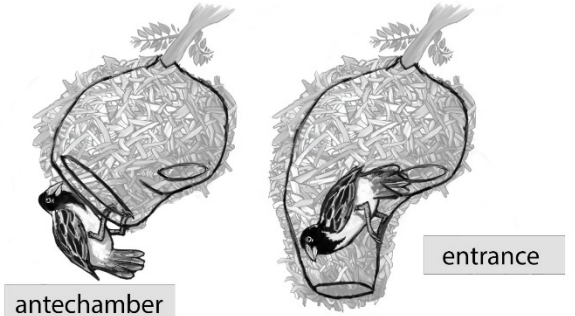
- Nope
- Cultural evolution, driven by unconscious selective attention, can also generate complex function units that appear designed to solve specific problems.
  - Spice tastes and recipes
  - Nardoo
  - Alkali in corn
  - Writing systems (Reading changes our brains)
- Also, natural selection can act on cultural variation.

half hitch overhand slip knot





ring roof egg chamber



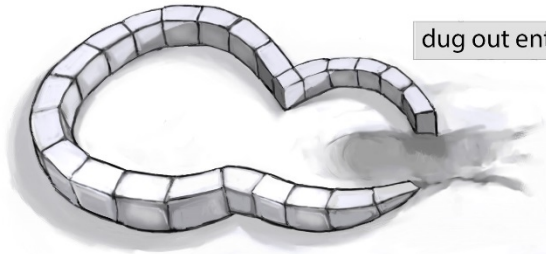
antechamber entrance

built by selection-driven genetic evolution

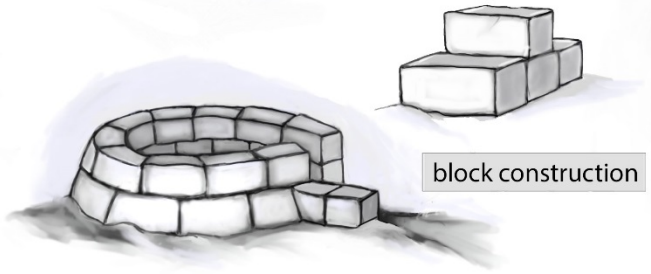
snow knife

soap stone lamp

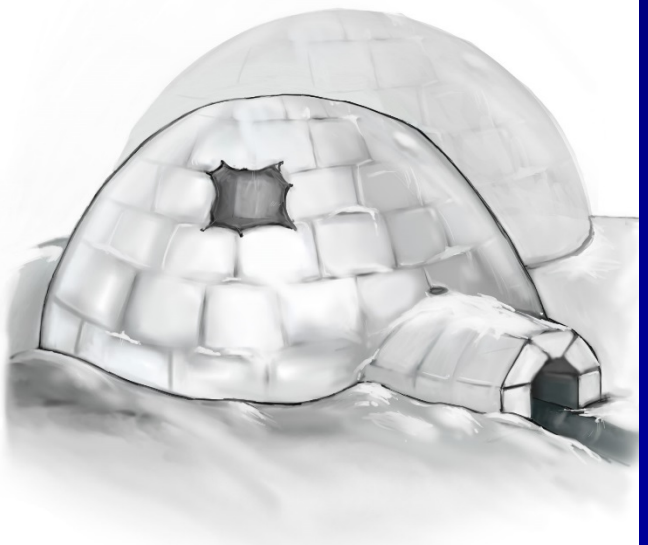
seal gut



dug out entrance



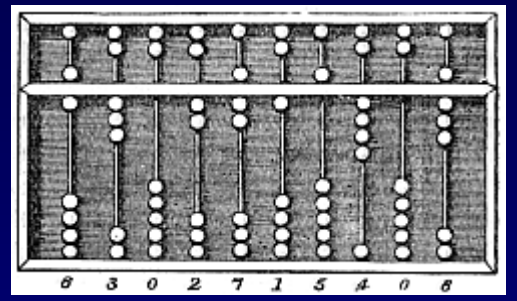
block construction

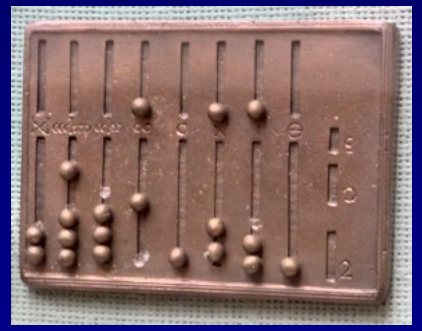


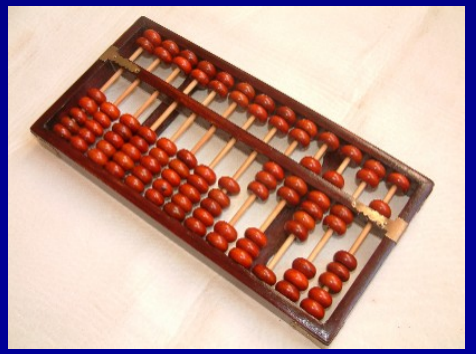
built by selection-driven cultural evolution

Culturally-evolved cognitive adaptations

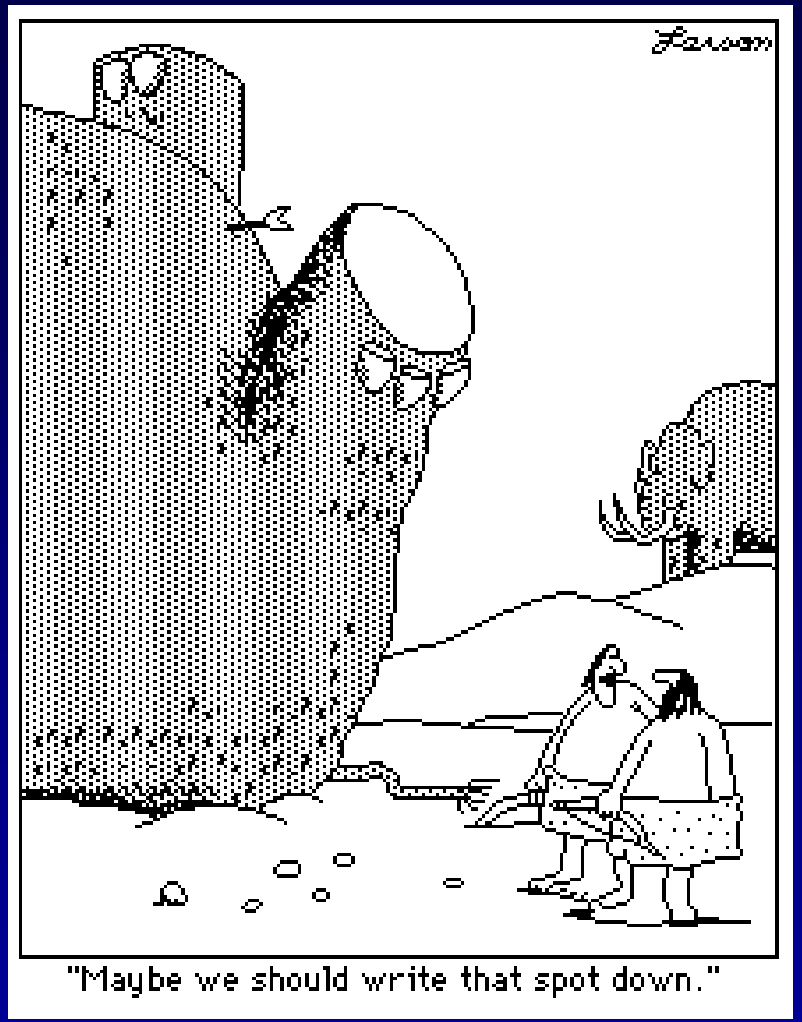
- Numerals & spatial reference systems
- These mental abilities evolved culturally to fit our innate psychology.
- Mental abacus—extraordinary computation abilities
  - Real abacus—harnesses visio-spatial abilities, object tracking & grouping abilities.
- Languages evolved culturally to “fit” our brains, and to be easily learnable by children







The Collective Brain



Chapter 12, *Secret of Our Success*

Population Size and Tool Complexity

- 10 societies, Oceania (eHRAF)

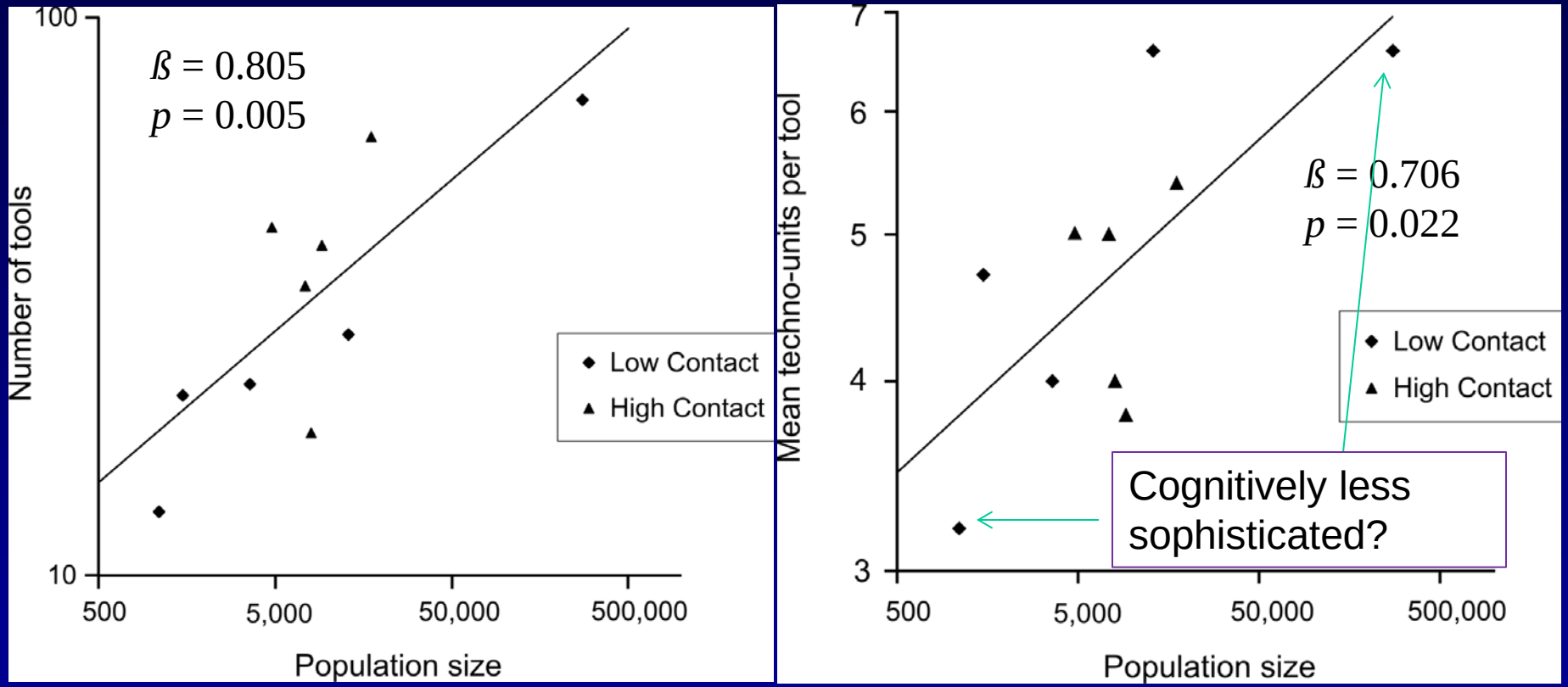
Kline and Boyd 2010 Proc-b

Need a natural experiment:

Does population predict the size and complexity of toolkits?

Marine foraging tool complexity

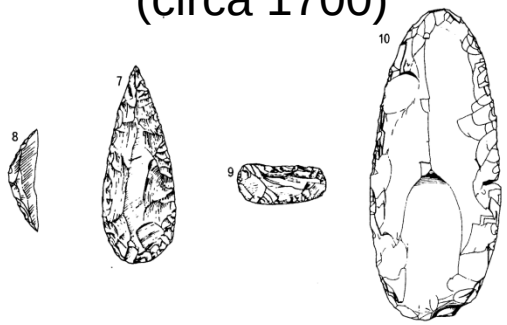
Technological variety and complexity

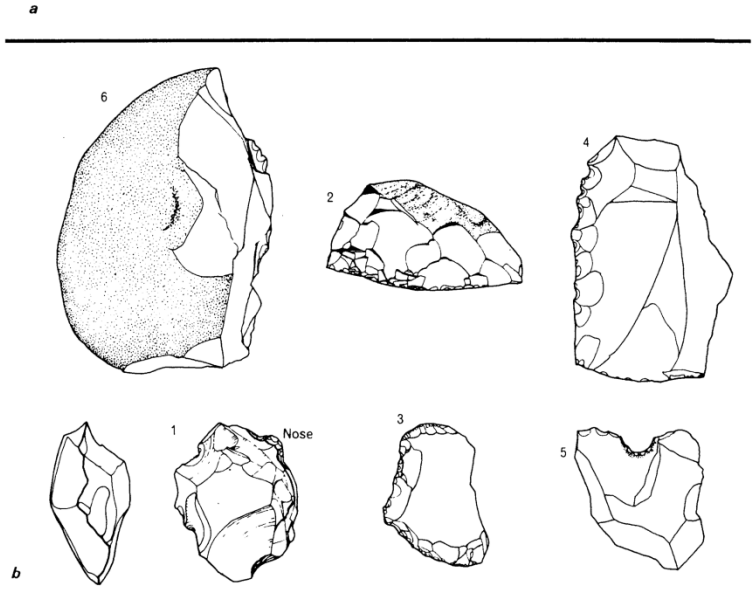


Log Scale

Larger islands had larger populations, more tools, and greater tool complexity. This all occurred in a few thousand years. Stands up to many control variables (ecological variables).

Australian Aboriginal Stone tools
(circa 1700)

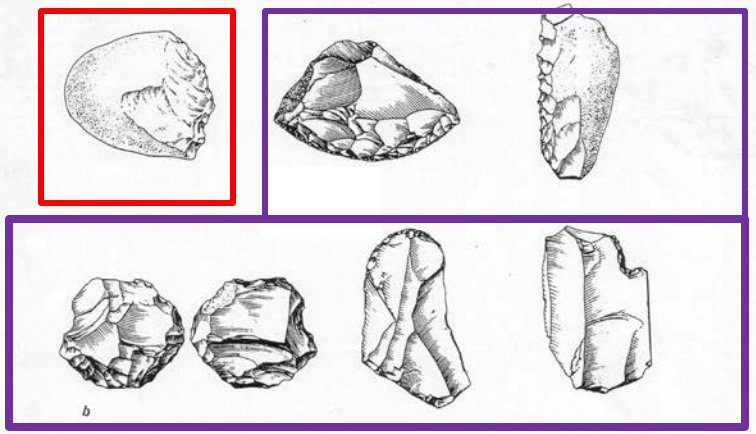




Tasmanian Tools
(circa 1700)

?

Upper Paleolithic tools (35K)



Mousterian (Neanderthals)

Oldowan 1.8 mya

- Europeans 1642
- Hunter-gatherer bands
- ~4000 Tasmanians on an island 2/3rd the size of Ireland
- Simplest technology of any people ever

Wallaby Skin
(one piece)

Archaeology deepens the puzzle

- In last 10,000 years, Tasmanians lost or never evolved a series of valuable skills and technologies.
- ***Bone tools***, ***fishing***, *cold-weather clothing*, *hafted tools*, nets, fishing spears, *barbed spears*, spear-thrower, *durable watercraft*, and boomerangs.
- Dressed in one-piece wallaby skins, used 1-piece spears and clubs for hunting. Drank from skulls.
- In all, the Tasmanian toolkit consisted of only about 24 items.

Tasmania watercraft (no paddles)

Drinking vessel

The control group

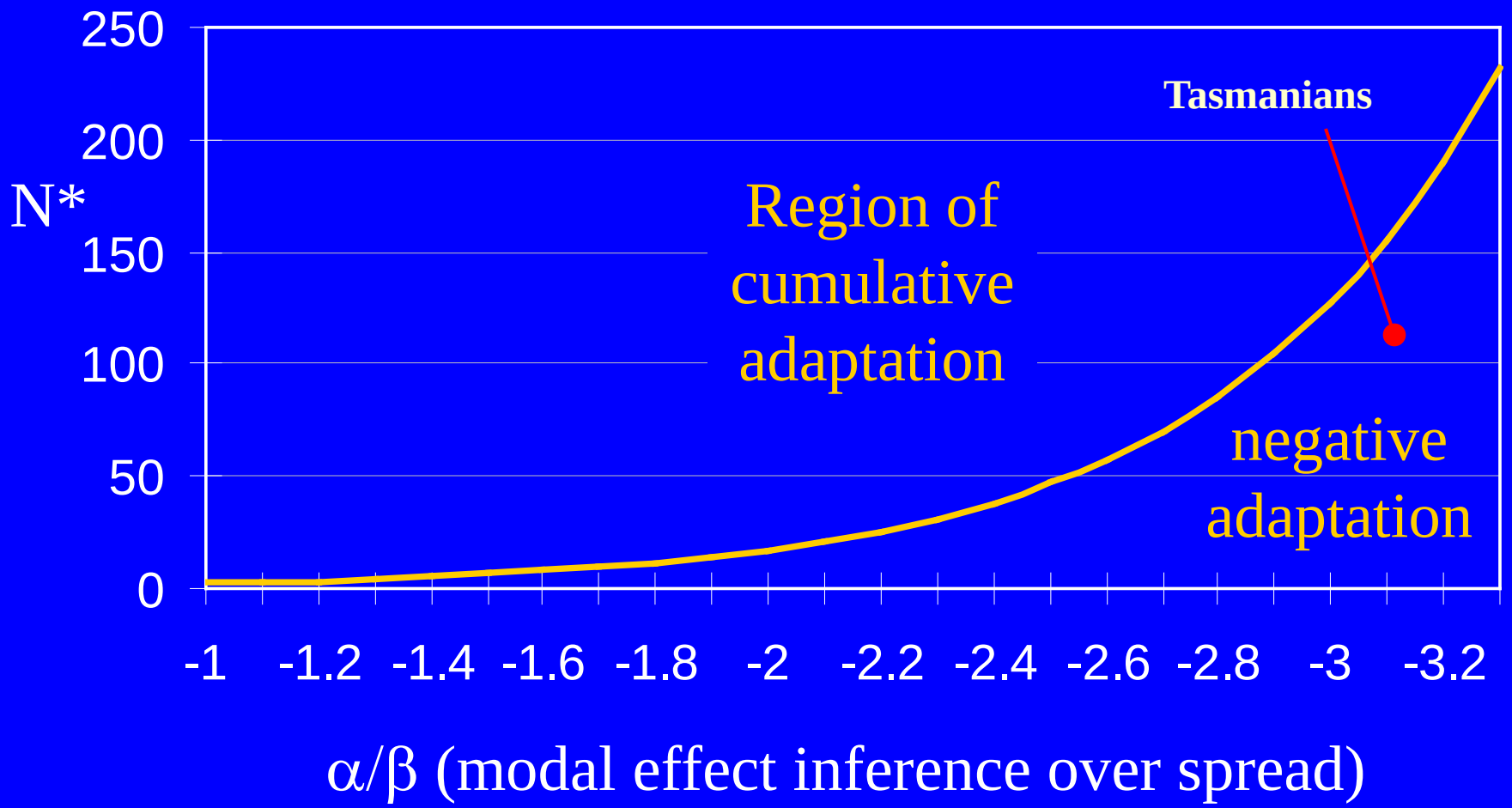
- Across the Bass Strait, the Victorian aborigines possessed almost the entire Tasmanian toolkit plus hundreds of additional specialized tools including…
- Multi-pronged fishing spears, spear throwers, boomerangs, mounted adzes, composite tools, a variety of nets for birds, fish and wallabies, sewn bark canoes, string bags, ground edge axes and wooden bowls for drinking

Why would they lose such useful pieces of technology?

Collective Brains Can Shrink

- Rising seas cut Tasmania off
- This drastically reduced the effective size of the social network for cultural learning
- Gradually, over 1000's of years, useful technologies and knowledge ebbed away.
- This did not happen in Victoria, as they were connected with larger networks of Australia.
- Point: cultural evolution is a social process that depends on the size of interconnected population→ at some level, the size of the continent.
- Innate differences unlikely.

Polar Inuit

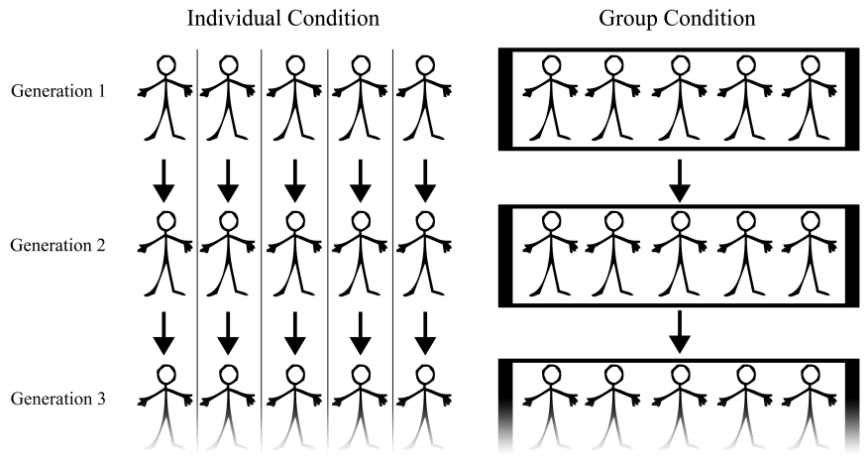


Cultural transmission may create cumulative adaptation,
but only if the pool of potential cultural models is sufficiently large
(sudden drops in population size may initiate adaptive losses

To the laboratory….

- Field evidence is provocative, but can we demonstrate this in the lab, in a controlled setting?
- Micro-societies over success laboratory generations

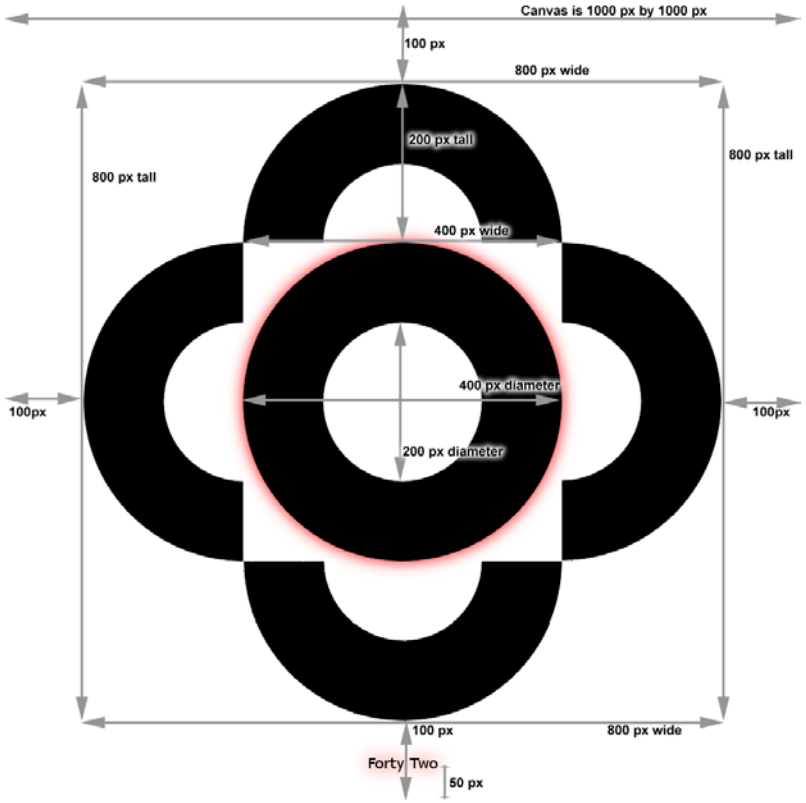
- 2 experiments
  - Start with naïve, unskilled: will greater sociality *cause* skill to accumulate? (*n* = 100)
  - Start with experts: will greater sociality inhibit loss of skill over generations? (*n* = 100)



k = 1 *k* = 5

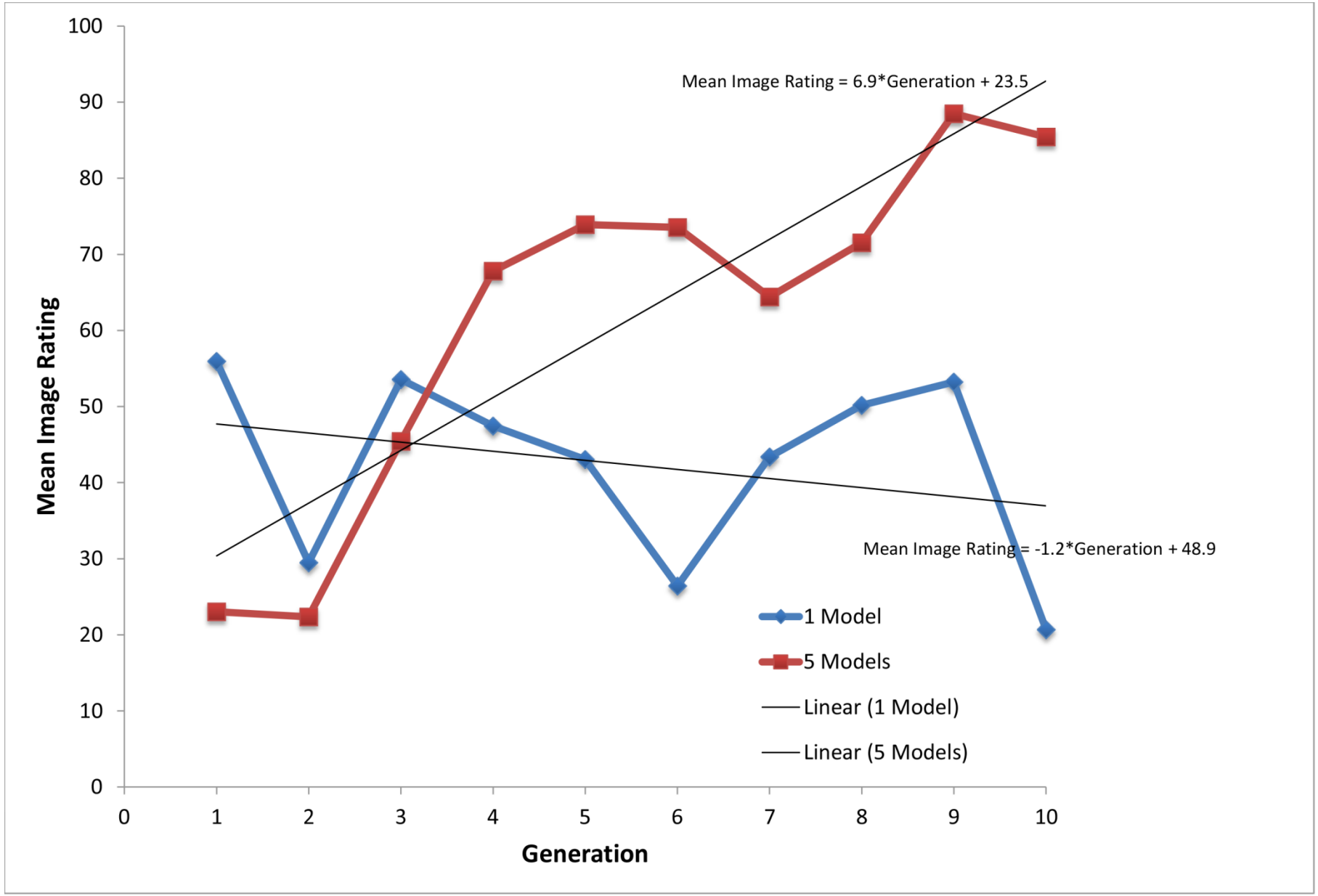
Collab: Michael Muthukrishna

Experiment 1: Unskilled Generation 1



- Goal: replicate target image using complex image editing program
- Time limit
- Paid for own and student's performance.
- Access 1 or 5 models
- After task: can write up to 2 pages for "student"

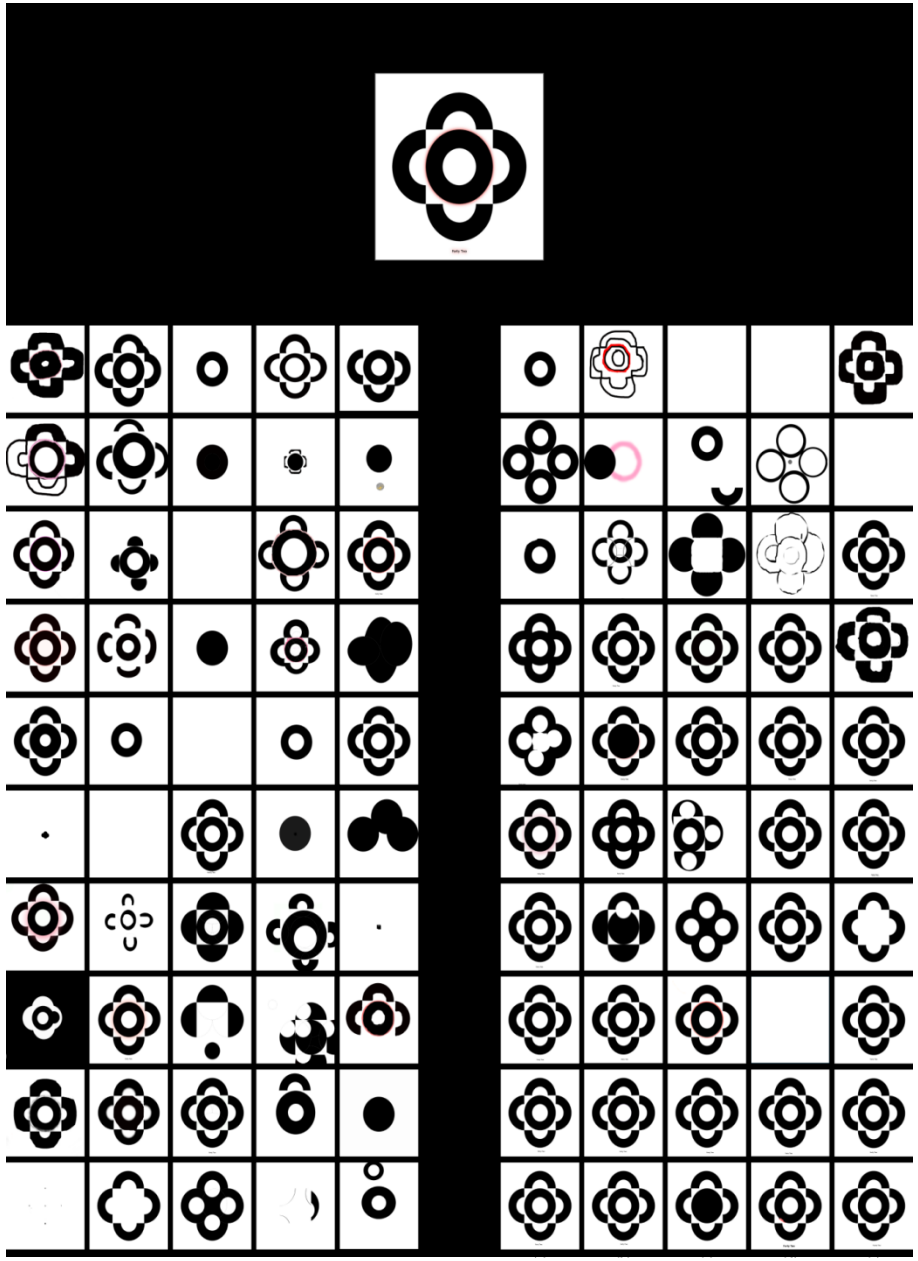
- Next generation gets the (1) model's product, (2) write-up and (3) target image
- Skill = similarity to target image


Mean Image Rating = 6.9*Generation + 23.5
Mean Image Rating = -1.2*Generation + 48.9
Mean Image Rating
Generation
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
1 Model
5 Models
Linear (1 Model)
Linear (5 Models)

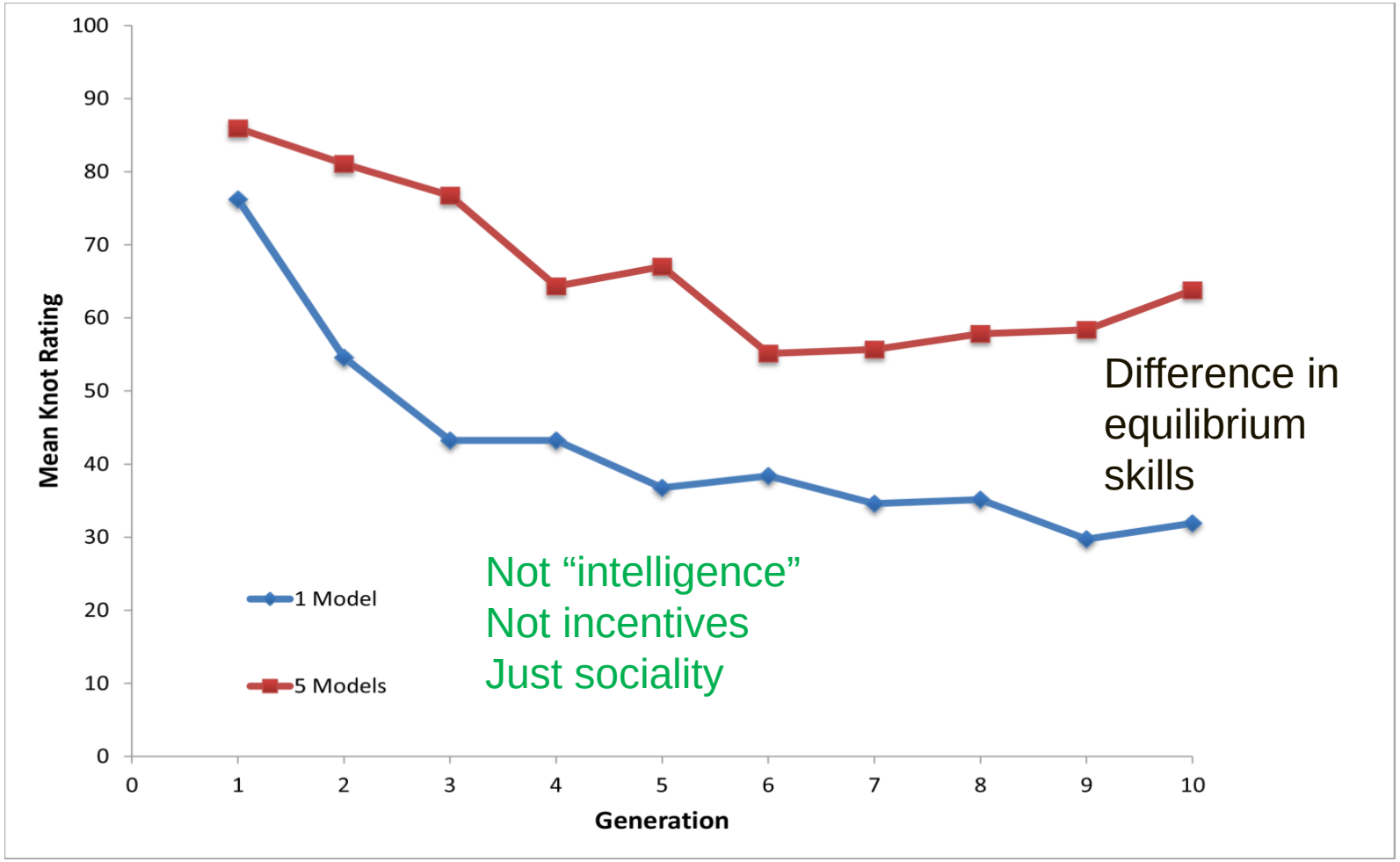
The data

In Generation 10

Everyone in 5-Model treatment is more skilled than everyone in 1-Model treatment.

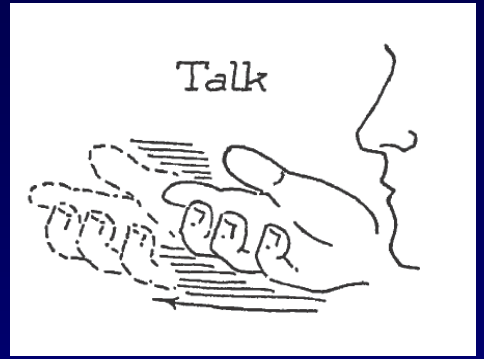


More sociality slows decay rate and raises equilibrium skill level

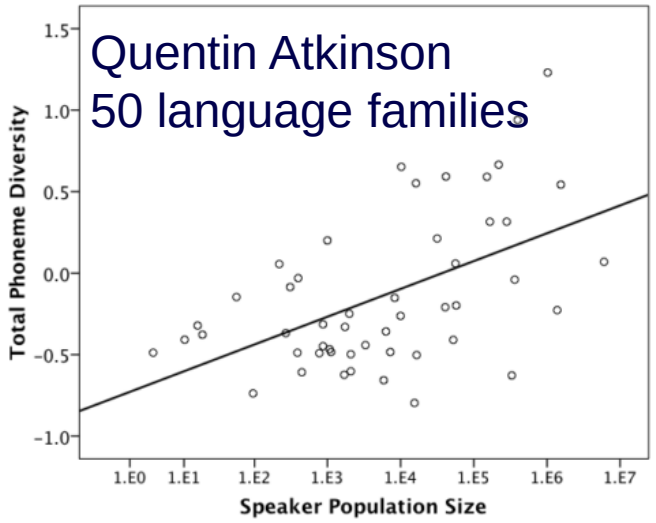


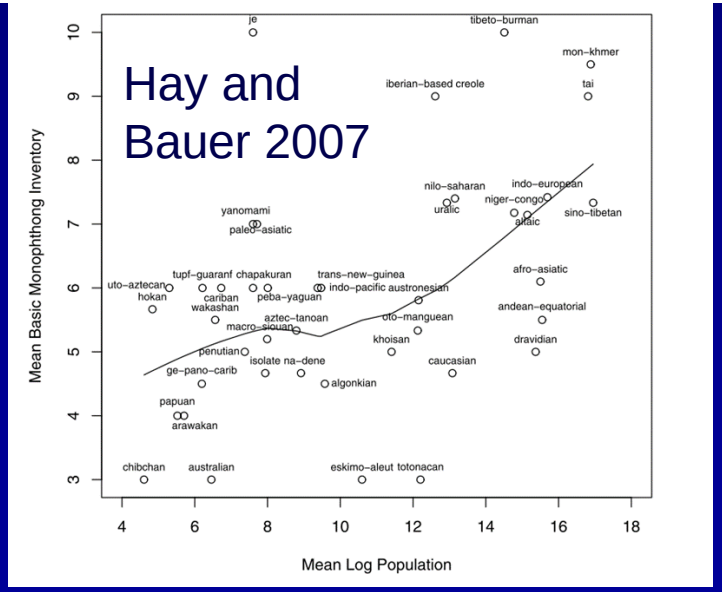
Tools and rules for communication

- Languages are products of cultural evolution, sets of tools and rules.
  - Adaptations for communication
    - Sign, whistle and hum languages
    - Warmer climates have more sonorous languages
- Ergo, the same predictions apply
  - Larger speaker communities have
    - ✓ *More words—gain and loss in Polynesia.*
    - ✓ *More phonemes*
    - ✓ *Informationally more efficient*



Sound (phonemes) Inventories

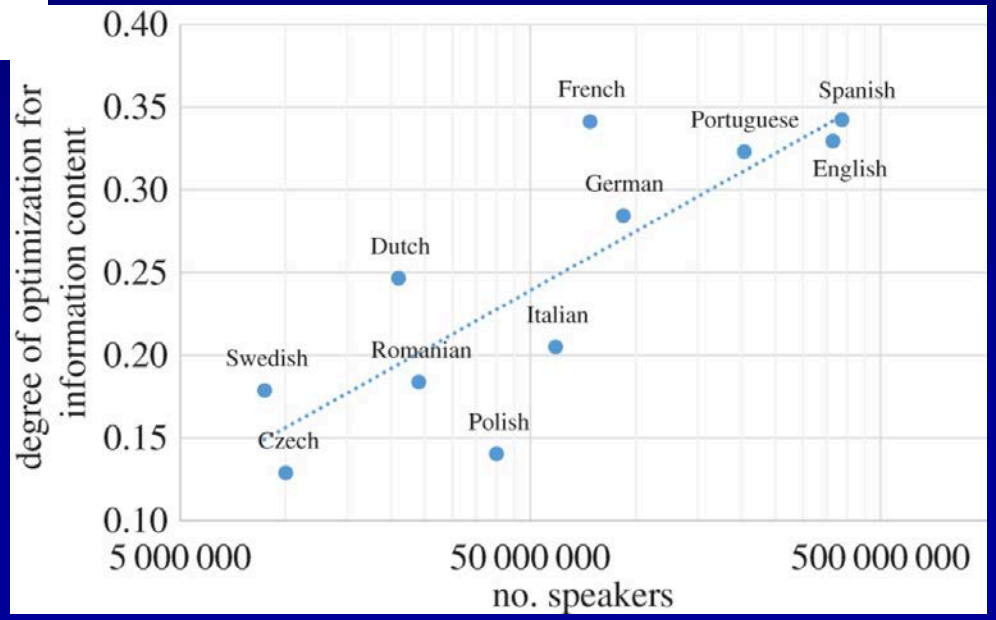




Phonemes vary from 11 to 140 across languages

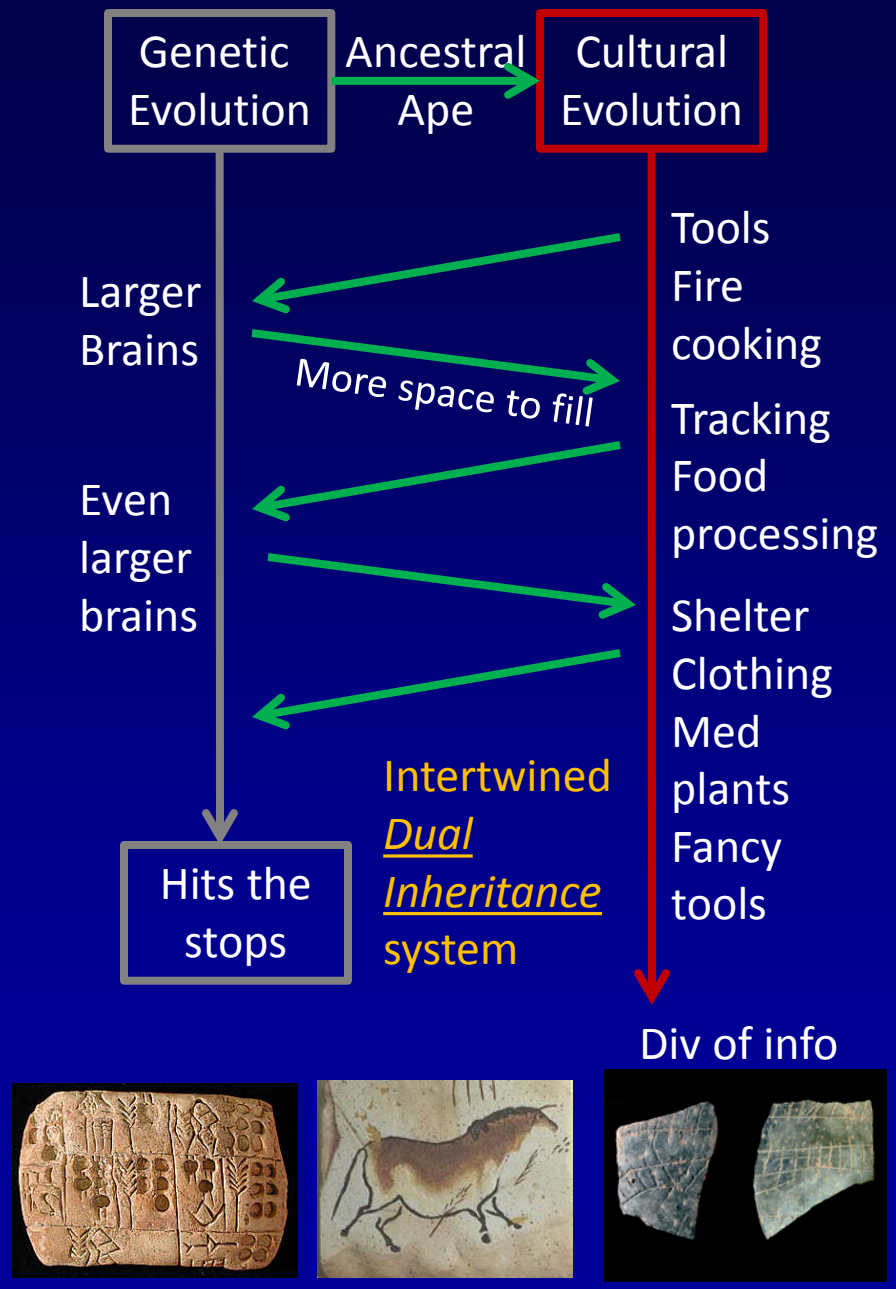
More phonemes → shorter words

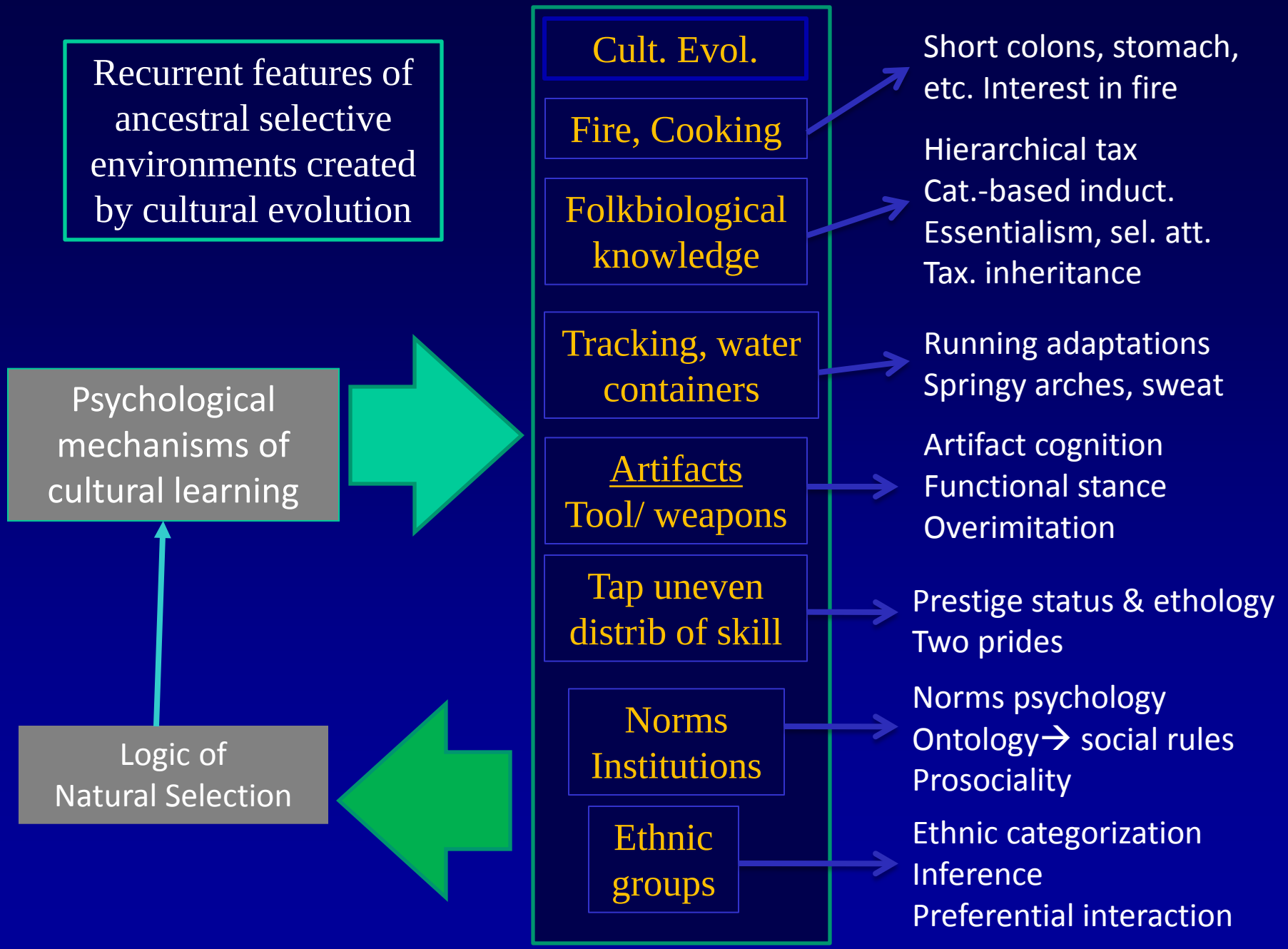
WEIRDist Language: English
(most words, high IE, morpho-simple)



The Cultural Brain Hypothesis

- Constant pressure for larger brains that are better able to acquire, store, organize and retransmit cultural info.
- As soon as brains improve, increasing in size, cultural evolution rapidly expands the pool of information.

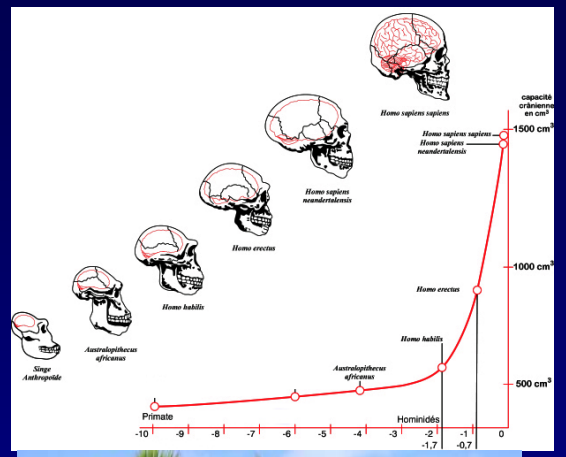



Recurrent features of ancestral selective environments created by cultural evolution
Psychological mechanisms of cultural learning
Logic of Natural Selection
Cult. Evol.
Fire, Cooking
Folkbiological knowledge
Tracking, water containers
Artifacts
Tool/ weapons
Tap uneven distrib of skill
Norms
Institutions
Ethnic groups
Short colons, stomach, etc. Interest in fire
Hierarchical tax
Cat.-based induct.
Essentialism, sel. att.
Tax. inheritance
Running adaptations
Springy arches, sweat
Artifact cognition
Functional stance
Overimitation
Prestige status & ethology
Two prides
Norms psychology
Ontology→ social rules
Prosociality
Ethnic categorization
Inference
Preferential interaction

Cultural Brain Hypothesis

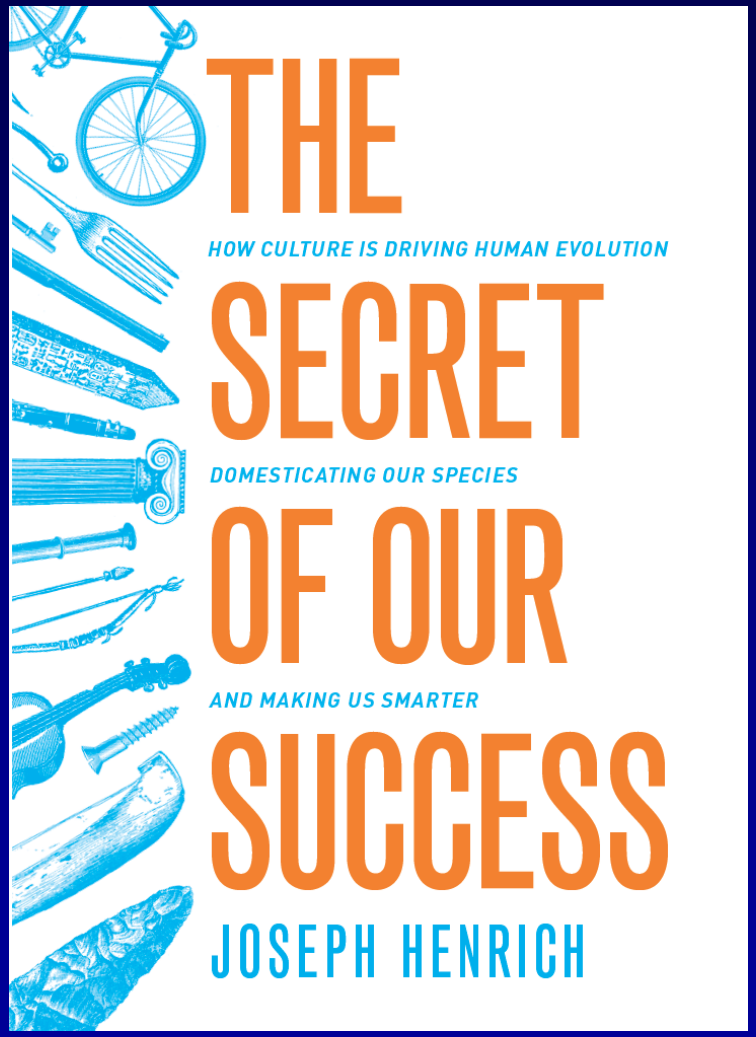
Predicts our specializations & oddities

- Explains rapid expansion of our brains, and large size.
- Account for many features of human anatomy/psychology
- Cognitive differences between species
- Cultural learning, over-imitation
- Extended childhoods
- Menopause



Big Picture

- What kind of animal?
- Important question
- Effects institutional and policy design.
- All social/behavior sciences implicit assume answers.
- A cultural species, produced by culture-driven genetic evolution



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The Secret of Our Success

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Professor in the Department of Human Evolutionary Biology, Harvard University
Holder of Canada Research Chair at UBC

Professor Timothy Besley

School Professor of Economics and Political Science
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