



# HOLOCENE CROSSROADS

## – Managing the Risks of Cultural Evolution –

*George F. Steiner*

### SYNOPSIS

The steady growth of hominin cranial capacity during the Lower and Middle Paleolithic (L/MP) supported the emergence of controlled vocalizations, orchestrated mimetic techniques, deductive tracking skills and exogrammatic information storage. ‘Exograms’ are defined as memory traces stored outside the brain as consciously-sequenced information packages meant to stabilize abstract calibrations of reality. The first instances of their use document the universal emergence of a species-specific objective state of consciousness. Although the ability to produce them is a biological development, the transmission of exogrammatic meaning becomes culturally-conditioned. As all the faculties listed above were in place long before the Aurignacian, the Upper Paleolithic (UP) ‘revolution’—unlike the L/MP transition—cannot be attributed to changes in the size or shape of the cranium. The period was rather characterized by accelerated cognitive specialization to deterministically-predictable cultural niches constructed in unreliable environments. By adapting to their calibrated models of reality, archaic populations underwent rapid physiological/psychological transformations. It is contended that the UP ‘creative explosion’ illustrates the attempt to counter cognitive losses inherent in cumulative cultural evolution and incipient self-domestication.

Unfortunately, by considering the cumulative type of cultural evolution as the ‘natural choice’ of all cognitively modern humans, gene-culture coevolution theory implies that the ‘ratcheting’ of innovations is the only index of ‘progress.’ In the modelling of the theory the stress is placed on social complexity, the absence of which would render small and isolated populations vulnerable to the ‘treadmill effect,’ the inevitable consequence of impaired social learning. However, the anthropological literature documents isolated hunter-gatherer groups that have developed intricate exchange networks that do not necessarily rely on technological innovation and function only in low demographical settings. Not only that the biases upon which transmission depends in cumulative cultural evolution—prestige, skills, success—are unknown, but certain ‘leveling mechanisms’ inhibit these very parameters and thus, no cultural models can rise to prominence. Contrary to the predictions of the theory, these societies do not seem to be plagued by cultural ‘loss’ and, instead of hopelessly running the treadmill and living in poverty, they have developed egalitarian and, to an extent, ‘affluent’ societies.

Populations following a non-cumulative type of cultural evolution—known in anthropology as ‘immediate-return’ hunters-gatherers—are often described as ‘pedomorphic,’ due to their markedly neotenuous morphological features and cognitive attitudes. On the other hand, populations that follow a cumulative type of cultural evolution are surprisingly ‘robust’ phenotypes. In the case of the latter, a cultural ‘sudden jump’ seems to have occurred during the Late Pleistocene which, in its turn, resulted in the entrenchment of archaic behavioral traits and the establishment of hierarchical societies. Conversely, with certain isolated hunters-gatherers, a cultural ‘regression’ seems to have taken place during the Early Holocene. The adoption of a cultural ‘primitivism’—immediate-return subsistence—offered a degree of evolutionary flexibility that allowed for a neotenal leap. This, in its turn, enabled the reduction of archaic behavioral traits and the emergence of egalitarian societies.



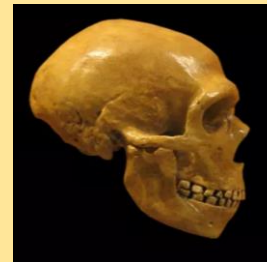
|                                 | African   | Levantine | European  |
|---------------------------------|-----------|-----------|---|
| <b>Period A</b><br>(~11-17 ka)  | Mobilized | Mobilized | Mobilized                                       |
| <b>Period B</b><br>(17-22 ka)   | Emergent  | Emergent  | Mobilized                                       |
| <b>Period C</b><br>(22-42 ka)   | Emergent  | Emergent  | Mobilized <sup>1</sup><br>Emergent <sup>2</sup> |
| <b>Period D</b><br>(42-72 ka)   | Emergent  | Ancestral | Emergent  |
| <b>Period E</b><br>(72-123 ka)  | Emergent  | Emergent  | Ancestral                                       |
| <b>Period F</b><br>(123-191 ka) | Emergent  | Ancestral | Ancestral                                       |

X

'Mobilized'?



'Emergent'?



(Hoffman et al. 2018)

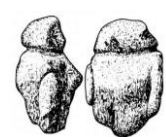
- The archaeological record documents both L/MP examples of iconic understanding and UP instances of abstract representation: **the relationship between them is rather complementary than linear.**

- The anthropological literature mentions cultures that favor 'meaningful' abstract patterns over 'childish' iconic illustrations (but also instances in which there is a balanced and simultaneous use of both).

(Culley 2016)

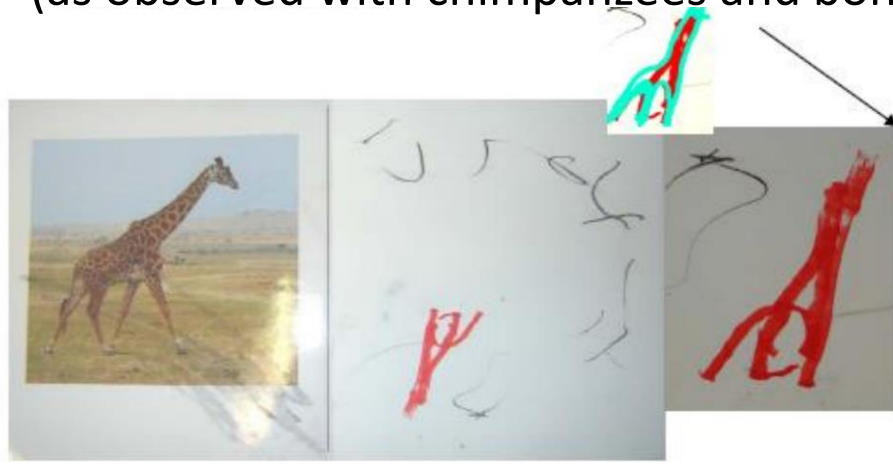
<sup>1</sup>The archaeological record associated with AMH that dates to Period C is Mobilized. <sup>2</sup>The archaeological record associated with Neanderthals that dates to Period C is Emergent.

**Period G?**  
(191-350 ka)?



(Bednarik 1994, 2013, 2014; Goren-Inbar 1986)

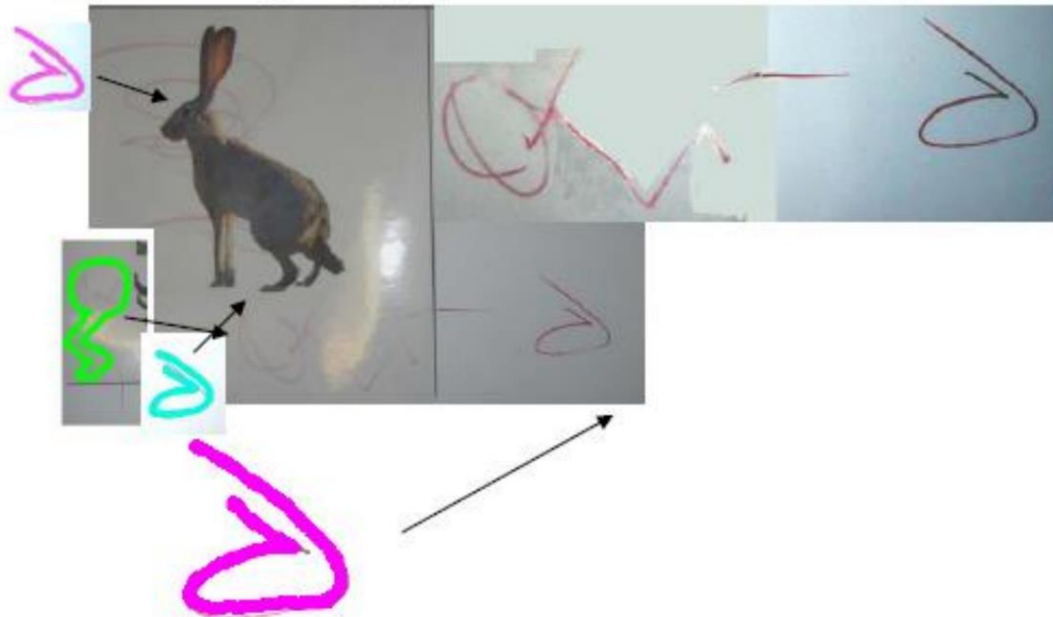
ANATOMICAL (A) + BEHAVIORAL (B) + COGNITIVE (C) CHANGES IN **ARTIFICIAL** ENVIRONMENTS  
(as observed with chimpanzees and bonobos)



Kanzi's 'giraffe'



Kanzi's early *Homo*-type 'tools'



Kanzi's 'rabbit'

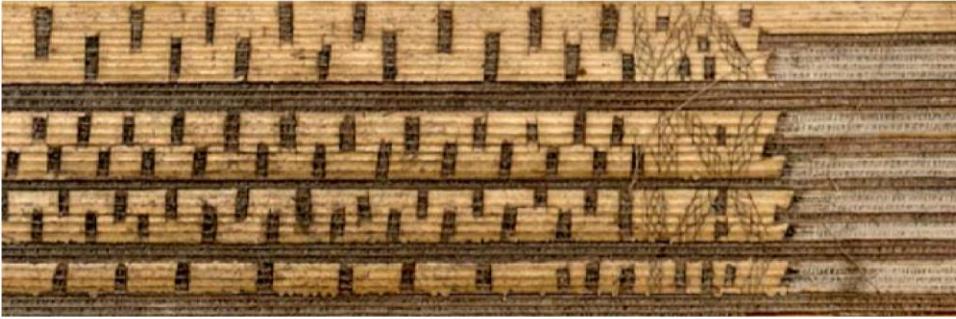


Markedly advanced bipedal locomotion/gait

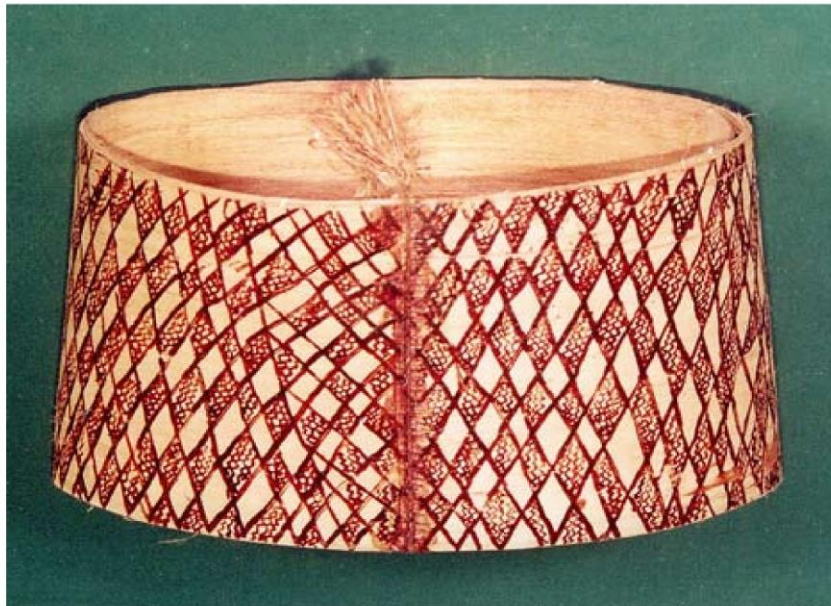


**ANDAMANESE JARAWAS:**

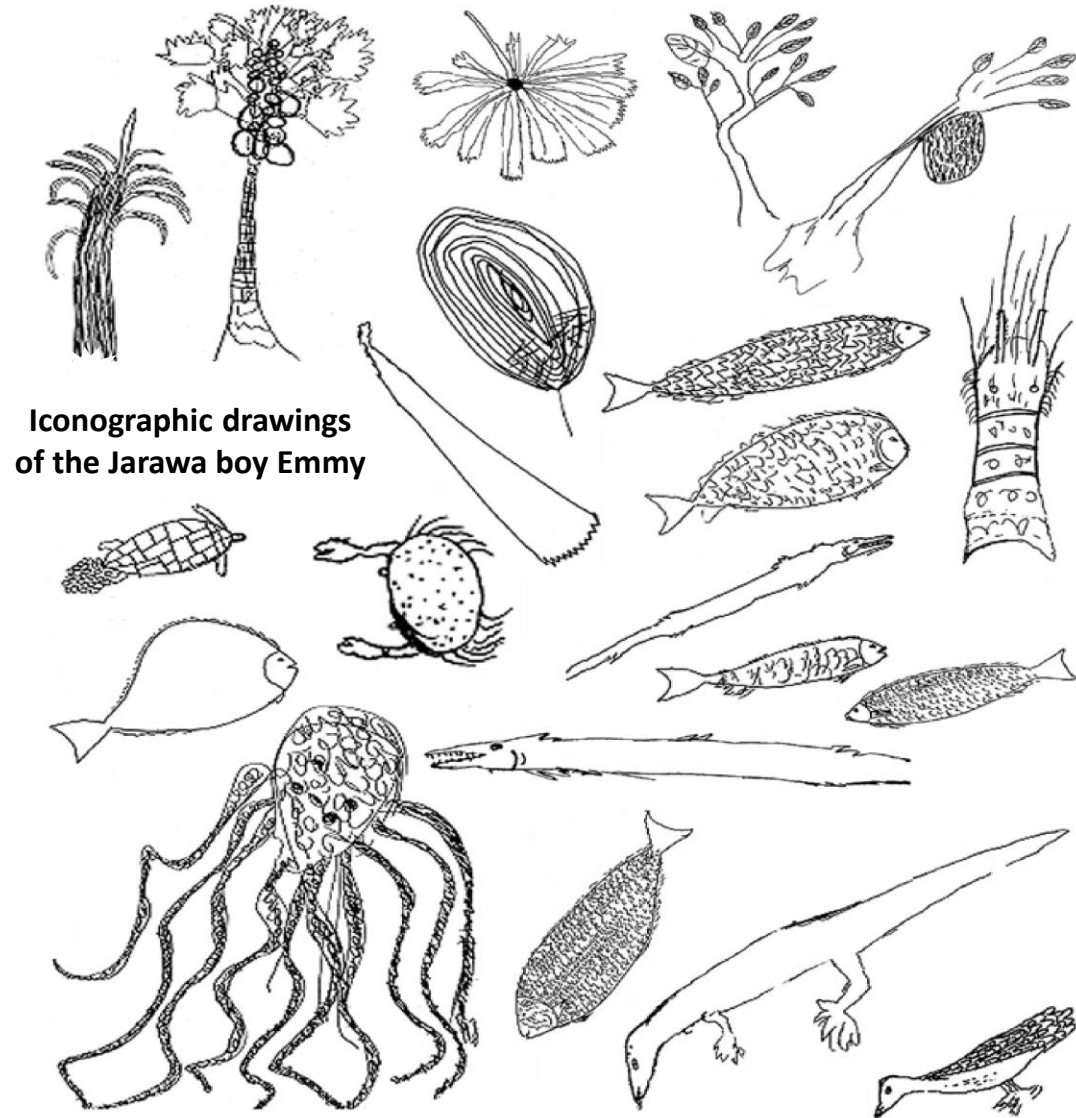
**'MEANINGFUL' PATTERNS** IN A NATURAL ENVIRONMENT / **'CHILDISH' DRAWINGS** IN AN ARTIFICIAL (HOSPITAL) ENVIRONMENT



Jarawa headband featuring a traditional woven pattern



Jarawa chestguard featuring a painted red on white pattern



Iconographic drawings  
of the Jarawa boy Emmy

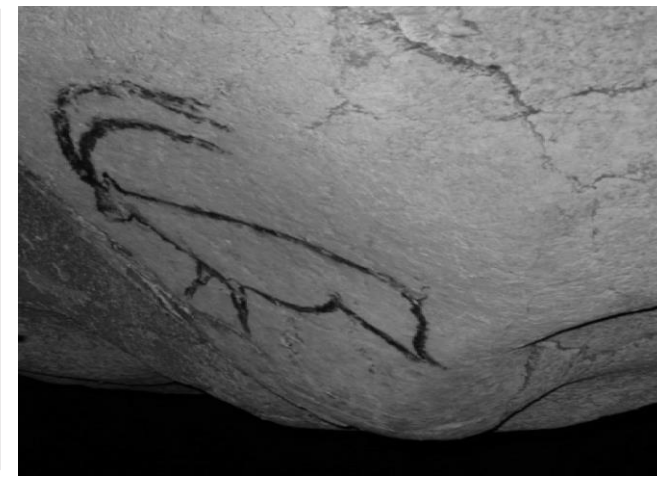


A Cro-Magnon specimen attributed to the Aurignacian which, in fact, is of the Gravettian.

Presumed lack  
of *osteological*  
*transition*  
between 'old'  
and 'new' Upper  
Paleolithic  
Eurasians.

EXPLAINING THE 'DISCONTINUITY'  
(e.g. Mellars 1989; but see Saniotis and Henneberg 2010)

Presumed lack  
of *cognitive*  
*transition*  
between 'old'  
and 'new' Upper  
Paleolithic  
Eurasians.



An illustration from Chauvet attributed to Cro-Magnon but possibly drawn by Neanderthals.

REPLACEMENT...

REVOLUTION...

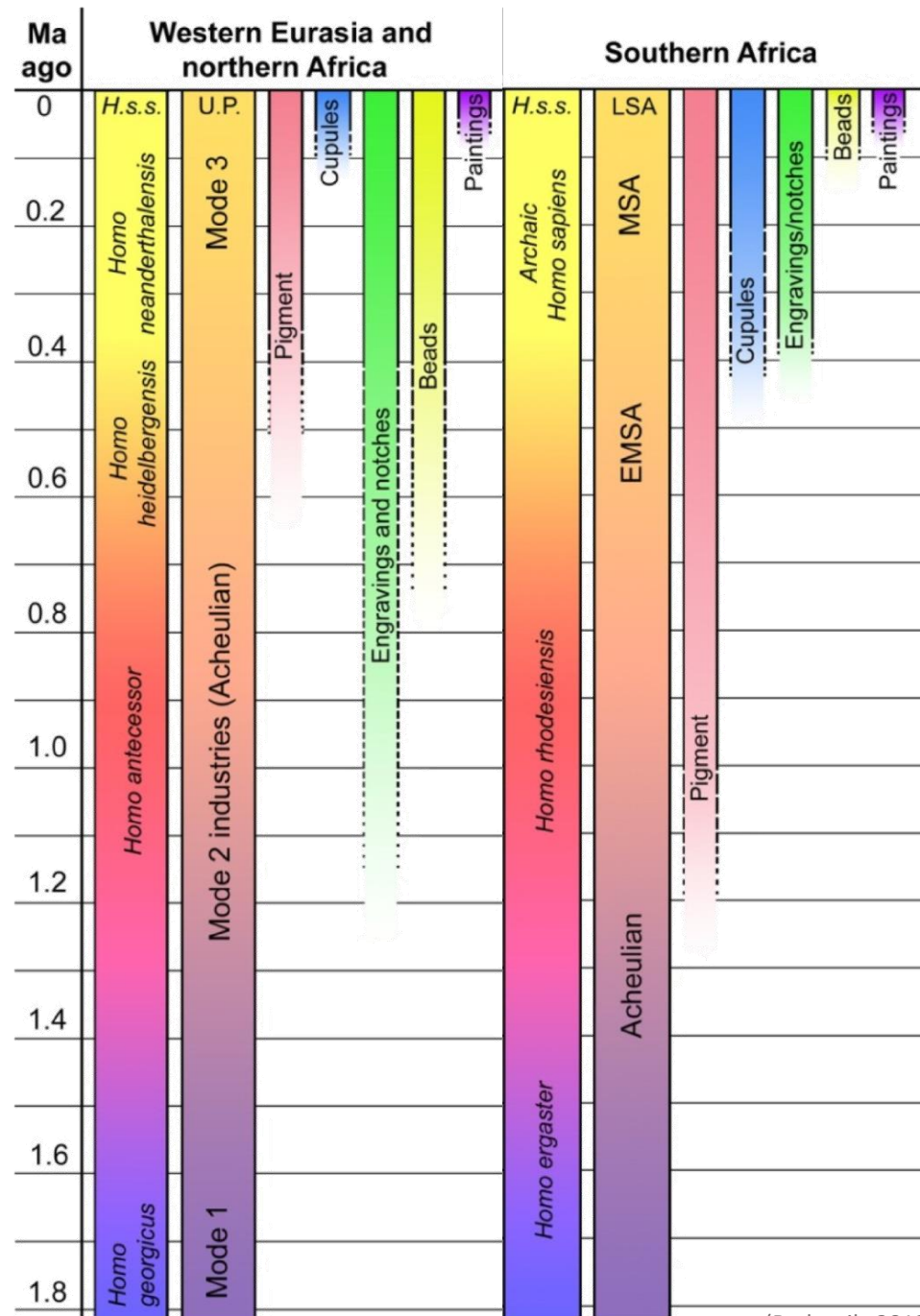
DISCUSSION

The **Eurasian Upper Paleolithic transition** should not be perceived as the replacement of one species with another but as a **culturally-determined behavioral 'sudden jump'** followed by a **morphological transition within the same [cognitively already modern] species.**

'A-B-C of modernity'  
(**A**natomical, **B**ehavioral, **C**ognitive)  
Western Eurasia: **C-B-A**  
Southern Africa: **C-A-B**

The 'missing link':  
**EXOGRAMS**





(Bednarik 2013)

A COMPARISON OF HOMININ EVOLUTION AND TECHNOLOGY IN **WESTERN EURASIA/NORTH AFRICA** (left) AND **SOUTHERN AFRICA** (right) SHOWING THE RELATIVE DURATIONS OF THE USE OF MAJOR **PALEOART** FORMS IN THE PLEISTOCENE. (Although there are differences in the duration of some of the indices, none of the regions can be regarded as a source area for the general use of exograms.)

**L/MP pigment use, engravings and notches, beads and pendants, cupules:**

indexes of [biologically-developed] **CONSCIOUSNESS** and **COGNITIVE 'MODERNITY'**

**MP/UP abstract representations + UP iconic paintings:**

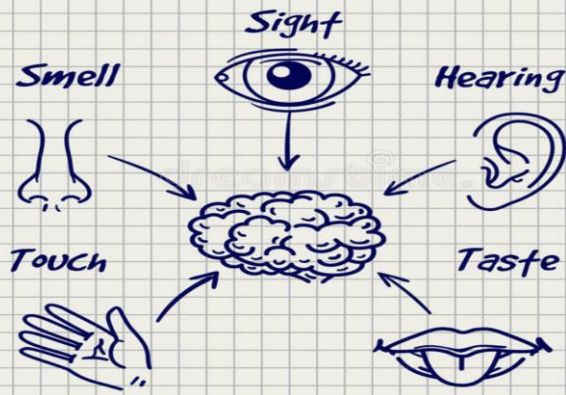
indexes of [culturally-acquired] **'CONSCIOUSNESS-AS-WE-KNOW-IT'** and **BEHAVIORAL 'MODERNITY'**

**EXOGRAMS:**  
EXTERNALLY  
STORED  
**'MEMORY**  
TRACES'

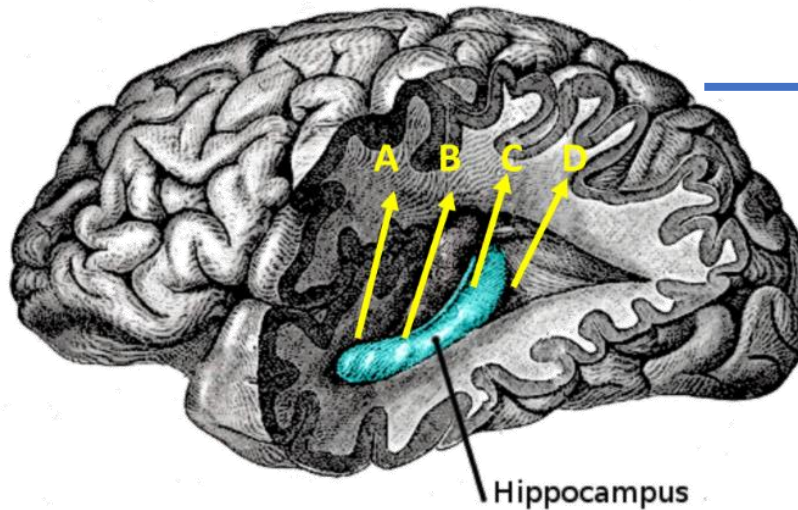
(Steiner 2017)

(Bednarik 2014)

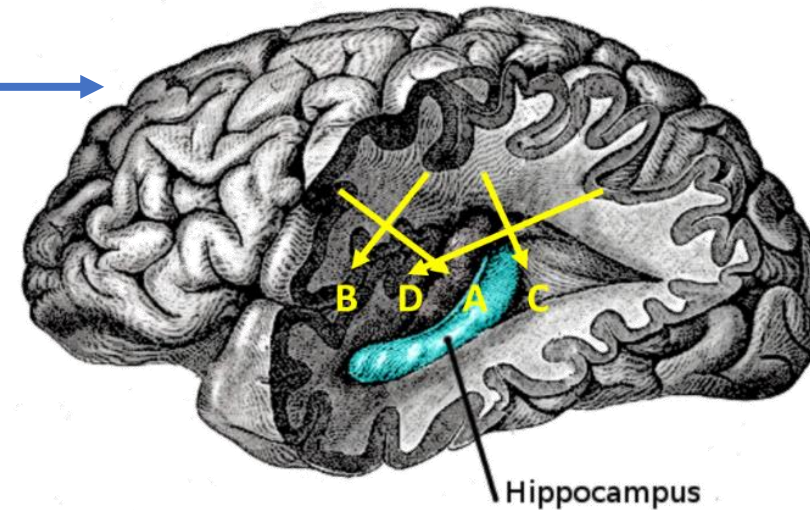
## Human Sense organs



- Do you remember your first kiss?
- How does she/he remember it?



Short-term memory storage



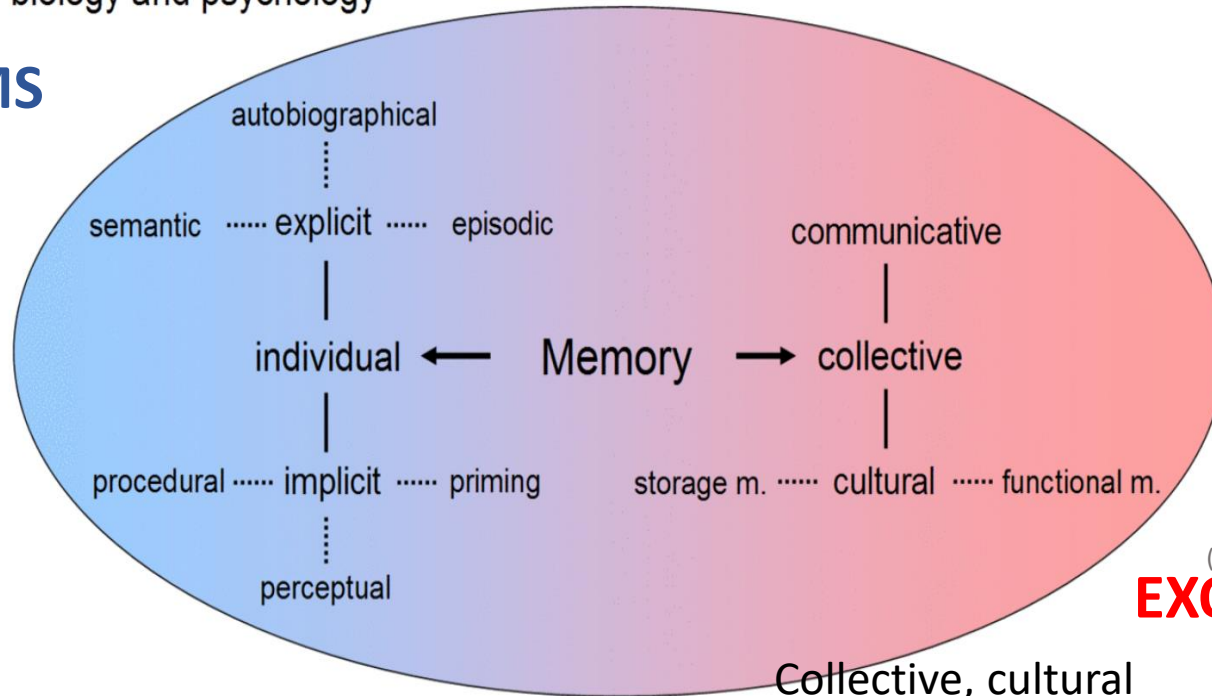
Long-term memory [re]consolidation

(Thum et al. 2007; De Jaeger et al. 2014)

Individual, autobiographical  
biology and psychology

## ENGRAMS

(Semon 1921)



Collective memory can  
be *constructed, fixed*  
and *passed on*, by  
small and/or large  
social groups. (Wikipedia)

(Donald 1991)  
**EXOGRAMS**

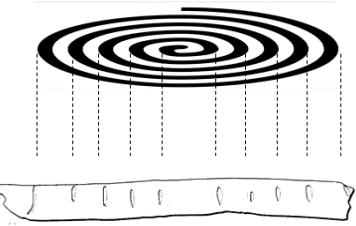
Collective, cultural  
social and cultural studies

COGNITIVE ARCHAEOLOGY →

**EXOGRAMS = 'memory traces' stored outside the brain as consciously-sequenced long-term information packages *meant to stabilize causal calibrations of reality*.**



e.g. *Tjuringas* - (MODE 3) 'MATERIAL MNEMONIC TECHNIQUES'  
(= EXOGRAMS)



THE FUTILITY OF  
'INTERPRETATION'  
WHEN ONLY IN THE  
POSSESSION OF  
ARCHAEOLOGICAL  
'MATERIAL  
MNEMONIC  
TECHNIQUES'



High-fidelity **cultural**  
**transmission** of Dreamtime  
stories 'fixed in stone'



## ART OR KNOWLEDGE?

(Cameron 2015)



+ (RHYTHM + MUSIC + DANCE + SONG) =  
'STABILIZED' **RITUAL TRANSMISSION**\*



\* *via material + non-material 'mnemonic techniques'*

“Science is the attempt to make the chaotic diversity of our sense-experience correspond to a logically uniform [unified] system of thought.”

- Albert Einstein

### CONTEXTUAL FOCUS HYPOTHESIS

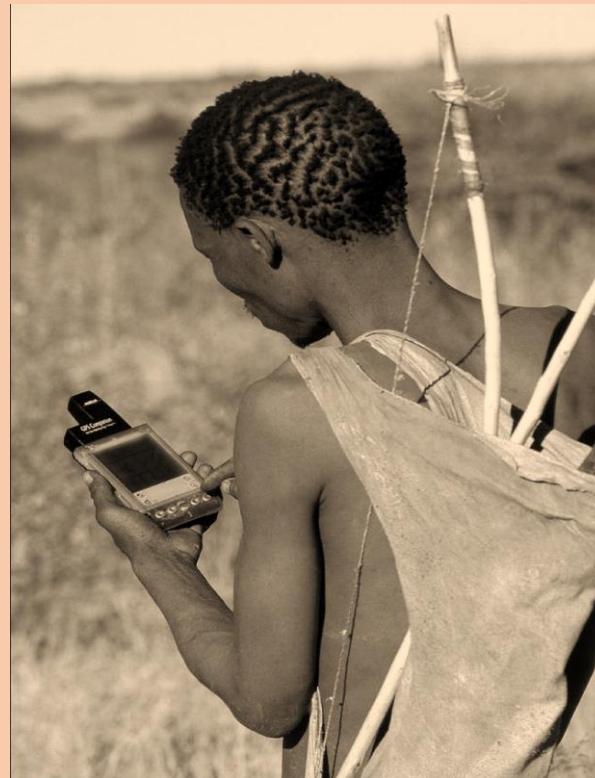
(Gabora 2003)

“The capacity to shift between *associative*—conducive to forging new and random *concept combinations*—and *analytic* thought, conducive to *manifesting* them in an ordered, reciprocally understandable fashion.”

### + HYPOTHETICAL TRACKING/TRANCE TRACKING

(as documented in Attenborough 2002)

THE ART AND SCIENCE OF TRACKING  
(Liebenberg 2013)



← CREATIVE SCIENCE

### CROSS-MODALITY INFORMATION TRANSFER HYPOTHESIS

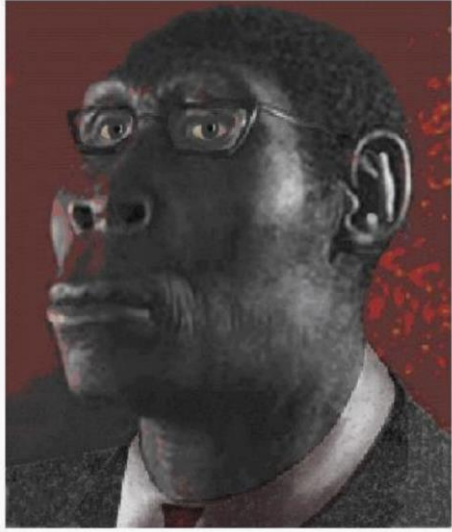
(Miyagawa et al. 2018)

[Early rock art] is the **conversion** of acoustic [and other] signals into symbolic visual representations.

“Symbolic thinking led to a fundamentally different way to compute data, one that *extracts only the essence required for abstract representation* instead of *computing the entire set of incoming raw information*.”

(cf. Mithen 1996; Dauvois 1996; Tattersall 2017; Spikins 2018)





*Homo erectus*



*Homo heidelbergensis*

## THE EVOLUTIONARY ORIGINS AND ARCHAEOLOGY OF MUSIC

(Morley 2003)

With *H. erectus*, the vocal and neurological apparatus for **voluntary control** over the structure and complexity of vocal utterances fully-developed → **Extended and planned sequences** of such utterances likely common 600 ka ago.

"Short sequences of vocalizations **consciously-controlled** for pitch/contour/intensity would be **communicative** in their own right. As control increased, the **length/complexity of sequences** could also increase.

Subsequently, the **order** in which the expressive vocalizations occurred could assume **meaning**."

## THE ORIGINS OF THE MODERN MIND

(Donald 1991)

*Three uniquely human systems of memory representation:*

- 1) Mimetic** (*H. erectus* - 1.5 million years BP); **2) Lexical** (Archaic *H. sapiens* - 300 ka BP);
- 3) External** ('anatomically modern humans' - 40 ka BP).

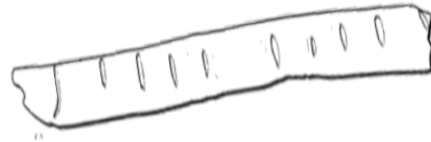
**BUT:** Evidence points to a **single transition** instead of 3 distinct punctuations → the cognitive expressions of the **1<sup>st</sup> + 2<sup>nd</sup> 'stages'** include **all** the abilities attributed to the **3<sup>rd</sup>**.



## FROM NUMBER SENSE TO NUMBER SYMBOL

(d'Errico et al. 2017)

- Cultural exaptations



**Exosomatic devices meant to store numerical information were in use with archaic humans during the African MSA and the European MP.**

## HOW MAN MADE LANGUAGE, HOW LANGUAGE MADE MAN

(Bickerton 2009)

## BIOLOGICAL TIME

(Taylor 2017)

## ART

(sensu Ellul 1964; Zerzan 1999)



Axial Gallery, Lascaux (ed.)

## ORCHESTRATED REDUCTION (OR)

(Penrose and Hameroff 2011)

- *Copenhagen*

**Conscious observation *results in* quantum state reduction.**

- *O.R.*

**Consciousness *is the result of* quantum state reduction.**

## FROM PHENOMENAL [P-] TO ACCESS [A-] CONSCIOUSNESS

(Block 1995)

- *P-consciousness*

**Raw experience of movement, colors, forms, sounds, sensations, emotions and feelings, with our bodies and responses at the center.**

- *A-consciousness*

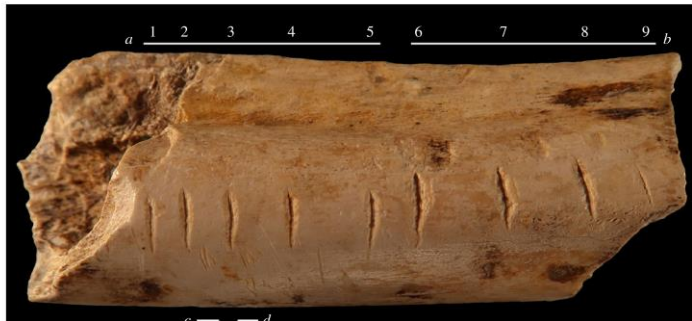
**Information stored in our mind made accessible for verbal report, reasoning, and the control of behavior.**

## FROM [P-] SENSE TO [A-] SYMBOL

(d'Errico et al. 2017; Block 1995)



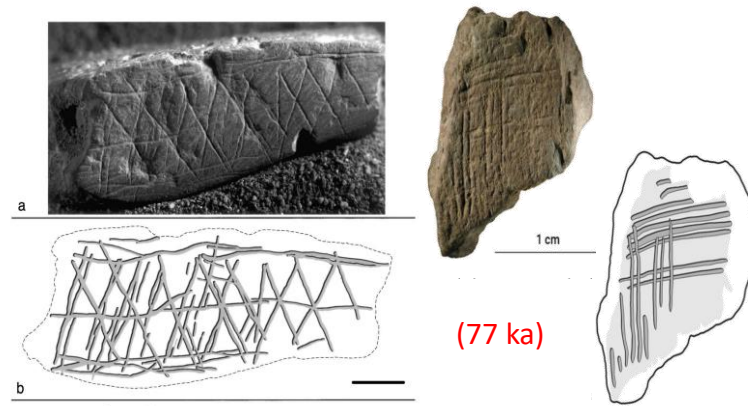
Baboon fibula from **Border Cave, South Africa**  
(44 ka)



Fragment of a hyena femur from **Les Pradelles, France**  
(72 ka)

## Blombos Cave, South Africa

(d'Errico et al. 2013, 2018)



(77 ka)



Stone plaque with engraved lines, **Wonderwerk Cave, South Africa** (c. 300 ka) (Bednarik 2013)

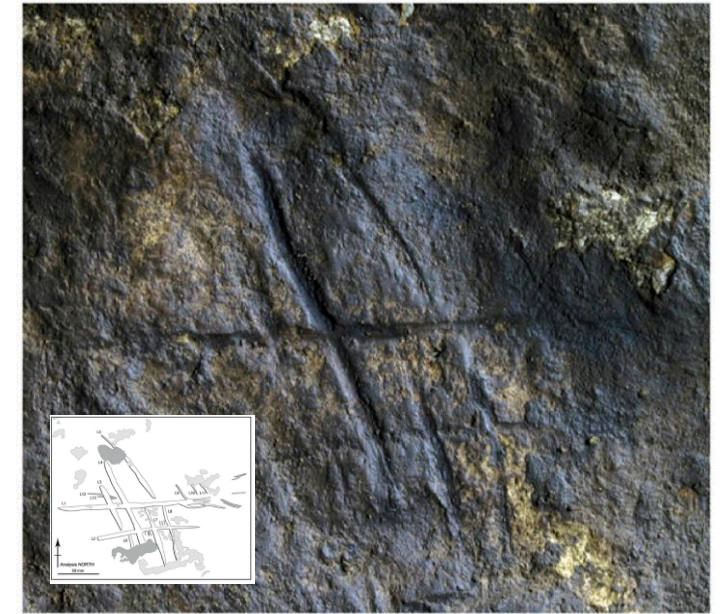


Engravings on a forest elephant tibia, **Bilzingsleben, Germany** (>325 ka) (Bednarik 2014)

## Gorham's Cave, Gibraltar

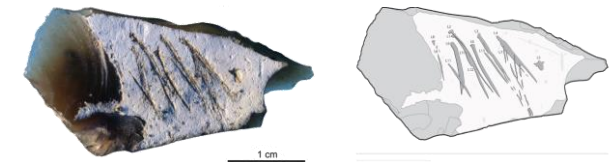
(Rodriguez-Vidal et al. 2014)

(>39 ka)



## Kiik – Koba, Crimea

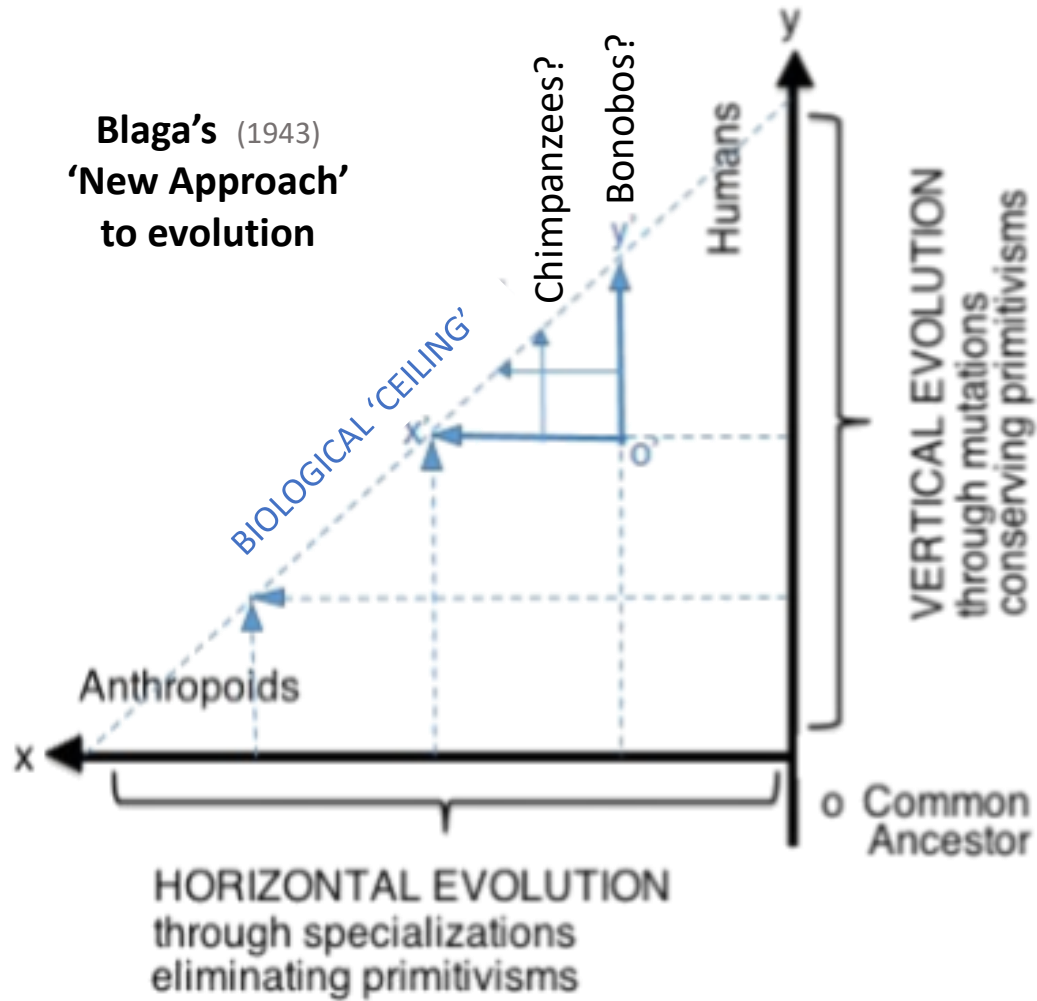
(Majkić et al. 2018) (Mousterian)



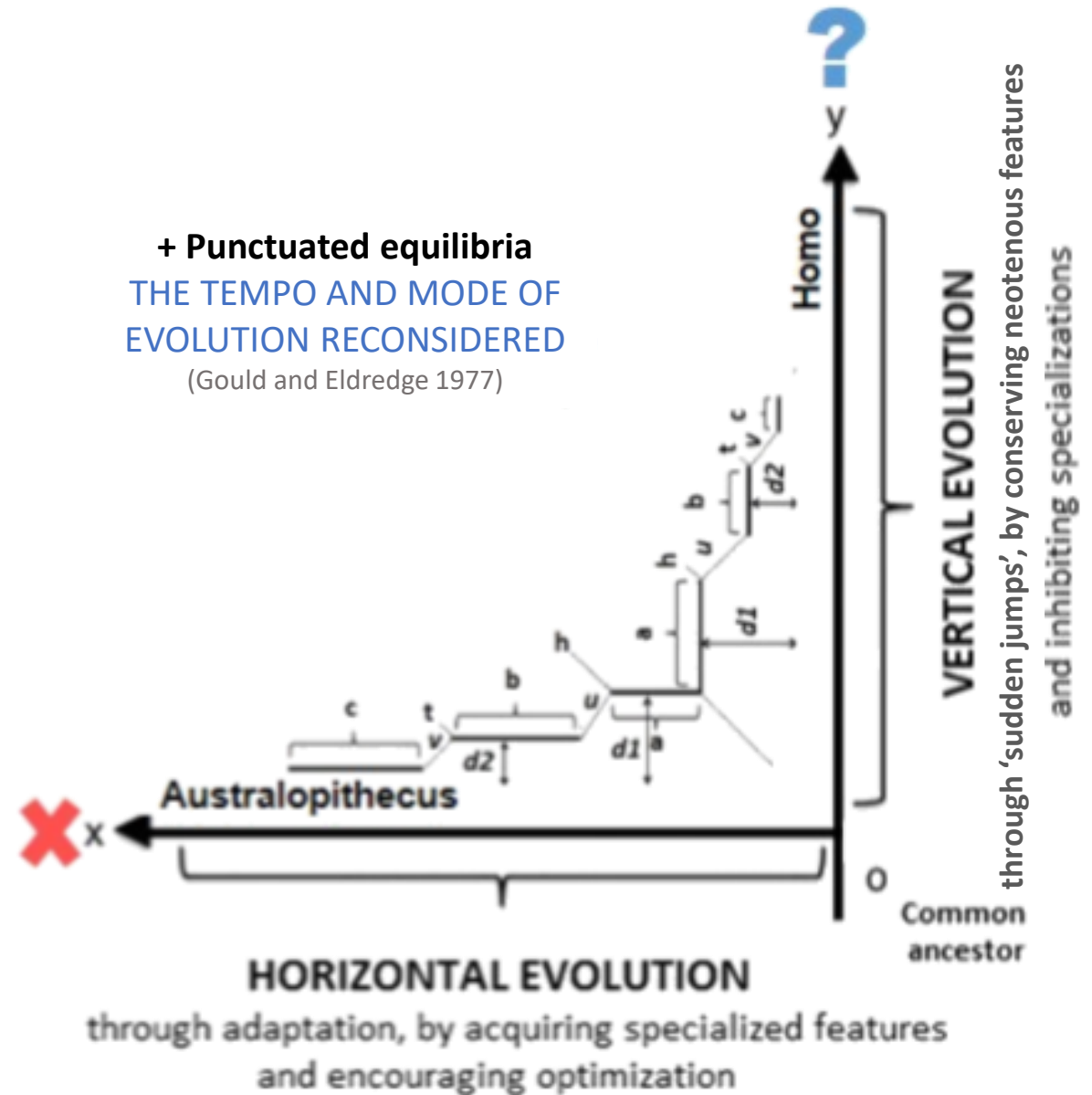
Grooves on a bovid bone, **Kozarnika Cave, Bulgaria**  
(>1 million years old?) (Bednarik 2014)



Blaga's (1943)  
'New Approach'  
to evolution



+ Punctuated equilibria  
THE TEMPO AND MODE OF  
EVOLUTION RECONSIDERED  
(Gould and Eldredge 1977)







## NICHE CONSTRUCTION THEORY (NCT)

NC is the process in which an organism alters its own—or other species'—environment, often *but not always*, in a manner that increases its chances of survival.

Changes that organisms bring about in their worlds that are of no evolutionary or ecological consequence are not examples of niche construction.

(Odling-Smee et al. 1997)

## DUAL INHERITANCE THEORY (DIT; *Gene – Culture Co-evolution*)

[o' – x']

***Ratcheting  
techniques/  
Treadmill effect***

(Tomasello 1999/

Henrich 2004)

(contra: Andersson & Read 2016)

+

[o' – y]

***Leveling mechanisms***

(Woodburn 1982)

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ONLY WHEN BOTH MECHANISMS  
CONSIDERED DO WE GAIN **A COMPLETE  
PICTURE OF CULTURAL EVOLUTION**  
[WITHIN A CONSTRUCTED NICHE]

UNIFIED THEORY OF CULTURAL EVOLUTION

o' - x'

## LATE NEANDERTHAL SOCIAL MEMORY UNITS (SMU)

Richter 2000

- Social memory is the ability of a group of humans to maintain a specific set of information by means of tradition over many generations.

60,000  
years of  
cumulative  
cultural  
evolution

- The more individuals contribute to and participate in such a pool of ideas and concepts, the higher the chance for successful transmission and for long-term maintenance of the pool's contents.

- *By contrast, a small population which is isolated from others may develop specific ideas and concepts which get lost as soon as the population becomes extinct by starvation or other factors.*

o' - y

## 'LEVELING MECHANISMS' (LM)

Woodburn 1982

10,000 YEARS OF **CULTURAL NEOTENY**

*Culturally-refined 'regulation' of:*

- Mobility and flexibility
- Access to means of coercion
- Access to food and other resources
- Sharing
- Sanctions on the accumulation of personal possessions
- The transmission of possessions between people
- Leadership and decision-making

- *Leveling mechanisms disengage people from property and inhibit the elaboration of social complexity (without the risk of cultural loss through the 'treadmill effect').*

*Accumulation* (left) vs. *Reduction* (right) of

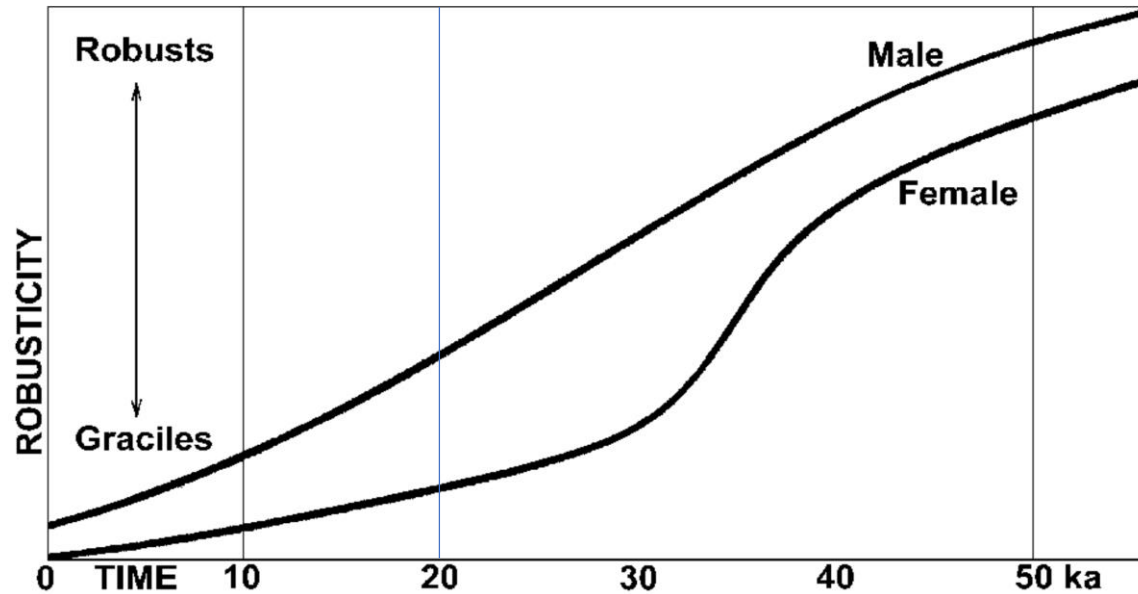
- Prestige
- Power
- Wealth... and of the biases they pertain (*sensu* DIT)



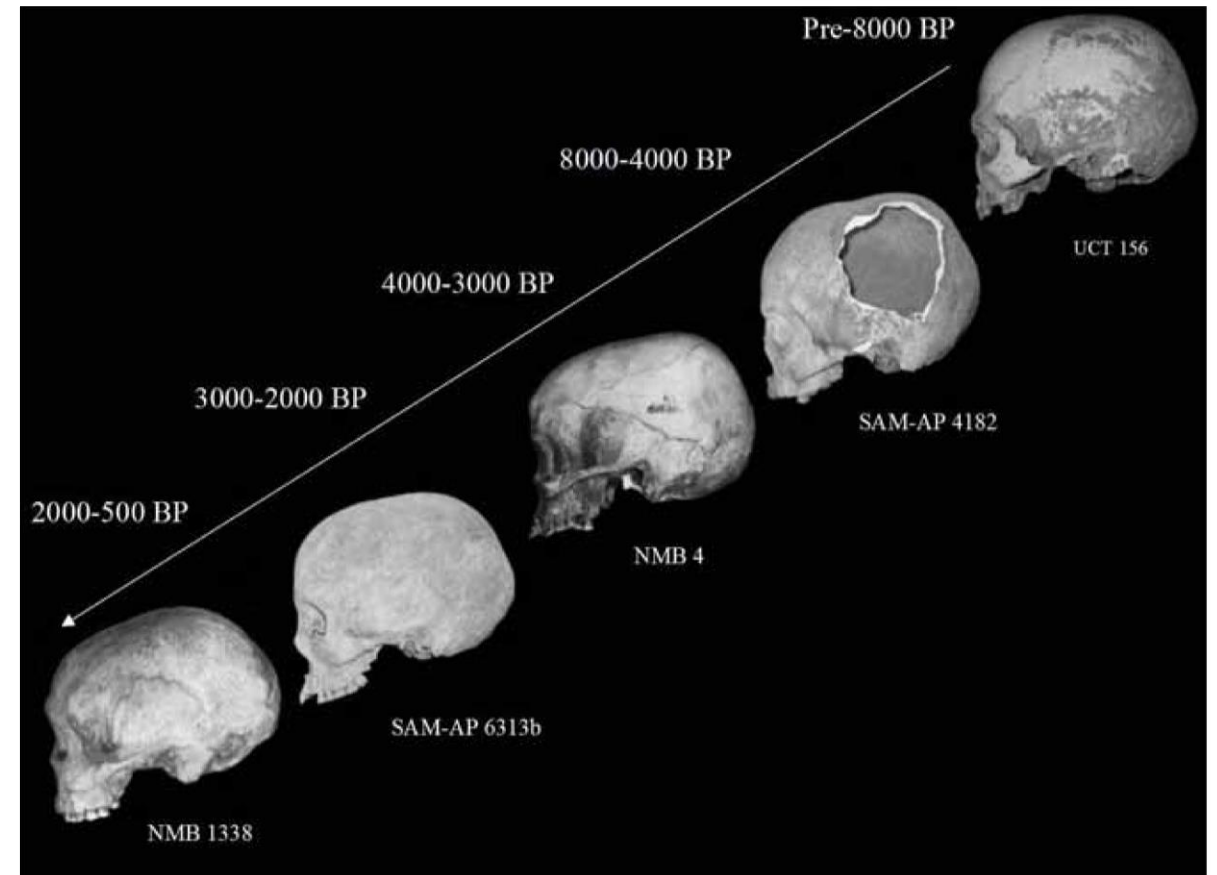
After continuously growing in size over the span of the Pleistocene, our brain volume has contracted by 13% in the past 20,000 years or so (Hawks 2011).

Cultural **gracilization** vs.

↓ Biological **neoteny** →



Depiction of male/female relative *cranial gracility* in Europe through time: the decline in robusticity is gradual in males, but accelerated in females between 40 and 30 ka (Bednarik 2008, 2017).

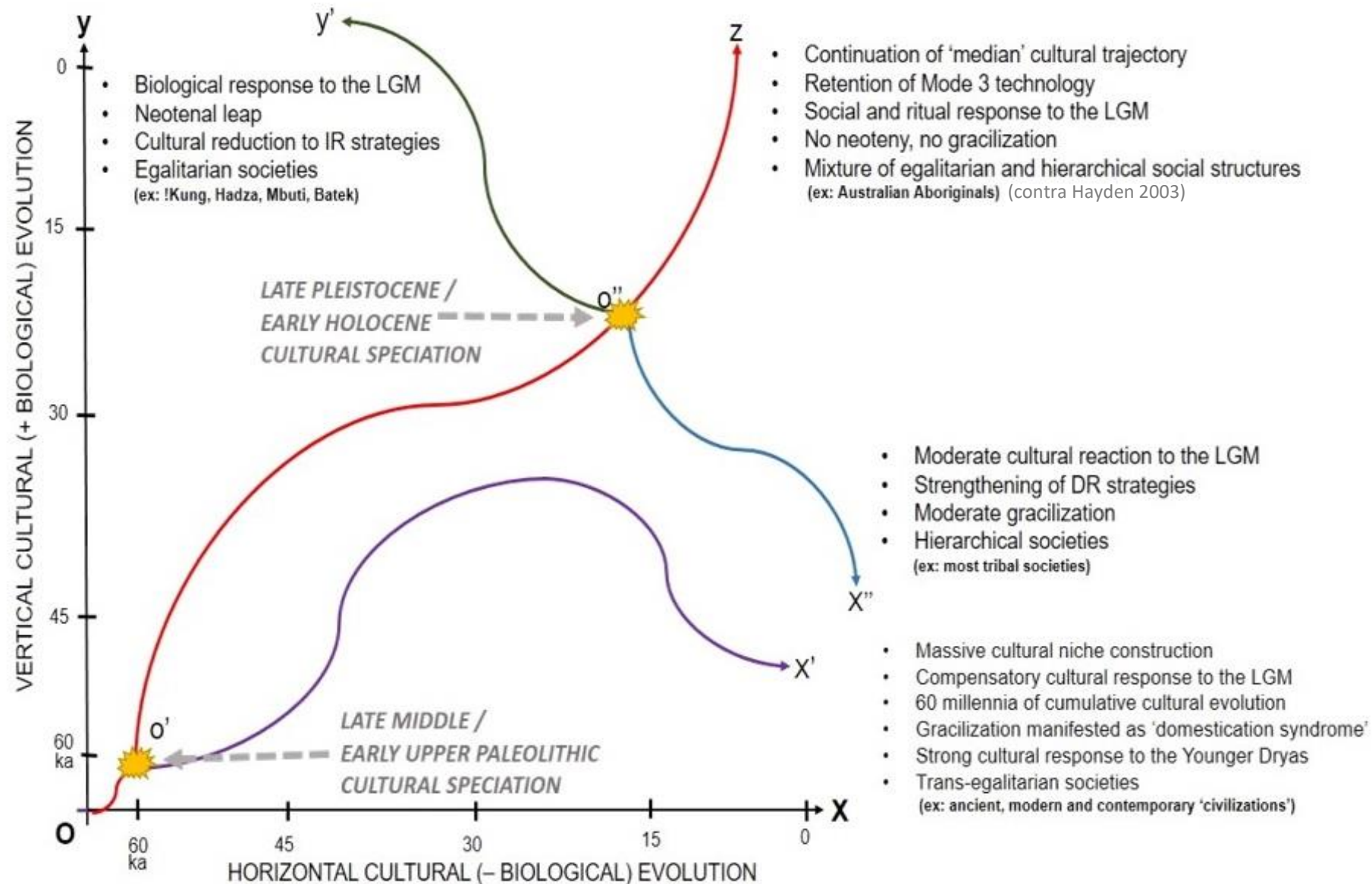


Osteological evidence (Stynder 2006) supports Morris' (2002) hypothesis of a relatively recent (Late Pleistocene/Early Holocene) origin of recognisably KhoeSan *pedomorphic cranial morphology*. But: large body size/robust bone structure until c. 8,000 BP (Bräuer and Rösing 1989).

# CULTURAL SPECIATION

## + CULTURAL HETEROCHRONY

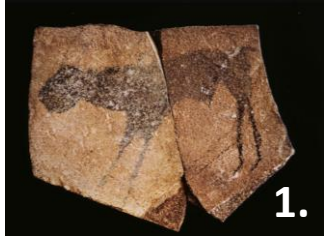
( = DIFFERENT **TEMPO**/DATE OF CULTURAL **EVOLUTION**/SPECIATION)







Apollo 11 Cave,  
Namibia, 27 ka BP  
(Rifkin et al. 2015)



Inherited **iconographic expression** from robust  
(DR/non-egalitarian) 'ancestors' used in the  
**ILLUSTRATION OF BEHAVIOR**



Nchwaneng, SE  
Kalahari; 400 ka BP  
(Beaumont and  
Bednarik 2010)

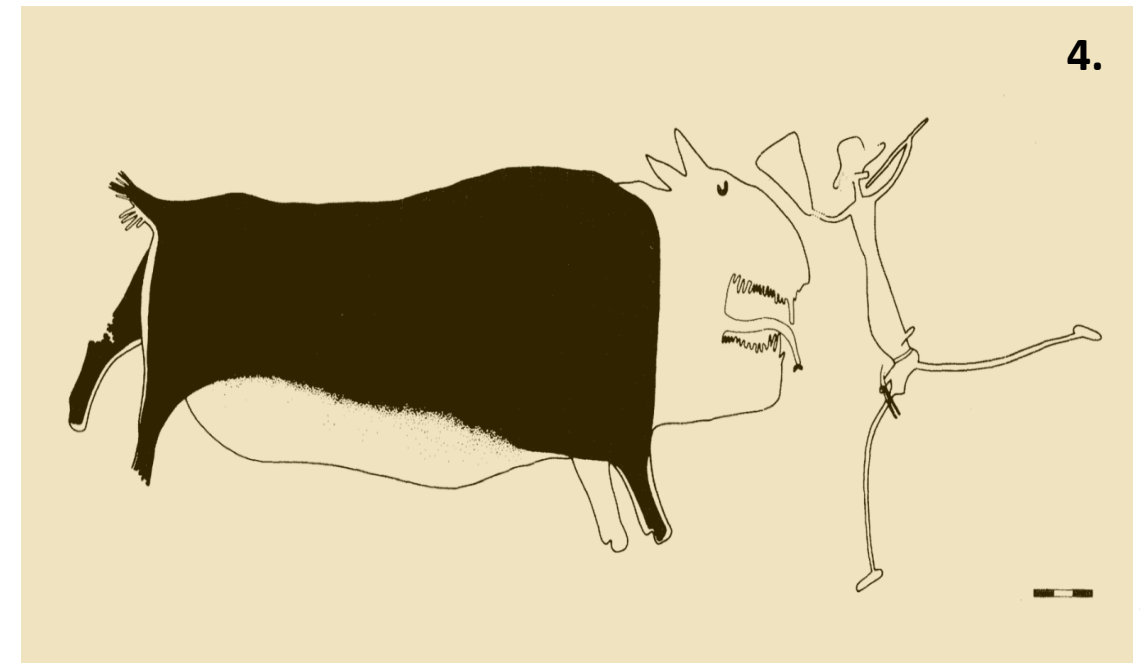
Pre-'Bushman'  
abstract  
petroglyphs  
(cupules)

## FROM COMMUNAL (EGALITARIAN) TO SPECIALIZED (ON-DEMAND) RITUAL

Orange Springs, Orange Free State



AT CONTACT



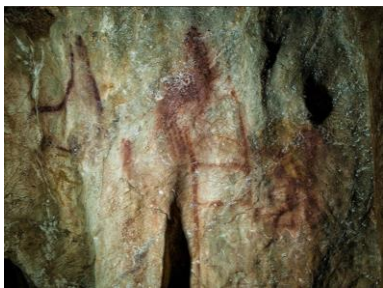
Sterkstroom, Orange Free State

AFTER CONTACT

(EXTERNALLY-INDUCED CULTURAL ENVIRONMENT → BEHAVIORAL CHANGES)



La Pasiega Cave,  
> 66 ka BP



Gorham's Cave,  
> 39 ka BP

From inherited and *moderately-employed* abstract and illustrative expression to the ratcheting and *grandiose display* of CREATIVITY (ART?)



Chauvet Cave,  
> 37 ka BP

## FROM (COMMUNAL) **COPING** TO (MONOPOLIZED) **CONTROL**



FROM EXPRESSION OF COGNITIVE ABILITY



(Clottes 2016; see also Otte 2003)

TO DISPLAY OF CULTURAL BEHAVIOR

(SELF-CONSTRUCTED CULTURAL ENVIRONMENT → SELF-INDUCED BEHAVIORAL/ANATOMICAL CHANGES)





37 ka old footprint of a child in Chauvet Cave, apparently of a 'Neanderthaloid' individual.

(Bednarik 2017)

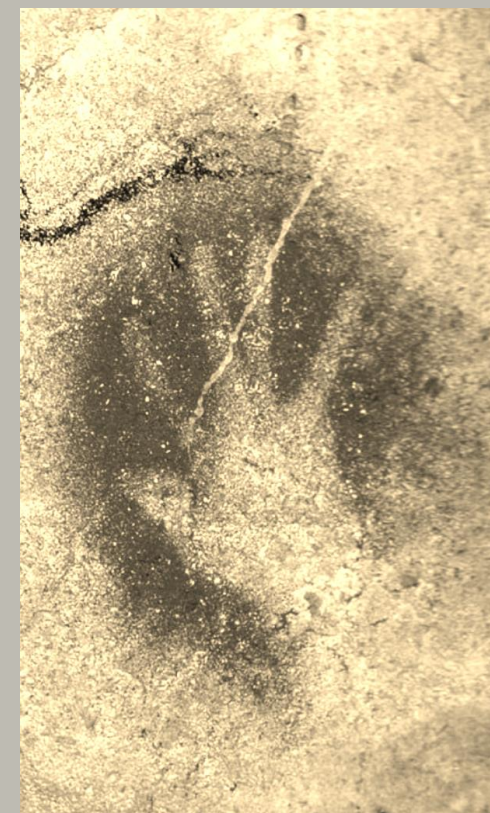
- WHY THE SUDDEN AND  
OBSESSIVE FORCING OF THE  
POSSIBILITIES GRANTED BY  
PSYCHOLOGICAL NEOTENY?

(*sensu* Charlton 2006)

[contra Spikins et al. 2018]

- WHY DO THE (PERCEIVED AS)  
'SUPERIOR' CREATIVE CAPACITIES  
OF CHILDREN BECOME SUDDENLY  
IMPORTANT?

'**CREATIVITY**' – the upper  
'zoom-out' limit of the  
operational range of the  
contextual focus, 40 ka ago  
(*sensu* Gabora 2003)



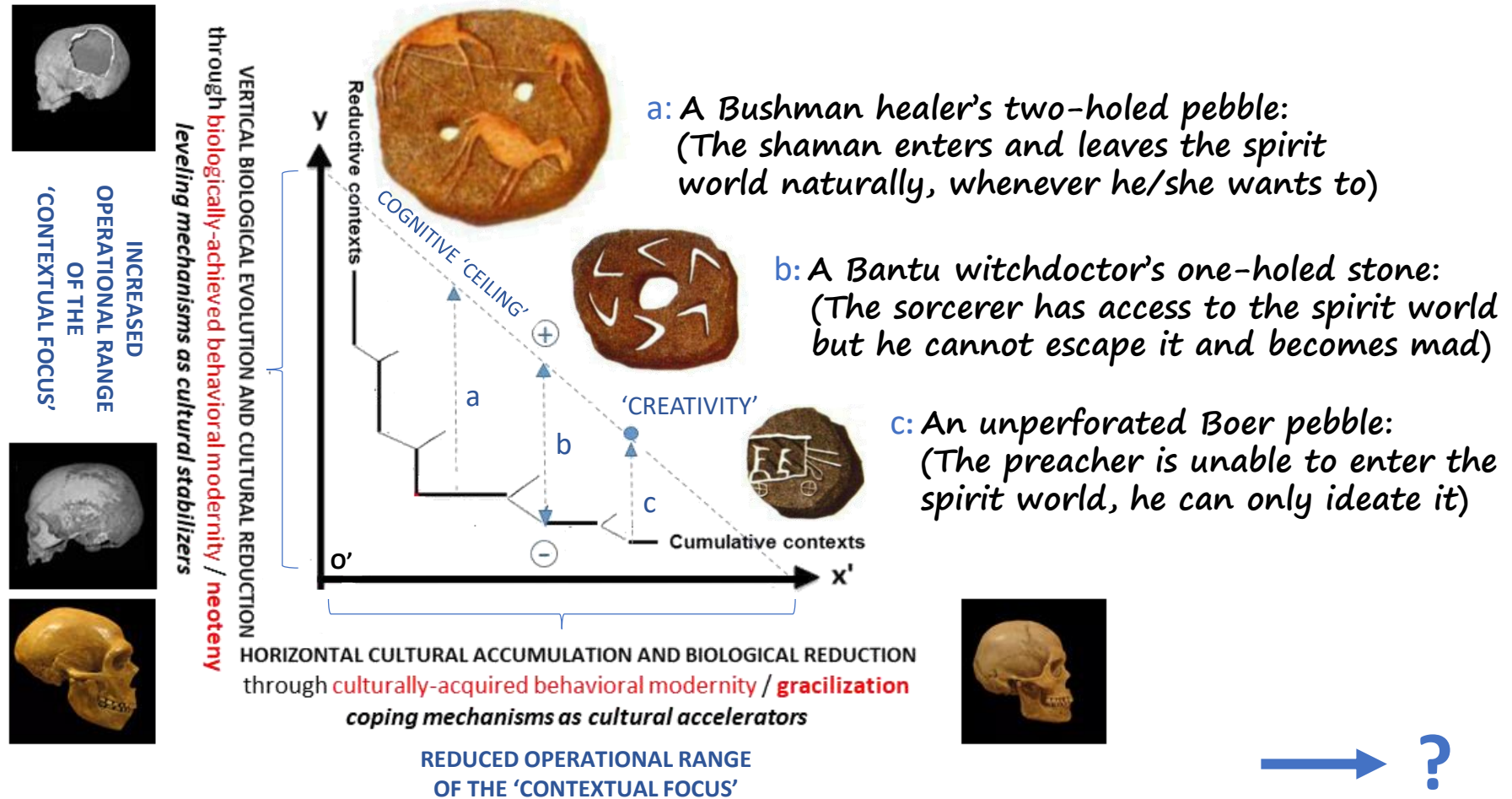
37 ka old handprint of a presumably  
'Neanderthaloid' child

(Snow 2013)

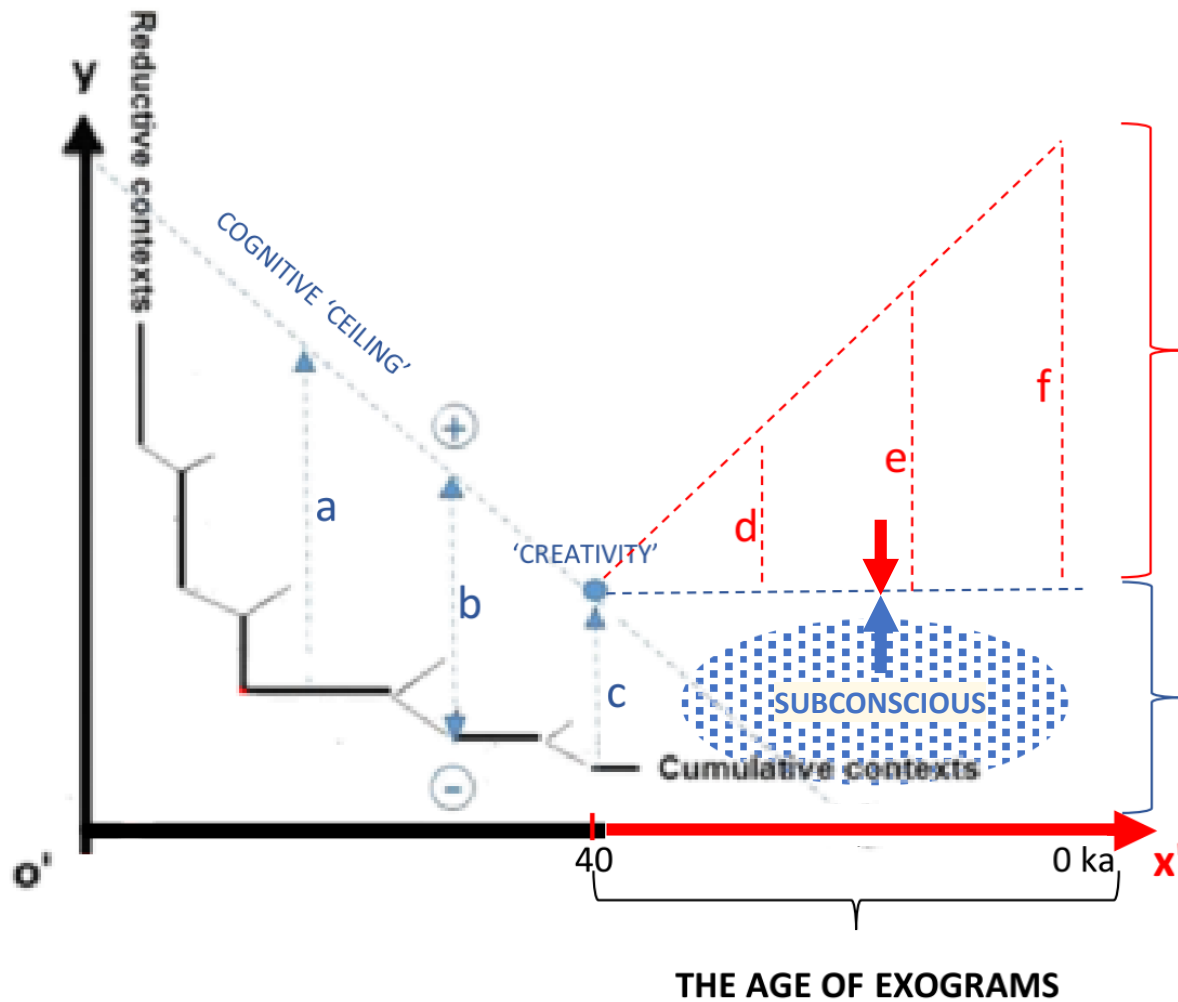
The perceptions of the 'savage mind' in anthropological and ethnographical works of the 19<sup>th</sup> century seem to document a less restricted operational range of the CF: **"The cognitive capacities of natural people were considered to be 'childish,' with cause and effect randomly sequenced in a world of probabilities that was also able to accommodate contradictions that were not recognized and 'corrected,' and in which the spiritual side was not a stranger to reality."**



## COGNITIVE FLEXIBILITY/SPECIALIZATION



From a painting by Pippa Skotnes [For //Kunn, 1993]  
(Groenwald 2008 and explanations therein)



CULTURALLY-  
EXTENDED  
COGNITION

**[KNOWLEDGE]**  
ACQUIRED/STORED/ACCESSED  
WITH THE HELP OF  
TECHNOLOGY

CULTURALLY-  
REDUCED  
COGNITION

**[ART]**

## REFERENCES

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