



How do brains handle the future?

- Not merely anticipation of what has happened before (mealtime).
- Imagining what President Bush will do next. What new mistake lies ahead?

In particular, how do we generate on-the-fly novelty of high quality?

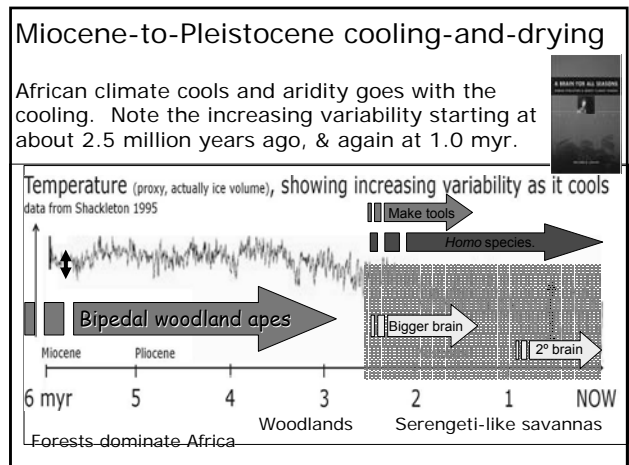
- Which we do every time we speak a sentence that we've never spoken before.
- Make novel plan of action, *then* frame it so listener can recreate it without ambiguity in his own head.

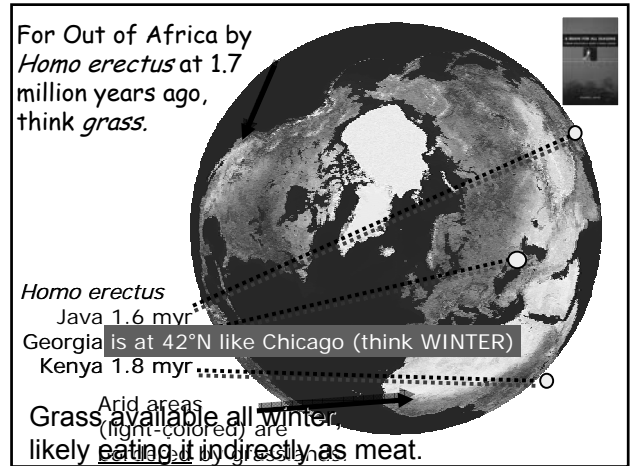
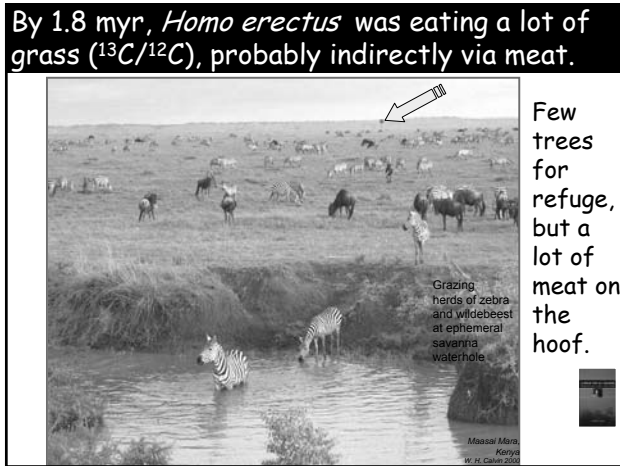
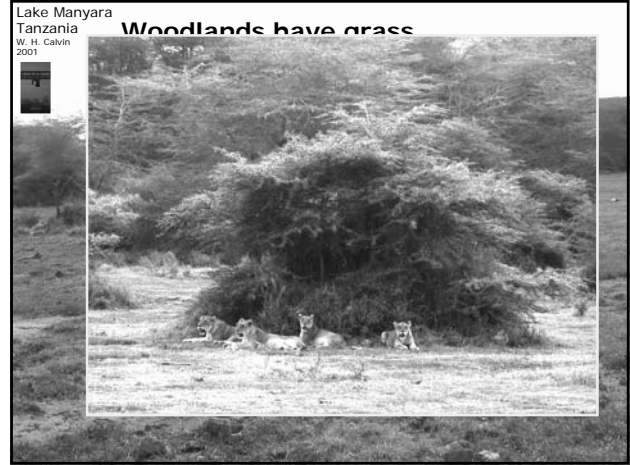
We are often right the first time, even when novel. So *HOW* do we...

- *weed out the nonsense?*
- *gradually improve our plan?*
- *avoid getting stuck?*
- *recognize a coherent answer, the perfect fit to our current situation?*

talk outline

- From early hominids (6-7 myr) to the *Homo* species (165,000 yr)
- Brain Enlargement ≠ Cleverness
- Creative Explosion (Mind's Big Bang at 50,000 B.C.)
- Intellect = Structured Stuff
- But *how? Why* so suddenly?
 - Language as an infectious disease
- Pyramiding Levels and Intellect



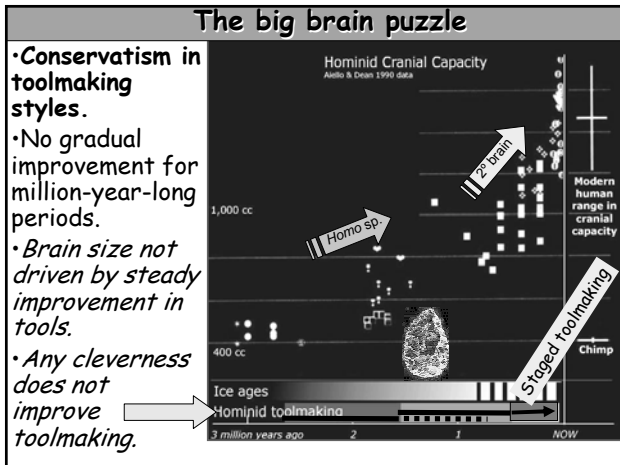


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"Big brain problem" is a puzzle

Archaeologists say that brain size grew gradually, but that cleverness improved in jerks.

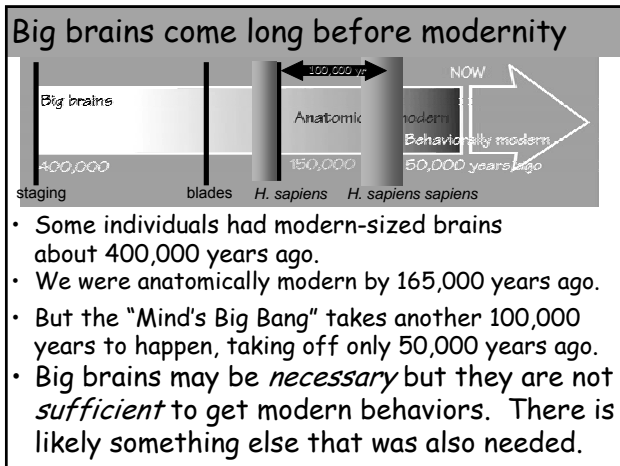


Staged Toolmaking

1. Make
2. Use p
3. Strike of

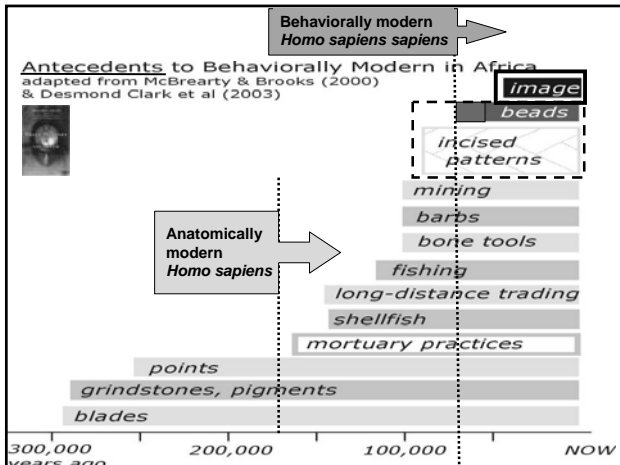
Blades started about 280,000 years ago, but well established by 120,000 years ago.

Obsidian blades



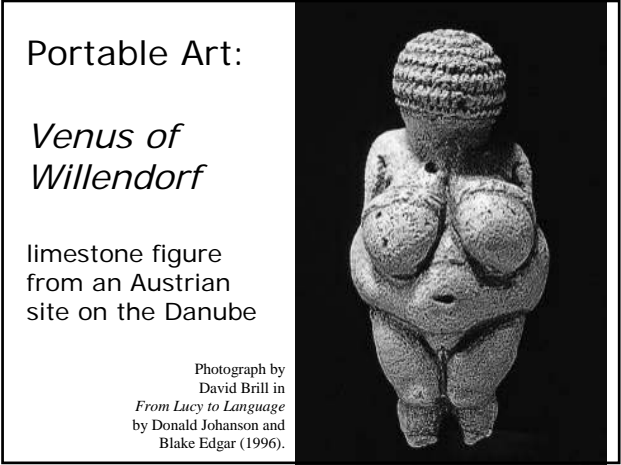
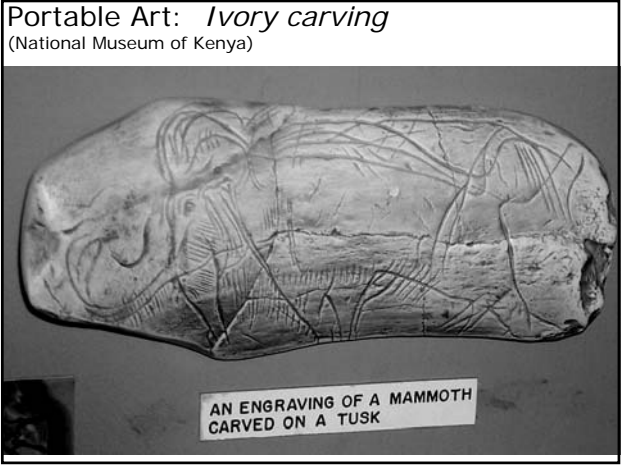
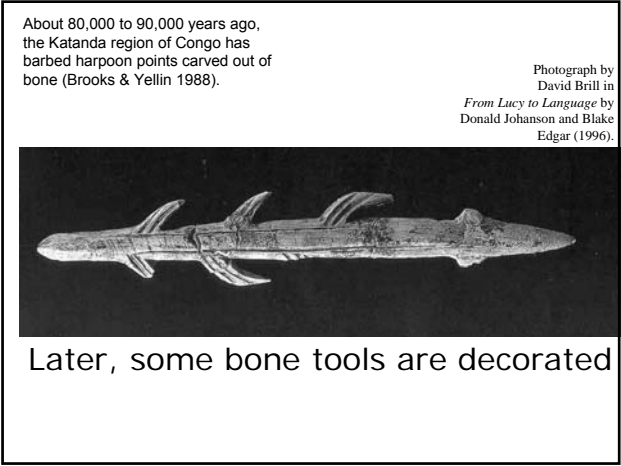
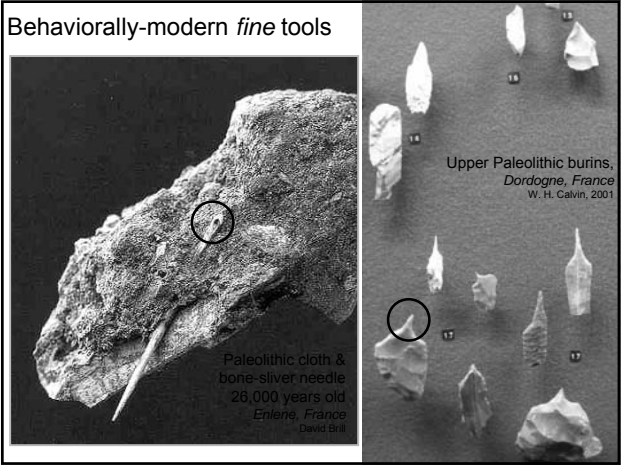
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Engraved red ochre, 77,000 years ago, near southernmost tip of African coast. Earlier finds at 90,000 years, same coastline.

Emergence of Modern Human Behavior: Middle Stone Age Engravings from South Africa, Christopher S. Henshilwood, Francesco d'Errico, Royden Yates, Zenobia Jacobs, Chantal Tribolo, Geoff A.T. Duller, Norbert Mercier, Judith C. Sealy, Helene Valladas, Ian Watts, Ann G. Wintle. *Science* (2002)



**Wall Art:
Cave art sites**

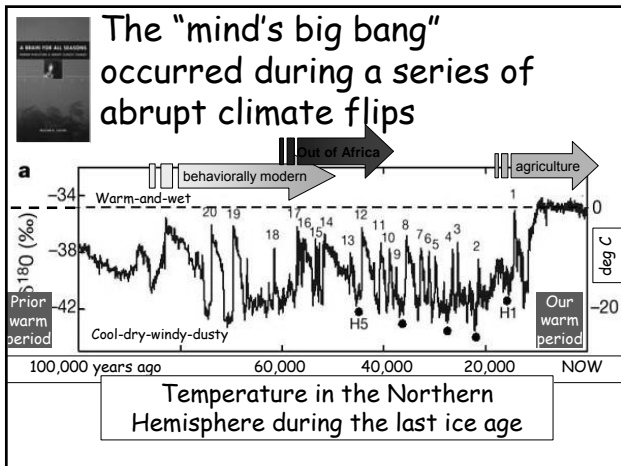
"Creative intelligence"
35,000 years old (earlier in Asia???)

After
Out of Africa
think
Out of Asia

Into central
Asia at 60,000-
40,000 years.

All directions from
the "stans" about
40,000 years ago.

Y-chromosome data, Weiss et al PNAS 2001



Other hominid
species got
extinct

Homo erectus
last seen in
China and SE
Asia about
17,000 years
ago.

Neanderthals
last seen in
Spain about
30,000 years
ago.

For the last 50 years, anthropologists have emphasized the step up from anatomically-modern *Homo sapiens* to behaviorally-modern *Homo sapiens sapiens*. There are various formulations for this big step up.

replica cave painting of three stick figures from the Vache cave, National Museum, Kyoto, W. H. Calvin 2000

Mimicry as a Behaviorally-modern Candidate

- Much mimicry is seen in birds
 - so it isn't that difficult to do, even with a bird brain.
- But, even if easy, there is little mimicry in our closest relatives.
 - Chimp nut-cracking mimicked by infants but...
 - Tomasello's experiment with young chimps *failing to mimic gestures* even when there is intense observation and motivation.

Mimicry as a Behaviorally-modern Candidate

- Yet lots of social mimicry in modern humans.
- "Mirroring, echoing, matching"
- Will synchronize breathing, mimic postures and intonation, even with strangers.
- Use to quickly establish rapport. (How to motivate bigger tips.)

talk outline

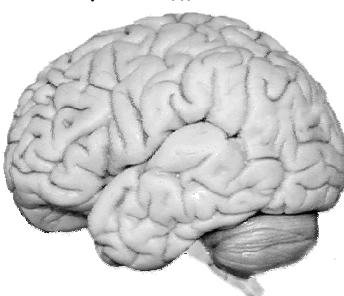
apes hominids US

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Candidates for transition to *Homo sapiens sapiens*


1. Imitation
2. Creativity
3. Symbolic stuff
4. Language
5. Consciousness
6. Planning
7. More working memory

I would add "structured" to all of them.



Expanding the two-word sentence

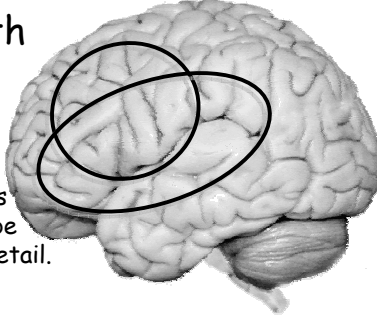
- With syntax, you can nest sentences like Russian dolls, as when you say "I think I saw him leave to go home" with its four verbs.



Candidates for transition to *Homo sapiens sapiens*

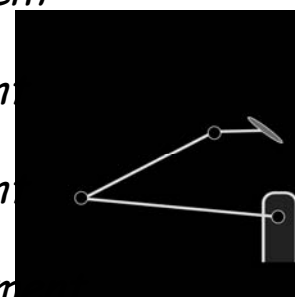
Movement planning overlaps with language locations

- Some nested movements such as throwing have to be planned in great detail.
- Maybe borrow....

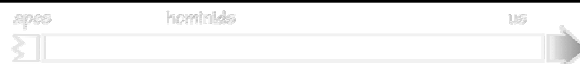


Nested aspect of coherence judgments

- Throwing nests a wrist movement inside the elbow movement and an elbow movement inside the shoulder movement.





talk outline





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Higher Intellectual Functions are *structured*

- *Syntax*
- *Games* with arbitrary, changeable rules (gambling, too) 
- *Music* that goes beyond rhythm and melody to use multiple voices, as in part singing and symphonies. 
- *Coherence-finding*, as when we discover hidden patterns amidst seeming chaos. "Intellect."


Higher Intellectual Functions are *structured*

- *Complex thought*, as in figurative speech, house-of-cards analogies, parables, and narrative frameworks. 
- Indeed, they are *all examples of structured thought*, all separate humans from the great apes. 
- Now, *imagine us without this...*

Mental life before "The Mind's Big Bang"



- The premodern mind likely had thought, in Freud's sense of "trial action." 
- But without *structuring* plus off-line *quality improvement*, you cannot create novel sentences of any length or complexity - and you likely cannot think such thoughts, either.
- We wouldn't worry about Pres. Bush.

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Lessons from epidemiology

- Vertical transmission 
 - "line of descent," catch from Mom
 - AIDs or hepatitis B, passed from mother to baby.
- Horizontal transmission 
 - Often catch it from unrelated people.
- One is slow (25 yrs), other fast.

Lessons from epidemiology

- Toolmaking conservatism might come from vertical transmission
 - Learn it slowly from your relatives
- *Modern Transition* might come from cultural spread of language.
 - Like a disease, catch it quickly just by listening (when young!).

The "outbreak" of structured stuff

- BEFORE: words, short sentences
- IMAGINE THAT some adults or older children *slowly manage* to consistently speak long sentences.
 - Develop conventions ("syntax") to identify actors, the acted-upon, etc.
- NOW small children hear structured stuff. They figure out the syntax and are even better as adults because...
- ...earlier softwiring works better.

The "outbreak" of structured stuff

- Now long-sentence language can spread like an infectious disease.
 - Just need kids, listening to syntax.
- Trade routes would have spread "structured thought," just as today's truck drivers spread HIV-AIDs in Africa.
- And the softwiring for structuring in youth enables other aspects of intellect (planning, logic, games).

apes hominids us

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For an understanding of intellect,

- Need to understand control of the error-prone creative process.
- The way its constructions resonate with the underlying emotional judgments common to all the apes. (Freud's tripartite action)
- The levels of intellect. [A level is semi-independent of its foundations, a study unto itself, as in fleece spun into yarn, yarn woven into cloth, cloth stitched together into clothing.]



We see the **pyramiding of levels** as babies encounter the patterns of the world around them.

1. A baby first picks up the short sound units of speech (**phonemes**),
2. then the patterns of phonemes called **words**,



We see the **pyramiding of levels** as babies encounter the patterns of the world around them.



3. then the patterns within strings of words we call syntax,

We see the **pyramiding of levels** as babies encounter the patterns of the world around them.



4. then the patterns of strings of sentences called "a good story" (whereupon she will start expecting a proper ending for her bedtime story).

Levels of meaning



Besides searching sentences for nesting and such, we search for meaning at different levels -- from the *concrete* to the *relational* to the *metaphorical*.

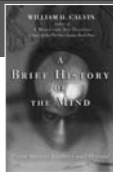
Illustrate with two Seattle jokes.

The Seattle Coffeehouse Joke:



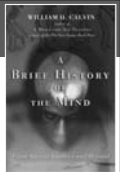
Each morning, we struggle with the one-word level of language ("██████").

Finding the right level



- Poets have to compare candidate metaphors.
- They must prop up their mental house of cards, *stabilize a new level*.
- This may require all manner of beyond-caffeine substances and superstitious practices.
- We invent *new levels on-the-fly*.

Finding the right level

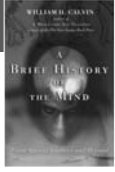


- You usually cannot get the joke without locating the concrete-to-abstract level of organization to which it refers...
- ...and it is often the alternative interpretations at different possible levels that can make it so funny. To finish up our future tasks in brain research, consider this
 - Seattle longshoreman's joke.

Finding the right level

"And about how many people work here?" the bored visitor politely asks the boss.

"Oh, about half."



The End

My books and talks
(including this one)
may be found at:

WilliamCalvin.com

