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June 21, 2013

### Emergence of the Human 'SuperBrain' 75,000 Years Ago --"The Neurologic Internet"



There is archaeological evidence for the evolution of a human "super-brain" no later than 75,000 years ago that spurred a modern capacity for novelty and invention, according to [John Hoffeecker](#), an archaeologist at the [University of Colorado](#). Scientists seeking to understand the origin of the human mind may want to look to honeybees -- not ancestral apes -- for at least some of the answers, according to a Hoffeecker.

Hoffeecker says there is abundant fossil and archaeological evidence for the evolution of the human mind, including its unique power to create a potentially infinite variety of thoughts expressed in the form of sentences, art and technologies. He attributes the evolving power of the mind to the formation of what he calls the "super-brain," or collective mind, an event that took place in Africa no later than 75,000 years ago.

An internationally known archaeologist who has worked at sites in Europe and the Arctic, Hoffeecker said the formation of the super-brain was a consequence of a rare ability to share complex thoughts among individual brains. Among other creatures on Earth, the honeybee may be the best example of an organism that has mastered the trick of communicating complex information -- including maps of food locations and information on potential nest sites from one brain to another -- using their intricate "waggle dance."

"Humans obviously evolved a much wider range of communication tools to express their thoughts, the most important being language," said Hoffeecker, a fellow at CU's Institute of Arctic and Alpine Research. "Individual human brains within social groups became integrated into a neurologic Internet of sorts, giving birth to the mind."

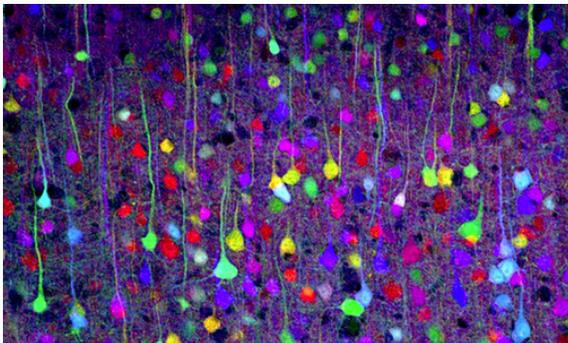
The image below illustrates the neocortex (Tamily Weissman, Jeff Lichtman, and Joshua Sanes).The neocortex, Latin for "new bark," is our third, newly human brain in terms of evolution. It is what makes possible our judgments and our knowledge of good and evil. It is also the site from which our creativity emerges and home to our sense of self.

The Neocortex says [Carl Sagan](#) in his iconic *Cosmos*, is where "matter is transformed into consciousness." It comprises more than two-thirds of our brain mass. The realm of intuition and critical analysis,--it is the Neocortex where we have our ideas and inspirations, where we read and write, where we compose music or do mathematics. "It is the distinction of our species," writes Sagan,"the seat of our humanity. Civilization is the product of the cerebral cortex."

Each cubic millimeter of tissue in the neocortex, reports Michael Chorost in *World Wide Mind*, contains between 860 million and 1.3 billion synapses. Estimates of the total number of synapses in the neocortex range from 164 trillion to 200 trillion. The total number of synapses in the brain as a whole is much higher than that. The neocortex has the same number of neurons as a galaxy has stars: 100 billion.

One researcher estimates that with current technology it would take 10,000 automated microscopes thirty years to map the connections between every neuron in a human brain, and 100 million terabytes of disk space to store the data.

Self-aware, language-using, tool-making brains are very new in the evolutionary timeline, some 200,000-years old. Most of the neurons in the neocortex have between 1,000 and 10,000 synaptic connections with other neurons. Elsewhere in the brain, in the cerebellum, one type of neuron has 150,000 to 200,000 synaptic connections with other neurons. Even the lowest of these numbers seems hard to believe. One tiny neuron can connect to 200,000 neurons.



While anatomical fossil evidence for the capability of speech is controversial, the archaeological discoveries of symbols coincides with a creative explosion in the making of many kinds of artifacts. Abstract designs scratched on mineral pigment show up in Africa about 75,000 years ago and are widely accepted by archaeologists as evidence for symbolism and language. "From this point onward there is a growing variety of new types of artifacts that indicates a thoroughly modern capacity for novelty and invention."

The roots of the mind and the super-brain lie deep in our past and are likely tied to fundamental aspects of our evolution like bipedalism and making stone tools, he said. It was from the making of tools that early humans first developed their ability to project complex thoughts or mental representations outside the individual brain -- our own version of the honeybee waggle dance, Hoffeecker said.

While crude stone tools crafted by human ancestors beginning about 2.5 million years ago likely were an indirect consequence of bipedalism -- which freed up the hands for new functions -- the first inklings of a developing super-brain likely began about 1.6 million years ago when early humans began crafting stone hand axes, thought by Hoffercker and others to be one of the first external representations of internal thought.

Ancient hand axes achieved "exalted status" as mental representations since they bear little resemblance to the natural objects they were made from -- generally cobbles or rock fragments. "They reflect a design or mental template stored in the nerve cells of the brain and imposed on the rock, and they seemed to have emerged from a strong feedback relationship among the hands, eyes, brains and the tools themselves," he said.

The emerging modern mind in Africa was marked by a three-fold increase in brain size over 3-million-year-old human ancestors like Lucy, thought by some to be the matriarch of modern humans. Humans were producing perforated shell ornaments, polished bone awls and simple geometric designs incised into lumps of red ochre by 75,000 years ago. "With the appearance of symbols and language -- and the consequent integration of brains into a super-brain -- the human mind seems to have taken off as a potentially unlimited creative force," he said.

The dispersal of modern humans from Africa to Europe some 50,000 to 60,000 years ago provides a "minimum date" for the development of language, Hoffercker speculated. "Since all languages have basically the same structure, it is inconceivable to me that they could have evolved independently at different times and places."

A 2007 study led by Hoffercker and colleagues at the [Russian Academy of Sciences](#) pinpointed the earliest evidence of modern humans in Europe dating back 45,000 years ago. Located on the Don River 250 miles south of Moscow, the multiple sites, collectively known as Kostenki, also yielded ancient bone and ivory needles complete with eyelets, showing the inhabitants tailored furs to survive the harsh winters.

The team also discovered a carved piece of mammoth ivory that appears to be the head of a small figurine dating to more than 40,000 years ago. "If that turns out to be the case, it would be the oldest piece of figurative art ever discovered," said Hoffercker, whose research at Kostenki is funded in part by the National Science Foundation.

The finds from Kostenki illustrate the impact of the creative mind of modern humans as they spread out of Africa into places that were sometimes cold and lean in resources, Hoffercker said. "Fresh from the tropics, they adapted to ice age environments in the central plain of Russia through creative innovations in technology."

Ancient musical instruments and figurative art discovered in caves in France and Germany date to before 30,000 years ago, he said. "Humans have the ability to imagine something in the brain that doesn't exist and then create it," he said. "Whether it's a hand axe, a flute or a Chevrolet, humans are continually recombining bits of information into novel forms, and the variations are potentially infinite."

While the concept of a human super-brain is analogous to social insects like bees and ants that collectively behave as a super-organism by gathering, processing and sharing information about their environment, there is one important difference, Hoffercker said. "Human societies are not super-organisms -- they are composed of people who are for the most part unrelated, and societies filled with competing individuals and families."

Since the emergence of the modern industrial world beginning roughly 500 years ago, creativity driven by the human super-brain has grown by leaps and bounds, from the invention of mechanical clocks to space shuttles. Powerful artificial intelligence could blur the differences between humans and computers in the coming centuries, he said.

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Stephen Hawking agrees with Hoffercker. Although it has taken homo sapiens several million years to evolve from the apes, the useful information in our DNA, has probably changed by only a few million bits. So the rate of [biological evolution](#) in humans, Stephen Hawking points out in his Life in the Universe lecture, is about a bit a year.

"By contrast," Hawking says, "there are about 50,000 new books published in the English language each year, containing of the order of a hundred billion bits of information. Of course, the great majority of this information is garbage, and no use to any form of life. But, even so, the rate at which useful information can be added is millions, if not billions, higher than with DNA."

This means Hawking says that we have entered a new phase of evolution. "At first, evolution proceeded by natural selection, from random mutations. This Darwinian phase, lasted about three and a half billion years, and produced us, beings who developed language, to exchange information."

But what distinguishes us from our cave man ancestors is the knowledge that we have accumulated over the last ten thousand years, and particularly, Hawking points out, over the last three hundred.

"I think it is legitimate to take a broader view, and include externally transmitted information, as well as DNA, in the evolution of the human race," Hawking said.

In the last ten thousand years the human species has been in what Hawking calls, "an external transmission phase," where the internal record of information, handed down to succeeding generations in DNA, has not changed significantly. "But the external record, in books, and other long lasting forms of storage," Hawking says, "has grown enormously. Some people would use the term, evolution, only for the internally transmitted genetic material, and would object to it being applied to information handed down externally. But I think that is too narrow a view. We are more than just our genes."

The time scale for evolution, in the external transmission period, has collapsed to about 50 years, or less.

Meanwhile, Hawking observes, our human brains "with which we process this information have evolved only on the Darwinian time scale, of hundreds of thousands of years. This is beginning to cause problems. In the 18th century, there was said to be a man who had read every book written. But nowadays, if you read one book a day, it would take you about 15,000 years to read through the books in a national Library. By which time, many more books would have been written."

But we are now entering a new phase, of what Hawking calls "self designed evolution," in which we will be able to change and improve our DNA. "At first," he continues "these changes will be confined to the repair of genetic defects, like cystic fibrosis, and muscular dystrophy. These are controlled by single genes, and so are fairly easy to identify, and correct. Other qualities, such as intelligence, are probably controlled by a large number of genes. It will be much more difficult to find them, and work out the relations between them. Nevertheless, I am sure that during the next century, people will discover how to modify both intelligence, and instincts like aggression."

If the human race manages to redesign itself, to reduce or eliminate the risk of self-destruction, we will probably reach out to the stars and colonize other planets. But this will be done, Hawking believes, with intelligent machines based on mechanical and electronic components, rather than macromolecules, which could eventually replace DNA based life, just as DNA may have replaced an earlier form of life.

The Daily Galaxy via via [kurzweil.net](#) and [colorado.edu](#)

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## Comments

Absolutely astounding piece. When a human being dies , a galaxy dies. Our mind is a Galaxy and so is the mind of the next human! Evolved as equals. You may be a Sunni, he a

Shiite both are epitome of mankind's evolution. You may be a Brahmin and he may be a Dalit or an untouchable but you are both equal.

Our neocortex has the same number of neurons as a galaxy has stars: 100 billion. Don't ever dumb yourself down, you are so unique. You can be the greatest mind or the smallest thinker based in the heart of global research in Silicon Valley or in the backyard of forgotten lands in North Waziristan. WWW of today brings together a collection of global brain, these social sites are our emerging Humanity neocortex. The fate of future civilisation depends on the decision we make here at 'the seat of our humanity.'

Think rationally, think globally, think inclusively. Human super-brain is a consequence of a rare ability to share complex thoughts among individual brains. In an article today in Daily Galaxy our neurologic Internet of sorts is highlighted that gave birth to emergence 75,000 years. WWW of today brings together a collection of global brain, these social sites are our emerging Humanity neocortex. The fate of future civilisation depends on the decision we make here at 'the seat of our humanity.'

Carl Sagan describes 'The neocortex,' comprises more than two-thirds of our brain mass. The dominion of perception and essential analysis, "It is the distinction of our species," where "matter is transformed into consciousness." It makes possible our judgements, our knowledge of good and evil and our sense of self, where we have our ideas and inspirations, where we read and write, where we compose music or do mathematics. It is "the seat of our humanity. Civilization is the product of the cerebral cortex."

Don't ever dumb yourself down, you are so unique. You can be the greatest mind or the smallest thinker based in the heart of global research in Silicon Valley or in the backyard of forgotten lands in North Waziristan. WWW provides you this unique opportunity to be a part of world sans frontiers. Please don't contaminate this great vision of future with the backwardness of useless knowledge, learn the knowledge of today, think of tomorrow not yesterday ,think of sanctity of humanity and kindness towards every being. Hawkings says that if the human race manages to redesign itself, to reduce or eliminate the risk of self-destruction, we will probably reach out to the stars and colonize other planets.

We are through a phase that Hawking calls self designed evolution." We are on the cusp of a new mankind that will discover how to modify both intelligence, and instincts like aggression.

Posted by: [Iqbal Latif](#) | [June 21, 2013 at 09:59 AM](#)

Without vowels we would be still chimps, we will only grunt and not make words!! Things that make us human.

Thu Feb 28, 2013 8:34 AM

evolutionsciencelanguagechimpsvowelsconsonants

Without vowels we would be still chimps, we will only grunt not make words!! No language, means no skills, no literatures, no classics no books no writers and no music. The journey of evolution from how did we get from animal barks, howls, grunts to human language is a very interesting part of our evolution? Though the three billion letters that make up the human genome, only 15 million of them—less than 1 percent—have changed in the six million years or so since the human and chimp lineages diverged. Evolutionary theory holds that the vast majority of these changes had little or no effect on our biology. But somewhere among those roughly 15 million bases lay the differences that made us human.

Chimpanzees are the closest living relatives of humans and share nearly 99 percent of our DNA. But we are not Chimps, One thing that distinguishes us, despite of all DNA similarities is Vowels. Yes, you read it right. Vowels made us humans. We owe our language, our literature, our classics and our culture to vowels.

Two things that makes a huge difference where humans differ so profoundly, despite having nearly identical DNA blueprints is the position of Larynx and Bipedalism. Look at AEIOU the 5 vowels, 21 consonants alone cannot be used to form a word, every word needs the help any of the five vowels to be pronounced. We humans have the ability to turn the sound of the voice shaped in a manner to form words. Words are made up of vowels and consonants. The shaping is done by the muscles of the mouth, palate, lips, and tongue.

The descent of larynx is the reason we humans learned to speak. Without speech, there would have been no language, no literature or sciences. Sciences need expression; the relative truths need someone to think, speak and write. The reason chimps only grunt and cannot make words is because their larynx is slightly higher than we humans. Chimps have a poor Vocal-auditory function and therefore no 'Vowel perception.' A higher larynx in chimps leaves them only to grunt, barks, howls. Development of voice, speech and language ultimately became a substantial contributing factor in human evolution and development. This is a perfection that gave us thinking and ability to enrich our minds through communication and exchange of ideas. (Vowels are not part of the Arabic alphabet. They are little symbols on top or underneath letters, Japanese have 5 synthetic and natural vowels and French eight natural vowels)

Vowels are accompanied by vibration of the larynx and passing of the sound unobstructed through the mouth. Consonants are formed mainly by the alteration of the laryngeal sound by the tongue, teeth, lips, and palate. A word cannot be made up of consonants alone, because most of these cannot be voiced unless a vowel precedes or follows them. Some consonants are called labials (Latin labia, lip) because they are formed by the lips; it is impossible to say b, p, f, m, or v with your mouth alone. Others (d, t, l, n, r, s, z, ch, j) are linguals, requiring the use of the tongue (Latin lingua, tongue). G, q, and k are gutturals, made with the back of the palate (Latin gutter, throat). For me, the most important privilege and perfection we as humans achieved was posterior migration of the tongue into the pharynx, descent of the larynx and shortening of the soft palate with loss of the epiglottic-soft palate lock-up; without this movement of the larynx we could not have been further away from chimps. There is an evolutionary reason for it.

Ancestral roots of human language is in animal sounds: grunts, barks, whines. Chimpanzees cannot produce three vowel sounds a, e, i, o, u they have thinner tongues and a higher larynx, than humans, making it hard for them to pronounce vowel sounds. The vocal tract of chimpanzees is incapable of the articulation of the full range of sounds used by modern humans; e.g. chimp cannot raise tongue toward the roof of its mouth to articulate vowel sounds like "oo" and "ee" or cut off passage of air and make consonant sounds like "k."

Posterior migration of the tongue into the pharynx, descent of the larynx: The descent of the larynx is a recent occurrence in terms of the age of our cold planet. 300,000 years ago, early Neanderthals still could not pronounce "ee" "oo" or "a" (as the vowel in "father") It is just 100,000 years ago, first modern vocal tract appears in fossils of Homo sapiens. 100,000-50,000 years ago, gradual brain lateralization and localization of certain language abilities in left hemisphere; beginnings of development of symbolic thought and of language as we know it. Common origin of all human languages in a single language (Proto-World) first spoken in Africa around 70,000-60,000 years ago.

That gave us the ability to think, talk and write gave us the ideas of the myths of afterlife. The events in our biological maturity like posterior migration of the tongue into the pharynx, descent of the larynx and Bipedalism helped us create a myth of soul, a life that never ends. Our ability to talk gave us words to create myths, unlike smart chimps or dolphins. Our ambidexterity gave us the tools to free our hands to make Sphinx and Terra Cotta warriors that will serve us in the next world; Pharaohs and Chin died for posterity and left all these great tombs and sphinx to be served in their afterlife. It was not the Abrahamic holy prophets who primed the legend of afterlife, it was a myth that was born with evolution of our self consciousness and senses. The journey into the afterlife and search of elixir came with our increasing skill to talk, make stories and created new affection for eternity.

Posted by: [Iqbal Latif](#) | [June 21, 2013 at 10:05 AM](#)

Although I realize this is a quote from Hoeffcker, himself, I get really frustrated with buzzwords like 'the neurologic internet', as though every bit of knowledge we gain is only relevant if it can somehow be tied in to our current techno-pop culture.

Does it make more sense that symbolic communication bears a similarity to a technological connectivity developed 75,000 years later, or is it more likely that the internet is an extension of the ability to communicate complex thoughts that came long before it?

Posted by: [Chuck Rackers](#) | [June 21, 2013 at 12:01 PM](#)

We're born from a planet, birthed by an exploding star. Now we reflect on our origins looking back at the universe with a mind that not only mirror's the object of our attention but was created by it. What goes around comes around!

Posted by: [Terry](#) | [June 21, 2013 at 09:44 PM](#)