

Evolution of Consciousness Literature Review, Notes & Excerpts by Doug Phillips

Social and Cultural Accounts of the Evolution of Consciousness

The Origin of Consciousness in the Breakdown of the Bicameral Mind
By Julian Jaynes

Introduction

When did consciousness begin?

- 1) with matter
- 2) beginning of animal life
- 3) some time after life had evolved (during the appearance of associative memory or learning)
- 4) the metaphysical view ala Wallace- evolution has three distinct points
 - A) the beginning of life
 - B) the beginning of consciousness
 - C) the beginning of civilized culture
- 5) consciousness is an epiphenomenon of the brain
- 6) consciousness emerged at some point in evolution underivable from its parts- becomes causally efficacious
- 7) behaviorism- consciousness does not exist- conduct is a matter of reflex to the surrounding environment
- 8) consciousness resides in the brain (perhaps in the reticular formation)

Book I, Chapter 1: What is consciousness? (not!)

-Consciousness is not the same as reactivity, recognition is far vaster than recall, is not necessary for concepts, consciousness is not the basis of learning (learning is organic rather than conscious), not necessary for thinking (judgment is not conscious but immediate), not necessary for reason (rather the domain of logic) - expectation based on experience is not the same as consciousness, not in our heads

Chapter 2: Consciousness

-metaphor is the ground of language, the word 'understanding' as applied to consciousness is itself metaphorical

-"For it should be immediately apparent that there is not and cannot be anything in our immediate experience that is like immediate experience itself. There is therefore a sense in which we shall never be able to understand consciousness in the same way that we can understand things we are conscious of." (53)

-consciousness does not have a location in the physical sense

-Features of consciousness:

- 1) Spatialization- mental space
- 2) Excerption- selecting experience to identify
- 3) The Analog 'I'- the metaphor we have of ourselves
- 4) The Metaphor 'Me'
- 5) Narratization- explains and narrates our actions
- 6) Conciliation- bringing together the contents of narration into mental space

Chapter 3: The Mind of Iliad

- tracing consciousness back to the origins of language (primarily written)
- 3,000 BC represents an important landmark
- the Iliad was written down between around 900-850 BC
- no consciousness present in the Iliad
- nous-noos-from noein (to see)
- the gods of the Iliad take the place of consciousness
- the hero did not have a conscious ego
- the self later develops and accepts responsibility and can debate within himself- we have become our own gods

Chapter 4: The Bicameral Mind

- an executive part called a god and a follower part called man- neither part was conscious
- stress as a result of decision making

Chapter 5: The Double Brain

- areas of the brain associated with language: Wernicke's area, Broca's area and the supplemental motor area- almost entirely in the left hemisphere of right handed individuals
- Jaynes suggests that the corresponding area in the right hemisphere to Wernicke's area on the left may have been the location of hallucinatory visions and auditions (where gods spoke to men)
- studies of temporal lobe stimulation in the right hemisphere often conjures up voices

Chapter 6: The Origin of Civilization

- the group evolves!
- "It is thus the experience of one individual and his dominance that is an advantage to the whole group." (127)
- "The important thing for us here is that this social structure depends upon the communication between the individuals." (127)
- Jaynes argues that the development of language occurred in the late Pleistocene Age from 80,000 BC to 8,000 BC
- 2 million years ago we see the emergence of *Homo*
- each new stage of word formation created new perceptions and attentions
- intentional calls- nouns (the referants) appear to have emerged between 25,000-15,000 BC (corresponds with the drawings of animals)
- "Everyone agrees that the change from a hunting and gathering economy to a food-producing economy by the domestication of plants and animals is the gigantic step that made civilization possible." (137)
- "The king dead is a living god." (143)
- the Agricultural Age begins around 9,000 BC

Book II, Chapter 1: Gods, Graves, and Idols

- early architecture- a god house surrounded by man houses
- a shrine appears in almost every household

-idols may have been used to help cement the bicameral mind

Chapter 2: Literate Bicameral Theocracies

- "Memphite Theology" - 8th century BC - discusses the creator (commander) god Ptah
- the Egyptian concept of 'ka' - will power, goes to when dead
- in 2100 BC in Ur the judgments of gods through their steward mediums became the basis for law

Chapter 3: The Causes of Consciousness

- "In the bicameral era, the bicameral mind was the social control, not fear or repression or even law." (205)
- writing weakened the bicameral mind divine authority - the word of god had a controllable location
- Jaynes emphasizes the importance of trade on consciousness development
- "The very practice of cruelty as an attempt to rule by fear is, I suggest, at the brink of subjective consciousness." (214)
- volcanic eruptions and other natural catastrophes led to more displacement of peoples around the world
- "The observation of difference may be the origin of the analog space of consciousness." (217)
- "...I wish to be very clear that consciousness is chiefly a cultural introduction, learned on the basis of language and taught to others, rather than any biological necessity." (220)
- prayer develops when the gods no longer speak to man face-to-face
- gods began to be seen as living in the sky or heaven
- the spatialization of time, so important to narratization, seems to have occurred about 1300 BC - inaugurates the beginning of 'history'

Chapter 5: The Intellectual Consciousness of Greece

- consciousness and morality are a single development
- the Fall in the book of Genesis is indicative of the breakdown of the bicameral mind

Social intelligence, innovation, and enhanced brain size in primates

By Simon M. Reader and Kevin N. Laland

- "Behavioral innovation and cultural transmission are proposed to be central to the evolution of the human brain." (4436)
- "Social intelligence hypotheses posit that complex social interaction was responsible for the selection pressures that favored enhanced primate intelligence." (4436)
- "Social learning, innovation, and tool use have all been proposed as explanations for the evolution of enhanced brain size in primates." (4437)
- "Members of large-brained nonhuman primate species innovate, learn from others, and use tools more frequently than members of small-brained primate species." (4439)
- "Individuals capable of inventing new solutions to ecological challenges, or exploiting the inventions and discoveries of others, may have had a selective advantage over less able conspecifics, which generated selection for those brain regions that facilitate complex technical and social behavior." (4440)

- "...our findings support the view that social learning and innovation may have been important processes behind the evolution of large brains in primates." (4440)

Technology's Role in the Evolution of Consciousness

"Evolution consciousness and the new technologies: crisis in communication for the twenty-first century"

By Mike Aldridge

Communicatio, Volume 23 (1) 1997

- suggests that the emergence of life occurred approximately 2-3 billion years ago and *Homo sapiens sapiens* began to appear 2-300,000 years ago

- "The consistent failure of revolutions in the twentieth century to deliver anything other than 'more of the same' repression, exploitation and imperialism is proof of our political failings; but perhaps we are capable of greater things, if we are able to utilize our theoretical knowledge to build technologies which can aid the development of our consciousness, the essential mechanism for the harmonious development of the human species on Planet Earth." (3)

- "... the current rapid changes we are creating in our environment can launch a new spurt of evolutionary growth." (4)

- "... our technological innovations are already impacting on our consciousness in the form of various communications technologies which have been developed." (4)

- "... further technological advances will bring us enhanced capacities for communication as well as the manipulation of genetic codes and the bio-mechanical interface." (4)

- "This in turn requires some sacrifices, that is universal voluntary reduction in birth rates and limitations on the affluence and power possessed by individuals and groups." (5)

- "In presenting alienation as a defining feature of human experience, Marx proposed that human beings were alienated from the products of their work activities because of factors such as the division of labour and money." (6)

- "In the Information Age, the dominant means of production in the global economy is the production of symbolic forms, that is knowledge, through educational institutions, mass media, the culture industry and bureaucracies. In advanced capitalist countries such as the USA, more than 50 percent of labour production involves the manipulation of information." (7)

- "Marx and Hegel both thought of history as having a purpose, a goal-- for Hegel the self-consciousness of mind and for Marx the liberation from alienation of the human species." (7)

- "However, if we conceive of our universe as consisting of information, then it may be that thought in the form of self-organising information is what precedes existence." (8)

- IME- Information, Matter, Energy

- "Evolution is thus 'a change of organization' which occurs through 'instruction from a higher level of co-ordination' which orders or encodes information in a semantic fashion." (12)

- "The form of mind as inclusive of both individual and mass consciousness, together with the signification systems of language and technology, has brought us to the 'Information

Age' of the late twentieth century. This is the time of the 'digital renaissance', where art and science fuse in the furnace of digital technology." (12)

- "...increasing understanding of the world is a broadening of consciousness." (13)

- "Marshall McLuhan (1964) viewed technology, in the form of media, as 'extensions of consciousness'." (13)

- "The evolution to which I speak is one in which individual self-consciousness is linked to global human self-consciousness." (13)

- "Terrence McKenna posits that the universe is information, of which matter is an embodiment. If we take this view to be true, then mind can be seen as an amplificatory device for analyzing and translating information. The idea of a holistic, unitary universe, together with an understanding of that universe as an informational construct, greatly facilitates a view of reality which enables understanding of singularities such as psi phenomena, or mind as a collective phenomenon." (14)

- "If the interface to communication through media occurs at the level of community media, it enables more people to become involved in processes of meaning construction." (17)

- "...the way forward for media lies in the efficient management of interactive information." (18)

- "Media impacts on consciousness, so by changing the images through which we uncover our existence, we alter the gestalt of consciousness." (19)

- "A change in our way of thinking is already taking place as a result of the advent of electronic multimedia and hypertext mediums." (20)

- "... this could potentiate an alteration in the collective consciousness, manifested in aspects such as global outlooks, or an experience of being, or a kind of 'communal mind'." (21)

- "Just as the individual neuron in the brain does not experience consciousness, so individuals linked into the cyber network will not 'know' some sort of god-like superconsciousness, except partially, through Gnostic induction. The effect of this experience for the individual will be inspirational, where knowledge is in effect shared among the participants in an initially unconscious fashion. This knowledge will only become conscious if the ideas are formulated into language by the individual and ultimately shared collectively through the creation of media images and words." (21)

- "The site of struggle on our planet has moved into the realm of consciousness-- we must create ourselves anew through actualizing the potentials of mind if we want to be free." (22)

Biological Approaches to Brain Evolution

"Molecular Insights into Human Brain Evolution"

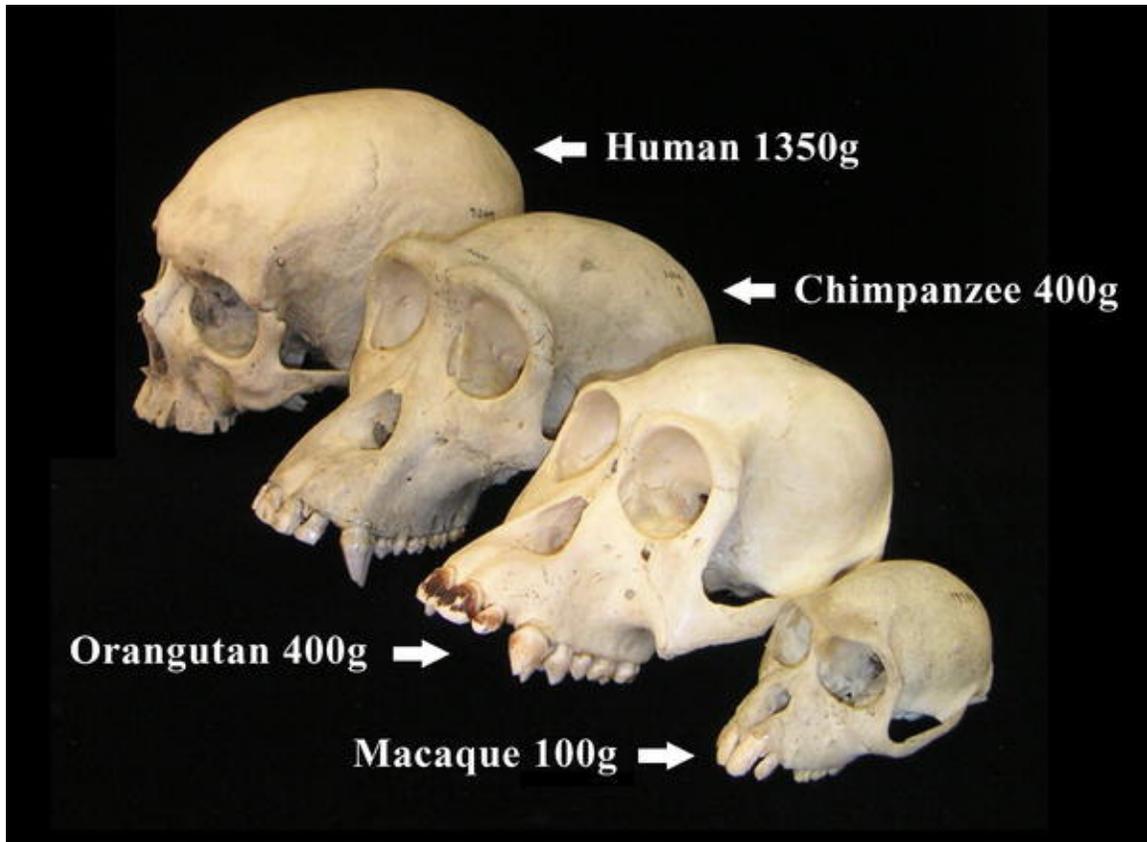
by Jane Bradbury

Bradbury J (2005) Molecular Insights into Human Brain Evolution. PLoS Biol 3(3): e50

URL: <http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pbio.0030050>

- "Like in humans and other primates, the neocortex in whale brains is huge, but its structure is very different to that of our neocortex."

- "Dunbar believes instead that brain evolution in primates and more generally in mammals 'has been driven by the need to manage social relationships, and in primates, in particular, to coordinate coherence in social groups through time and space'."
- "Furthermore, during primate brain evolution, the trend has been to add more material to the front than the back of the brain. The front of the brain is where information from the rest of the brain is interpreted, and the capacity to interpret information underlies social interactions, says Dunbar."
- "Walsh has recently reported that deletion of a gene called *Nde1* produces mice with very small brains."
- "Preuss, who began training as a paleoanthropologist before turning to neuroscience, has been comparing post-mortem human and chimpanzee brains since the mid 1990s, believing that "if we want to understand human brain evolution, we really have to compare humans with chimpanzees, our nearest relatives", even though chimp brains have been evolving separately from ours for 5–7 million years."



Skulls from the Harvard Museum of Comparative Zoology
Image by Christopher Walsh, Harvard Medical School

Mirror Neurons and the Evolution of Brain and Language
 Edited by Maxim I. Stamenov and Vittorio Gallese
 John Benjamins Publishing Company, Philadelphia, 2002
 Introduction

-humans are complex adaptive systems (2)

- "The mirror neurons become activated independently of the agent of the action- the self or third person whose action is observed." (2)

"Is the Human Brain Unique?"
by Gerhard Roth

Brain Weight in Mammals (grams)

Sperm Whale	8,500	Chimpanzee	400
Elephant	5,000	Lion	220
Human	1,300	Dog	135
Horse	590	Cat	30
Gorilla	550	Rat	2
Cow	540	Mouse	0.4

-among primates, humans have the largest relative brain size compared to body mass, although some rodents are up to 10% brain/body compared to only 2% for humans, and 0.01% for blue whales (66)

-humans have a much larger brain than expected among primates (69)

- "While about 100,000 (or more) neurons are found in one mm³ of motor cortex in mice, 'only' 10,000 neurons are found in the motor cortex of man" (Jerison, 1991). (69)

- "It has been estimated that the mouse cortex contains about 10 million neurons and 80 billion synapses and the human cortex about 100 billion neurons and a quadrillion synapses, ten thousand times more than the mouse cortex" (Jerison, 1991; Schuz, 2000; Palm, 1989). (70)

- "We do not know enough about the organization of the elephant cortex, but elephants should come close to the cognitive and mental capabilities of man, if it were only the number of cortical neurons and synapses that count." (41)

-PFC (prefrontal cortex) volume to brain as a whole (71)

Rats 6.5%

Dogs 8.7%

Cows 9.8%

Humans 10.6%

- "While in non-human primates as well as in hominids that did not represent our ancestors, brain size increases with body size to a power of 0.33-0.34, in the lineage leading to homo sapiens it increased to a power of 1.73, i.e. in a positively allometric fashion, which means that brain size increased faster than body size. However, the reasons for this phenomenon are completely unclear." (72)

-The size of the human brain has increased dramatically over the past 3-4 million years. (72)

-side note- the brain and body size relationship is clearly an important indicator of a species' relative intelligence as evidenced by the history of hominid evolution. Our ancestors had smaller brains relative to body size, and presumably, less general intelligence.

- "Only two traits have been discovered that could drastically distinguish the human cortex from that of other primates, viz., (1) differences of growth rate and length of growth period and (2) the presence of the Broca speech center." (73)

- "Maturation of the brain is more or less completed at 2 years after birth in prosimians and 6-7 years in monkeys and non-human apes, but the human brain still continues to mature until the age of 20, which is much longer than in any other primate." (73)
- "Without any doubt, the drastically prolonged period of brain development constitutes one important basis for an increased capability of learning and memory formation." (73)

"Some features that make mirror neurons and human language faculty unique"

by Maxim I. Stamenov

- "In psychological terms, human Long-Term Memory (LTM) must have a qualitatively different organization compared to LTMs of the other species." (249)
- "... role-playing and strategic positioning on oneself in an interpersonally structured mental space become possible on a regular basis only with the advent of language." (258)

How Did Humans Evolve Big Brains?

by Roger Lewin

- many of the points made here are based on the research conducted by Robert Martin of University College, London
- the postnatal growth period in humans is something unique among primates
- Martin says, "It is the mother's energetic potential that determines the brain size of the developing fetus." (840)
- human evolution occurred under very stable environmental conditions
- Martin: "Human infants have brains and bodies twice as big as you'd expect, given the length of gestation." (841)
- "In addition to the accelerated fetal development, the human brain expands four times from the neonatal size to adult status, compared with the doubling typical of primates." (841)
- "Martin points out that there is a correlation between brain size and generalized diet and he suggests that hominids would have benefited from expanding their dietary habits in as many directions as possible. The inclusion of substantial meat eating later in human evolution was probably important in this respect, he acknowledges." (841)

The Role of Language and Symbol Construction in the Evolution of Consciousness

"On the Evolutionary Origin of Language"

by Charles N. Li and Jean-Marie Hombert

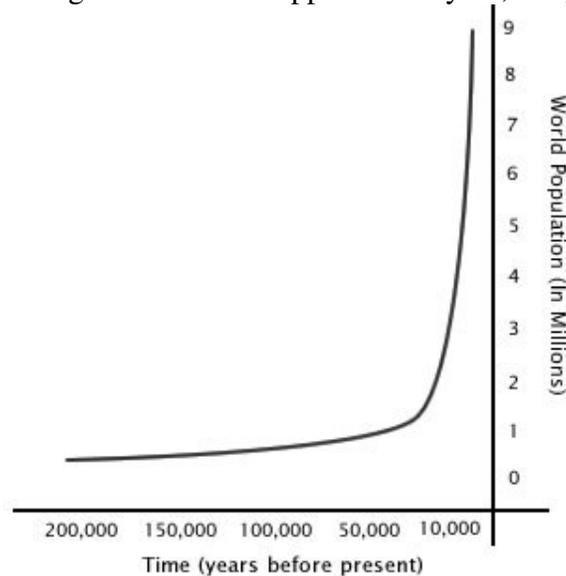
- "Rapid and efficient transmission of knowledge conferred an immense competitive advantage to the hominids for securing resources and possibly vanquishing others, including other species of hominids whose communicative behavior was less developed in the direction toward language." (176)
- "The emergence of the first symbolic communicative symbol among hominids is not only an important evolutionary landmark but also represents a quantum leap from non-human primate communication." (177)
- vocal production may be largely innate (177)
- "The production of casual, spoken language is primarily mediated by the neocortex." (177)

- "Linguistic change, the change of language after its origin, however, is by and large tied to society and culture." (178)

- "This confluence of evidence has led us to postulate that language emerged around 80-60 thousand years ago, several tens of thousand years *after* the appearance of anatomically modern humans." (178)

- two major population explosions- around 40,000 years ago and again around 10,000 years ago- the second population explosion was driven by the development of agriculture. (179)

- "At around 40,000 years before present, a 'Big Bang' of art occurred. The oldest preserved rock paintings discovered to date are the red ochre figures of half-human and half-beast found in the Fumane Cave northwest of Verona at 36,000-32,000 years old and the Grotte Chauvet paintings of animals at approximately 32,000 years old." (179)



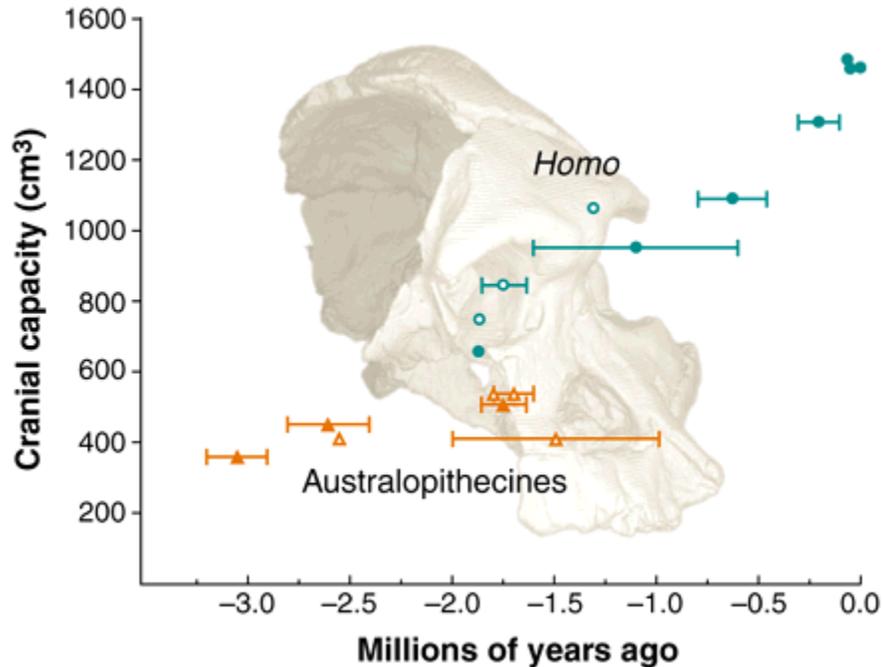
- personal ornaments appear around 35,000 years ago and the sophistication of tools increases dramatically, and people begin to cross oceans (perhaps the first to cross were those separating Asia from Australia) (181)

- Four evolutionary processes leading to the emergence of language (182-183)

1. Reduction of the gastrointestinal tract
2. Enlargement of the vertebral canal
3. Descent of the larynx
4. Increase in encephalization

- "The human brain of a newborn infant, for instance, consumes 60% of the energy it takes in." (182)

- "...it took approximately 1.5-2 million years for hominid communicative behavior to evolve into casual spoken language." (186)



Img source: http://cas.bellarmine.edu/tietjen/images/hominid_brain_evolution.htm

-changes of the developmental clock for both the brain and body of hominids contributed significantly to encephalization

-both behavior and change in habitat can inaugurate evolutionary adaptations. James Mark Baldwin (1896) was the first evolutionary scientist to suggest that behavior can influence the course and direction of evolution.

-"In the evolutionary development of hominids, the speed and capacity of social learning and imitation expanded dramatically. More specifically, the increase of mirror neurons in the neocortex plays a significant role in the expansion of hominids' capacity of learning and imitation." (188)

-the naming of a concrete object may have been the first step in the evolution of hominid communicative behavior. (188)

-"Contrary to the common belief, written language is not just spoken language written down. Written language is a recent cultural invention with approximately 5000 years of history, representing a crowning cultural achievement and a critical cultural instrument of great importance." (191)

-"We believe that that the onset of symbolic communication began with Homo erectus." (192)

-"Not all humans are destined to acquire literacy. Learning to write requires education, assistance, guidance and years, if not decades, of practice. There is as much gradation in the quality of written language as there are educated people in a society." (198)

-"Written language is not the result of biological evolution. As we have pointed out, it is a cultural product." (199)

The Symbolic Species: The Co-evolution of Language and the Brain

by Terrence W. Deacon

W.W. Norton and Company, New York, 1997

Part I Language

- "In summary, then, symbols cannot be understood as an unstructured collection of tokens that map to a collection of referents because symbols don't just represent things in the world, they also represent each other. Because symbols do not directly refer to things in the world, but indirectly refer to them by referring to other symbols, they are implicitly combinatorial entities whose referential powers are derived by virtue of occupying determinate positions in an organized system of other symbols." (99)

- "Without question, children enter the world predisposed to learn human languages." (102)

- "But there is another alternative: that the extra support for language learning is vested neither in the brain of the child nor in the brains of parents or teachers, but outside brains, in language itself." (105)

- "Languages don't just change, they *evolve*." (109)

- "Biological change is vastly more slow and inflexible than language change." (110)

- "Language evolution is probably thousands of times more rapid than brain evolution." (110)

- "There is an important sense in which artifacts and social practices evolve in parallel with their living hosts, and are not just epiphenomena." (114)

- "Human children appear preadapted to guess the rules of syntax correctly, precisely because languages evolve so as to embody in their syntax the most frequently guessed patterns." (122)

- "Even surgical removal of most of the left hemisphere, including regions that would later have become classic language areas of the brain, if done early in childhood, may not preclude reaching nearly normal levels of adult language comprehension and production. In contrast, even very small localized lesions of the left hemisphere language regions in older children and adults can produce massive and irrecoverable deficits." (124)

- "Brains have evolved to be able to employ many different learning strategies at different times and in different circumstances and these strategies are often competitive with one another in their recruitment of neural resources. This is why a severe impairment affecting one learning strategy can inadvertently provide a release of resources to some other complementary, or mutually exclusive, learning strategy." (140)

- "Immaturity of the brain is a learning handicap that greatly aids language acquisition." (141)

Part II Brain

- "The brain is by far the most complex organ of the body, and one whose outward appearance provides little hint of its functional organization." (147)

- "The question is not whether brain size is an important correlate of human brain evolution. It is. It is not whether our unusually large brains and the differences in our cognitive abilities are somehow linked. They undoubtedly are." (148)

- "Our brains are not the biggest, nor do they have the most neurons or connections. Elephants and whales are vying for that honor. We do have large brains for our bodies, but in simple ratio terms mice are more brainy." (149)

- "Nineteenth-century evolutionists took it for granted that habitual use of an organ, over many generations, could bring about evolution to develop and enlarge it, and that organs that were not used would eventually become reduced or vestigial." (151)

- "If larger brains also have to service the information processing demands of larger bodies, they will not necessarily offer their possessors any net increase in cognitive power with their greater size." (154)

- "A low ratio of brain to body size has also been used to argue for low intelligence in large dinosaurs and to explain the apparently greater intelligence of humans compared to larger-brained whales and elephants. Unfortunately, a simple ratio approach fails to make sense of the high ratio of brain to body size in mice (as much as twice the ratio in humans) and other small mammals, since no one seems ready to claim that mice have a slight intellectual edge over humans and a large advantage over other great apes." (154)

- "The brain is the most metabolically expensive organ at rest, consuming up to ten times more glucose and oxygen for its mass than any other organ." (157)

- "increasing size means an increasing fragmentation of function. It also means loss of speed, both because of the increased distances and because of the increased numbers of nodes that must be traversed by a signal to reach comparably removed sites in the overall network." (162)

- "The inevitable information-processing geometry of size determines that bigger brains cannot be just scaled-up small brains, and this makes the brain size/intelligence equation all the more messy and complicated." (163)

- "When seen in terms of encephalization, primates have nearly twice as much brain for their body size as other typical mammals, and humans have almost three times more brain than a typical primate." (169)

- "For brain development, the autonomy of the developmental clock means that the number of cell divisions completed by the time the cells of the brain have taken on their final fates is decided before there is any sign of a brain or other body regions in the embryo. From that point on, the size of the brain depends on what fraction of the developing embryo is selected to become neural tissue by the expression of the homeotic genes." (188)

- "If brains evolved piecemeal, structure by structure, then how could a new structure be added or modified in any significant way and have any hope of being useful, given that it must be linked up in a highly systematic fashion with hundreds of thousands or millions of other neurons in dozens of other brain regions?" (193)

- "As it matures, a brain literally adapts to its body." (194)

- "Unlike other cells of the body, neurons can be in direct contact with many cells that are located quite far apart from one another, by virtue of their long output (axons) and input (dendrite) branches." (194)

- "Neurons born in distant regions and following different developmental trajectories can directly and specifically communicate with each other, and so affect each other's differentiation." (195)

- "When a pig neuron grows up in a rat brain environment, it integrates with other neurons according to rat rules." (200)

- "...each developing brain region adapts to the body it finds itself in. There is a sort of ecology of interactions determined by the other brain regions to which it is linked that selects for appropriate brain organization." (205)

- "Learning, then, is only the late-stage expression of a fine-tuning process that progresses from patterns involving the whole brain to those involving its smallest cellular branches." (206)

- "Among competing structures, the structure that sends the greatest number of axons to a particular target will tend to drive the activity patterns of cells in the target more effectively, and this will give connections that are from a larger source population a 'voting' advantage in determining which connections will remain." (207)

- "Among cortical areas it appears as though the prefrontal cortex may have inherited additional territory in the human brain, perhaps from reduced motor areas nearby. According to separate extrapolations derived from independent data sources, I have estimated that human prefrontal cortex is roughly twice the size that would be predicted in an ape brain as big as ours." (218)

- "I will argue that the ability to produce skilled vocalizations can be traced to changes in motor projections to the midbrain and brain stem, while the ability to overcome the symbol-learning problem can be traced to the expansion of the prefrontal cortical region, and the preeminence of its projections in competition for synapses throughout the brain." (220)

- "... if one brain structure is relatively enlarged compared to another, this should translate into both displacement of connections during development and displacement of computational influence in adulthood with respect to other competing inputs from other brain structures. More inputs equals more votes influencing the computational outcome." (221)

- "To organize vocalization requires the coordinated activation of clusters of motor neurons that control the muscles for breathing, the tension of the larynx, and the movements of the oral and facial muscles. The motor neurons controlling all of these are located in the upper brain stem." (232)

- "Humans have a degree of voluntary motor control over the sound produced in the larynx that surpasses any other vocal species." (243)

- "Within a few months of birth, human infants begin spontaneously and incessantly experimenting with sound production, sampling most of the range of possible phonemes that speech will later employ. No other mammal species' babies produce even a tiny fraction of the sort of unstereotypic vocal play that human babies produce." (251)

- "These data suggest that human vocal skills first exceeded the capabilities of any living non-human primate at least 2 million years ago, in the hominid fossil species *Homo habilis*, since this species marks the first significant upward shift in relative brain size. Since the trend toward larger brains continued from that point until about 200,000 years ago, we can predict with some confidence that vocal abilities were enhanced continuously over this entire extended period of hominid evolution. These data suggest that it is unlikely that speech suddenly burst on the scene at some point in our evolution. The ability to manipulate vocal sounds appears to have been in a process of continual development for over 1 million years." (252)

- "So, what does the prefrontal cortex do? This is no simple question. In fact, it remains one of the most debated questions in neuropsychology. The reason it is difficult is that the explanation cannot be tied to any sensory or motor functions." (259)

- "... human prefrontal patients often fail at card-sorting tasks that require them change the sorting criteria." (263)

- "Prefrontally damaged patients also often have difficulty learning mazes based on success/failure feedback, making plans, spontaneously organizing behavior sequences,

and performing tasks that require taking another's perspective (allocentric as opposed to egocentric)." (263)

- "The contributions of prefrontal areas to learning all involve, in one way or another, the analysis of higher-order associative relationships." (264)

- "We should not, however, make the mistake of thinking that prefrontal cortex is the place in the brain where symbols are processed. It is not. Massive damage to the prefrontal cortex does not eliminate one's ability to understand word or sentence meaning." (265)

- "The critical role of the prefrontal cortex is primarily in the construction of the distributed mnemonic architecture that supports symbolic reference, not in the storage or retrieval of symbols." (266)

- "Intelligence isn't a unitary brain function, and language isn't walled off from other cognitive functions." (269)

- "It has long been known that prefrontal damage can often produce a disturbance in social behaviors." (271)

- "Recently, a number of psychologists have shown that autistic patients have a quite specific difficulty with tasks that require imagining what is going on in other peoples' minds." (275)

- "The cerebellum also turns out to be one of the group of brain structures that has been selectively enlarged in humans as compared to other primates." (276)

- "...the cerebellum is probably far more involved with sound analysis in human beings than it is in any other species." (277)

- Broca's Area- ability to speak Wernicke's Area- ability to understand

- "Wernicke's genius was in recognizing that brains needed to be analyzed in terms of circuits, and not just collections of regions with distinct functions." (283)

- "If there was ever a structure for which it makes sense to argue that the function of the whole is not the sum of the functions of its parts, the brain is that structure." (287)

- "...language functions may be widely distributed and processed simultaneously in many different places at once." (293)

- "Even a 700-gram brain (as might result from hemispherectomy), if organized appropriately, can acquire sophisticated language skills and pass as humanly intelligent." (311)

- "The right hemisphere is not the non-language hemisphere. It is critically and intimately involved in language processing at many levels during both development and maturity." (311)

Part III: Co-Evolution

- "To know the 'true name' of a thing was thought to be source of power over it in many traditions." (321)

- "The evolutionary miracle is the human brain. And what makes this extraordinary is not just that a flesh and blood computer is capable of producing a phenomenon as remarkable as a human mind, but that the changes in this organ responsible for this miracle were a direct consequence of the use of words." (322)

- "I mean that the major structural and functional innovations that make human brains capable of unprecedented mental feats evolved in response to the use of something as abstract and virtual as the power of words. Or, to put this miracle in simple terms, I suggest that an idea changed the brain." (322)

-". I do suggest that the first use of symbolic reference by some distant ancestors changed how natural selection processes have affected hominid brain evolution ever since." (322)

-"Baldwin suggested that learning and behavioral flexibility can play a role in amplifying and biasing natural selection because these abilities enable individuals to modify the context of natural selection that affects their future kin." (322)

-"Evolution seldom follows straight lines." (326)

-"Of all the forms of adaptation, the flexibility to learn new behavioral responses during one's lifetime can produce the most rapid and radical evolutionary consequences. Indeed, the ability to learn and thus inherit acquired behaviors may be one of the most powerful sources of evolutionary change." (326)

-"Most researchers would agree that language change is likely to be many orders of magnitude more rapid than genetic change." (329)

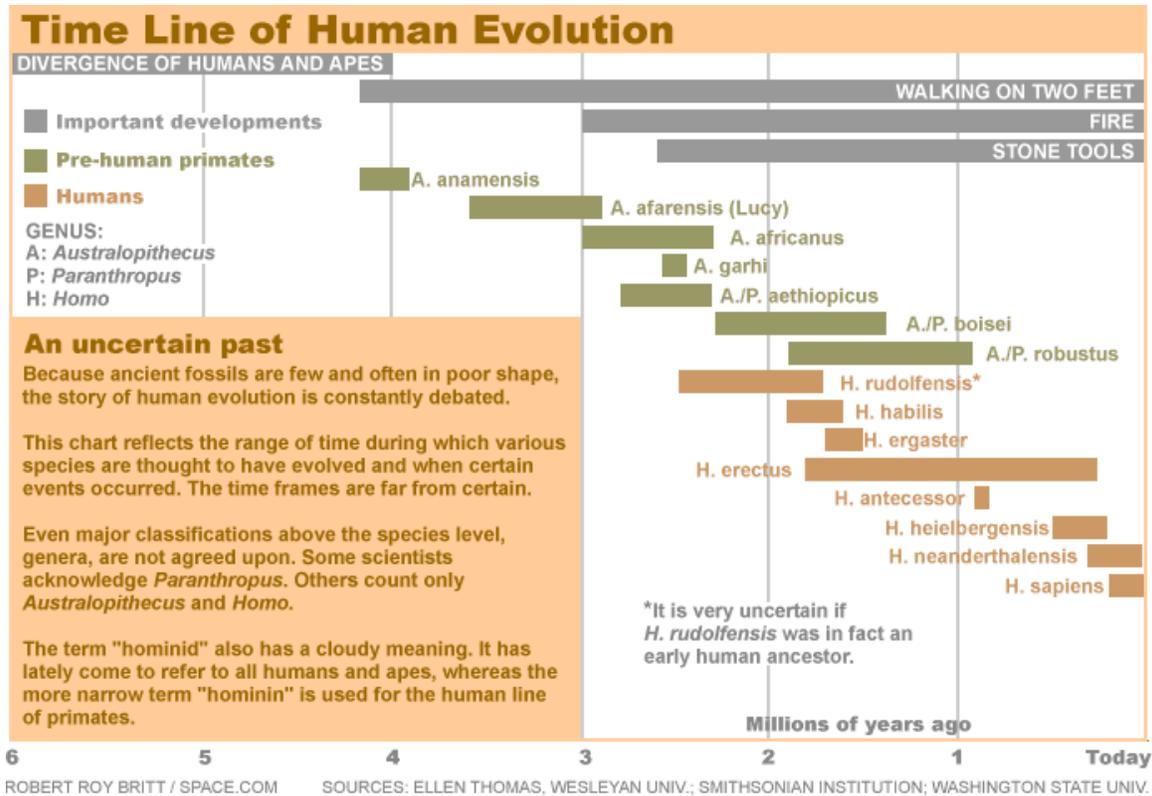
-"Symbol use itself must have been the prime mover for the prefrontalization of the brain in hominid evolution." (336)

-"Use of language also places inevitable demands on neural systems not directly involved in the production of perception of speech. The amount and rate of the information that is presented during linguistic communication, and the requirement that symbolic reference must be constructed combining many component symbols, place special demands on short-term memory and attentional processes." (337)

-"The remarkable expansion of the brain that took place in human evolution, and indirectly produced prefrontal expansion, was not the cause of symbolic language but a consequence of it." (340)

-"...the critical difference is not the addition of some essential brain structure, but the quantitative modification of relationships within the whole brain, particularly the relative contribution of the prefrontal cortex." (343)

-"The size of the hominid brain increased almost threefold from African ape averages, which were similar to those of our australopithecine precursors. There is little disagreement among paleontologists that hominid brains first began to enlarge significantly in comparison to body size approximately 2 million years ago, with the appearance of the paleospecies designated *Homo habilis*. This habiline increase was as much as 150 percent above australopithecine values, from roughly 500 to 700 cc." (343)



- "It cannot be doubted that such a robust and persistent trend in brain structure evolution reflects forces of natural selection acting on major brain functions, and it is hardly coincidental that these most salient changes in human brain structure correlate with the development of a unique human facility for symbols." (344)

- "More than any other group of species, hominids' behavioral adaptations have determined the course of their physical evolution, rather than vice versa. Stone and symbolic tools, which were initially acquired with the aid of flexible ape learning abilities, ultimately turned the tables on their users and forced them to adapt to a new niche opened up by these technologies." (345)

- "The first stone tools slightly predate the first appearance of the genus *Homo*, as defined in part by its expanded brain." (347)

- "The Baldwinian perspective suggests another possibility: that the first stone tools were manufactured by australopithecines, and that the transition into *Homo* was in part a consequence rather than the cause of foraging innovation they introduced." (347)

- "For most of their evolution, australopithecines were clearly not symbol users. There is no evidence of the changes of brain structure we can now associate with this function during their presence for millions of years before any such 'humanlike' neural adaptations appeared." (347)

- "Ultimately, all these curious physical traits that distinguish modern human bodies and brains were caused by *ideas* shared down the generations." (349)

- "As more functions came to depend on symbolic communication, it would have become an indispensable adaptation." (352)

- "If the first languages were manual languages, they might have provided an intermediate stage between the ape and modern human conditions." (355)

- "The higher vocal tract of other primates and mammals significantly reduces the range and flexibility of sound production." (357)
- "Our prehistoric ancestors used languages that we will never hear and communicated with other symbols that have not survived the selective sieve of fossilization." (365)
- "Most of the symbol use in a society, even excluding language, is not even embodied in any material, but only in ceremonies, habits, and rules that govern everyday life." (367)
- "Many scenarios for the origins of language have focused on the middle and later stages of the Upper Paleolithic period, between about 40,000 and 15,000 years ago, as a source of evidence for the first use of symbols." (370)
- "A plausible story could be woven from almost any of the myriad of advantages that better communication could offer: organizing hunts, sharing food, communicating about distributed food sources, planning warfare and defense, passing on toolmaking skills, sharing important past experiences, establishing social bonds between individuals, manipulating potential sexual competitors or mates, caring for and training young, and on and on." (377)
- "In other words, males try to communicate information that favors them, and females try to receive information that gives them a basis to choose between the males and cut through any potential misinformation provided by them." (381)
- "The appearance of the first stone tools nearly 2.5 million years ago almost certainly correlates with a radical shift in foraging behavior in order to gain access to meat." (386)
- "In most mammalian species, sexual access is either determined by rank and ongoing competition, and results in polygyny; or else it is a result of a courtship process in which two individuals become 'attached' to one another, and then isolate themselves from other members of their species." (387)
- "Not surprisingly, some of the most complex rituals in all societies grow out of efforts to convey some of the most intangible and ineffable symbolic notions: the meaning of existence, the nature of God, what it means to be a member of a particular ethnic tradition, and so on." (405)
- "A wife, a husband, a warrior, a father-in-law, an elder-- all are symbolic roles, not reproductive roles, and as such are defined with respect to a complete system of alternative or complementary symbolic roles." (406)
- "The origins of the first symbolic communication have nothing intrinsically to do with language per se." (409)
- "The key to this is the co-evolutionary perspective which recognizes that the evolution of language took place neither inside nor outside our brains, but at the interface where cultural evolutionary processes affect biological evolutionary processes." (409)
- "Like the character portrayed in *Rain Man*, who sees the world in terms of numbers of objects, we cannot help but see the world in symbolic categorical terms, dividing it up according to opposed features, and organizing our lives according to themes and narratives." (416)
- "The unusual size of the prefrontal cortex in comparison to other not so enlarged brain structures may have costs as well as incidental side effects. These may be realized in the form of susceptibilities to disorders centered on prefrontal dysfunction." (421)
- "Manic states, panic states, and obsessive-compulsive disorders appear to be associated with hyperactivity in the prefrontal cortex, whereas schizophrenia, depression,

Parkinsonism, and Alzheimer's disease appear to be associated with hypoactivity of the prefrontal cortex." (422)

- "The idea that an unconscious process might 'rewrite' our personal memories to cover up past trauma puts us in doubt of even our direct experience of self. In other words, if our mental experiences are mediated by representation all the way down, then there is no direct knowledge." (425)

- "With increasingly powerful symbolic abilities comes an increasingly sophisticated ability to model the world that symbols enable us to represent." (431)

- "We can easily become overloaded and confused by our ability to generate and respond to multiple what-if worlds." (431)

- "We intuitively hold the most intelligent, most educated, and most experienced people to higher ethical standards, and are more willing to give children and even adolescents the benefit of the doubt. This is because we recognize that these symbolic insights require some of the most counter-intuitive shifts of perspective and recoding processes of any symbolic activity. When these cognitive difficulties are considered in the context of choices that may be in conflict with immediate self-interest, it becomes obvious why ethically guided self-control is both uncommon and fragile." (432)

- "As a species, we seem to be preoccupied with ends, in all senses of the word. We organize our actions around imagined extrapolations of the consequences they will produce." (433)

- "Symbolic analysis is the basis for a remarkable new level of self-determination that human beings have alone stumbled upon." (434)

- "One might respond that calling some actions 'free' and others not oversimplifies what is really only a matter of the degree of the strengths of competing compulsions to act, some compulsions arising from automatic and hormonal sources and others from our imagined self satisfaction at reaching a symbolized goal." (434)

- "Wherever we look we expect to find a purpose." (435)

- "We are not just applying symbolic interpretations to human words and events; all the universe has become a symbol." (435)

- "There is no culture that I know of that lacks a rich mythical, mystical, and religious tradition." (436)

- "What we mean by 'consciousness' is tied to issues of complexity. We intuitively believe that simple information-processing devices could not be as conscious as more complicated ones." (440)

- "There is, therefore, a threshold of neural complexity below which symbolic processes are not possible." (440)

- "Animals can have conscious minds, without sharing all the attributes of human consciousness." (442)

- "The source of symbolic reference is not in the brain at all. This is why it is pointless to look for the basis for symbolic consciousness in a lower-level essence that is only associated with brains, or to invoke special physical laws that undermine the deterministic character of neural mechanisms in order to explain intentional consciousness. Symbolic reference does not derive from anything particularly special about the brain, but from a special sort of relationship that can be constructed by it." (447)

- "No matter what else various theorists might claim about the nature of consciousness, most begin by recognizing that to be conscious of something is to experience a representation of it." (448)
- "All nervous systems support iconic and indexical representational processes, irrespective of their size and complexity." (449)
- "We live most of our concrete lives in the subjective realm that is also shared with other species, but our experience of this world is embedded in the vastly more extensive symbolic world." (450)
- "The self that is the source of one's experience of intentionality, the self that is judged by itself as well as by others for its moral choices, the self that worries about its impending departure from the world, this self is a symbolic self." (452)
- "This self is indeed not bounded within a mind or body, and derives its existence from outside- from other minds and other times." (452)
- "We live in a world that is both entirely physical and virtual at the same time." (454)
- "As we have seen, at every step the design logic of brains is a Darwinian logic: overproduction, variation, competition, selection." (456)
- "...different neuronal computations may be in competition with one another for representation in the brain both during development and within each cognitive activity." (457)
- "Unlike the mechanistic view of mind that is suggested by digital computer metaphors, mind as evolution provides a way of understanding that aspect of our experience that is least like clockwork: our experience of being the originators of our own thoughts, perceptions, and actions." (458)
- "Evolution is the author of its spontaneous creations." (458)
- "It is not the size of the network that is crucial to symbolic processes, but the special logic of the relationships between learning processes." (460)

Synaptic Self: How Our Brains Become Who We Are

Joseph Le Doux

2002. New York: Viking

- "My notion of personality is pretty simple: it's that your 'self,' the essence of who you are reflects patterns of interconnectivity between neurons in your brain." (2)
- quote from William James: "In its widest possible sense... a man's Self is the sum total of all that he CAN call his, not only his body and psychic powers, but his clothes and his house, his wife and children, his ancestors and friends, his reputation and works, his lands and horses, and yacht and bank account... If they wax and prosper, he feels triumphant; if they dwindle and die away, he feels cast down,- not necessarily in the same degree for each thing, but in much the same way for all." (13)
- "In modern personality theory, as in philosophy, the notion of the self typically refers to the conscious self, in the sense of having self-knowledge, a self-concept, and self-esteem; of being self-aware, self-critical; of feeling self-important; and of striving toward self-actualization." (26-27)
- "The self is not static. It is added to and subtracted from by genetic maturation, learning, forgetting, stress, aging, and disease." (29)
- "As important as learning is, not all aspects of the self are learned. Some are due to our genetic heritage. All of the capacities that we have as *Homo sapiens*, including our

capacities to learn and remember, are made possible by the genetic make-up of our species."(29)

- "What then is it? In my view, the self is the totality of what an organism is physically, biologically, psychologically, socially, and culturally... It includes what we would like to be as well as what we hope we never become." (31)

-notes: consider genetic self, time relative self (ie. The self is not the same during all times), environmentally sensitive self (ie. The self is not the same or consistent at all places or during various social engagements with others and the world)

Spiritual Approaches to the Evolution of Consciousness

I. Aurobindo

- "The evolution of consciousness and knowledge cannot be accounted for unless there is already a concealed consciousness in things with its inherent and native powers emerging little by little." (The Life Divine, 612)

- "Consciousness is a fundamental thing, the fundamental thing in existence." (Letters on Yoga, 236)

- "Evolution on Earth is a development, a growth of consciousness in material forms, which becomes ever more refined and complex as the growth proceeds." (Van Vrekhem, Beyond Man, 75)

- "Consciousness is usually identified with mind, but mental consciousness is only the human range which no more exhausts all the possible ranges of consciousness than human sight exhausts all the gradations of colour or human hearing all the gradations of sound." (Letters on Yoga, 234)

- aurobindo's continuum of being: 1) Sat-chit-ananda (being-consciousness-bliss) 2) humans and higher animals 3) plants and lower animals 4) minerals

- "The avatar is one who comes to open the way for humanity to a higher consciousness." (On Himself, 463)

- "The laws of science are indeed exclusively, and only partially, the law of the material level of existence, occupying the outer layer of the globe of being." (Van Vrekham, Beyond Man, 59)

-stages of human evolution (see Vrekham pgs. 260-262)

I. Symbolical- origin of man as a social being

II. Typal- formation of 'types' based on moral norms

III. Conventional- external supports become more important than spiritual 'ideal'

IV. Individualistic/Reason- individual becomes discoverer and pioneer of truth (ie. Renaissance)

V. Subjective- discovery of subjective truths and realities in which authenticity, reality, and truth will again be the basis of experience.

- "The final dream was a step in evolution which would raise man to a higher and larger consciousness and begin the solution of the problems which have perplexed and vexed him since he began first to think and to dream of individual perfection and a perfect society. This is still a personal hope and an idea, an ideal which has begun to take hold both in India and in the West on forward-looking minds. The difficulties in the way are more formidable than in any other field of endeavor, but difficulties were made to overcome and if the Supreme Will is there, they will be overcome. Here too, if this

evolution is to take place, since it must proceed through the growth of the spirit and the inner consciousness, the initiative can come from India and, although the scope must be universal, the central movement may be hers." (On Human Unity, 406)

- "A new spirit of oneness will take over the human race." (On Himself, 406)

- "In actual fact humanity has always been one, despite its colorful diversity, but it is now becoming aware of that fundamental unity. This awareness is indispensable, said Sri Aurobindo, to realize the following step in its evolution." (Van Vrekham, Beyond Man, 259)

- matter=energy=consciousness (Van Vrekham, Beyond Man, 311)

II. Schleiermacher

Schleiermacher's Development of Subjective Consciousness

By Edmund H. Hollands

- "The course followed by the evolution of consciousness in general is for Schleiermacher determined by the fact that it is rooted in social life." (296)

- "The widening feeling of unity with other beings is at the same time an intensified (immediate and subjective) consciousness of self as the focus of this unity." (296)

- "The subjective consciousness has expanded, and the merely individual feelings have been sublated in the social." (297)

- "So far the development of feeling appears as the widening of our subjective self-consciousness to embrace all mankind, a gradual extension of the sphere of our affective life accompanying the expansion of our interests, activities, and knowledge." (298)

- "At their greatest extension, then, the nature-feelings, like the social, merge in the religious. They prepare the comprehensive character of the religious feelings, though it is the social feelings which open the way to their higher development." (300)

- "Such an 'identification of one's self with being as such' is an essential property of human nature, since it is the sole condition on which being in its entirety 'can become consciousness'." (301)

- "Human experience is a process of gradually widening relations and increasing unification; and this process is apprehended both in cognition and in feeling." (304)

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