

The Evolution of Evolutionary Linguistics

Jeff Roesler Stebbins

University of Colorado

For more than a century after Darwin's *Origin of Species*, linguists said little about the origins of human speech. In the past 30 years, however, some linguists and evolutionary biologists have proposed descriptions of the roles of gestures, the vocal apparatus, cognition, syntax, and social interaction in the emergence of language. This paper summarizes some of their claims, especially those that assume the certainty of Neo-Darwinian evolution. Neo-Darwinism, though, has various critics disputing its claims to be settled fact. After brief consideration of some of those criticisms, the paper will encourage linguists to exercise more caution in their dependence upon Neo-Darwinian theory. Finally, several other fields of science will be mentioned as possible candidates for offering linguists an increasing understanding of the emergence of speech.

1. Introduction

Many linguists are aware of the 1866 Linguistic Society of Paris' ban on discussion of the evolution of language shortly after Darwin's 1859 *Origin of Species* (e.g. Newmeyer 2003:59). This formal ban spread informally elsewhere, and until recently, silence ruled. It appears that the topic re-emerged a century later after Bickerton's discussion of "proto-language" in his 1981 *Roots of Language*, but it could also be that interest in language evolution increased after comments in John Lyons' widely-used two-volume *Semantics*, wherein he wrote,

The attitude of most linguists to evolutionary theories of the origin of language tends to be one of agnosticism. Psychologists, biologists, ethologists and others might say, if they so wish, that language must have evolved from some non-linguistic signaling-system; the fact remains, linguists might reply, that there is no actual evidence from language to support this belief (1977:85-6).

Lyons here echoes questions he had raised seven years before in an earlier title (1970:229). Regardless of the source of their inception, discussions of the evolution of language have recently proliferated—so much so that there is now a bi-annual *International Conference on the Evolution of Language*. Its sixth meeting was in Rome in April of 2006.

Three decades is not long for any new discipline or sub-discipline, and the field still seems to be in its formative stages. There are 'evolutionary biologists,' but 'evolutionary linguists' remain hard to find. Still, we might reasonably speak of 'evolutionary biolinguistics,' for Cambridge has published a text entitled *Biolinguistics*, with a chapter on the evolution of language. And Tecumseh Fitch,

for example, is an evolutionary biologist studying the physiology of animal communication. He often cooperates with Marc Hauser, whose research is in zoology and physical anthropology. Richard Dawkins, an evolutionary biologist, and Robert Pennock, a philosopher of science, have also considered the evolution of language in popular books, but neither are likely to call themselves linguists. It is not clear—nor perhaps need it be—whether the new topic should be a branch of linguistics, of biology, a marriage of the two, or a part of physical anthropology. Hauser, Chomsky and Fitch, in a much-discussed article in *Science*, sought to “promote a stronger connection between biology and linguistics,” and to “clarify the biolinguistic perspective on language and its evolution” (2002:1570).

Ever since Darwin, of course, *evolution* has been a potent term in the life sciences. Other disciplines (such as economics and political science) occasionally appropriate it as a metaphor for developments observed in their fields. Those who study the origin and development of language, however, are not merely appropriating evolution as a metaphor; rather, they are applying evolutionary biology to human speech as the foundational approach in which to conduct their research. This paper will therefore summarize what prominent linguists and biologists are writing about the evolution of language before considering the implications of linguists’ dependence upon evolutionary biology.

2. Evolutionary Linguistics

Every discipline depends heavily upon clear definitions of its terminology, and evolutionary linguistics may need to do so more than most. Writers in this new field argue for certain precursors to (or essential building blocks of) language. Assuming that humans are what we are, and have language as we have it, because of long processes of natural selection acting upon random variations, then what do we have, and how and in what order did we acquire it?

2.1. Essential building blocks

Some precursors of speech are obvious, even to lay persons: the abilities to speak and to hear, agreed upon lists of words, and so on. But within linguistics, psycholinguists, phonologists, syntacticians, semanticists and others each emphasize their own respective foci of study, whether they are conceptual frameworks, vocal physiology, systems of reference, or word order. Nobody seems able to agree upon the *sequence* in which these several elements of speech must have evolved, or even if it would have been possible for any of the phenomena to emerge without the simultaneous emergence of all of them. Such is the interrelatedness of the ingredients of language that linguists have difficulty imagining any existing independent of most others. The index to Jackendoff’s *Foundations of Language*, for example, lists 18 interface relationships (in which one element of language interfaces with another): intonation with syntax, phonology with conceptual structures, syntax with semantics and pragmatics, and gestures with morphophonology are just four examples (2002:469). Some have

even wondered whether language might actually be an irreducibly complex system, which would necessarily preclude it evolving piecemeal, a bit at a time.

Lieberman says that “brain mechanisms adapted for adaptive motor control were the starting point for the evolution of human language” (2003:255). After that, Lieberman’s sequence is unclear. Knight, Studdert-Kennedy and Hurford believe that “the emergence of syntax was the final step” (2000:4). Jackendoff agrees (2002:260-1). In the absence of a clear evolutionary sequence, linguists and other scientists have divided their labor among the parts of what they think may have happened, leaving other parts of the sequence to experts in other fields. They may not know what happened when; still, what follows will briefly describe their hypotheses about several ingredients of the evolution of language in this order: primate gestures, the vocal apparatus, cognition and logic, syntax, and the social elements of the development of speech.

2.2. A need for tentative hypotheses

In their dependence upon the presumed certainties of evolutionary biology, some in evolutionary linguistics make strong claims with words such as *know*, *certainly*, and *obviously*; others in the field are more circumspect. MacNeilage and Davis, for example, begin their discussion of evolving speech complexity asserting, “It is common sense that speech must have been simpler in earlier times than it is now” (2000:148). But linguists have so far sought in vain for evidence to support that claim, which is disputed by others writing on the topic (e.g. Pinker 2003:22). No trace of anything like a ‘primitive’ language has ever been found.

MacNeilage and Davis use ‘*must have*’ four times in five lines. Such confidence might be warranted were there certainty in the evolutionary biology upon which they depend, but (as will become clear below) this is problematic. Fitch, on the other hand, begins more modestly by saying that “discussions of the evolution of language often involve more speculation than data” (2000:258). In contrast to MacNeilage and Davis, Fitch uses *might have* or *could have* four times in a dozen lines (2000:263). The following, then, is a partial, tentative outline of what some linguists say *might have* happened:

2.2.1. Primate gestures

Evolutionary linguistics presupposes the theory that non-human primates and humans are descended from some common, prehistoric ancestral primates. Linguists therefore study the behavior of other primates, none of whom share the vocal apparatus or vocal acuity of humans. Other primates, however, do use manual and facial gestures communicatively, and humans have trained some to use a few hundred words of sign language. Linguists therefore study primate gestures to discover what they may have in common with our non-vocal gestures, which are assumed to have preceded human speech (e.g. Hewes 1973:5-24, Corballis 2003:201-18). Modern human ‘body language’ is also thought by some

to include vestiges or ‘fossils’ of gestural communication used by humans’ and apes’ common ancestors long ago.

Years of research has shown that, unless they receive extensive training (and most, even if they do), primates do not imitate others’ gestures or vocalizations, do not point, are apparently incapable of directing or sharing attention (which requires a *theory of mind*—see below), and do not use gestures referentially to represent anything not present (Tomasello 2003:100-1, Corballis 2003:203). And even when primates (orangutans, chimpanzees, bonobos, or gorillas) receive years of training, they remain unable to understand or use tenses, questions, commands, recursion, or even negation (Corballis 2003:204).

Giacomo Rizzolatti and Michael Arbib believe they may have discovered how we evolved our capacity for imitative gestures and vocalizations. A part of primate brains appears to cause them to grasp (close their hands) when they see another grasping something. Because this part shares (or is close to) the part of the brain responsible for vocalizations, Rizzolatti and Arbib say that this area of the brain may have contained evolutionary ‘bridges’ from mere manual movements to imitative gestures, imitative vocalizations, and then presumably, communicative vocalizations (Rizzolatti and Arbib 1998, Arbib 2003).

While various birds (esp. parrots and mynahs) and some aquatic mammals have demonstrated amazing abilities of vocal learning and imitation, primates have proven especially disappointing in this regard (Fitch 2000:261); they appear unable to voluntarily control vocal musculature, or even to restrain emotional vocalizations when it would be safer to do so (Lieberman 2003:258). Fitch, too, points out that other primates lack our “freedom from stimulus-driven control of vocalization” (2000:265).

So far, comparisons of human language and primate gestures (whether vocal or non-vocal) appear to teach us more about how we differ than about what we may have in common. Experiments in which primates are trained to use sign languages, furthermore, are conducted under such stringently controlled situations that we learn very little about primates in the wild.

2.2.2. The vocal apparatus

Here is where linguists most require the expertise of biologists, those who can detail the physiology of sound production and perception. Given the human laryngeal-pharyngeal complex, glottis, tongue, soft palate, nasal passage, teeth and lips, how and why have humans—only humans—come to have vocal tracts with parts uniquely, interdependently arranged to enable speech?

Among those varied parts of the human vocal tract, the larynx has received the most attention. Nineteenth century anatomists noted that other primates’ larynxes are not as low as those of humans. Then, in the 1960s, Lieberman highlighted the acoustic implications of this fact: only the human larynx is low enough (and the human pharynx relatively long enough) to produce the phonology of human language. Since then, physical anthropologists have been

striving to determine the speech abilities of earlier hominids by estimating the length of their pharynx and the position of their larynx. Soft tissues decay rapidly, so researchers must base their estimates upon speculations about the position of the hyoid bone, from which the larynx is suspended. So far, such questionable data “do not appear to provide reliable indicators of the speech abilities of extinct hominids” (Fitch 2000:262).

Because differences between larynxes entail trade-offs, it is not clear what these facts about the larynx mean to evolutionary theory. With longer supra-laryngeal vocal tracts (and hence lower formant frequencies), it has been assumed that lower larynxes enable animals to sound larger, and therefore too formidable to attack. This is the ‘size exaggeration hypothesis’ (Fitch 2000:264, Lieberman 2003:258), which some claim gave humans a selective advantage over other primates. But with their higher larynxes, other primates can swallow liquids or solids while breathing; humans cannot. Some believe this offers non-human primates significant survival advantages, but evolutionary biologists disagree about whether it would be a greater advantage than that possible advantage provided by lower formants, or even by speech.

Not all of the attention paid to the vocal apparatus has been focused upon the larynx. Lieberman (2003:258-62) and Fitch (2000:264-5) mention the tongue and lips in regard to how we use them to form some vowels, which apes cannot produce. This does not seem central to the discussion of survival or other evolutionary selection pressures. Iain Davidson, finally, includes a table which summarizes several theories about connections between language evolution and archaeological measurements of skeletal indicators for hominid brains, spinal cords, hypoglossal canals, hyoids and vocal passages (2003:145). While those findings remain inconclusive, they represent interesting possibilities for much more future research.

2.2.3. Cognition and logic

The size and shape of brains can be estimated from the crania of fossilized skulls, but minds and thoughts leave no fossil evidence. Einstein, among many, commented often about how little we understand about the physical brain’s relation to the mind:

We have the habit of combining certain concepts and conceptual relations (propositions) so definitely with certain sense experiences that we do not become conscious of the logically unbridgeable gulf which separates the world of sensory experiences from the world of concepts and propositions (1944:287).

Decades later, Andrew Huxley, president of England’s Royal Society, complained that Neo-Darwinists have “too often swept under the carpet the biggest problem in

biology, the existence of consciousness” (1981:v). There may be little to say about what earlier hominids had in mind, but Davidson (2003:140-57) strives to employ archaeological evidence of tool-making to indicate their mental capabilities. Tool-making and language are both products of intelligence, but his leap from chipping stone to language does not clearly differentiate between physical dexterity and that of mind. Jackendoff, Pinker, Dunbar and others also write about the cognitive and logical essentials of language, what a mind must be able to do in order to use language as we do.

Jackendoff’s discussions of the relationship between cognitive conceptual structures and language in *Foundations of Language* appear perceptive and bear extensive examination. One of his claims:

Conceptual structure is not part of language per se—it is part of thought. It is the locus for the understanding of linguistic utterances in context, incorporating pragmatic considerations and “world knowledge”; it is the cognitive structure in terms of which reasoning and planning take place. That is, the hypothesized level of conceptual structure is intended as a theoretical counterpart of what common sense calls “meaning” (2002:123).

Our brains contain what he calls the *f-mind* (‘functional mind,’ much like our everyday use of ‘mind’), which contains conceptual structures, our cognitive organization of what we know and think. Conceptual structures are connected to what happens in the real world through cognitively constructed *percepts*. Percepts are the bundled chunks of experience (esp. sights and sounds) or perceptions delivered to the conceptual structures in the mind (or brain) by our “perceptual systems [which] evolved in order that organisms may act reliably in the real world” (2002:307). That which our conceptual structures perceive is not reality itself (not the events themselves), but it is “reality for us” (2002:309)—good enough to enable us to survive and function in the world. Our brains, in other words, do not ‘get’ the real world directly; rather, they indirectly receive perceptions of the entities and experiences of the real world:

events in world > perceptual systems > percepts > conceptual structures in f-mind

Jackendoff emphasizes that each stage in this cognitive process is physical, that the sequence from external event to our meaning of it is (and can only be studied as) a natural, material event:

People find sentences (and other entities) meaningful because of something going on in their brains... There is no magic. That is, we seek a thoroughly naturalistic explanation that

ultimately can be embedded in our understanding of the physical world (2002:268).

Jackendoff then has quite detailed diagrams of relationships between meaning (those conceptual structures in our minds) and the grammatical functions of language. But, of course, between concepts and grammar are the words, the linguistic symbols employed to index the elements of a concept. Jackendoff and others discuss this at length.

For language to happen, two parties must “have the cognitive components that allow meaning to be attached to arbitrary signals in order to transfer information from one mind to another” (Dunbar 2003:225). Those parties must have a *theory of mind*: they must realize the existence of other consciousnesses, that they can affect the attention and intent of other minds. So far, it does not appear that any non-human primates have this capacity (Tomasello 2003:100-1). Animals do seek to affect each other’s behavior, but not, from what we can tell, to affect each other’s minds through information transfer.

What Dunbar calls ‘arbitrary signals’ are usually called *linguistic symbols*. Like Dunbar, Jackendoff (1999:273), Deacon (2003:117-9), Pinker (2003:17) and others emphasize that symbols must be *arbitrary*: there is, for example, no iconic resemblance of any kind between an elephant and the word (the symbol) used to index it in spoken language. While most written symbols are also arbitrary, there remains in some languages some residual iconic or visual resemblance between a symbol and that which it represents. In Chinese, several characters (e.g. those for mountain and door) still retain some faint resemblance to that which they index.

Symbols are triadic conventions involving the speaker, the hearer, and a referent; because they are arbitrary, they work only if agreed upon by those who employ them. Agreement entails a theory of mind, of course, and must apparently be reached through the use of language (i.e. other symbols). Symbols cannot be conventionalized by using only icons and indices; symbols require pre-existing symbols (Oller 2002:17). Deacon does not address this problem in his discussion of the logic of icons, indices and symbols (2003:111-39, 1997:70ff). And if, as Jackendoff claims, “symbol use [is] the most fundamental factor in language evolution” (1999:273), then Oller’s point above reveals a serious question to consider in the evolution of language from non-language. Oller is not the first logician to argue for symbols’ dependence upon symbols, for, even a century ago, Charles Sanders Peirce did so in his 1902 paper “The Icon, Index and Symbol” (156-173). Both Deacon and Oller frequently refer to Peirce’s writings.

So if vervet monkeys warn each other with one sound when they see a leopard, another when they see a snake, and a third when they see an eagle, are they using symbols? No, for symbols are not situation-specific; they are used to index something not present, an activity only humans are able to do. While it appears that “some of the foundations of the human conceptual system are present in other primates, such as the major subsystems dealing with spatial, causal, and social reasoning” (Pinker and Jackendoff 2005:205), those primates appear able

neither to know nor to index what they do not immediately perceive with their senses.

Of course, humans go far beyond merely using an arbitrary symbol to stand for some object or event—we can *combine* a finite range of sounds into a seemingly infinite range of segment-symbols (syllables, words, phrases, clauses, etc.) in such a way that we can utter propositions about complex relations among objects and events. Just as our minds deal in reference, predication, categorization and the like, so does our language. And that is syntax.

2.2.4. Syntax

When Noam Chomsky began writing about the role of language in issues of nature and nurture, he may have been a significant catalyst for the resurgence in discussion of the evolution of language. After proposing almost half a century ago that all humans are born with some innate biological capacity for syntax (*Universal Grammar*, or UG), Chomsky and others have spent much of the decades since revising theories of what it is and where it came from. Chomsky has consistently denied that UG and other components of the human language capacity can be the result of natural selection acting upon random variation (1975:59, 1978:38-9). Pinker and Bloom (1990:707), however, argued that the ability to use syntax is an example of adaptive complexity, and that it certainly must have evolved by conventional Darwinian means, for natural selection is the only means known to science which can produce such adaptive complexity. Thirteen years later, Pinker still uses the same argument, a form of question-begging: we have syntax, so natural selection must have done it, for only natural selection can do things like that (2003:21-2). This is not too far removed from “The Bible is true, because God said so in the Bible.” Deacon (1997:258) also uses the same logic to reach the same conclusion.

Deacon, Pinker and Bloom are not alone in this position. Dawkins (1976) and Dennett (1995), neither of them linguists, are also adaptationists, using the same logic to claim that syntax emerged as a biological adaptation to the environment. Jackendoff, too, has joined this camp (1999:272, 2002:231-5). Arguing from anti-adaptationist perspectives are almost everyone else in the discussion: Chomsky, Gould, Bickerton, Newmeyer, Kirby, Hurford and others.

Basically, the anti-adaptationist position says that there is no selective advantage (no increased survival fitness) to our complex conceptual structures or to the expressions thereof (e.g. Hurford 2003:44-9). Chomsky, especially, opposed any suggestion that the “principles of UG arose by virtue of their utility in fostering the survival and reproductive possibilities of the individuals possessing them” (Newmeyer 2003:60). He and some others in the camp have allowed for the possibility of an ‘exaptationist’ scenario, in which UG may have arisen as a byproduct of other evolutionary processes. Still, he insisted that “It would be a serious error to suppose that all properties, or the interesting properties of structures that evolved, can be ‘explained’ in terms of natural selection”

(Chomsky 1975:59). Anti-evolutionists agree, and some evolutionary biologists have accused Chomsky of closet creationism. Jackendoff calls this a “retreat to mysticism” (2002:234). Among evolutionary linguists, then, a lot of attention has been given to how some syntactic properties resemble (and may therefore be an evolutionary by-product of) some physical survival ability. Syntactic recursion, for example, might be said to parallel an animal’s ability to seek and find food inside an egg inside a nest inside a hole inside an old tree inside a forest.

Recursion itself has recently received much attention by some in this field. Bickerton says, “Syntax forms a crucial part, arguably the most crucial part—since no other species is capable of it—of human language. If we are going to explain how language evolved, we have to explain how syntax evolved” (2003:87). But Hauser, Chomsky and Fitch claim that it is only *recursion*, rather than all of syntax, that is uniquely human (2002:1570).

In an important 2002 paper in *Science*, Hauser, Chomsky and Fitch speak of a ‘faculty of language in the broad sense’ (FLB), which includes both the needed sensory-motor abilities (vocalization, breathing, hearing, vision, and gestures) and the conceptual-intentional abilities (cognitive grasp of reference, predication, etc.). These two groups of abilities, and others, according to Hauser, Chomsky and Fitch, evolved as adaptations to an environment, or as by-products of such adaptations. Within this shared FLB is what they call the ‘faculty of language in the narrow sense’ (FLN), consisting only of recursion. This faculty is not shared with other species; it is recently evolved and unique to humans (Hauser, Chomsky and Fitch 2002:1573). While their paper makes other points, the ‘recursion only’ claim is its primary one.

Pinker and Jackendoff respond in a lengthy article in *Cognition*, the main idea of which is that, while recursion is uniquely human, there are other key elements of language which are also unique to humans, among them “phonology, morphology, case, agreement, and many properties of words” (2005:201). They also maintain that “language is a complex adaptation for communication which evolved piecemeal...” (201). In his 1999 article, and in his 2002 book, Jackendoff proposes some possibilities for how the evolution of syntax may have proceeded from context-dependent single symbol (word) utterances through the concatenation of words to more fully-formed syntax (1999:272-9, 2002:242-64). As ‘fossilized’ evidence of the transitional stage (mere concatenation), he offers some English compounds of differing relations between their parts: doghouse, housedog, snowman, man-eating, garbage man, etc. (1999:276, 2002:249-50).

Far more has been written about the possible evolution of syntax. Close attention, though, should be paid to the possibly crucial role of symbolic logic and semiotics in understanding the evolution of syntax. Deacon, Jackendoff and Tomasello have avoided, or only barely touched upon, the serious problem raised by Peirce and Oller above. The logical and mathematical prerequisites of human communication (as defined by Information Theory, which began with Claude Shannon’s 1949 *Mathematical Theory of Communication*) would also seem to apply, but that shall have to be considered in another paper.

2.2.5. Social elements

According to Bickerton (2003:82), “The most crucial thing to grasp about the emergence of symbolic representation is that it must have been primarily a cultural rather than a biological event.” How communities without symbols cooperated to conventionalize the use of symbols is not explicit in his account, but he appears to make indirect reference to this gap:

It is no accident that in most, if not all, computer simulations of language evolution, the self-organizing ‘agents’ *already know what their interlocutor means to say*. If the problem space were not limited in this way, the simulations simply wouldn’t work—the agents would never converge on a workable system. But such unrealistic initial conditions are unlikely to have applied to our remote ancestors (2003:86, italics in original).

In addition to this problem, of course, is perhaps an even greater one for evolutionary linguists. Biological evolution is a tale of competition, of natural selection eliminating the less fit and empowering the more fit. If this is the case, how could the evolution of language have occurred, if language (even the mere agreement upon symbols) requires the cooperation of hominids competing with each other for survival? Darkness and tall grass may have caused gestural communication to give way to more socially beneficial vocal communication, but how does this reconcile with ‘survival of the fittest?’ It is to each hominid’s survival advantage that his/her competitors *not* know his/her intent. Numerous studies by Tomasello, Hare, and Call, for example, have revealed how animals (especially apes, goats, and dogs) strive to follow each other’s gaze when competing for food. Such observations about cooperation and competition are not naïve responses to a merely *apparent* contradiction, or evolutionary biologists and evolutionary linguists would not struggle so vigorously to counter it. Knight, Studdert-Kennedy and Hurford do so creatively:

...language is no ordinary adaptation, but will require ‘special’ Darwinian explanation, ...which isolates biologically anomalous levels of social cooperation as central to the evolutionary emergence of language... Language, in short, is remarkable—as will be any adequate Darwinian explanation of its evolution (2000:12).

Richard Dawkins has put forth an extremely creative ‘special Darwinian’ theory to address this anomaly, his Selfish Gene Theory. Very simply, the theory asserts that within each organism is a selfish (or selfishness) gene, bent on survival, and willing to put up with temporary inconveniences such as altruism, co-operation, even sacrifice, in order to achieve longer term viability. This gene

'lives on' across many generations, and it can even foresee that short-term anomalies benefit long-term patterns (Dawkins 1976:2-3). If such a gene has no consciousness, it is hard (perhaps impossible) to grasp how it might 'foresee' anything; if it has consciousness, believing in it differs little from faith in a god.

Dawkins' approach is one of a variety of attempts to address the issue of depending upon a theory about competition to explain the development of an intrinsically co-operative activity. Others have written much more about the integral part played by a theory of mind, by shared attention, by the triadic use of symbols, by culture, and so on. Those, however, are also beyond the scope of this very brief introduction to the field.

In a summarizing statement, Jackendoff *does* use evolution as a metaphor when he says, "Languages may change and 'evolve' in the sense of *cultural* evolution, but as far as can be determined, this is in the context of a fully *biologically* evolved capacity" (2002:232, italics original).

Each of the scientists above makes frequent reference to tenets of physical evolution, for it is upon a foundation of evolutionary biology that evolutionary linguistics is building. And some want even more:

Chomsky has stressed that language is a biological phenomenon. But prevalent contemporary brands of linguistics neglect the evolutionary dimension. The present facts of language can be understood more completely by adopting an evolutionary linguistics, whose subject matter sits at the end of a long series of evolutionary transitions, most of which have traditionally been the domain of biology...

The key to explaining the present complex phenomena of human language lies in understanding how they could have evolved from less complex phenomena... Modern languages are learned by, stored in, and processed online by evolved brains, given voice by evolved vocal tracts, in evolved social groups (Hurford 2003:40).

Newmeyer also believes in recruiting other scientists from other fields to the study of language evolution, and he states this strongly:

... if the properties of Universal Grammar are what they are as a result of *physical* principles, then it falls to the physicist and molecular biologist to unravel language origins, not to the theoretical linguist (2003:60).

Obviously, then, given the interdependencies of speech organs and phonology, of the brain and meaning, linguistics and biology are necessarily and irrevocably entangled.

If Neo-Darwinian evolutionary biology is supported by solid facts and logic, then linguistics can take this foundation for granted and focus instead upon how best to construct an account of the emergence of human speech. But is it possible that linguists are assuming too much? Now, with some sense of the current state of evolutionary linguistics, let us briefly consider the evolutionary biology upon which it apparently depends.

3. Evolutionary biology

The details of what is almost universally taught about evolutionary biology are too well known to describe at length. Over billions of years, from non-organic matter (often called the ‘pre-biotic soup’) organic compounds emerged by sheer chance. From this organic matter, combined with time and chance, the first living, self-replicating cell appeared by some process of self-organization. And from that first cell evolved many more single-celled, then multi-celled, ever more complex organisms: bacteria, amoebae, invertebrates, vertebrates, fish, amphibians, reptiles, birds, mammals, primates, and ultimately, linguists. The genius of Darwin was in proposing that the driving force for progress (or the filter which preserved the superior and eliminated the inferior) was natural selection.

When Darwin’s theory was informed by the discovery and application of more modern sciences (especially genetics), the result was called *Neo-Darwinism*, now the dominant theory in evolutionary biology. Most renowned scientists in the field (Cousteau, Dawkins, Dennett, Dobzhansky, Gould, Haldane, Huxley, Leakey, Mayr, Sagan, *et al*) are or were Neo-Darwinists.

According to Neo-Darwinists, then, as living organisms evolved at micro (genetic) and macro (species) levels, those variations or mutations which provided survival fitness were selected and passed on by those who had them. Variations which provided no survival fitness, no selective advantage, were eliminated as those who possessed them died off. Hence, the popular expression ‘survival of the fittest.’ This, roughly, is Neo-Darwinian micro- and macroevolution.

3.1. Established fact?

If one reads the popular science writing of Carl Sagan, Stephen Jay Gould, Richard Dawkins, and Daniel Dennett, if one peruses the pages of *National Geographic*, if one wanders the websites of the National Center for Science Education (ncseweb.org) or the American Association for the Advancement of Science (aaas.org), one will likely conclude that Neo-Darwinian progressive macroevolution is solid, unquestionable fact, with a few stray details still left to be filled in. Some (mostly religious) people are not yet totally convinced, but it is only a matter of time before everyone is enlightened. Dennett states this even more strongly, seeming to prefer *ad hominem* to argument:

To put it bluntly but fairly, anyone today who doubts that the variety of life on this planet was produced by a process of evolution is simply ignorant—inexcusably ignorant—in a world where three out of four people have learned to read and write. (Dennett 1995:46)

The writings of Dennett, Dawkins, Gould, Sagan and others are featured in *Skeptic* magazine (www.skeptic.com). Differing views are often caricatured there, dismissed as those of “hordes of Creationists that infest the American pseudo-intellectual landscape and stubbornly try to legislate scientific ignorance in our public schools” (Pigliucci 2001:54). If scientifically-challenged school board members are Neo-Darwinism’s only opposition, then evolutionary linguists likely need not concern themselves with such disputes. But this is not the case.

Some of Neo-Darwinism’s recent, high-profile challenges have come from those who hold to the theory of Intelligent Design. As something of a philosophy of science ‘think tank,’ I.D.’s people do not conduct laboratory experiments in pursuit of hard data to support a competing theory; rather, they apply accepted principles of science, math and logic to highlight areas in which Neo-Darwinism has more work to do before it can claim to represent unassailable, demonstrable fact. While mainstream media claim or imply that I.D. people are fundamentalist Christian Creationists, little research is needed to learn that numerous prominent adherents do not fit that description. Mustafa Akyol, Michael Behe, Gertrude Himmelfarb, Seyyed Hossein Nasr, Gerald Schroeder, and Vladimir Voeikov may be amused or troubled by such a simplistic caricature, by being dismissed with little more than a transparent *ad hominem*.

Also contrary to most media, I.D.’s primary unifying focus is neither religion nor public school curricula (though courts have rejected any discussion of I.D. in public schools). I.D. argues that, while the explanatory force of natural selection remains great, it is still unable to account for much of the *specified complexity* observable in the universe. Though no conflict exists between random variation and *accidental* complexity, specified (or functional) complexity usually indicates intelligence. The Search for Extra-Terrestrial Intelligence (or SETI), for example, is predicated upon precisely that fact. If SETI were someday to detect radio pulses in Morse code, or sequences of prime numbers, it will have detected specified complexity (or even language), and would assume that some purposive intelligence is ‘out there.’ Few scientists attack SETI, though, and the difference, of course, lies in the respective intelligences that I.D. and SETI seek.

Among I.D.’s apparent leaders (Michael Behe, William Dembski, Stephen Meyer, and others) are credentialed, practicing, peer-reviewed, published scientists, or scholars in non-scientific fields, not exactly Dennett’s “inexcusably ignorant” folk. Their writings detail technical, procedural, or logical/conceptual weaknesses in Neo-Darwinism. Here, for example, is just one of many questions Dembski raises, one clearly relevant to the evolution of language:

...there is an inherent tendency in evolving systems for selection pressures to force such systems toward simplicity. This is not to say that Darwinism requires or entails that evolution proceed toward simplicity. The point is simply that Darwinism, in itself, does not mandate increasing complexity and inherently favors simplicity. Thus, if we see increasing complexity, something besides Darwinism must be at work (Dembski 2004:256).

By implication, perhaps, entropy, information theory, complexity theory, and Occam's Razor might all be productively applied to questions about the relationship between simplicity and complexity in the evolutionary emergence of language. Dembski is referring to ongoing discussion among scientists as varied as Stephen Jay Gould, Stuart Kauffman, and Hubert Yockey.

For those troubled by the apparently metaphysical implications of I.D., the skepticism of various credentialed, *non-I.D.* scholars certainly warrant attention. Franklin Harold, for example, is emeritus professor of biochemistry and molecular biology at Colorado State University. From his Oxford University Press text, *The Way of the Cell*:

Life arose here on earth from inanimate matter, by some kind of evolutionary process, about four billion years ago. This is not a statement of demonstrable fact, but an assumption almost universally shared by specialists as well as scientists in general. It is not supported by any direct evidence, nor is it likely to be. ...The reasons for the general consensus are, first, the lack of a more palatable alternative; and second, that absent the presumption of a terrestrial and natural genesis there is no basis for scientific inquiry into the origin of life (Harold 2001:236-7).

Recall that Newmeyer (2003:60), above, recommends that linguists turn to molecular biologists (such as Harold) to secure answers to persistent questions about the evolution of life and language. Another skeptic, a significant figure in chemistry, genetics and microbiology, is the University of Chicago's Robert Shapiro. He points out that

There are far more unresolved questions than answers about evolutionary processes, and contemporary science continues to provide us with new conceptual possibilities. Unfortunately, readers may remain unaware of this intellectual ferment because... serious open-minded discussions of the impact of discoveries in molecular biology are all too rare. The possibility of non-Darwinian scientific viewpoints is virtually never considered (Shapiro 1998).

Shapiro is one of Dawkins' professional peers who finds both Neo-Darwinian and creationist accounts scientifically unsatisfactory, and who wants to reopen discussion. This 'intellectual ferment,' as he puts it, is no threat; it is, rather, essential for the progress of scientific knowledge. Later, he writes:

...our current knowledge of genetic change is fundamentally at variance with postulates held by Neo-Darwinists... Nonetheless, Neo-Darwinist writers like Dawkins continue to ignore or trivialize the new knowledge... This is to be expected from Creationists, who naturally refuse to recognize science's remarkable record... But the Neo-Darwinian advocates claim to be scientists, and we can legitimately expect of them a more open spirit of inquiry. Instead, they assume a defensive posture of outraged orthodoxy and assert an unassailable claim to truth, which only serves to validate the Creationists' criticism that Darwinism has become more of a faith than a science (Shapiro 1998).

Although Shapiro's scientific achievements and credentials are remarkable, with uncompromisingly forthright comments such as these, he may be running the risk of being professionally shunned.

Mary Midgley, philosopher of science at the University of Newcastle-upon-Tyne, has two fascinating titles, *Evolution as Religion* (1985) and *Science as Salvation* (1992), both of which list many examples of the phenomena Shapiro describes above. But because Midgley is not a lab coat scientist, her observations are perhaps more easily discounted by the likes of Dawkins and Dennett.

Stephen Jay Gould (until his death Harvard's renowned evolutionary paleobiologist) figures prominently in *Skeptic*, and in the writings of other Neo-Darwinists. He echoes the concerns of Shapiro and Midgley: "...we have persecuted dissenters, resorted to catechism, and tried to extend our authority to spheres where it has no force..." (1977:146). This is precisely what concerns Shapiro, who also says,

Dogmas and taboos may be suitable for religion, but they have no place in science. No theory or viewpoint should ever become sacrosanct, for experience tells us that even the most elegant Laws of Nature ultimately succumb to the inexorable progress of scientific thinking and technological innovation (Shapiro 1998).

If Neo-Darwinism is established fact, then it has nothing to hide, for as John Milton says in *Areopagitica*, "who ever knew Truth put to the worse, in a free and open encounter?" (1674:746). Science need not fear I.D., Harold, Shapiro or Midgley, or others like them who agree with *much* of what scientists say when they write of scientifically demonstrable facts.

Numerous scientists agree with evidence for microevolution within species but question the macroevolutionary (producing *new* species) claims of Neo-Darwinism. Opponents with purely religious motives (who offer no scientific evidence or logical argument) need not concern scientists. If connections were to exist between life's origins and a biblical account of creation, or between the diversity of languages and a biblical story of Babel, such connections would likely be inaccessible to the scientific methods we now employ. Significant dissent, however, has arisen not just from these corners but among scientists who are content to leave Bible stories to the clergy.

Clearly, skepticism about Neo-Darwinism's claims and presuppositions is not just emerging from Intelligent Design, or from a few isolated religious institutions or rural school districts. The wide variety of scholars above are just several of many calling for more transparent discussions of macroevolution's unsettled questions. In the halls of scientific academia, some of Neo-Darwinism's most important assumptions still warrant truly objective (re)consideration.

It does not yet appear that the Neo-Darwinian approach to biology is in imminent danger of collapse; nevertheless, the foundations of evolutionary linguistics are not as solid as some have apparently assumed. A consensus among scientists certainly exists about evolution, but consensus is not scientific evidence. We did not lose the flat earth or gain the Periodic Table by sheer numbers of voting scientists, and consensus will not serve us well if we try using it to prove or disprove anything in evolutionary linguistics.

3.2. Linguistics' dependence upon evolutionary biology

As we have seen above, language is much more than merely biological; it is conceptual/logical, social, mathematical, and more. Anatomy and acoustics, for example, inform linguistics' understanding of the productions and perceptions of sound. Between the sounds we share with animals, however, and the meanings to which only humans can harness them, there remains a vast and still poorly understood gulf.

To grasp how humans bridged this gulf, it seems that linguistics needs more than evolutionary biology has to offer. Psycholinguistics already depends upon developmental psychology and cognitive science. Sociolinguistics, too, depends upon sociology and political science. These are fields formerly dominated by two of Darwin's most influential disciples, Freud and Marx. If 'oedipal' and 'proletarian' now sound like quaint old jargon, they may also caution linguists against depending too heavily (or even exclusively) upon one still unstable and fallible scientific theory.

This will hardly limit evolutionary linguistics, for there also exist other fields whose intersections with linguistics warrant far more research. The rich writings of Charles Sanders Peirce and Claude Shannon, mentioned above, are seldom referenced in linguistics, yet from them we have much to learn about problems in the logical complexities and mathematical probabilities of homo

sapiens sapiens acquiring the capacity to use a finite range of linguistic symbols to express a potentially infinite range of concepts. Plotkin and Nowak (2000) and Oller (2002) are some of the few who have begun exploring how we might benefit from a synergy among the studies of linguistics, information theory, mathematical probability, complexity theory, the logic of symbols, and more.

Regardless of the sciences to which linguists turn, we will benefit by a commitment to responsibly follow evidence, rather than consensus, even when it leads us to temporarily inconvenient conclusions:

I will not inquire as to the details of how increased expressive power came to spread through a population, nor how the genome and the morphogenesis of the brain accomplished these changes. Accepted practice in evolutionary psychology... generally finds it convenient to ignore these problems; I see no need at the moment to hold myself to a higher standard than the rest of the field (Jackendoff 2002:237).

For the sake of brevity and clarity, perhaps, Jackendoff might be forgiven for postponing the discussion of certain tangential issues. But as linguists strive to determine and describe the origins of language, we will be wise not to ignore Neo-Darwinism's glaring problems as we strive to avoid the sorts of errors that Shapiro and others warn against above.

"If a single conclusion drawn from [General Relativity] proves wrong, it must be given up; to modify it without destroying the whole seems to be impossible" (Einstein 1934:60). Linguists need not, indeed cannot, surrender all that we have learned from evolutionary theory, but we may regret not exercising more caution, or not asking more questions about the evolutionary biology upon which we currently depend, and not imitating Einstein's increasingly rare intellectual modesty.

References

- Arbib, Michael. 2003. "The Evolving Mirror System: A Neural Basis for Language Readiness." In Christiansen, Morten and Simon Kirby. *Language Evolution*. New York: Oxford. 182-200.
- Bickerton, Derek. 1981. *Roots of Language*. Ann Arbor, MI: Karoma.
- Bickerton, Derek. 2003. "Symbol and Structure: A Comprehensive Framework for Language Evolution" In Morten Christiansen and Simon Kirby (eds.). *Language Evolution*. New York: Oxford. 77-93.
- Chomsky, Noam. 1975. *Reflections on Language*. New York: Pantheon.
- Chomsky, Noam. 1978. *Rules and Representations*. New York: Columbia.
- Christiansen, Morten and Simon Kirby (eds.). 2003. *Language Evolution*. New York: Oxford.

- Corballis, Michael. 2003. "From Hand to Mouth: The Gestural Origins of Language" In Morten Christiansen and Simon Kirby (eds.) *Language Evolution*, 201-18. New York: Oxford
- Davidson, Iain. 2003. "The Archaeological Evidence of Language Origins: States of Art." In Morten Christiansen and Simon Kirby (eds.). *Language Evolution*. New York: Oxford. 140-57.
- Dawkins, Richard. 1976. *The Selfish Gene*. London: Oxford.
- Deacon, Terrence. 1997. *The Symbolic Species: The Co-evolution of Language and the Brain*. New York: Norton.
- Deacon, Terrence. 2003. "Universal Grammar and Semiotic Constraints" In Morten Christiansen and Simon Kirby (eds.). *Language Evolution*, 111-39. New York: Oxford.
- Dembski, William. 2004. *The Design Revolution*. Downers Grove, IL: Intervarsity.
- Dennett, Daniel C. 1995. *Darwin's Dangerous Idea: Evolution and The Meanings of Life*. London: Penguin.
- Dunbar, Robin. 2003. "The Origin and Subsequent Evolution of Language." In Morten Christiansen and Simon Kirby (eds.). *Language Evolution*, 219-34. New York: Oxford.
- Einstein, Albert. 1934. *The World as I See It*. New York: Covici-Friede.
- Einstein, Albert. 1944. "Remarks on Russell's Theory of Knowledge." In Paul Arthur Schilpp (ed.), *The Philosophy of Bertrand Russell*. New York: Tudor.
- Fitch, W. Tecumseh. 2000. "The evolution of speech: a comparative review." *Trends in Cognitive Science*: 258-67.
- Gould, Stephen Jay. 1977. *Ever Since Darwin*. New York: Norton.
- Hare, Brian and Michael Tomasello. 1999. "Domestic dogs use human and conspecific social cues to locate hidden food." *Journal of Comparative Psychology* 113: 173-7.
- Harold, Franklin M. 2001. *The Way of the Cell*. New York: Oxford University Press.
- Hauser, Marc, Noam Chomsky and W. Tecumseh Fitch. 2002. "The Faculty of Language: What Is It, Who Has It, and How Did It Evolve?" *Science* 298: 1569-79.
- Hewes, G. W. 1973. "Primate communication and the gestural origin of language." *Current Anthropology* 14: 5-24.
- Hurford, James R. 2000. "Introduction: the Emergence of Syntax" In Chris Knight, Michael Studdert-Kennedy and James Hurford. *The Evolutionary Emergence of Language*, 219-30. New York: Cambridge.
- Hurford, James R. 2003. "The Language Mosaic and Its Evolution." In Morten Christiansen and Simon Kirby (eds.) *Language Evolution*, 38-57. New York: Oxford.
- Huxley, Andrew. 1981. *Supplement to Royal Society News* 12: v.
- Jackendoff, Ray. 1999. "Possible stages in the evolution of the language capacity." *Trends in Cognitive Science* 3: 272-9.

- Jackendoff, Ray. 2002. *Foundations of Language: Brain, Meaning, Grammar, Evolution*. New York: Oxford.
- Knight, Chris, Michael Studdert-Kennedy and James R. Hurford. 2000. *The Evolutionary Emergence of Language*. New York: Cambridge.
- Lieberman, Philip. 2003. "Motor Control, Speech and the Evolution of Human Language." In Morten Christiansen and Simon Kirby (eds.). *Language Evolution*, 255-71. New York: Oxford.
- Lyons, John. 1970. *New Horizons in Linguistics*. Baltimore, MD: Penguin.
- Lyons, John. 1977. *Semantics*. New York: Cambridge.
- MacNeilage, Peter and Barbara Davis. 2000. "Evolution of Speech: The Relation Between Ontogeny and Phylogeny." In Chris Knight, Michael Studdert-Kennedy and James R. Hurford. *The Evolutionary Emergence of Language*, 146-60. New York: Cambridge.
- Midgley, Mary. 1985. *Evolution as a Religion*. London: Methuen.
- Midgley, Mary. 1992. *Science as Salvation*. London: Routledge.
- Milton, John. 1674. "Areopagitica." In Merrit Hughes (ed.). 1957. *John Milton: Complete Poems and Major Prose*, 746. Indianapolis, IN: Bobbs-Merrill.
- Newmeyer, Frederick. 2003. "What Can the Field of Linguistics Tell Us About the Origins of Language?" In Morten Christiansen and Simon Kirby (eds.). *Language Evolution*, 58-76. New York: Oxford.
- Oller, John, Jr. 2002. "Languages and genes: Can they be built up through random change and natural selection?" *Journal of Psychology and Theology* 30: 26-40.
- Peirce, Charles Sanders. 1932 [1902]. "The Icon, Index, and Symbol," In C. Hartshorne and P. Weiss (eds.) *Collected Papers of C. S. Peirce*, Vol. 2: 156-173. Cambridge, MA: Harvard.
- Pigliucci, Massimo. 2001. "Review of *Mathematics and Evolution*, by Sir Fred Hoyle." *Skeptic* 8(4): 54.
- Pinker, Steven. 2003. "Language as an Adaptation to the Cognitive Niche." In Morten Christiansen and Simon Kirby (eds.). *Language Evolution*, 16-37. New York: Oxford.
- Pinker, Steven and P. Bloom. 1990. "Natural language and natural selection." *Behavioral and Brain Sciences* 13: 707-784.
- Pinker, Steven and Ray Jackendoff. 2005. "The faculty of language: what's special about it?" *Cognition*, 95: 201-36.
- Plotkin, Joshua and Martin Nowak. 2000. "Language Evolution and Information Theory." *Journal of Theoretical Biology* 205: 147-59.
- Rizzolatti, Giacomo and Michael Arbib. 1998. Language Within Our Grasp. *Trends in Neurosciences* 21(5): 188-194.
- Shannon, Claude and Warren Weaver. 1949. *The Mathematical Theory of Information*. Urbana, IL: University of Illinois Press.
- Shapiro, James A. 1998. *Scientific Alternatives to Darwinism: Is There a Role for Cellular Information Processing In Evolution?* Retrieved from World Wide Web: <http://www.asa3.org/archive/asa/199809/0015.html>

- Tomasello, Michael. 2003. "On the Different Origins of Symbols and Grammar."
In Morten Christiansen and Simon Kirby (eds.). *Language Evolution*, 94-110.
New York: Oxford.
- Tomasello, Michael, Josep Call and Brian Hare. 1998. "Five primate species
follow the visual gaze of conspecifics." *Animal Behaviour* 55: 1063-9.
- Yockey, Hubert. 2005. *Information Theory, Evolution and the Origin of Life*. New
York: Cambridge.