

## Lecture 7: On the Origins of Language. Edited by B.J. King

Until very recently humans were quite sure that we were the only species who uses language. However, when evolution became a dominant scientific paradigm, we wondered how we alone developed this facility. This quickly led to investigations of whether other primates did indeed have language capacities. One example was the early work by Garner in the 1890's who went to Africa with the latest in Edison wax recording cylinders to investigate the potential for language in wild gorillas. He was not successful and it rapidly became evident that apes and monkeys did not have what humans recognize as language, but it also became clear through the captive work by people such as Yerkes that they did have complex mental abilities and intra species communication systems.

This book discussed in lecture 7 "On the Origins of Language" arose from a multidisciplinary seminar held at the School of American Research to bring a variety of specialists together to share ideas on this topic. The group included primate neurologists, linguists, child development specialists, neuro-linguists, primatologists and ape language researchers. It was important to have input from this wide range of participants because the theoretical positions held in various disciplines constrained and shaped what was considered possible, which affected the kinds of research conducted in each field and therefore the kinds of questions asked. The variety of researchers involved in this project lead to a process of reformulating and shaping the original question "Where did language come from?" into the question "How is language different from and similar to non-human communication systems?" In other words the question "What is Language?" must be answered before "How does it develop genetically, ontologically and evolutionarily?" can be entertained. Another important aspect of the language issue is "What is its function?" Bickerton requires that language refer to the environment: King suggests it arose to manage relationships while others (e.g. Cheney and Seyfarth) feel that complex predator defense was its original primary function. Since, in Darwin's evolutionary model, function is an important precursor to form as creatures become modified to cope with their environments, this question is quite relevant.

Part of the difficulty in answering questions about the function and development of language is that we are not yet completely sure about the function and development of the brain in either humans or primates. We have a basic understanding of the mechanical route of language production in the intact human brain, but how memory works, how we comprehend metaphors and symbolism, how we develop and store vocabu-

lary, compartmentalize different languages and embed language into our nonlinguistic communication skills is still being discovered. The differences between reception and production and the ages in human infants when these first occur also make it difficult to determine the function of language. It is clear that reception and recognition develop first so it seems likely that, at least in early life, what children take in from the language environment around them (i.e. the social impact) is more important than what they produce. The recognition that children comprehend language before they can produce it makes the requirement that apes need to produce language before they can be said to have it, no matter how good their receptive skills appear to be, a rather unreasonable criterion as is argued by Sue Savage-Rumbaugh (see lecture #6). As a member of this research group she argues strongly for an equivalent standard when comparing and assessing language capabilities in apes and children.

The parallel development of complex communication skills in New World and Old World monkeys as well as Apes does suggest that the pressures driving the development of these skills are common across a wide range of primate. These three categories of primates have been separated genetically for between 20 and 30 million years, so it seems much more reasonable that the pressures fostering language development were more likely to arise as social forces than as environmental or genetic ones. The complexity of primate social groupings and the level of learning involved in maturing socially and sexually is very much greater in higher primates than in most other mammals. This is reflected in the very long gestation and maturation time required in this clade compared to their body size. Your average 4 kilo domestic cat has had 5 or 6 litters of kittens before your average 4–5 kilo female monkey living in a social group has begun to reproduce at age 3 1/2 to 4 years. Rapidly reproducing prosimians such as nest building mouse lemurs may have more frequent births but they have very loose social groups and a very high loss rate as youngsters have not spent time learning how to deal with the environment or co-operate for predator protection.

This long stage of maturation not only allows time to learn complex communication skills, but also the individual social recognition which is the basis for long term social grouping. It also allows time for brain maturation which is not a standardized process in which every part gets larger at the same time and to the same degree, but a process in which differentiation of parts, neuron selection, differential myelination and functional repair if any portions are damaged, all take place. Thus a neonatal brain cannot function like an adult one but the experiences of the young animal/child have a profound effect on how that maturation occurs. It does seem possible that the highly social na-

ture of human group life, originally required for safety and maximal exploitation of resources, could have reinforced the development of brain circuits that lead to complex verbal abilities. However, these larger more complex brains require a substantial nutritional support which engenders a feedback cycle in terms of maximizing resource exploitation (requiring planning and sharing), as well as the social support that mothers might require to raise young helpless children.

Thus an argument can be made that while the costs of having a brain that can support complex verbal language are much higher than most non-human primate species can afford, the advantages may have meant that other hominid species may not have been able to compete with a form that specialized in social cooperation and the development of verbal skills. We are currently finding that there were a number of Homo species alive at one time even fairly recently (up to about 40,000 years ago) but the fact that only one is left may mean that this particular niche can only support one species. If all the forms of hominid that ever lived were available to study it seems likely that there would be a greater range of verbal skills than we see now.

Non human primates did not specialize along the path of verbal fluency, but their social and communicative complexities still show indications of the advantages of this specialization. In particular, their ability to 'conventionalize' actions such as predator alarm calls such that they eventually develop into arbitrary signals such as a vervet's 'leopard alarm bark' indicate that the concept of arbitrary symbols is within their grasp. Mother monkeys use a drop of the hindquarters to signal to infants that they want them to get up on their backs, usually so that the mother can carry the baby to another location. In many species males use a 'hip touch' to indicate to females that they want them to present and stand braced in a mating posture. Since the female must bear the weight of the male during mating she needs a warning of his intentions in order to brace her legs and not collapse under his weight. But a 'hip touch' is not a necessary movement to make while mating: it is a signal about what the male plans to do. These 'conventionalizations' are the beginnings of symbolic referents and demonstrate that through the process of ontogenetic learning gestures can come to have meanings which move beyond the present and into the near future. Burling (one of the participants) refers to these as gesture calls and includes them as a distinctive part of human communication. He thinks that whole groups of gestures, icons and gesticulations could be transformed into language by this process of conventionalization. It would require increased memory capacity and learning capability but could be the foundation of complex symbolic language. These capabilities combined with the increasing brain capacity and

complexity of developing humans may have been the foundation for this highly significant adaptation we call language.

**Barbara J. King, ed. (1999) *The Origins of Language: What Nonhuman Primates Can Tell Us*. Santa Fe: SAR Press. By Anne C. Zeller**

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Arguments about when, how and why human language originated have bedevilled researchers for over 150 years. The answers will require input from a wide variety of disciplines, since aspects of anatomy, neurology, linguistics, cognitive development, ontogeny and primate behaviour must be considered. The question of language origins deals with both what is language, and how we produce it, and looks to evidence from the past and the present, both naturalistic and experimental. B.J. King, the editor of *The Origins of Language*, decided to assemble such a multidisciplinary group through the School of American Research Advanced Seminar Series to engage in a discussion of this age-old topic. The participants included primatologists King, Snowdon and Maestriperi, linguists Burling and Wilcox, ape language researcher Savage-Rumbaugh, primate neurologists Gibson and Jessee, and child language specialists McCune and Davidson. They began by recognizing that there were two major theoretical positions concerning language origins. One is the nativist approach supported by Chomsky's idea that the brain structure of the developing child holds an innate, rule-based system of grammar derived from the genetic specialization of the human brain. This approach "is not concerned with the perceptual or pragmatic aspects of language comprehension and use" (Tomasello 1995 in King 1999: 4). The other position accepts an evolutionary background for the development of the anatomy and mental abilities that language requires, linking them in a feedback loop with the gradual increase in mental abilities which vocal language systems allow, such as planning abstract thought and complex deception skills; the kinds of abilities that are subsumed under the idea called "Theory of Mind" (Premack 1988).

A number of modifications of these two positions exist, including, in particular, Pinkerton and Bloom's idea that the genetic change that causes language arose through natural selection in the hominid lineage as a specialized biological system only present in modern humans, thus supporting the discontinuity position. King and her colleagues were more interested in asking and answering questions about what language has in

common with the communication systems of non-human primates, and also with their non-linguistic behaviour.

Approaching the question this way will also eventually allow researchers to assess what is similar about these systems. In addition, this approach provides a focus on the communication systems of our closest living relatives and comparative work may allow us to extrapolate into the past, looking for origins of human specializations. King is critical of those who try to approach this topic with little understanding of the characteristics of primate communication (which were, after all, the basis of how our earliest ancestors communicated).

In order to address substantial issues concerning the similarities and differences between primate communication systems and human language, the topic must be broken into a series of sub-questions. These include such questions as “To what degree does primate vocal and gestural communication unfold in a flexible manner, according to experience and interaction, instead of according to prespecified, biologically determined structures and processes?”(8) “How do events during ontogeny contribute to the development of language?”(8) and “Are there (or were there) linguistic and/or behavioural precursors to language in non-human primates, including the hominids?”(8).

When struggling with the issue of defining language, it seems clear that the theoretical position from which you begin will define the questions asked. From an innatist’s perspective, who sees language as an inborn uniquely human trait, questions of the presence, origin and function of syntax as the organizing fundamental of language will loom large. From the evolutionary perspective you might look at language as a set of functional subsystems, such as classificatory ability, controlled vocalizations, and the ability to build up calls or gestures, from a combination of available elements. The primate precursor systems can then be examined for evidence of such abilities, or of even more complex ones, such as the understanding of relationships among patterns which can show up in complex social interactions where differential responses are directed to individuals who have different types of relationships with the sender.

These kinds of observations on primates depend on long-term detailed studies of both free ranging and captive groups. Free ranging studies are particularly important because of the complexity of social organization in undisturbed groups which provides evidence of how animals in them classify their relationships.

In addition, detailed study of the structure of face and body gestures, as well as vocal communications, provides evidence for how these systems operate and whether there are indications of a basic underlying syntax or at least a level of meta-communication. King, in particular, states that she sees language not as a static set of features, but as a dynamic interactive system of production and reception.

King's first chapter begins with a discussion of Bickerton's viewpoint about the importance of syntax as a defining feature of language. Immediately this means that data from primates is not a productive place to look because, according to Bickerton, primates can only communicate about emotion, not about specific features of the environment. He agrees that other animals can infer meaning from the first (as in a predator alarm) but argues that there is a huge difference between that function of communication and an intended meaning to warn others about a dangerous feature. He also argues that primates do not show variable responses to particular calls, and thus maintains that there is a separate cognitive base for animal communication.

King argues with this viewpoint because she states that monkeys and apes have relationships — not just interactions — and that these relationships involve attending to the other, such that if a mother calls to an infant she means that it should come, and will go and retrieve it if it does not respond. This is particularly evident in captive and enculturated apes interacting with humans, or with other apes, where they visibly wait for a response after making a communicative gesture. King discusses Wallman's approach to language origin issues by noting that his observations support both the continuity and the discontinuity theories because he suggests that differential monkey vocal alarms are "plausible precursors of words" (35) while concluding that primates do not evince language-like principles in their natural systems of communication. He comes to this conclusion because he does not find many language-like features such as duality of patterning and vocal learning in primate systems. In fact, vocal learning is now widely accepted for a variety of primates, e.g. Snowdon (this volume) and bonobos direct particular gestural movements towards infant bonobos, that depend both on the context and the responses of infants, in a clearly communicative way. Another good example of call modification is the development of co-calling and counter-calling in gibbons, where mates gradually align their calls to form a unified duet. King argues that looking at what primates really do, before imposing constraints based on standards of human behaviour, will help us learn a great deal more about primate communication systems than starting with human standards which apes may not match.

The next theorist King discusses is Gibson, who as a continuist, looks on brain structure and communication skills as basic to primates and expanded in humans. She sees language as essentially an emergent property built up out of components, as a mosaic of features to allow interaction and social information donation, rather than focussing on single utterances. Other features of language, such as voluntary control of utterances, and combining two calls to make a new meaning, are present in primates in a rudimentary form according to her. Thus, Gibson argues that human language is not unique, even though it has distinctive features based on the increased intellectual abilities of humans. The key claim in this approach is that small neurological changes can explain the incremental changes in communicative abilities in primates such that the differences between apes and humans should be seen in quantitative rather than qualitative terms. King supports this argument by citing in her own work evidence of referentiality, vocal control, precursors for syntax and processors for turn taking. The evidence for precursors for syntax is supported by Armstrong, Stokoe and Wilcox (1995), who emphasize that continuity in the gestural-optical channel allow visible gestures to promote an understanding of sequential actions. An example is a raptor seizing a prey animal being modelled by a hand grasping an object; in other words an actor, a target and an action. Once the sequential organization of action is mapped onto meaning, then basic syntax can be said to occur.

Evidence for these levels of ability are difficult to discern in wild populations of primates, but enculturated apes can demonstrate an understanding of agent- action-object quite clearly. This is particularly true for language trained apes such as Kanzi, who can even deal with embedded clauses in a received sentence. Those who argue that apes only live in the present may not be interpreting their excellent memories for past acquaintances, or ability to move around their ranges to forage optimally, as evidence of an understanding of the past. Delayed redirected aggression, in which an animal attacks another who has a close relationship with the one who offended it the day before, also shows ability to remember the past and perhaps to plan future retaliation if the original attacker was too powerful to be challenged. Despite the many arguments from discontinuity theorists that enculturated apes show little or no use of language since the signing that they do is often “instrumental” (they are requesting something), or in response to being signed to, there are certainly many episodes of ape-initiated comments and rule governed productions of strings of signs. In her work with Kanzi, Sue Savage-Rumbaugh (1998) has tested his ability to comprehend novel sentences and found that without reward and on one presentation of each request, he was able to perform a variety of what must have seemed like odd behaviours, such as “put

the grapes in the swimming pool.” Her interest in focusing on comprehension permits a comparison with human language and a way to look for the key elements of language. Production without comprehension is not much use as an evolutionary strategy, so it seems likely that comprehension of signal forms was a major underpinning to the structuring of language and co-occurred with production.

Since detailed information on primate vocal and gestural systems is still being gathered, Maestriperi, in the next chapter, investigates how the social environment influences the cognitive abilities and communication systems of primates. In this work Maestriperi compared Rhesus, Pigtail and Stumptail macaques in terms of their dominance and kinship organization in relation to the complexity of their patterns of affiliative bonding and development of temporary alliances. The results of this study suggested that the less dominance oriented species, e.g. the Pigtail and Stumptail, have a wider repertoire of non-aggressive gestures and more sophisticated communicative interactions. Rhesus macaques do not use many affiliative signals and use gestures mainly to express dominance and subordination. In particular, evidence from Stumptail macaques who are less organized by dominance and the impact of matrilineal kin, suggests that the need to co-operate with unrelated individuals requires clear signals of affiliative intent, since the variety of assertive and submissive gestures indicates a great potential for within-group conflict in the species. Therefore, expressions of reassurance and bonding are needed to maintain cohesion in their relatively large social groups. This is an interesting approach, especially if the results suggest that particular types of early hominid social organization might have influenced the sophistication of their communication system.

In particular, as Maestriperi notes, it is much more probable that pressures for complex communication were likely to arise in the context of social behaviour than in the context of external referents. The strategies of intra-group co-operation and competition in primate groups are more complex than seen among almost all other animals and have been suggested as the basis for increasing development of primate cognitive skills (Whiten and Byrne 1988; Tomasello and Call 1997).

Snowdon’s chapter extends the range of this book to a discussion of the communicative capabilities of New World Monkeys. This is important from the phylogenetic perspective because New World forms have been separated genetically from Old World ones for over thirty million years. Thus, if there is a unified genetic basis to complex primate communication skills this must have developed a very long time ago. On the



other hand, if what we see is parallel development, this suggests that the parallel features of primate social life and functional adaptations to group living are powerful forces in the development of complex communication skills. Snowdon maintains strong empiricist views and promotes the value of good empirical data to support his theoretical position. He begins by addressing Hockett's design features of language and discusses at what level these features are present in primate systems. After running through all the criteria, Snowdon claims that all of them are present in one primate species or another, although he does agree that no non-human communication system incorporates them all. He then discusses the uniqueness of human production and perception of sounds as speech, but concludes that other primates can categorically perceptualize human speech sounds. This discussion proceeds to evidence that primates have categorical perceptions of their own vocalizations, such as occurs in pygmy marmosets who categorize their trill vocalizations on the basis of call duration. Evidence for within- category discrimination occurred when pygmy marmosets would respond differentially to playbacks of short trills made by known individuals who usually made short trills, versus long trill playbacks of the same animal, and vice versa. Snowdon uses this data to argue that there is nothing "special" about speech perception. It uses phylogenetically old perceptual contrasts, but in certain social situations within-group categorization of social factors such as age, sex and individual, impact the meaning of the actual linguistic signal. He goes on to deal with the concept of language universals, critical periods, word order learning patterns, and individual learner preferences. By examining language development in a variety of cultures, and in the bilingual learning situation, Snowdon argues that all of these frequently accepted truisms about language development do not hold globally.

He then moves to monkey vocal development. Comparison with isolation reared and deafened song birds suggests that the development of vocal production in primates is quite conservative, since they are less affected by isolation procedures than song birds (based on Seyfarth and Cheney 1997). However, the calls investigated were usually predator alarm or infant lost calls, which need to be ritualized and rapidly responded to for survival reasons. Vocalizations used in social relationships are much more plastic and influenced by learning. He supports this claim with data on affiliative vocalizations in marmosets and tamarins. Trill vocalizations of pygmy marmosets have traits that allow individual recognition. In the wild, as animals get farther away from the group, they alter the structure of their calls so they can be more easily located. The members of the group take turns calling and thus all group members know where everyone is. The development of captive pygmy marmosets indicated that the calls developed with age,

becoming deeper and longer, as would be expected from maturational development. However, some were also shorter and higher pitched, so that the changes could not be accounted for by maturational factors. Social impacts also affected trill structure, as stranger and established animals both changed their vocalizations after being placed together for some time. When animals were newly paired they also changed their trill structure to converge with their new mate. This study was compared to the results of humans joining a new group and changing their speaking patterns (Giles and Smith 1979). Another parallel with humans that Snowdon discussed was the presence of babbling in infant pygmy marmosets. He is currently investigating whether adults respond differentially to infant marmosets when they are babbling, and if the adult's reinforcement changes or directs the structure of the calls. Altogether, Snowdon was making three points in his chapter. First, he found it difficult to find explicit criteria that differentiate human language from the vocal communication of other species, except for the use of words and the concomitant neurological complexity and increased social dependence of humans. Second, the ideas supporting the innateness argument, such as universals of development and critical periods, may depend more on learning patterns and motivational processes than on a genetic basis. Third, the data derived from marmosets and tamarins on social impact, babbling and teaching of food associated calls provide experimental evidence to support an argument that learning and cognitive variables are very important aspects of developing primate communication systems. In particular, language and communication are socially constructed. Communication signals are learned and shaped into adult modes of production usage and comprehension. Savage-Rumbaugh begins her chapter by questioning whether the accepted scientific method of hypothesis and experiment is, in fact, the best way to understand what is going on in the minds of primates. In order to prove goal direction, intentionality and consciousness without being able to talk with an animal, what means can researchers use, since such mental attributes cannot be empirically proved for humans, except by self-report? Savage-Rumbaugh clearly expresses the difficulties she has faced in attempting to scientifically prove that the Yerkish-using chimpanzees, particularly Kanzi, utilize language. Her argument maintains that a study based on replicable, countable linear events is not going to provide much of an indication about the mental abilities of apes. Data collection techniques can be structured to "make minds appear to be like machines. One can count and classify and lump, but one learns little by making a mind appear to fit the current mold of science" (119). New methodologies need to be developed and accepted to study the multiple phenomena that make up ape behaviour, because otherwise the kinds of questions we ask will not bring us answers relevant to understanding what apes are really like.

The chapter continues with a Platonic imaginary dialogue between Savage-Rumbaugh and an invented critic. They discuss many of the questions that are currently at issue. Savage-Rumbaugh gives examples of bonobos referring to past events, such as a fire. After the fire occurred, one of the apes led a caregiver out to the location of the fire, but arguments were put forward that since there are no past tense symbols on a Yerkish board, that we do not know if the bonobo just used the word and led the caregiver there because she wanted to see the place again, rather than transfer the information that a fire had happened. If this were the only event of its kind this reductionist level of explanation might be reasonable, Savage-Rumbaugh argues, but when there are hundreds of events over the years, they cannot all be chance or mindless occurrences. The main question that was repeatedly asked by the critic was “how can we ... be sure that what you (Savage-Rumbaugh) see in the apes is really there?” He argues that she cannot be objective about the apes because she participated in raising them, and therefore, she will interpret any situation as if it were evidence of comprehension. The problem with his question is that he would probably see something different than she because it takes a well-trained and experienced eye to perceive what is happening in ape communication. In her anecdote about getting her keys back from one bonobo who wouldn't give them to her by asking Kanzi to tell Tamuli to give me my keys (136), she agreed that the critic probably would not have asked Kanzi for help, and thus would not have had the opportunity to observe this three way interaction. What she is trying to say, as the Gardners and Fouts have already said, is, if you don't think the animals are going to understand you, you will probably not see any evidence that they do. You may see manifestations but you could always say they were random or accidental responses and not true evidence. I have certainly seen, and have video of, apes who clearly understood what they were being asked to do and who were not trained for that particular situation. The critic in this imaginary debate ends by saying that he can't imagine how primates can use referential communication because we do not know what is going on in their heads, and that the ape language researchers may be over-interpreting their results. The chapter ends with a discussion of the critic's arguments. In particular, the critic has suggested that Savage-Rumbaugh is not objective and her reply is that all scientists have feelings about their work which will affect how they collect, classify, analyse and interpret their findings. To me, an objective researcher is one who is willing to accept whatever results the data show, whether or not the hypothesis is supported.

The other major issue was the difference between anecdote and experiment. If some ape communications such as greeting routines are standardized, they are not of inter-

est to the linguist because they might be rote actions, or repetitive, and therefore do not reflect linguistic competence. On the other hand, a novel or unusual behaviour or incident that displays an intelligent solution is an anecdote and therefore not acceptable to science. Savage-Rumbaugh calls this a double standard because unique behaviours for humans are considered to provide evidence of intelligence, possible problem solving, and linguistic competence. First verbalizations, and even repetitions of “Mama” by infants, are considered evidence of preliminary linguistic skill.

The chapter ends with a description of how Panbanisha (a pregnant female bonobo) responded by pointing at her belly the first time she was asked “Where is your baby?” She also touched her stomach when the baby moved and she was watching it on a sonogram (which she had never seen before) and she did not normally touch herself when the fetus moved. For the observers it seemed clear that she understood the sonogram was a picture of her hidden baby. When the infant was born and she was asked “Where is your baby?” she always pointed to it, not to her stomach or vagina. This was her first pregnancy, but she had seen her mother, and a number of humans, when they were pregnant, and later with their babies. The conceptual ability to know that a baby is inside you represents a fairly sophisticated understanding of self and other, since she recognized the born object as her baby.

Kathleen Gibson and Stephen Jessee approach the language origins questions by investigating the “brains, anatomy and behaviour of humans and their closest phylogenetic kin” (194). They examine quantitative differences in the size of the brain and many of its parts. Their argument is that larger brain areas in humans allow increased mental capacities, differentiation, conceptual schema, and advanced motor and object manipulation skills. This viewpoint supports the position that quantitative differences provide sufficient mental capabilities for what seem to be uniquely human traits.

Lieberman had suggested that apes could not articulate because their epiglottis was level with their uvula, but dissections of chimpanzees indicate that it usually lies just below the uvula. In humans, the epiglottis also lies below the uvula, but the distance below has a range of over 20 mm. Thus, there is a quantitative range between the distance of the epiglottis below the uvula in apes and human, but overall structure is not nearly as different as Lieberman had indicated.

These arguments do not mean to suggest that the differences between apes and humans are minimal, because they are clearly quite substantial. Most human brains are three times the weight of an average ape brain. Since brain and body size are highly correlated, the EQ or encephalization quotient is a common equation used to factor out effects of body size. High human EQs correlate with our perception of humans as having the highest brain/body ratio, but EQ levels do not correlate well with mirror self-recognition and tool use in non-human primates. Dunbar suggests that the ratio of neocortical brain size correlates with the size of social groups in his hypothesis, that social skills are the underlying basis of cognitive complexity. However, Gibson and Jesse feel that large absolute brain size with enlarged circuits, complex dendritic branching, and many interacting neural regions, is associated with long periods of learning and is important in mediating sensory motor and cognitive functions. They go on to suggest that linguistic skills are not mediated only by a developed Broca's area alone but by "coordinated changes in the sizes of many structures and tracts with diverse functions" (20).

Procedural learning is the development of habits and skills that become almost automatic (like riding a bicycle). Parts of the brain involved in this are larger in more taxonomically advanced primates. In humans, complex dance routines, piano playing, speaking and writing clearly reflect procedural learning, which makes its development an important role in learning vocabulary. The foraging lifestyle of primates would benefit from this type of learning and it has been experimentally demonstrated in monkeys and apes who have the enlarged hippocampus and frontal and temporal type circuits on which it depends. This learning is mediated by emotion and thus emotional control is an important aspect of taking advantage of this ability. The size of the neocortex relates to the complexity of the function of the part controlled rather than its size. The interconnectedness of motor neurons leads to an exponential growth of the number of movements controlled. Therefore, the need to combine and recombine the movements of lips, tongue, and oral cavity and to fine-tune mouth movements requires multiple parallel neural tracts working together. In humans, large association cortices provide multiple simultaneous and sequential control over motor acts as is required for speech or writing. The level of cross-modal integration in humans allows smells and sounds to be reconstructed into a larger whole, such as "that's a predator."

After discussing the structure of ape and human brains and the advantages modern humans gain from their increased brain size, the authors discuss developmental process in children. They suggest that hierarchical and cross-modal connections are the

basis of being able to comprehend “object-name” when an object is presented to an infant and the name is spoken, which are two separate information sources which must be combined. The child constructs a concept of the word, from seeing the object, a caretaker’s reference to it, and the sound of its name. Words thus depend on mental constructional skills, as do phrases, sentences and stories. As they become more complex, they convey more information. Human language has an overall hierarchical structure, but it may not require abilities unique to humans to make it function. Language trained apes can merge or construct concepts by seeing objects and hearing their names even though their abilities to hierarchically construct multi- word utterances are much poorer than children over age two. It may be that the number of parallel circuits they have to keep a variety of concepts in mind simultaneously is just not sufficient to create complex verbal strings.

Early human minds may have started at the same place, but interactions of human skills and the development of complex procedural activities may have interacted to increase manipulative, social, and eventually linguistic complexity. As tool use and making emerged and developed, sensory motor, imitative, and planning skills, which are essential for making stone tools, would have emerged. Gestures and vocalization used to process foods, indicate travel direction or direct a youngster’s attention to a foraging opportunity would have had serious selective advantages. By the time *Homo erectus* with a cranial capacity of 900- 1000 cc (halfway between apes and modern humans) were in existence, they were making balanced, symmetrical, bifacially flaked stone tools for cutting, butchering, and perhaps throwing.

Modern pre-school children can communicate about actions, events and locations present in the environment, but amplify their descriptions with considerable use of gesture. Older children (age 7+) can communicate comprehensibly about absent objects, abstract ideas and previous events. By this time, their brains are larger than those of most *Homo erectus*. They develop the use of deictic devices which allows them to discuss distant events more accurately. If they were foragers they could talk about distant resources. The development of language skills seems to track the increase in brain size very well, and Gibson and Jessee argue that Lieberman’s ideas about deficient Neanderthal verbal skills are not supported by this approach. In fact, they replicated the cranial base study on which Lieberman’s hypothesis rested, and found that the cranial base flexure in modern infants was well within the range of variation of verbal children. Moreover, the degree of cranial base flexion in the La Chapelle Neanderthal, which was the original one underlying Lieberman’s ideas, was also within the modern human child

range. Gibson and Jessee's conclusion, therefore, maintains that language evolution is based on the coordinated evolution of a variety of neural functions arising from the increased size of the modern human brain.

Davidson's chapter on continuity and discontinuity in language origins starts from the continuity perspective because, he argues, most other research begins from the discontinuity end. This is because the arbitrary nature of languages, by their symbolic nature, encourages this approach. He begins by discussing the concept of naming as a discontinuous aspect of an essentially continuous communicative skill. The analogy he uses is the episodic nature of historical events embedded in the continuum of history. In looking for language origins he comments that even this process produces discontinuity because we see an origin as a new and different thing than previously existed. He does, however, argue that there is a distinct discontinuity between non-human primates and modern humans which means that primate evidence is not a direct source of information about human behaviour. The big question is "how these differences emerged" (231). Davidson looks to four types of data to answer this question. A frequently used approach is to argue by analogy from non-human primates to early humans. The author argues that this is a very weak source of data. The second approach is a discussion of ecological functional similarities as a conceptual model to reinforce the referential models by establishing a theoretical basis for possible similarities between primates and early hominids. This approach is judged to have some promise, but the environmental flexibility of humans makes it difficult to clearly delineate evolutionary processes of change in early hominids. The next approach is an effort to reconstruct the last primate/human common ancestor by using a cladistic style of assessment. The problem of convergence makes it difficult to proceed with confidence, and the processes by which the differences between the lines developed are difficult to identify. However, archaeological material shows us some of the intermediate stages in the development from common ancestor to modern human, and allows us to check our model. In spite of the difficulties Davidson sees in the first three approaches, he does accept that his fourth methodology might be useful. This involves using primate data to set a primate baseline for human activity. Apes make tools, use complex communication, and live in complex social groups. They eat meat, hunt, and spend a long time raising their young. But this does not tell us how or when early humans refined these abilities. In particular, for language we do not know when or where human capacities advanced beyond apes, but since production would be useless without reception, the two must have developed concurrently, and thus probably in social groups. The ultimate cause of language was probably the development of particular solutions to gen-

eral primate problems. However, it couldn't have happened without relaxations of the selection pressures against larger brains. Brains are expensive to maintain and need to be kept at a constant temperature. As Australopithecines developed, their tool-making skills may have provided more meat and the potential for brain growth. Another jump in brain size occurred with the development of *Homo erectus* and increasing tool production skills. Eventually the brain growth pattern of infants included a substantial post-birth growth phase, which greatly increased the potential for learning. Noble and Davidson (1996) argued that it was not actually a change in the form of communication which pushed it into language, but the discovery of the symbolic potential of referential utterances. This allowed a changeover from memorizing every instance of communication to developing a hierarchical structure of code utterances, thus allowing for a reduced "instruction set" for the use of these newly developed symbols.

The discontinuity between our ancestors and ourselves comes from the fact that all our ancestors are extinct so we can no longer see the developmental continuity that occurred; we have no idea how long the stages took or when they were. Archaeological evidence of conservative tool-making strategies and slow population growth suggests that language development took a long time. The appearance of symbols is recorded in the archaeological record but we will never know if we have found the first occurrence. Davidson's conclusion is that we can argue for continuity or discontinuity from the same evidence depending on how we interpret finds from the past.

Moving from the course of evolution to human ontogeny, McCune argues that attention to language acquisition processes in primates and humans may help to inform us about language development at the species level. If autonomic vocalizations occur in response to metabolic needs across species, they describe internal states and can prompt the recognition of sound-meaning correspondence. Communication requires both sender and receiver. If the receiver understands the message, Searle (1992) argues that s/he experiences an internal state of meaning closely related to that of the sender (270). He calls this an Intentional or I-state. These I-states characterize conscious experiences of the organism paying attention to its surroundings. It implies a sense of self, a focus, and an affective tone.

Infant humans experience I-states very early in life and utilize vocal grunts to comment on internal and external states. By the age of one month, they first exhibit linguistic referential ability, by using grunts when they notice objects. By nine to sixteen months, there are three uses of grunts with the third being used as accompaniment to commu-



nicative gestures and looks at the mother. This leads to the beginning of vocal interaction. Since the physiological effort of grunting and the visual attention suggest a consistent I-state, directed to environmental stimuli, the environmental focus and the grunt may then be joined in a symbol-referent relationship. The meaning may vary with the child's attention focus, but this may facilitate learning if it gets differential responses.

Parent/infant exchanges develop as parents learn to recognize their infant's signals and respond to them as if they had meaning, thus giving them meaning. Mutual attunement occurs in mother/infant pairs all through the primate order. Mother/infant attachment is developed through interaction, and human children develop language to help maintain that attachment (279). A set of interacting conditions is needed to produce referential language in humans. These include caring adults who will engage in representational play, a communicative focus, like the grunt, and developing phonetic skill that allows vocal schemes to emerge. Representational play can evolve through finger pointing at objects, often accompanied by a visual check on the social partner to see if they are attending to the designated object. This development of joint attention and object differentiation is evidence of differentiation between self, social partner, and object that is considered the basis of reference. This author claims that primates use object play and some pointing, but I do not think she gives apes enough credit for object attention interaction. At any rate, human children rapidly move from babbling to vocalizations organized by motor schemes that become more patterned and rhythmic. The author then deals with the question of whether a child's first words are already referential and states that situationally limited words (e.g., particular events and objects) may develop first. These include social words such as "bye bye" and game markers like "peek-a-boo". This is a practised, memorized use of words rather than the use of a word as a symbol, which characterizes referential language. The development of speech requires an interlocking set of species-typical experiences in a culturally maintained linguistic system. The child develops a concept of self in relation to others and the external world. The communication grunt mentioned above may be the child's initial personal symbol. Making similar noises allows matching of the I-state, so vervet monkeys making a "grunt to a dominant" are answered by the same sound, although it can't be true in both cases. Seyfarth and Cheney (1986), who studied vervet grunts, feel that the reply may indicate "message received" rather than the initial meaning. Since young monkeys must learn the correct contexts for effective use of vocalizations, they must be learning about sound-meaning correspondence.

Since there are eight types of grunts in the vervet repertoire, plus many other sounds, a considerable level of learning is involved. The same is true of chimpanzee vocalizations, some of which have individual aspects. They are used in a wide variety of situations. Gestures frequently accompany them, often with overlapping meaning. These gesture/vocalization packages may be developed into a ritual with considerable social relevance (such as greeting rituals). Chimpanzee food grunts usually combine presence and activity. Thus, when trying to teach language trained chimpanzees a label for a food item, researchers detach the concept of eating from the item's label. This is necessary so as to persuade animals to label items that are not present or not available to be eaten. Eventually, the experimental chimpanzees learned to distinguish the referential nature of the symbol from the expectation of eating it. Labelling absent tools and people revealed the same issue, with a sudden resolution and a jump to 100% correct answers after a few days of training. This learning experience may be one major underlying factor why captive chimps seem much more capable of problem solving than wild animals.

Burling is a linguist who utilizes Peirce's three way division of signs among icons, indices and symbols. The indices and icons are not symbols, but tied to their referent in a non-arbitrary way. An index is associated with a reference, like a paw print with a cat or smoke with fire, that is, by its causality. Icons are subdivided into three aspects: images, metaphors, and diagrams. Images have a physical resemblance to their referents such as the ASL signs for cat or tree. Metaphors are more abstract, but they relate to the idea in a physical way, such as holding up hands, palms inward, to indicate the size of a fish. Human languages are based on arbitrary word-object associations but also contain much iconicity and indexicality.

Burling claims that the distinctively human aspects of communication are language itself and what he refers to as "gesture calls." These include face and body gestures and the non-verbal sounds we make to indicate emotion. These gesture calls form an analogue system with continuous graded levels of expression. Some gestures are actually learned, such as the "V" for victory and these form a subset of what Kendon has called quotable gestures (1992). These edge out of the analogue category into the more digital arrangements of spoken language with its discrete phonemes and morphemes. Gesticulation and intonation are aspects of analogue language but complement the digital vocal production. Since Burling includes both of these in the analogue category, I've excluded them from a narrow definition of language components. All of these indices, icons, and forms mentioned, are types of motivated signs in Peirce's organization

deployed by Burling. Motivated signs were of much greater importance in early language than in modern forms. Actions became conventionalized and eventually developed into arbitrary symbols. If conventionalization goes far enough, motivation can be undermined and signs can become contrastive, and therefore digital. Sign language has a more iconic base than spoken language, but is still complex and arbitrary enough to require learning rather than being iconically obvious. As young primates/humans develop, they can turn very easily instrumental gestures into conventionalized gestures. Even baby orangutans raised with people hold their arms up to ask to be picked up. Conventionalization speeds up communication and makes the job of the producer easier. Apes in the wild use some motivated signs, and these can become conventionalized between parents and offspring. They are not universal in a species, but have to be learned by each interacting dyad.

At this point in the chapter Burling moves from discussing data to speculating about how this patterning of indices, icons, and gesticulations could have transformed into language through the process of conventionalization. The capacity to develop, remember, store and retrieve such communicative elements would have been enormously advantageous to those animals/early hominids successfully using them. Infants could learn these patterns from their mothers and increasing arbitrariness would have helped to keep the elements distinct. Burling comments that although innovated signs were probably an important underpinning for language, they were not, by themselves, sufficient to cause language. Brain development, increased cognitive mapping, and social bonding are all probable components of the developing system of human language.

Wilcox, in the final chapter of the book, proposes that language developed out of cognitive abilities, social processes and visible gestures present in primate ancestors. The key elements of language must have been present in early hominid abilities and behaviours. These abilities underlay novel inventive discoveries that increased linguistic ability in a fashion parallel to the punctuated equilibrium model of evolution. He argues that even distant primate ancestors possessed cognitive abilities sufficient to form structured conceptualizations, and to classify experiences based on similar features.

The essence of Wilcox's argument is that cognitive abilities, ritualization and visible gesture acted in concert to mediate the emergence of language. Language development rests on two aspects of visible gestures: the expressive bodily action and the coordinative structuring which takes a series of non-symbolic movements and arranges their production, resulting in a movement with meaning (like a "thumbs up"). For Wil-

cox, the raw material of visual gestures acted upon ritualization and cognitive abilities. Visible gestures mediate between individual and social arenas, as well as between action and perception. Originally, these actions may have had instrumental functions, as well as serving communicative purposes. In order for the refinement of visual gesture to linguistic attribute, the gesture must be refined to a single salient unmistakable movement or expression. This single feature is then interpreted as a communication cue and the other features of the gesture are disregarded. During this process, in many cases, ritualized gestures are emancipated from their original functions. As this occurs, the acts become free to take on alternative meanings and can be modified to become signals with the connotation of the original act being transformed to a denotative meaning. This, it is argued, is the initial stage of language because the action looks back to the gesture it was and the meaning it developed, and forward to the world of grammar. One might ask how we moved from visible to audible gesture systems, but Wilcox argues that the visible gestures often had auditory components, and during the course of initialization, auditory aspects could become the salient features.

He bolsters the argument by saying that increased vocal signalling may have become more useful if hands were busy using tools and performing a variety of tasks. Other selective factors could have contributed as well, such as the need for hunting signals, or communicating in the dark. The differences between the digital language system and the more continuous gestural one could have arisen as emergent properties arising from the process of ritualization. In animals, ritualized activities occur at “typical intensities,” because clarity of form is vital. Thus, no matter the level of stimulus, the display movement is invariable. This explains how previously continuous gestures could become digital.

The process could also underlie the development of arbitrariness. The ritualized response carries little information about the sender’s actual emotional state. Over time these gestures can become stylized to the point that their origin is hardly discernible. As stylization proceeds, a signal that matches the community standards will be perceived much more rapidly than one that does not. Standardization of signals thus develops which could serve as the foundation for grammar. The symbols would be most useful if they were discrete and contrastive, in addition to being combinable in productive ways. The long string of modifications that led to this stage each arose from the previous abilities that the animals/hominids possessed, emerging through the process of ritualization. Wilcox feels that this argument moves beyond Burling’s approach because it suggests a mechanism through which gestures could be converted to discrete

digital expressions. The key elements were in place before the development of language began and a series of developments, none of them uniquely human, allowed linguistic communication to develop.

This book provides ten schemata from the continuity perspective about how language could have developed. The new data about primate vocal learning, referentiality, and the impact of social relations on communicative complexity, are all important contributions. Those who discussed the ontogeny of human language took the argument to very early levels of development, showing how simple vocal indicators, such as grunts, can be shaped into language. These authors also related the similarities of vocal indicators to the situation in monkeys. Savage-Rumbaugh reinforced our awareness that theoretical positions constrain the types of questions we ask, and how this can influence our perceptions of what language is. Comparative data on brain size and its impact on function helped to clarify one approach concerning the necessary underlying foundations for speech. The lack of a concluding chapter synthesizing these positions is something of a loss, but altogether this book stimulates many ideas from one approach to language origins. It is well written, thoroughly referenced, and makes a substantial contribution to the ongoing discussion of this issue.

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