

THE EVOLUTIONARY EMERGENCE OF LANGUAGE

*Social Function and
the Origins of
Linguistic Form*

Edited by

Chris Knight

Michael Studdert-Kennedy

James R. Hurford

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The Evolutionary Emergence of Language

Language has no counterpart in the animal world. Unique to *Homo sapiens*, it appears inseparable from human nature. But how, when and why did it emerge? The contributors to this volume – linguists, anthropologists, cognitive scientists and others – adopt a modern Darwinian perspective to offer a bold synthesis of the human and natural sciences. As a feature of human social intelligence, language evolution is driven by biologically anomalous levels of social cooperation. Phonetic competence correspondingly reflects social pressures for vocal imitation, learning and other forms of social transmission. Distinctively human social and cultural strategies gave rise to the complex syntactic structure of speech. This book, presenting language as a remarkable social adaptation, testifies to the growing influence of evolutionary thinking in contemporary linguistics. It will be welcomed by all those interested in human evolution, evolutionary psychology, linguistic anthropology and general linguistics.

Chris Knight is Reader in Anthropology at the University of East London. His highly acclaimed and widely debated first book, *Blood Relations: Menstruation and the Origins of Culture* (1991), outlined a new theory of human origins. He has also authored many book chapters and journal articles on human cognitive and linguistic evolution and was coeditor of *Approaches to the Evolution of Language* (1998).

Michael Studdert-Kennedy is past President of Haskins Laboratories and Professor Emeritus of Psychology at the University of Connecticut and of Communications at the City University of New York. He has published numerous articles on speech perception and speech development and edited or coedited several books, including *Psychobiology of Language* (1983) and *Approaches to the Evolution of Language* (1998).

James R. Hurford has been Professor of General Linguistics at the University of Edinburgh since 1979. He is the author of many books, including *Language and Number: The Emergence of a Cognitive System* (1987), and was coeditor of *Approaches to the Evolution of Language* (1998). He is perhaps best known for his computer simulations of various aspects of the evolution of language.

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**Social Function and the Origins
of Linguistic Form**

Edited by

CHRIS KNIGHT

University of East London

MICHAEL STUDDERT-KENNEDY

Haskins Laboratories

University of Connecticut

City University of New York

JAMES R. HURFORD

University of Edinburgh



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Contributors

- Derek Bickerton*, Department of Linguistics, University of Hawaii, Honolulu, Hawaii 96822, USA. <derek@hawaii.edu>
- Bart de Boer*, Laboratory for Artificial Intelligence, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium. <bartb@arti.vub.ac.be>
- Robbins Burling*, Department of Anthropology, University of Michigan, 1020 LSA Building, Ann Arbor, Michigan 48109, USA. <rburling@umich.edu>
- Andrew Carstairs-McCarthy*, Department of Linguistics, University of Canterbury, Private Bag 4800, Christchurch, New Zealand.
<a.c-mcc@ling.canterbury.ac.nz>
- Barbara L. Davis*, Speech and Hearing Center, University of Texas, Austin, Texas 78712, USA. <babs@mail.utexas.edu>
- Rory A. DePaolis*, Department of Communication Sciences and Disorders, James Madison University, Harrisonburg, Virginia 22807, USA.
<depaolra@jmu.edu>
- Jean-Louis Dessalles*, Modèles Informatiques pour le Langage et la Cognition, Département Informatique, E.N.S.T., 46 rue Barrault, 75013 Paris, France.
<dessalles@enst.fr>
- Colin Fyfe*, Department of Computing and Information Systems, University of Paisley, High St Paisley, Renfrewshire PA1 2BE, UK.
<colin.fyfe@paisley.ac.uk>
- James R. Hurford*, Department of Linguistics, University of Edinburgh, Adam Ferguson Building, George Square, Edinburgh EH8 9LL, UK.
<jim@ling.ed.ac.uk>
- Simon Kirby*, Department of Linguistics, University of Edinburgh, Adam Ferguson Building, George Square, Edinburgh EH8 9LL, UK.
<simon@ling.ed.ac.uk>

Chris Knight, Department of Sociology and Anthropology, University of East London, Longbridge Road, Dagenham, Essex RM8 2AS, UK.

<c.knight@uel.ac.uk>

David Lightfoot, Linguistics Department, University of Maryland, College Park, Maryland 20742-7515, USA. <dlight@deans.umd.edu>

Daniel Livingstone, Department of Computing and Information Systems, University of Paisley, High St Paisley, Renfrewshire PA1 2BE, UK.

<livi-ci0@paisley.ac.uk>

Peter F. MacNeilage, Department of Psychology, University of Texas, Austin, Texas 78712, USA. <macneilage@mail.utexas.edu>

Frederick J. Newmeyer, Department of Linguistics, University of Washington, Seattle, Washington 98195, USA. <fjn@u.washington.edu>

Jason Noble, Center for Adaptive Behavior and Cognition, Max-Planck-Institut für Bildungsforschung, Lentzeallee 94, D-14195 Berlin, Germany.

<noble@canetoad.mpib-berlin.mpg.de>

Mark Pagel, School of Animal and Microbial Sciences, University of Reading, Whiteknights, Reading RG6 6AJ, UK. <m.pagel@reading.ac.uk>

Camilla Power, Department of Anthropology, University College London, Gower Street, London WC1E 6BT, UK. <ucsaccp@ucl.ac.uk>

Michael Studdert-Kennedy, Haskins Laboratories, 270 Crown Street, New Haven, Connecticut 06511-6695, USA. <msk@haskins.yale.edu>

Marilyn M. Vihman, School of Psychology, University of Wales Bangor, Gwynedd LL56 2DG, UK. <m.vihman@bangor.ac.uk>

Robert P. Worden, Charteris Ltd., 6 Kinghorn Street, London EC1A 7HT, UK. <rpw@charteris.com>

Alison Wray, Centre for Applied Language Studies, University of Wales, Swansea Singleton Park, Swansea SA2 8PP, UK.

<a.m.wray@swansea.ac.uk>

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Language: A Darwinian Adaptation?

CHRIS KNIGHT, MICHAEL STUDDERT-KENNEDY
AND JAMES R. HURFORD

Let me just ask a question which everyone else who has been faithfully attending these sessions is surely burning to ask. If some rules you have described constitute universal constraints on all languages, yet they are not learned, nor are they somehow logically necessary *a priori*, how did language get that way?

Stevan Harnad, in a conference question to Noam Chomsky
(Harnad, Steklis and Lancaster 1976: 57)

As a feature of life on earth, language is one of science's great remaining mysteries. A central difficulty is that it appears so radically incommensurate with non-human systems of communication as to cast doubt on standard neo-Darwinian accounts of its evolution by natural selection. Yet scientific (as opposed to religious or philosophical) arguments for a discontinuity between human and animal communication have come into prominence only over the past 40 years. As long as behaviourism dominated anglophone psychology and linguistics, the transition from animal calls to human speech seemed to offer no particular difficulty (see, for example, Mowrer 1960; Skinner 1957). But the generative revolution in linguistics, begun with the publication of Noam Chomsky's *Syntactic Structures* in 1957 and developed in many subsequent works (e.g. Chomsky 1965, 1966, 1972, 1975, 1986; Chomsky and Halle 1968) radically altered our conception of language, and posed a challenge to evolutionary theory that we are still striving to meet.

The central goal of Chomsky's work has been to formalise, with mathematical rigour and precision, the properties of a successful grammar, that is, of a device for producing all possible sentences, and no impossible sentences, of a particular language. Such a grammar, or syntax, is autonomous with respect to both the meaning of a sentence and the physical structures (sounds, script, manual signs) that convey it; it is a purely formal system for arranging words

(or morphemes) into a pattern that a native speaker would judge to be grammatically correct, or at least acceptable. Chomsky has demonstrated that the logical structure of such a grammar is very much more complex and difficult to formulate than we might suppose, and that its descriptive predicates (syntactic categories, phonological classes) are not commensurate with those of any other known system in the world, or in the mind. Moreover, the underlying principle, or logic, of a syntactic rule system is not immediately given on the surface of the utterances that it determines (Lightfoot, this volume), but must somehow be inferred from that surface – a task that may defeat even professional linguists and logicians. Yet every normal child learns its native language, without special guidance or reinforcement from adult companions, over the first few years of life, when other seemingly simpler analytic tasks are well beyond its reach.

To account for this remarkable feat, Chomsky (1965, 1972) proposed an innate ‘language acquisition device’, including a schema of the ‘universal grammar’ (UG) to which, by hypothesis, every language must conform. The schema, a small set of principles, and of parameters that take different values in different languages, is highly restrictive, so that the child’s search for the grammar of the language it is learning will not be impossibly long. Specifying the parameters of UG, and their values in different languages, both spoken and signed, remains an ongoing task for the generative enterprise.

By placing language in the individual mind/brain rather than in the social group to which the individual belongs, Chomsky broke with the Saussurean and behaviouristic approaches that had prevailed in anglophone linguistics and psychology during the first half of the twentieth century. At the same time, by returning language to its Cartesian status as a property of mind (or reason) and a defining property of human nature (Chomsky 1966), Chomsky reopened language to psychological and evolutionary study, largely dormant since *The Descent of Man* (Darwin 1871).

We have no reason to suppose that Chomsky actually intended to revive such studies. For although he views linguistics as a branch of psychology, and psychology as a branch of biology, he sees their goals as quite distinct. The task of the linguist is to describe the structure of language much as an anatomist might describe that of a biological organ such as the heart; indeed, Chomsky has conceptualised language as in essence the output of a unitary organ or ‘module’, hard-wired in the human brain. The complementary role of the psychologist is to elucidate language function and its development in the individual, while physiologists, neurologists and psychoneurologists chart its underlying structures and mechanisms. As for the evolutionary debate, Chomsky has had little to offer other than his doubts concerning the likely role of natural selection in shaping the structure of language. This scepticism evidently stems, in part, from

the belief (shared with many other linguists, e.g. Bickerton 1990 and Jackendoff 1994) that language is not so much a system of communication, on which social selection pressures might indeed have come to bear, as it is a system for mental representation and thought. In any event, Chomsky has conspicuously left to others the social, psychological and biological issues that his work has raised.

The first to take up the challenge was Eric Lenneberg (1967). His book (to which Chomsky contributed an appendix on 'The formal nature of language') is still among the most biologically sophisticated, thoughtful and stimulating introductions to the biology of language. Lenneberg drew on a mass of clinical, comparative and evolutionary data to construct a theory of epigenetic development, according to a relatively fixed maturational schedule, with 'critical periods' for the development of speech and language. Lenneberg saw language as a self-contained biological system, with characteristic perceptual, motoric and cognitive modes of action; for its evolution he proposed a discontinuity theory, intended to be compatible both with developmental biology and with the newly recognised unique structure of language.

Other researchers were less willing to accept a gap in the evolutionary record. Indeed, it was apparently concern with the discontinuity implicit in the new linguistics that prompted the New York Academy of Sciences in 1976 to sponsor a multidisciplinary, international conference entitled 'Origins and Evolution of Language and Speech'. In his opening remarks at the conference, Stevan Harnad observed:

Virtually all aspects of our relevant knowledge have changed radically since the nineteenth century. Our concept of language is totally altered and has become both more profound and more complex. The revolution in linguistics due to Noam Chomsky has provided a very different idea of what the nature of the 'target' for the evolutionary process might actually be. (Harnad, Steklis and Lancaster 1976: 1)

While assembling many diverse and often still useful contributions on virtually every topic that might conceivably bear on the evolution of language, the conference did little to meet the challenge it had undertaken to address. In fact, its main achievement was to reveal the fierce recalcitrance of the problem, and the need for a more sharply focused attack on the evolution of linguistic form.

Such an attack came first from Derek Bickerton (1981, 1990, 1995, 1998), a linguist and an expert on pidgins and creoles. Bickerton has been at the controversial center of discussions on language evolution for nearly twenty years, and several aspects of his work deserve comment. First is his contribution to the continuity/discontinuity debate. Our difficulties arise, according to Bickerton, because we have focused too heavily on communication instead of on more

basic systems of underlying representation. Natural selection favours increasingly complex systems of perceiving and representing the world. This is because enhanced sensitivity to aspects of the environment predictably affords an animal advantages over its fellows (cf. Ulbaek 1998). Eventually, however, curiosity, attention and long-term memory reach a point of development such that any further gain in knowledge of the world can come only from more complex representation, and this is what language provides. 'Language . . . is not even primarily a means of communication. Rather it is a system of representation, a means for sorting and manipulating the plethora of information that deluges us throughout our waking life' (Bickerton 1990: 5).

How and when did the new representational system arise? According to Bickerton, the first step was taken by *Homo erectus* somewhere between 1.5 million and five hundred thousand years ago. This was the step from primate-style vocalizing into 'protolanguage', a system of arbitrary vocal reference that called only 'for some kind of label to be attached to a small number of preexisting concepts' (Bickerton 1990: 128). Bickerton's protolanguage is a phylogenetic precursor of true language that is recapitulated in the child (cf. Lamendella 1976), and can be elicited by training from the chimpanzee. Speakers (or signers) of a protolanguage have a referential lexicon, but essentially no grammatical items and no syntax. Bickerton justifies the concept of protolanguage as a unitary mode of representation, peculiar to our species, because it emerges, naturally and in essentially identical forms, through mere exposure to words. This happens not only in children under age two, but also in older children deprived of language during the 'critical period,' and even in adults obliged to communicate in a second language of which they know only a few words. The pidgins of the Caribbean and the Pacific, and of Russian and Scandinavian sailors in the Norwegian Sea, are adult forms of protolanguage.

The final step, the emergence of syntax in anatomically modern *Homo sapiens*, is more problematic. In his first book, *Roots of Language* (1981), Bickerton argued for the gradual evolution of a syntactic 'bioprogram', a dynamic, epigenetic process according to which language unfolds in the child, guided by the ambient language. He stressed that 'evolution has advanced not by leaps and bounds, but by infinitesimal gradations' (Bickerton 1981: 221). In his second book, however, Bickerton (1990: 177ff.) was troubled by logical difficulties in conceiving an 'interlanguage' that might have mediated between protolanguage and full language. He abandoned his gradualist bioprogram in favor of Chomskyan UG, and proposed a saltationist account of its origin. To support this account he drew on three main lines of evidence. First was fossil evidence for a sudden increase in the hominid 'tool kit' (bladed tools, cave paintings, stone figurines, lunar calendars and other artefacts) at the '*erectus-sapiens* interface',

without any corresponding increase in brain size. Second were studies of child development, including the emergence of syntactically structured creole languages out of structureless pidgins in a single generation. Third was evidence, from the distribution of mitochondrial DNA in modern populations, that all modern humans descend from one female who lived in Africa about 220,000 ($\pm 70,000$) years ago (Cann, Stoneking and Wilson 1987). Bickerton proposed this female as the carrier of a single 'crucial mutation' that, in a catastrophic cascade of sequelae, reshaped the skull, altered the form of the vocal tract and rewired the brain (1990: 196).

Prominent archaeological contributors to debates on the evolution of 'modern' behaviour (e.g. Klein 1995; Mellars 1991, 1998) endorsed the notion of some such genetically based cognitive leap. But among evolutionary biologists Bickerton's syntax-generating macromutation met with incredulity and a barrage of forceful criticism. In response Bickerton (this volume) has moderated his position to allow for a slower, though still rapid, process of genetic assimilation through cumulative 'Baldwin effects' (Baldwin 1896). On this account, syntax emerged by cognitive exaptation of thematic roles (Agent, Theme, Goal) that had already evolved in the service of a social calculus of reciprocal altruism.

Criticism of Bickerton's saltationist Darwinism doubtless owed much of its vigour and confidence to a change in intellectual climate precipitated by the 'selfish gene' revolution in the life sciences (Hamilton 1964; Trivers 1971; Dawkins 1976). Notice of the impact of this revolution on linguistics was served by Steven Pinker and Paul Bloom, who broke the barrier between generative linguistics and language evolution with a widely discussed article entitled 'Natural language and natural selection' (Pinker and Bloom 1990). In this article, they portrayed the human language faculty (specifically, the capacity for generative grammar) as a biological adaptation that could be explained in standard neo-Darwinian terms (see also Newmeyer 1991). Appearing in a respected and widely read interdisciplinary journal, *Behavioral and Brain Sciences*, the article situated language evolution for the first time as a legitimate topic within the natural science mainstream, prompting a debate that has continued to this day.

In championing gradualist Darwinian adaptationism against the scepticism of Chomsky and others, Pinker and Bloom in fact set themselves a modest agenda. They attributed the language module to unspecified selection pressures whose onset they traced to the Australopithecine stage. They exempted themselves from having to offer a more precise or testable theory by arguing that Darwinians need not address the emergence of novelty, being required only to provide evidence that a novel adaptation – once it has emerged – confers fitness. The two authors therefore by their own admission said 'virtually nothing' (Pinker and Bloom 1990: 765) about language origins. They were satisfied

with having established language as a biological adaptation, its evolution falling within the remit of standard Darwinian theory.

We may easily suppose that the evolution of language is unproblematic since it seems so beneficial to all. Indeed, as Nettle (1999a: 216) has pointed out, Pinker and Bloom in their seminal paper clearly take this view:

[There is] an obvious advantage to being able to acquire information second-hand: by tapping into the vast reservoir of knowledge accumulated by other individuals, one can avoid having to duplicate the possibly time-consuming and dangerous trial-and-error process that won that knowledge. (1990: 712)

For a strategy to evolve, however, it must not only increase fitness, but also be *evolutionarily stable*. That is, there must be no alternative strategy which gives competitors higher fitness. In the case of information exchange, there are such strategies: individuals who deceive others in order to further their own interests, or who ‘freeload’ – enjoying the benefits of cooperation without paying the costs – will, under most circumstances, have higher fitness than those abiding by the social contract (Nettle 1999a: 216). In the light of what we know about the ‘Machiavellian’ manipulative and deceptive strategies of the great apes (Byrne and Whiten 1988), it is far from self-evident that reliance on *second-hand information* would have been a viable strategy for early hominids. Or rather, unless there were additional mechanisms to ensure against *cheating on contractual understandings*, it would seem that language could not have been adaptive (Nettle 1999a; Knight 1998; Power 1998, this volume). We return to this point.

Pinker and Bloom dated language to some two to four million years ago, arguing that it allowed hominids to share memories, agree on joint plans and pool knowledge concerning, say, the whereabouts of food. Built into this model was the assumption that something resembling the lifestyle of extant hunter-gatherers was already being established during the Plio-Pleistocene. Such an approach has one clear advantage: it apparently allows sufficient time for slow, gradualist evolution of the posited complex module. However, palaeolithic archaeologists have been unable to confirm claimed evidence for hunter-gatherer levels of cooperation among Australopithecine or other early hominids. Even as brain size exceeded the ape range, corresponding lifestyles seem to have remained essentially primate-like: *Homo erectus* males may have been relatively competent hunters and scavengers, but they were not provisioning dependents with hunted meat carried back to base camps (O’Connell et al. 1999). If these hominids had ‘language’, then it seems remarkable how little its effects show up in the archaeological record, which affords no evidence for home bases, logistically planned hunting, personal ornamentation, art or ritually enforced

social contracts until late in the Pleistocene (Bickerton 1990; Binford 1989; Knight 1991; Mithen 1996, 1999; Stringer and Gamble 1993).

While these debates were under way, primatologist Robin Dunbar (1993, 1996) intervened with a substantially novel methodology and explanatory framework. In work conducted jointly with palaeontologist Leslie Aiello (Aiello and Dunbar 1993), he correlated language evolution with the fossil record for rapid neocortical expansion in *Homo sapiens*, dating key developments to between 400,000 and 250,000 years ago. For the first time, this work specified concrete Darwinian selection pressures driving language evolution. The outcome was a model consistent with primatological theory and testable in the light of palaeontological and archaeological data.

Dunbar (1993) set out from the observation that primates maintain social bonds by manual grooming. Besides being energetically costly, this allows only one individual to be addressed at a time; it also occupies both hands, precluding other activities such as foraging or feeding. As group size in humans increased, multiplying the number of relationships each individual had to monitor, this method of servicing relationships became increasingly difficult to afford. According to Dunbar (1993), the cheaper method of 'vocal grooming' was the solution. Reliance on vocalisation not only freed the hands, allowing simultaneous foraging and other activities, but also enabled multiple partners to be 'groomed' at once.

For Dunbar, the switch from manual to vocal grooming began with the appearance of *Homo erectus*, around two million years ago. At this early stage, vocalisations were not meaningful in any linguistic sense but were experienced as intrinsically rewarding, much like the contact-calls of geladas and other primates. Then from around four hundred thousand years ago, with the emergence of archaic *Homo sapiens* in Africa, 'vocalisations began to acquire meaning' (Dunbar 1996: 115). Once meaning had arrived, the human species possessed language. But it was not yet 'symbolic language'. It could enable gossip, but still fell short of allowing reference to 'abstract concepts' (Dunbar 1996: 116). Language in its modern sense – as a system for communicating abstract thought – emerged only later, in association with anatomically modern humans. According to Dunbar, this late refinement served novel functions connected with complex symbolic culture including ritual and religion.

Dunbar's account left many questions unanswered. Darwinians have recently come to understand that the discernible costliness of animal signals underscores their reliability (Zahavi 1987, 1993; Zahavi and Zahavi 1997). This requires us to build into Dunbar's model some way of explaining how the low-cost vocalisations which we term 'words' could have replaced costly manual grooming in signalling commitment to alliance partners (Power 1998). We also need to

explain language's most remarkable, distinctive and unprecedented feature – its dual hierarchical structure of phonology and syntax. Instead of highlighting such challenges, Dunbar sought to minimise them by suggesting continuity with primate vocal communication. For example, he pictured the vocal signalling of vervet monkeys as 'an archetypal protolanguage', already incipiently speechlike. These monkeys, in Dunbar's view, are almost speaking when they emit 'quite arbitrary' sounds in referring to 'specific objects'. Grammar, argues Dunbar, is present long before human language, being central to primate cognition including social intelligence (cf. Bickerton, this volume). Dunbar has not addressed the problem of how 'meanings' came to be attached to previously content-free vocalisations; he glosses this development as a 'small step' not requiring special explanation (1996: 141). Nor does he see any theoretical difficulty in his scenario of premodern humans 'gossiping' in the absence of 'symbolism', their vocalisations counting as 'language' even though not permitting 'reference to abstract concepts'.

For psychologist Merlin Donald (1991, 1998) and for neuroscientist Terrence Deacon (1997), by contrast, the question of how humans, given their non-symbolic primate heritage, came to represent their knowledge in symbolic form is the central issue in the evolution of language. The emergence of words as carriers of symbolic reference – without which syntax would be neither possible nor necessary – is the threshold of language. Establishment of this basic speech system, with its high-speed phonetic machinery, specialised memory system and capacity for vocal imitation – all unique to humans – then becomes 'a necessary step in the evolution of human linguistic capacity' (Donald 1991: 236; cf. Deacon 1997: ch. 8).

What selective pressures drove the evolution of the speech system? Donald (1991) starts from the assumption that the modern human mind is a hybrid of its past embodiments, still bearing 'the indelible stamp of [its] lowly origin' (Darwin 1871: 920). Much as Bickerton takes the structureless word strings of modern pidgins as evidence for a protolanguage, Donald finds evidence for a prelinguistic mode of communication in the gestures, facial expressions, pantomimes and inarticulate vocalisations to which modern humans may have recourse when deprived of speech. 'Mimesis' is Donald's term for this analog, largely iconic, mode of communication and thought. The mode requires a conscious, intentional control of emotionally expressive behaviours, including vocalisation, that is beyond the capacity of other primates. We are justified in regarding mimesis, like Bickerton's protolanguage, as a unitary mode of representation, peculiar to our species, not only because it emerges naturally, independent of and dissociable from language, in deaf and aphasic humans unable to speak, but also because it still forms the basis for expressive arts such

as dance, theatre, pantomime and ritual display. The dissociability of mimesis from language also justifies the assumption that it evolved as an independent mode before language came into existence.

Despite the current dominance of speech-based communication, we should not underestimate the continuing power of mimesis. Donald builds a strong argument for the necessity of a culture intermediate between apes and *Homo sapiens*, and for the value of a prelinguistic, mimetic mode of communication as a force for social cohesion. *Homo erectus* was relatively stable as a species for well over a million years, and spread out over the entire Eurasian land mass, its tools, traces of butchery and use of fire affording evidence of a complexity of social organization well beyond the reach of apes. Of particular importance for the evolution of language would have been the change in habits of thought and communication that a mimetic culture must have brought in its train. Mimesis, Donald argues, established the fundamentals of intentional expression in hominids, and laid the basis on which natural selection could act to engender the cognitive demand and neuroanatomical machinery essential to the emergence of words and of a combinatorial syntax as vehicles of symbolic thought and communication.

Can we specify more precisely the symbolic function fulfilled by words and syntax? As we have seen, many linguists insist that the primary function of language is conceptual representation, not communication. If we were to accept this argument, we would have no a priori grounds for attributing language to the evolutionary emergence of novel strategies of social cooperation. Most chapters in this book, however, take a different view. Language – including its distinctive representational level – is intrinsically social, and can only have evolved under fundamentally social selection pressures. Perhaps the most sophisticated, ambitious and elaborate presentation of this case was made by Terrence Deacon (1997) in his extraordinary book, *The Symbolic Species*, a work unique in its subtle meshing of ideas from the behavioural and brain sciences. Here, Deacon argues that language emerged concurrently with the emergence of *social contracts*. A contract, he observes, has no location in space, no shape or color, no physical form of any kind. It exists only as an idea shared among those committed to honouring and enforcing it. It is compulsory – one is not allowed to violate it – yet wholly nonphysical. How, then, might information about such a thing be communicated?

Deacon's insight was that nonhuman primates are under no pressure to evolve symbolic communication because they never have to confront the problem of social contracts. As long as communication concerns only current, perceptible reality, a signaller can always display or draw attention to some feature as an index or likeness of the intended referent. But once evolving humans had begun

to establish contracts, reliance on indices and resemblances no longer sufficed. Where in the physical world is a 'promise'? What does such a thing look like? Where is the evidence that it exists at all? Since it exists only for those who believe in it, there is no alternative but to settle on a conventionally agreed symbol. In Deacon's scenario, such a symbol would originally have been an aspect of the ritual involved in cementing the contract. Selection pressures associated with such novel deployment of ritual symbolism led to the progressive re-engineering and enlargement of the primate brain.

Deacon argues that the key contracts whose symbolic representation pre-adapted humans for linguistic competence were those through which human females, increasingly burdened by child care, managed to secure long-term commitment from males. This argument ties in closely with recent Darwinian theory premised upon potential male/female sexual conflict, and brings speculation about the origins of language into the domain of anthropology in its widest sense – including current debates in sexual selection and mate choice theory, palaeoanthropology, evolutionary psychology, human palaeontology, archaeology and social anthropology. If Deacon is right, then his argument would add force to a growing contemporary awareness that language evolution must have been driven by strategies not just of cooperative males, but crucially of females (cf. Dunbar 1996; Key and Aiello 1999; Knight 1991, 1998, 1999, this volume; Knight et al. 1995; Power and Aiello 1997; Power 1998, this volume). In any event, regardless of the fate of Deacon's detailed anthropological scenario, his work in 'putting it all together' has raised our collective sights, lifting us decisively to a new plane.

The present book is the second published outcome of a series of international conferences on the evolution of language. Like its predecessor (Hurford et al. 1998), it addresses the need for a sharply focused attack on the evolution of language from a post-Chomskyan perspective. We have limited it to papers that deal directly with some aspect of form or function *unique to language* – points at which continuity with lower primate cognition and communication seems most difficult to establish.

In the introduction to the previous volume, we remarked on 'the interactive evolutionary spiral through which both individual language capacity and a communal system of symbolic communication must have more or less simultaneously emerged' (Hurford et al. 1998: 4). Yet few of the chapters in that volume in fact discussed that interactive spiral. By contrast, roughly half the chapters in the present volume are concerned directly or indirectly with language transmission across generations. One reason for this is their concern with social function. For only its early social function, whatever that may have been, can have launched language on its evolutionary path.

General recognition of this simple fact has perhaps been hindered by Chomsky's (1986) proscription of externalised language (E-language), the Saussurean language of the community, as a coherent object of linguistic and psychological study. Students of language evolution have instead chosen as their proper object of study Chomsky's internalised language (I-language), a structural property of an individual mind/brain. For Darwinians, an attraction of this focus is that the individual (or the gene), not the group, is the unit of natural selection in any adaptively complex system. But we have yet to work through the implications of the fact that it is only through exposure to fragments of E-language, to the utterance-meaning pairs of daily conversation, that a child learns its I-language. It is through others' performance – in other words, through language as embodied in social life – that speakers internalise (and, in turn, contribute to) the language in which they are immersed.

Theoretical models of such social processes are necessarily speculative, top-heavy with questionable assumptions, even when they draw on hard facts, such as the energetic costs of brain growth or fossil evidence of neuroanatomy. Mathematical modelling is often then the best method we have for objective testing of our assumptions. The following chapters illustrate several modes of mathematical modelling. Jason Noble, for example, applies game theory to test the Krebs-Dawkins predictions of the cooperative or competitive social conditions under which communication systems might arise (Krebs and Dawkins 1984). He assesses, within the limits of his own assumptions, a powerful, hitherto untested, verbal argument that has had wide impact on theories of animal communication. At the other end of the volume, Mark Pagel pursues the analogy between languages and species (Darwin 1871: ch. 3). He draws on methods from mathematical statistics, previously used to gauge past species diversity and rates of speciation, to estimate prehistorical language diversity and rates of change. He also estimates mathematically the role of both intrinsic ('glottochronological') and extrinsic (ecological and cultural) factors in language change.

Perhaps most remarkable among the modelling chapters are those that simulate social interaction between speakers and learners (Bart de Boer, Simon Kirby, James Hurford and others). Here, aspects of linguistic structure are shown to arise by self-organisation from the process of interaction itself without benefit of standard selection pressures. These papers might be read as an unexpected, if only partial, vindication of Chomsky's scepticism concerning the relevance of Darwinian evolution. Certainly, they promise a sharp reduction in the amount of linguistic structure that has to be attributed to natural selection. Computer simulations of birth, social engagement in linguistic action, and death, within a group of individuals, promote a novel view of language as an emergent, self-organising system, a view as unfamiliar to biologists and psychologists as to linguists.

Yet to explain the emergence of group phenomena from the premises of Darwinian individualism is certainly not a new idea. We have long recognised that biological processes involve complex hierarchies, with structure manifested on more than one level. The need to distinguish between analytic levels, and the possibility of modelling major evolutionary transitions between them, have indeed become central to modern Darwinism (Maynard Smith and Szathmáry 1995). Genes as such are never altruistic; yet few today would dispute that it is precisely gene-level 'selfishness' which drives the emergence of altruism and cooperation at higher levels. Many of the contributors to this book argue that linguistic communication emerges and varies as an expression of distinctively human coalitionary strategies. Such models acknowledge no incompatibility between the methodological individualism of modern Darwinism and the group-level focus of much social, cognitive and linguistic science (Dunbar, Knight and Power 1999; Nettle 1999b).

Linking all the following chapters is the idea that language is no ordinary adaptation, but will require 'special' Darwinian explanation (cf. Maynard Smith and Szathmáry 1995). This is explicit in Part I, which isolates biologically anomalous levels of social cooperation as central to the evolutionary emergence of language. It remains a theme in Part II, in which emerging phonetic competence is attributed to unique evolutionary pressures for vocal imitation, social learning and other forms of social transmission. Finally, it is central to Part III, where the emergence of syntax is acknowledged to be entangled in complex ways with novel social and cultural strategies. Language, in short, is remarkable – as will be any adequate Darwinian explanation of its evolution.

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PART I

THE EVOLUTION OF COOPERATIVE COMMUNICATION

Introduction: The Evolution of Cooperative Communication

CHRIS KNIGHT

‘Selfish gene’ Darwinism differs from earlier versions of evolutionary theory in its focus on one key question: Why cooperate? The faculty of speech which distinguishes *Homo sapiens* from other species is an aspect of human social competence. By inference, it evolved in the context of uniquely human strategies of social cooperation. In these chapters, therefore, Darwinism in its modern, socially aware form provides our theoretical point of departure.

Where, previously, attention has focused on speech as the biological competence of individuals, here our themes are social. To study communication is inevitably to study social structure, social conflict, social strategies, social intelligence. Communication, as Robbins Burling observes in the next chapter, ‘does not begin when someone makes a sign, but when someone interprets another’s behaviour as a sign’. Reminding us of this elementary principle, Burling spells out the logical corollary: where the evolution of language is concerned, it is comprehension, not production, which sets the pace. Even a purely instrumental action, after all, may be read by others as a signal. Where this has evolutionary significance, instrumental behaviour may then undergo modification in the service of novel, socially conferred, signalling functions. Chomsky’s focus upon the innate creativity of the speaker has been enormously productive. But over evolutionary time, Burling points out, ‘the only innovations in production that can be successful, and thus consolidated by natural selection, are those that conform to the already available *receptive* competence of conspecifics’. If Burling is correct, then that syntactical structure which so radically distinguishes speech from nonhuman primate signalling must have become progressively elicited and then consolidated by generations of comprehending listeners. First, conceptual complexity is ‘read into’ signalling by the attentive mind reader; subsequently, the signaller – given such encouragement – may succeed in externalising aspects of that complexity in the signal itself.

Consistent with this scenario, one possible speculation is that speech emerged in the human lineage thanks to novel levels of care, solicitude and understanding shown by mothers toward immature offspring. Drawing on Tomasello's work, Burling cites the infant chimpanzee 'nursing poke' – a conventionalised begging gesture suggestive of a human speech act. To this might be added the 'head nod', 'head shake', 'wrist flap' and 'tap/poke' – cognitively expressive gestures, each with its own meaning, used by immature apes in playful interaction with each other or with mothers (Blount 1990: 429). Poignantly, however, such incipiently symbolic signs do not survive into adulthood. As potential 'memes', therefore, they lack any prospect of being passed on. Each mother-infant dyad or immature peer group is condemned within each generation to 'reinvent the wheel'.

Associated with this is a social fact: whereas the human infant may anticipate long-term kin-based solicitude, benefiting from social provisioning well beyond infancy, the young chimp, from around age five, must fend for itself. Deprived of the prospect of caring support, it abandons the now irrelevant nursing poke along with any other subtle indications of need. Given the competitive exigencies of impending adulthood, the best preparatory training for the ape youngster may in fact be to *avoid* excessive reliance on cooperative understanding from others. From this perspective, elaboration of symbolic potential as young apes mature appears constrained less by cognitive deficits than by a decisive *social* one – the obvious absence, in the wild, of any unconditionally supportive or caring audience. Why bother to elucidate one's aims or interests to others who may at best show indifference – or at worst exploit such intelligence for their own ends?

Jason Noble takes up the theme of cooperation versus competition to ask whether a 'pure' state of competition is consistent with any kind of signal evolution at all. He sets out to test a theory first proposed by John Krebs and Richard Dawkins (1978), according to whom conflict in the animal world leads to costly, manipulative signalling. Noble's simulations suggest that contrary to these authors' expectations, intensification of competition does not culminate in maximally manipulative, inefficient signals. Rather, the outcome is simply a breakdown in all communication. If empirically confirmed, this would endorse the more traditional standpoint of theoretical linguistics, linking communication with shared interests. However, we need not assume generalised social harmony. According to Zahavi and Zahavi (1997), even violent antagonists may communicate on the basis of interests which they share. Predator and prey, for example, may share an interest in avoiding a chase if the potential victim is able to demonstrate that pursuing it would be a waste of time. Likewise, human military combatants may seek to retain at least certain honest channels of communication to avoid costly misunderstandings.

From all this, it would appear that there is no ultimate incompatibility between Noble's findings, Zahavi's and the tenets of Krebs and Dawkins. In the real world, both competition and cooperation may prevail simultaneously, albeit on different levels. Babblers collectively 'mobbing' a predator, for example, are on one level cooperating. Yet on another, they are competing in advertising to one another their ability to afford taking such risks (Zahavi and Zahavi 1997).

Dessalles (1998) roots speech evolution in a comparable dynamic, in which status-seeking individuals compete to emit signals perceived as relevant by their peers. Dissolving simplistic dichotomies, such behaviour might be termed 'competition to cooperate'. Consistent with Krebs and Dawkins, however, is the finding – confirmed from all sides – that fast, cheap, efficient communication presupposes at least *some level* on which interests converge. Signals become costly and inefficient – culminating eventually in physical violence – in proportion as mutual conflict on that level intensifies.

In his contribution to this volume, Dessalles sets out to delineate more precisely the cooperative social matrix in which speech must therefore have evolved. With Dunbar (1996), Deacon (1997) and many others, he posits an evolutionary background in which increasingly large, stable coalitions engage in group-on-group competition and local conflict. The decisive selection pressure is status-linked social inducement to provide information relevant to the concerns of one's own group. Dessalles accepts that such coalitionary activity amounts to cooperation, driven by strategies of reciprocal altruism which are a precondition for the evolution of speech. In his view, however, speaking as such is *not* reciprocal altruism.

A speaker, according to Dessalles, does not donate valuable information on a tit-for-tat basis, checking to ensure repayment in kind. Rather, it is listeners – not speakers – who are left to pay the costs of checking up on cheats. This is because, whether honestly or dishonestly, speakers are always striving to persuade their audience to reward them with status. Those coalitions which can award such status, according to Dessalles, are 'groups of individuals showing solidarity in action, i.e. being able to take collective decisions'. In competing against the out-group, each coalition seeks to allocate *internal* status exclusively in return for relevance. Rather than displaying altruism, therefore, conversationalists – like contestants in any competitive board game – strive to win through linguistic 'moves' capable of earning status while diminishing the relative significance of rival contributions.

Why is it that within human coalitions, status is earned this way – whereas in ape society it may be earned more effectively by manipulation or concealment of relevant information? In suggesting an answer, Dessalles points to the intrinsic dynamic of group-on-group conflict, whose effect may be to progressively

exclude physical aggression and/or manipulative signalling from the sphere of *in-group* communication. 'In primate societies, the company of strong individuals is much sought after. From the perspective we propose, relevant information may have replaced physical strength as a determining factor in the decision to join a coalition and remain in it'. As threats and correspondingly exploitative signals become reserved for outsiders, internal status – emancipated from determination by such factors – becomes allocated on quite different grounds. Internally, signallers may now avail themselves of a novel opportunity – to compete in producing messages valued by other members of their group. As Dessalles concludes: 'Social status among humans is not extorted by brute force. It emerges from others' willingness to establish social bonds with you. The decision to become closer to somebody is taken according to definite criteria. Linguistic relevance may be an essential component of this choice'.

Adopting the same perspective with respect to coalitionary dynamics, status and relevance, Camilla Power reminds us of the evolutionary centrality of sexual and reproductive strategies. In Power's model as in those of Dunbar (1996) and Knight (1991), the stable coalitions responsible for speech arise out of long-term strategies of reciprocal altruism between *females*. A key area of potential conflict between females is the issue of differential male sexual attention and associated provisioning. In particular, according to Power, pregnant and nursing mothers may experience younger and/or imminently fertilisable local females as a sexual threat. In Power's model, they respond by coercively controlling and bonding with pubescent females from the moment of menstrual onset. Signals of imminent fertility, which might potentially incite males to differentially target menstruants, are now deliberately scrambled.

On this basis, Power explains the ethnographic pattern in which first menstrual onset in pubescent girls triggers coercive initiation into a ritual group. Although the subjects of such treatment surrender freedom of movement and incur numerous immediate costs, in the longer term these should be outweighed by benefits. Each menstruant will one day be a nursing mother herself, whereupon she will reap the benefits of a coalitionary strategy aimed at preventing younger or more attractive female rivals from gaining disproportionate provisioning and attention. Moreover, the costly and often painful process of initiation has intrinsic value, acting as a demonstration of personal commitment. Here is Power's answer to Dessalles's question about how listeners can check up on 'cheats' – speakers who falsely gain status by faking the relevance of their utterances. In Power's model, nobody even listens to speakers who have not already paid the costs of initiation into the secret society or coalition. Gossip depends on the relationships of trust that are established as commitment to the sisterhood is signalled via hard-to-fake, costly display. Relevance-based in-group status allocation operates only within such a framework.

Power demonstrates the precision with which this model's expectations match details of the ethnography of women's 'secret' language use in the context of African initiation rites. In her case studies, however, in-group solidarity is neither uniform nor unconditional. Instead, ritually bounded coalitions do show internal status differentials. Depending on their status, speakers can control or determine the relevance and availability of vital social information – such as who has been having sex with whom, or who has fathered a given child. 'Gossip' is the exchange of *social* information; inevitably, it is manipulated to serve sectional interests. The relevance or irrelevance of an utterance, according to Power, depends less on any objective informational content than on *prior* ritually established relationships linking the speaker with her audience.

Power observes that during an actual ritual performance, or when deployed to signal ritual status, an utterance may be accepted as relevant despite lack of propositional meaning or content. Theoretically, even a nonsense rhyme learned during initiation might appear relevant. This recalls Maurice Bloch's (1975) ethnographic study, in which Merina political elders display ritual status through verbose speeches almost devoid of creativity, syntactical combinatoriality or any novel content. At first sight, all this might seem in conflict with Dessalles's expectation that status should depend on linguistic relevance. Ethnography indeed suggests the reverse possibility: where the purpose of signalling is to display evidence of ritually conferred status, the most relevant strategy may be to produce propositionally meaningless, repetitive verbiage.

If this is accepted, then to retain consistency with Dessalles, we must distinguish between two contrasting settings in which 'authorised language' (Bourdieu 1991) is used. Where internal status differentials are in the process of being established by *ritual* as opposed to verbal means, we expect displays or negotiations of such status to violate Dessalles's 'relevance' maxims. In such contexts – as Power shows – signalling may be relevant without informational content and without making any contribution to collective decision making or problem solving.

'Relevance' in Dessalles's terms, however, cannot be a property of nonsense rhymes or ritualistic, repetitive verbiage. Neither can it be a feature of simple ritual marks such as bodily scars, cosmetic designs or tattoos. Where group members demand information relevant to cooperative decision making, the necessary vehicle is syntactical speech. Here, the social matrix is one in which preordained status can be ignored, for the simple reason that in principle, everyone shares the same such status. In this democratic setting, the ground is cleared for a quite different contest, in which communicators make no prior assumptions about status differentials dividing them. Conversationalists set out with a level playing field, in which the contest is to provide information of value to the group. Power has outlined a persuasive, ethnographically testable

model to explain how such status-conferring groups in the human case came to be established.

Knight turns from an examination of costly ritual signals to an examination of low-cost symbolic communication. Young primates frequently engage in play behaviour, whose make-believe creativity often seems suggestive of human cultural symbolism. In contrast to primate vocal signalling, the playful gestures of young apes may be rich in cognitive expressivity and complexity. Whereas ape vocal calls are analog indices of physical and/or emotional condition, the distinction between a play bite and its functional prototype is cognitive and categorical. Whereas ape vocal calls, when delivered in sequence, can yield only a blended compromise between meanings, a gesture indicating 'This is play!' may systematically reverse the significance of subsequent 'chases' or 'bites'. If we are seeking a primate precursor for speech creativity and combinatoriality, Knight suggests that the most convincing candidate is primate play.

But if conversational speech including humour in the human case extends and develops the creative, combinatorial potential of immature primate play, then we must ask how the conditions for such creativity came to be extended into adulthood during the course of human evolution. For Knight, the key factor acting to deny animals freedom to play is reproductive competition and conflict. The onset of sexual maturity brings with it the Darwinian imperative to engage in potentially lethal sexual competition. In the primate case, this impinges upon life concurrently with sexual maturity, setting up anxieties, divisions and status differentials which permeate and effectively constitute adult sociality. If imaginative playfulness diminishes in frequency, it is because autonomous, freely creative expressivity is simply not compatible with a situation in which individuals feel anxious or externally threatened. Admittedly, adult primates – most notably bonobos – do sometimes play with one another. But as competitive stresses intensify, the dominant tendency is for play fights to give way to real ones. On a more general level, by the same token, involvement in shared make-believe yields to a more narrow preoccupation with the serious competitive imperatives of adult life.

Among humans, however, the transition to adulthood takes a different form. Human offspring go through an extended period of childhood followed by adolescence (Bogin 1997). During this extended period, the young are enabled to rely to a considerable extent on social as opposed to 'fend-for-yourself' provisioning. Hunter-gatherer ethnography demonstrates in addition that at a certain point, young adolescents become coercively incorporated into ritual coalitions. Rites of initiation – central to intergenerational transmission of human symbolic culture – may be viewed as a modality of animal play. In fact, they are spectacular 'pretend-play' performances, drawing on hallucinatory techniques

such as trance, dance, rhythm, face painting and so forth. Whether or not genital mutilation is involved, the declared aim is to curb individualistic pursuit of sexual advantage. Bonds of coalitionary solidarity, typically modelled on sibling solidarity, are accorded primacy over sexual bonds.

How did such coalitions and associated rituals become established? Power's model of reciprocal altruism within female coalitions suggests a route through which the playfulness of infancy and childhood might have been preserved into adult life. If young fertile females are simply *prohibited* from presenting themselves as objects of male competitive attention, being instead retained under control by siblings and other protective kin, then such kin-based coalitionary solidarity might reduce sexual conflict and so establish extended opportunities for adults to engage in 'play'. Knight argues that with the emergence of *Homo sapiens*, the childhood significance of kinship indeed became preserved within adult sociality, overriding sexual bonds and thereby opening up a new social space within which language – an extension of the creativity of primate play – could now for the first time flower.

What is clear from all these contributions is the extent to which they dovetail and support one another. Burling sets the scene by reminding us that speakers could not effectively innovate in the absence of prior understanding on the part of listeners. The ensuing chapters in their different ways explore the evolutionary roots of such creative and rewarding acts of cooperative understanding. All are agreed that speech evolved to enable thoughts to be shared, its emergence inseparable from distinctively human strategies of social cooperation.

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Comprehension, Production and Conventionalisation in the Origins of Language

ROBBINS BURLING

The Priority of Comprehension

This chapter explores the implications of two observations that should be reasonably obvious, or at least familiar, but when they are considered together, they lead to an unfamiliar but interesting way of thinking about the early stages of language. The first of the two observations is simply that all of us, humans and animals alike, are always able to understand more than we can say. Comprehension runs consistently ahead of production. The second observation extends the first: both humans and animals are sometimes able to interpret another's instrumental behavior even when that other individual had no intention at all to communicate. In the first part of this chapter I seek to justify these two observations. I will then consider their implications for our understanding of the origins of language.

Children, who appear to learn their first language with such magical ease, give us the most familiar example of the priority of comprehension. Parents are always convinced that their children understand far more than they can say. Linguists have occasionally been sceptical of the superior comprehension of children, partly because a vaguely behaviourist bias makes the 'behaviour' of speaking seem more important than mere 'passive' comprehension, but also for the much better reason that it really is very difficult to study comprehension. How do we know whether or not a child understands, and how do we know how he understands? Hold out a cookie to a child and ask "Do you want a cookie?" When he responds enthusiastically, how do we know whether he understands the words, or simply interprets the situation correctly? It is difficult to prove to the satisfaction of a linguist, let alone some kinds of hard-nosed experimental psychologists, that children always understand more than they can say, but parents are rarely in doubt. At the time when one of my grandsons had a total productive vocabulary of exactly three words, one of which was a loud repeated

grunt meaning 'Give it to me', he could point appropriately not only in response to a request to show his eye, nose or mouth, but also to show his elbow, knee or shoulder. He could point not only to a window or door, but to the wall, ceiling or floor. He appeared to have a receptive vocabulary of hundreds of words at a time when he articulated only three. Comprehension is so consistently ahead of production that we ought to recognize that much that is essential about language learning happens silently as children learn to understand. Speaking should be seen as merely the final step in a long process, the point at which language that is already under firm passive control is finally made active.

Even as adults, we understand more than we can say. We all understand dialects that we cannot produce. English speakers from opposite sides of the Atlantic and from the southern extremities of the globe can generally understand each other with no more than an occasional hitch, but few of them would ever try to speak another's dialect. We all understand words that we would not use. We understand some of the slang of ethnic groups or generations other than our own, even if we would not risk using it ourselves. We understand some technical terminology from fields with which we are only partially familiar. We understand, and even admire, rhetorical styles that we cannot, ourselves, duplicate. In New Guinea people have a nice way of distinguishing receptive and productive skill. They may say 'I can hear that language but I cannot speak it', recognising that it is possible to have a skilled ability to understand a language without the ability to speak.

If we had been clearer about the ability of human beings, both young and old, to understand more than they produce, we might not have waited so long to ask how much spoken human language nonhuman primates can learn to understand. Even if an ape is incapable of uttering a single spoken word, an ability to comprehend would demonstrate some genuine knowledge of a language. Anecdotal reports have suggested that captive chimps have sometimes learned to understand a good deal of spoken language even though they said nothing at all. These reports have sometimes been met with some scepticism for the same reasons that parental claims for their children's ability to comprehend have been doubted, partly because production seems more real than passive comprehension, but also because it is so difficult to measure skill in comprehension. Like people, apes can infer a great deal from the context in which language is used. It is always difficult to know how much any listener, even an ape, depends upon context, and how much upon the language. Hayes and Nissen suggest that Viki learned to understand a considerable amount of spoken English, but they were so eager to teach her to articulate words that they did not systematically study her comprehension (1971). As a result, Viki is remembered for her failure to speak, rather than for her success at understanding.

With the help of Savage-Rumbaugh and her colleagues, Kanzi, the famous bonobo, has now dramatically confirmed the ability of apes to learn to comprehend a significant amount of spoken language (Savage-Rumbaugh et al. 1993). At the age of eight, Kanzi was compared to a two-year-old human girl, and their ability to understand English was remarkably similar. Kanzi, like the girl, was able to respond correctly to a large number of different words and to a considerable variety of spoken sentences. Kanzi's receptive skills give far better evidence of linguistic ability than has ever been shown by any nonhuman primate who has been trained to produce language or language-like signals, whether by articulating spoken words, signing, manipulating plastic chips or pressing buttons. Indeed, Kanzi's ability to comprehend a human language seems sufficiently extensive that he should be credited with a degree of linguistic competence that linguists have most often presumed to be exclusively human. No one need fear that a bonobo or any other ape is about to give serious competition to human children in their speed or thoroughness of language learning, but I do not doubt that Kanzi has learned a good deal of English. The pattern is consistent. Not only humans of all ages, but apes as well, are always able to understand more than they can say.

Ritualisation

Comprehension plays a crucial role in the origin of animal signals, for signals become communicative not when they are first produced, but only when they are first understood. The gestures and vocalisations by which animals communicate with one another develop from acts that were originally purely instrumental (Tinbergen 1952). Instrumental acts are the movements or noises that form a part of the ordinary business of living – moving around, eating, scratching, yawning. Although instrumental behavior is produced with no communicative intent whatsoever, conspecifics may still be able to interpret it. Only after such behavior has come to convey some sort of meaning to another animal can it develop into a specifically communicative signal. A classic example is a dog's snarl.

Snarls began as simple instrumental gestures, nothing more than a part of getting ready to bite. The lip had to be moved out of the way of the teeth, but at first, the gesture had no communicative intent and probably no communicative result. Eventually, however, potential victims came to recognize the retracted lip as a signal that a bite was imminent. Those clever enough to read the signs would then be encouraged to flee, and so they could avoid the bite and live to reproduce. Comprehension, in other words, came before any communication was intended by the snarler. Comprehension was the first step but once the victims were

able to understand, the aggressor was presented with a new opportunity. By retracting his lip as if to bite, he might manage to frighten off his enemy but avoid the much riskier activity of really biting. It might even help to move the lip in a stereotyped or exaggerated manner and so reduce the sign's ambiguity. As production and comprehension of the signal evolved together, the sign can be said to have become 'ritualised', modified from a purely instrumental act into a stereotypic communicative signal.

The instrumental lip movement evolved into a communicative snarl, transmitting information that was useful both to the aggressor and to his potential victim. All this happened, of course, under the slow but relentless pressures of natural selection, and it required no individual learning. The term 'phylogenetic ritualisation' is sometimes used for this process so as to emphasise that signals like the snarl develop by slow evolution, not by rapid learning, but the point that I want to stress here is that the process has to start with comprehension. The ritualisation of the lip movement could not even begin until it was understood. Other animal signs probably began much as did the snarl. Some sort of instrumental gesture or noise that was already being made for purposes other than communication was understood by other animals. Only then could it be ritualised into a specifically communicative signal.

By recognising that comprehension has priority over production, both in our own language and in the origin of animal signals, we can start to solve a puzzle that has hovered over the first appearance of language: what could the first speaker have hoped to accomplish with her first words if no one else was around with the skills to understand her? The puzzle disappears as soon as we recognize that communication does not begin when someone makes a sign, but when someone interprets another's behaviour as a sign. Comprehension must have been ahead from the very beginning. The original behaviour that was understood in a language-like way could not have been intended as a sign at all. A lonely producer who tries out a new kind of sign will almost certainly fail to communicate. A lonely comprehender, on the other hand, may gain considerable advantage by being able to interpret another's actions even when no communication at all had been intended. At every stage of evolution, the selective pressures favouring skill at comprehension are likely to have been considerably more insistent than the selective pressures favouring skill at production. Producers often benefit by *not* giving themselves away. Comprehenders have little to lose and much to gain by understanding more.

The precocity of comprehension implies that at every point along the evolutionary path toward language, understanders needed to be ready before another complexity could be added to production. More accurately: The only innovations in production that can be successful, and so consolidated by natural