Chris Knight, Michael Studdert-Kennedy & James R. Hurford (eds) 2000. *The Evolutionary Emergence of Language: Social Function and the Origins of Linguistic Form.* Cambridge: Cambridge University Press, pp. 1-15.

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 nonhuman 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, (1981), Bickerton argued for the gradual evolution *Roots of Language* 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: l77ff.) 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 (± 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 (l999a: 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 (Nettle1999a: 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 me 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 nonsymbolic 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 modem 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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