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THE HUMAN REVOLUTION

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Let me begin with a self-evident point, perhaps too often taken for granted. When academics participate in conferences and debates, we find ourselves operating under the rule of law. Protocols exist. We must disclose our sources, expose ourselves to criticism and renounce any temptation to use threats, material inducements or force. There is status competition, certainly. But the status of our output is determined on an intellectual basis by peer evaluation alone; we compete to demonstrate relevance in others' eyes.

What applies in academic life applies wherever language is used. Protocols always exist. Compared with academic discourse, informal gossip may be livelier, more relaxed, less abstract and more intimately bound up with non-linguistic modes of expression. But despite such obvious differences, the same principles apply. Civilised intercourse depends on respect for the law. This has nothing to do with any behavioural dominance of certain individuals over others. Legality is a contractual entity, genuine insofar as it is collectively agreed. Once contractual understandings are in place, then and then only can we 'do things with words' (Austin 1978 [1955]; Searle 1996, Bourdieu 1990, Deacon 1997).

This being the case, speech acts are never behavioural. Instead, we proceed as if playing an abstract game. As in chess, moves are made within a hallucinatory world, each intervention digitally specified and effective once its intention has been recognised. To emit a signal – even to transform the entire state of play – no physical investment need be made. In a game of this kind (Wittgenstein 1968), interventions cost nothing at all. In principle, a nod or wink might suffice. What constitutes a move is the fact that it is

agreed to be one – nothing more. Digital information is then transmitted – with intuitive mind reading filling any remaining gaps (Sperber and Wilson 1986).

Language evolved among hunters and gatherers. Hunter-gatherer communities are at least as civilised as any others (Lee 1988). Artificial regulations concerning kinship and marriage are designed to ensure that sex, for example, falls under the rule of law. Ritual taboos surround matters such as incest or menstruation. Protocols and ritual injunctions facilitate sexual circulation – rather in the way that traffic signals in a modern city ensure the flow of traffic. Humans need rules in order to transcend primate-style conflict. The law exists to uphold behaviour of a civilised kind (Lévi-Strauss 1969).

Language is inseparable from civilisation. Should civilisation collapse, the 'magic of words' would suddenly evaporate. Linguists recognise this when they make one of their most characteristic theoretical assumptions – that of a 'homogenous speech community' (Chomsky 1965: 3). The expression is Noam Chomsky's, but the underlying idea is traceable to Ferdinand de Saussure (1974 [1915]). If our postulated community is homogenous, then Darwinism is clearly irrelevant. Questions of sex, power, competition and conflict have no place. Using language is like going to the bank or post office: one must fill in the correct forms and observe the protocols. Speakers and listeners are subject to the rule of law.

It is well known that Chomsky took one component of Saussure's model and rejected the rest. For Chomsky, externally imposed behavioural regulation has nothing to do with language – the relevant principles are internal and innate. Almost everyone today would agree that ritual protocols are one thing – language quite another. They would also agree that linguistic creativity in some way mirrors innate properties of the distinctively human mind. But when Chomsky made his decisive intervention beginning in the 1950s, Darwinism was not fashionable and questions about the evolution of language were not uppermost in his mind. Now that Darwinism in the life sciences has become an unstoppable force, paradoxes accumulated since those early years cry out to be addressed.

Let us accept, with Chomsky, that linguistic theory does indeed presuppose a 'homogenous' speech community. Let us accept an abstract model in which every speaker is equally a listener – linguistic signs are bi-directional and communication flows both ways. By fiat, we have organised a revolution, totally eliminating all inequalities of status and power. We might argue that it is precisely this novel social situation that enables the mind's innate creativity to find linguistic expression: Darwinian politics would obstruct such creativity. But the remaining evolutionary problem now appears almost insurmountable. Given what we know about primate dominance hierarchies and competitive sexual politics, how could human liberation from such conflict have come about?

Wild-living apes may co-operate, particularly if they are related. For much of the time, group members foraging in proximity to one another may be relaxed and sociable. Periodically, however, a ferocious fight breaks out. This may be settled eventually, but it would be stretching credulity to apply the term 'civilised' to political arrangements of

this kind. Apes are under no pressure to operate within the law. They are not like human hunters and gatherers. They do not have formal kinship systems. They do not sustain institutional facts – facts whose existence depends on communal belief. Whether they compete or co-operate, the fact remains that they inhabit a Darwinian world, as all animals do. In such a world, language is not theoretically possible.

Language evolution: methods and approaches

Approaches to the evolution of language may either 'zoom in' or 'zoom out':

- Competing specialists may **zoom in** to identify postulated key factors. Steven Pinker (1997), for example, posits a crucial role played by the FOXP2 gene, whereas Tim Crow (2002) counters with a gene for lateralization on the Y chromosome.

- Multidisciplinary contributions **zoom out** to synthesise perspectives, seeking a view of the wider picture. Examples are Terrence Deacon's (1997) *Symbolic Species* and Michael Tomasello's (1996) *The Cultural Origins of Human Cognition.*

The two strategies complement one another. Without the rival specialist claims, there would be no jigsaw puzzle to assemble. Without the attempts at multidisciplinary integration, the pieces would not interlock and our results would make no sense.

This paper zooms in and also zooms out. The theoretical framework is behavioural ecology – Darwinism in its modern form. The specialist contribution concerns the role of reproductive signals in human evolution. But in order to explain why this topic may be relevant, I begin with a review the multidisciplinary context.

What does it mean to be 'multidisciplinary'?

According to many scholars, the term 'science' means 'natural science'. If linguistics is to count as a scientific discipline, it must therefore define its subject matter – namely, language – as a natural object. Noam Chomsky initiated this turn within linguistics; others have extended it to embrace research into language's evolutionary emergence. Were we to accept Chomsky's approach, multidisciplinary collaboration would have to be restricted to the natural sciences. Fields such as history, law, sociology, social anthropology and social psychology fall outside these sciences. Despite the value of multidisciplinary collaboration as a general principle, the traditionally defined human sciences would have to be excluded, since they do not properly count as science.

In the 1950s, when Chomsky initiated what is often termed the 'cognitive revolution' in linguistics and related fields, it seemed logical to divide up scholarship in this way. It made sense to endow natural science with the status of 'science' to the exclusion of everything else. Social scientists broadly agreed that their work fell on the wrong side of this barrier. Despite certain valiant efforts to be scientific, their disciplines were not truly integrated with the rest of science. Arguably, it was not even desirable to seek integration of this kind.

Since the 1960s and 1970s, however, it has become increasingly impossible to draw the line in this way. In 1964, Bill Hamilton published his paper on kin selection in the

Journal of Theoretical Biology (Hamilton 1964). In 1971, in the *Quarterly Journal of Biology,* Robert Trivers published his first paper on reciprocal altruism. E. O. Wilson published his *Sociobiology: The new synthesis* in 1975. In 1976, Richard Dawkins published the first edition of his best selling book, *The Selfish Gene.*

By the 1980s, the work of these and other theorists had transformed the face of biology. No longer were scientists studying organisms adapting to their environments conceptualised as an external factor. They were studying strategies – in particular, *social* strategies. These scientists' basic question was: 'Why co-operate?' Robert Axelrod (1984), John Maynard Smith (1982) and others adapted game theoretic models from economics, addressing the difficulties faced by contractual strategies in becoming evolutionarily stable. Their new use of economic theory had been rendered possible because genetic fitness now offered a universal currency, enabling costs and benefits to be compared. At around the same time, the great Israeli ornithologist Amotz Zahavi (1975, 1987, 1991, 1993, 1997) was developing his 'handicap principle'. This turned previous thinking on its head by stating that for signals in nature to be effective they must be reliable, while to demonstrate reliability, an apparently wasteful investment must be made and displayed. Given this condition, Zahavi's supporters were able to show, the costs for cheats become higher than those for honest signallers, enabling reliability to be guaranteed in a Darwinian world. All this amounted to a scientific revolution as profound in its implications as any previous intellectual upheaval in history.

Why is this relevant to the evolution of language? It matters because we can no longer divide science in the way recommended by Chomsky in the 1950s. Darwinian scholars today resist drawing any distinction between natural and social science. The study of competition and co-operation is natural science and also social science – albeit social science of an entirely new kind. Why do animals emit signals? How do signals evolve? Are there specific laws of signal selection, different from the laws of ordinary natural selection made familiar by Darwin? To study such questions is to study competitive and co-operative strategies, driven by instincts in turn built by selfish genes. For any Darwinian, language itself is incontrovertibly social. It is social even when we are talking to ourselves. Although statements of this kind would once have been considered heresies, the new Darwinism enables us to say them without thereby abandoning science.

Darwinism, then, qualifies equally as natural science and social science. Everything is cut from the same cloth. Although such unification is exciting, the development is equally a 'dangerous idea' – dangerous because it opens up the prospect of unifying physics, chemistry, genetics, biology, psychology, archaeology, palaeontology, anthropology, economics, law, history and ultimately all human knowledge. The social history of science suggests that integration on this scale may upset the authorities. It might be easier for them if limits were set on this intellectual revolution. A major obstacle to unification is the 'hard problem': the puzzle of language. Language – as Chomsky points out – appears to be 'off the scale'. It seems to have nothing to do with the evolution of communication in nature. For as long as this problem remains unsolved, science will remain a broken mirror. Once we have solved it – should that prove possible – we are likely to see ourselves as never before.

Peacemaking among linguists

Steven Pinker (1994, 1997) is surely right. The explanation we adopt will have to be Darwinian. This is simply because ancestral humans were and remain biological organisms. A theory requiring us to suspend Darwin's laws would not qualify as scientific at all. But despite this, Chomsky is right about the main thing: language is 'special'. It represents an entirely novel principle, without biological precedent. Accounting for novelty was never easy for Darwin or his followers. While continuing to respect evolutionary constraints, we may need a special and unexpected theory to explain a development of this kind. Run-of-the-mill invocations of 'descent with modification' fail to persuade. Pinker's commitment to Darwinian science needs to be retained not routinely, but in full awareness of the scale of challenge posed by language's very existence.

The continuity paradox

'Descent with modification' presupposes a precursor. As Noam Chomsky, Derek Bickerton (1990) and many others have pointed out, primate vocal signals do not qualify. They fail to qualify because they are not computational, not digital, not combinatorial, not syntactical and not stimulus-free. The idea of gradually modifying such calls to yield language does not work. Utter novelty cannot be explained in this way.

To be fair to Pinker, he does not argue for continuity between language and primate vocal signalling. He agrees that language is utterly novel. But he still argues for 'descent with modification', without suggesting any details. Chomsky is entitled to query whether this qualifies as a theory at all.

The dating paradox

Children acquire language as if innately designed to do so. They seem to possess a 'language instinct' (Pinker 1994). But our species' other instincts have non-human counterparts. Apes, for example, get sexually aroused, develop maternal feelings and sometimes become aggressive – very much as humans do. Such continuity makes it straightforward to invoke 'descent with modification'. The language instinct seems to have come from nowhere.

Pinker argues that this impression is illusory. If we take into account five million years of human evolution, intermediate stages can be envisaged. But five million years ago, the relevant ancestral populations were australopithecines: relatively small-brained bipeds. If they had the beginnings of a special new instinct, under what special selection pressures did it evolve? No evidence for symbolic culture can be found at such early dates. How and why did something as anomalous as a computational, syntactical, stimulus-free language even *begin* to get off the ground? Such a development apparently violates signal selection theory, which says that signals must be reliable (Zahavi and Zahavi 1997). Language is the most intrinsically unreliable communicative strategy ever to have become evolutionarily stable. To explain anomaly on such a scale, a concrete theory is required – a theory that addresses such problems.

Chomsky supports the idea that language was a late development, probably associated with the speciation of *Homo sapiens*. But his language organ, if it exists, must be the most complex entity known to science. The difficulty is that *Homo sapiens* emerged at most some 200,000 years ago. Such a time scale rules out the possibility that the 'special'

features of the language faculty evolved through descent with modification. To explain these features, Chomsky and his supporters have therefore turned to alternative possible mechanisms of rapid or even instantaneous change (Hauser, Chomsky and Fitch 2002).

The cognition/communication paradox

It is sometimes suggested that as the human brain became larger and more complex, complex language would automatically have evolved. But it turns out that this is a projection from a single case – the human one. In fact, there is no law associating communicative complexity with cognitive complexity. Wild chimpanzees vocalise at low rates, tend not to respond to calls that they hear, and, when they do respond, tend to give calls that are similar to the ones they have heard (Arcadi 1999). They have much larger brains than, say, vervet monkeys or African grey parrots – but vocalise in ways not noticeably more complex. As Chomsky (2002: 74-5) points out, bees have brains the size of a grass seed. Yet superficially at least, they would appear to have more language-like features in their systems of communication than are to be found in any species of ape. In fact, theoretical considerations might even suggest an *inverse* relationship between cognition and communication. Imagine that certain kinds of signals can be cognitively controlled. These will then be easy to fake. But no primate can afford to rely on potentially deceptive signals or displays. Easy-to-fake demonstrations will therefore be selectively ignored in favour of hard-to-fake alternatives. The signals that prove effective – that is, those under positive selection – will turn out to be those *least* subject to cognitive control, hence *least* capable of mirroring the mind. Apes are in fact poorly adapted to control their vocal signals. Thanks to this, their vocal signals are by human standards wasteful – but overwhelmingly reliable. None of this offers encouragement to Darwinian gradualists. The aim of Pinker and his colleagues is to model how language evolves in a Darwinian world. The difficulty is that signal selection in such a world drives evolution in precisely the wrong direction.

The syntax/meaning paradox

Cetaceans and songbirds display elements of syntax in their learned vocal sequences. But this is strictly phonological, not semantic. Meanwhile, the same animals emit other calls that *do* convey meanings. As the above considerations might have led us to expect, the call-sequences that matter most – the ones conveying the most important meanings – are the least cognitive, the least 'syntactical'. As has been confirmed by Kazuo Okanoya (2000) in his work with Bengalese finches, we have here a kind of 'see-saw'. That is, syntax and meaning are *inversely* related, such that when syntax is raised to the high position, meaning is set low and vice versa. In a nutshell: syntactical control over signals may evolve, but only at the expense of meaning. Syntax entails creatively re-arranging call sequences. But in a Darwinian world, the most reliable signals will be precisely those *resisting* any such 'playful' or 'creative' manipulation (Knight 1988, 2000). Against this background, human language appears theoretically impossible. Both syntax and meaning are set to the 'high' position. As if defying gravity, the horizontal bar of the 'see-saw' has miraculously levitated. 'Descent with modification' is unable to explain how anomaly on this scale could have emerged.

The modality paradox

Language is modality-independent. Where a child suffers from a vocal or auditory impediment, the language faculty finds expression in an alternative modality. Given an appropriate social environment, the child intuitively begins signing, language 'flowing out' quite naturally through the hands instead of the vocal organs. This supports Chomsky's view of language as internal, computational and autonomous with respect to any particular transmission system. No system of communication in the animal world has anything remotely resembling these properties.

The costly signals paradox

In a digital system, switches can be set at zero cost. In the case of speech, for example, voicing may determine the identity of a phoneme, this in turn determining the force of an entire speech-act. Switching voicing to the 'off' position costs nothing, even though it may send an entirely different message. In no animal system of communication can mechanisms of this kind work. Receivers would never allow others to manipulate their mental states so easily. To guard against deception, they rely essentially on the evidence of their senses, evaluating signals on an analogue scale. The signals that get noticed are bound up with the bodies of those emitting them. In an important sense, at least as far as apes are concerned, the audible, visible, tangible body – its position, velocity, size, state of arousal and so forth – *is* the signal. There is no separate digital component capable of reversing or otherwise manipulating that whole signal. This being the case, nothing comes at zero cost. Since according to the Handicap Principle, *senders must invest in their signals,* a separate digital component could not even begin to evolve. Once again, language appears to violate Darwinian law.

The competence/performance paradox

Apes do not have linguistic abilities, but they certainly possess symbolic ones. In captivity, they can be trained to use conventional signs. Young apes reared with older signing relatives or playmates may take enthusiastically to a rudimentary kind of signing, without requiring special training. In other words, when set in an appropriately stimulating environment, young apes may acquire some fluency in symbolic communication. We are forced to conclude that they possess the necessary instincts. The puzzle is that in the wild, these instincts do not appear to be used. Although certain kinds of gestures may assume partly conventionalised shape, no repertoire of signs accumulates over time. The theoretical implications are all too frequently overlooked. Let us suppose that in a particular ape or ancestral human population, certain individuals possessed some limited linguistic capability. Now add a further assumption: these 'special' individuals continued to inhabit a Darwinian world. Would they find any use for their limited linguistic abilities?

Why Darwinism is still the only answer

Modern Darwinism is not restricted to evolution conceptualised in gradualist terms. When we investigate competitive and co-operative strategies, it becomes clear that

different strategies may come to prevail under different circumstances. Strategies may provoke counterstrategies, these provoking counterstrategies in their turn. From time to time, a previously unstable strategy may quite suddenly become evolutionarily stable. When a novel strategy becomes stable, it may radically change – perhaps even reverse – the former terms of natural selection. Before dismissing the direct relevance of Darwinism, we therefore need to investigate whether language could have evolved in this complex and contradictory way.

If we accept that language emerged with the establishment of the hunting and gathering lifestyle, then a corollary is that language emerged as life became subject to the rule of law. By 'the rule of law' I mean such things as kinship rules, marriage rules, religious taboos, ritual injunctions and so forth. The Darwinian thinker John Maynard Smith proposed such a theory in his 1995 book co-authored with Eörs Szathmáry – *The Major Transitions in Evolution.* These authors (1995) argued that society emerged when group-level contracts became evolutionarily stable. It was difficult to achieve this, since enforcement entails heavy costs. Social contracts are vulnerable to cheats – individuals who seek to gain from co-operation without paying their share of the costs. Somehow, however – in at least one ancestral population – the contract remained in force.

The rule of law creates a climate of trust. Although competition is not abolished, it assumes a different form – it must proceed within the law. Hunter-gatherers are self-governing egalitarians. Where a community is self-governing, laws are conceptualised in moral terms. The laws are conceptualised as sacred. Pantheons of other worldly beings – spirits of various kinds – are personified contractual phenomena. Humans committed to enforcement share a common purpose and perspective. Competition is for moral standing in the community. Where language is concerned, individuals gain status by being perceived by others as relevant (Dessalles 1998, 2000). It is not possible to gain such status by being secretive, devious or inscrutable. Individuals come under pressure to co-ordinate personal perspectives with wider social aims, adopting what might be termed a 'god's eye' view of the world. Once having passed through the relevant initiation rite, people are expected to assume responsibility in this way (Knight 1999).

When individuals trust one another and share the same perspective, they may communicate effectively without language. For example, they may communicate using nods and winks. A wink can 'speak volumes' where mutual understanding is already well entrenched. Nods may be regarded as 'up/down' head-signals; a wink is perhaps closer to 'on/off'. It is immediately clear that this kind of communication presupposes trust: two parties engaged in a violent argument could not conceivably rely on signals of this subtle kind. On the other hand, a network of trusting co-conspirators might well go beyond such rudimentary cues. They could augment their head and eye signals by recruiting additional parts of the body, such as hands, tongue or lips. It is possible to imagine speech beginning to evolve in this way. Again, everything would depend on trust: without this, shared understandings would be elusive and conflicts would arise.

For most of the time, chimpanzees are too individualistic for this kind of communication. Chimpanzees are rather like motorists caught in a traffic jam. Imagine a busy city intersection at which the signals have failed. Using your right or left indicator no longer

works. Nobody takes the slightest notice; nobody makes way. Your vehicle is equipped with the necessary buttons for digital signalling, but they are useless under the circumstances. Civilisation has temporarily collapsed. The only solution is to use the whole vehicle, pushing, shoving and nudging your way through. Unless you are prepared to risk colliding, you will remain for hours in the same place. In this sense, each signal must be visibly costly if it is to prove effective at all. Where chimpanzees vocalise in a public space, they use the whole vehicle. Pant hoots and waa barks are body language in this sense. Individual animals have no realistic alternative to body language, since their communities lack what it takes to install traffic lights of any kind.

If ape signals are body language, can we define human speech signals as 'head language'? Certainly, no other animal communicates so one-sidedly in and through the head. Chomsky is surely right on this point: language is 'internal'. It offers a window into the nature of the mind. But Chomsky's 'natural science' approach to this topic is not the only possible one. In his book, *The Cultural Origins of Human Cognition,* Michael Tomasello (1999) addresses the problem of the evolution of language by invoking the social brain hypothesis. He points out that no ape is capable of bi-directional mind reading or continuously maintained joint attention. Apes don't point at things; humans from an early age do. These differences apparently reflect the fact that the human brain is wired up to *correlate social perspectives*; ape brains are not. Since an ape cannot view itself from another's perspective, it is unable to represent to itself its own mental states. Apes, in short, are incapable of what Tomasello calls 'intersubjectivity'.

If intersubjectivity is excluded, there must be a reason. When asked about ultimate causes, it is to the environment that a Darwinian scientist turns. The most basic fact of all is that apes inhabit a Darwinian world. Each strives to extract information from its rivals without giving too much away. Even the structure of non-human primate eyes – when compared with human eyes – makes clear that they are designed to *avoid* divulging direction of gaze (Kobayashi and Kohshima 2001). Although chimpanzees certainly co-operate, their status is not determined by what others think. It is determined by establishing dominance at others' expense, either individually or by forming an alliance. Alliance partners are valued for their fighting ability and capacity for Machiavellian scheming in a conflict-ridden world. Admittedly, strategies that humans might regard as caring or socially creative do have a place, as Franz de Waal (1996) has shown. But a consistently honest, open, socially responsible ape would not get very far in life.

By nature, humans are competitive or co-operative according to the circumstances. But on a face-to-face level at least, status competition among humans assumes a non-Darwinian form. Admittedly, class societies – capitalism in particular – appear at least superficially to embody Darwinian principles. But humans in general do not inhabit a Darwinian social world. Egalitarian hunter-gatherers long ago transcended that level of complexity. Under what I am here calling 'the rule of law', status must be gained by making contributions valued by the community as a whole.

Sexual strategies and signalling

I now come to my specialist contribution, which concerns sexual or reproductive strategies. During past human evolution, the arena of communication between the sexes – where conflict and co-operation are endemic – is liable to have produced the most elaborate signalling systems (Miller 1999).

According to one recent Darwinian model (Power and Aiello 1997; Power 1998, 1999), 'sham menstruation' (more usually known as 'female initiation') was a fiction-generating strategy in which newly fertile females were bonded in coalitionary alliance with their pregnant and nursing mothers, sisters, and other kin. I favour this model because, unlike some others that have been proposed, it sets out from premises in modern Darwinian theory.

As brain size increased dramatically during the later phases of human evolution (Middle Pleistocene), the heavily child-burdened female needed to avoid being made pregnant and then abandoned by her mate. Females who secured increasing levels of continuous investment from males had improved fitness. A popular hypothesis in this context is that females solved their problems through 'sham oestrus' (Hill 1982). The evolving human female ceased to restrict sexual activity to the period around ovulation, instead dampening 'oestrus' and extending her receptivity beyond the fertile period. By withholding precise information about her true periods of fertility, the human female kept her mate sexually interested over an increasingly extended period.

Sham menstruation builds on this idea, but gives it an additional twist. Even where females have evolved continuous sexual receptivity, they still risk being exploited by philandering males. Once ovulation signals have been phased out, menstruation becomes one of the few indicators of fertility to remain externally detectable. This may help explain the extraordinary attention focused upon it in virtually all hunter-gatherer and other traditional cultures (Knight 1991, 1996). The human female menstruates considerably more copiously than any other primate. Unless countermeasures are taken, this risks divulging information that would allow philanderers to discriminate against pregnant or nursing mothers in favour of females who are visibly cycling – hence potentially available to be impregnated in the near future. In a Darwinian world, we expect a philanderer to monitor such information, attempting to seduce an imminently fertile (cycling) female at the expense of his already impregnated mate.

This threat – according to sham menstruation theory – provides the stimulus in response to which 'the rule of law' emerges. Recall that by starting to menstruate, a young female divulges her imminent fertility, attracting corresponding male attention. We would predict that pregnant and nursing females in the vicinity might perceive this as a threat. In the counter-strategy envisaged by Power and Aiello (1997), these females take collective action to deal with this threat. It would be difficult to hide the young female, denying her condition or existence. Hiding her would also mean failing to exploit her attractions – her potential value in extracting additional mating effort from males. Instead of hiding her, therefore, the young woman's real and/or fictional mothers, aunts, and sisters do just the reverse. Publicly advertising her condition, they seek by proximity to identify with her 'imminent fertility' and corresponding attractions. Bonding together closely, the young

woman's female kin temporarily bar male sexual access to her and scramble her signal, packaging the released information in a form that philanderers cannot use.

Painting up with 'blood', the kinswomen dance and in other ways act in synchrony, asserting themselves as inseparable from their menstruating 'sister'. Defending against the threat of harassment, they draw jointly on their own and one another's male kin for support. As brothers consequently become involved in physically defending their sisters, would-be philanderers are deterred from picking and choosing between one female and the next on the basis of biological signals. The fiction is broadcast that everyone just now is imminently fertile. Sexual harassment or violence remains, of course, an option for would-be philanderers. But under the new conditions, sexual rewards can more easily be earned by going away hunting and returning to camp with supplies of meat. In the arrangement that now begins to emerge – known ethnographically as 'bride-service' – meat from the hunt is handed to senior figures within the bride's coalition. They then redistribute it among close and distant kin. To maximize provisions thereby obtained, kin-bonded females should logically maximize joint access to multiple in-married males. This in turn means ensuring that any male who already has a sexual partner is barred from monopolizing access to additional mates. Ideally, each young woman as she comes of age should bring in at least one additional bridegroom – preferably a young man with a good reputation as a hunter.

For intrinsic reasons – since outgroup male harassment may at any time be attempted – this strategy must involve coalitionary control over women's bodies and availability (cf. Knight 1991: 122-53). This in turn depends on one fundamental precondition. When any female is signalling sexual resistance, her kin – both male and female – must support her in this and ensure that her message is understood. Females must schedule their action to maximum effect, appealing to male kin as necessary, synchronizing with sisters and ensuring that signals are salient and unambiguous. As each young female comes of age, she must be decisively and permanently initiated into the same coalition-based strategy.

Against this background, we can derive a prediction about the precise form of the basic cultural replicator or meme (cf. Dawkins 1989). The expected signature of sexual resistance can be inferred by recalling its theoretical antithesis in the form of primate sexual soliciting. We may conduct this reasoning in two steps:

> 1. A chimpanzee in oestrus signals her availability with a prominent genital swelling. This is a competitive signal, advertising to males in the vicinity that she is of the right *(same)* species, the right *(different)* sex – and that this is the right *(fertile)* time.

> 2. On this basis, sexual resistance should be displayed by collectively signalling *wrong* sex (male), *wrong* species (animal) and *wrong* time (menstruating).

Matching these predictions, performances that actively reverse gender and/or species are intrinsic to women's traditional rituals of rebellion (e.g. Gluckman 1954/1963). Throughout sub-Saharan Africa, females asserting their togetherness and potency paint

up with cosmetics – especially brilliant reds; simultaneously, they act out male and/or animal roles (Power 2000). Cross-culturally, in every continent where research has been conducted, hunter-gatherer initiation ceremonies establish sexual inviolability – here termed 'the rule of law' – in comparable ways (Knight 1991; Knight *et al.* 1995; Power and Watts 1997).

The earliest use of pigments (invariably red) dates to about 300,000 years ago in Africa. By about 250,000 years ago, we occasionally see similar behaviour in Eurasia. But the habitual and widespread use of red ochre is only identified in the final Middle Pleistocene, between 130,000 and 200,000 years ago, again initially restricted to Africa. This is precisely the time and place that *Homo sapiens* evolved (Watts 1999).

Drawing on ethnographic data from the same region, the red ochre pigments have been interpreted as connoting blood, fertility, and the supernatural potency so widely attributed to menstruation (Power and Watts 1997; Watts 1999). Examples of more recent local rock art include therianthropes – creatures in which human and animal features are combined (Lewis-Williams and Dowson 1989). Khoisan traditions are of particular significance, since in their case strands of cultural, including ritual, continuity evidently stretch back into the Middle Stone Age (Watts 1999). In the Kalahari, a Ju/'hoansi maiden still celebrates her first menstruation by ceremonially bonding with female kin. While bleeding, she adopts the identity of the Eland Bull. Central to belief about this mythical creature is that he enjoys sexual relations with his multiple 'wives' – the maiden's kinswomen acting the part of eland cows. During the Eland Bull Dance – the ceremony held to celebrate a girl's first menstruation – such fictional sex is acted out by all concerned (Lewis-Williams 1981). Other hunter-gatherer representations of divinity – such as the Australian Aboriginal Rainbow Snake – illustrate the same logic of gender and/or species reversal (Knight 1983, 1988).

The 'human revolution' became consummated as coalitionary resistance to philandering drove up the costs of 'selfish' male strategies to the point where they were no longer affordable. With this source of internal conflict removed, enhanced community-wide trust transformed the context in which communication occurred. We have seen that signals may become conventionalized wherever trusting listeners can be assumed. The establishment of stable, 'blood'-symbolized kin-coalitions allowed 'brothers' and 'sisters' to trust one another as never before. Signallers no longer needed to ground each communicative performance in hard-to-fake displays whose *intrinsic* features inspired trust. Trust, in other words, no longer had to be generated signal by signal – it could be assumed. With this problem removed, even patent fictions could now be valued as evidence from which to reconstruct others' thoughts. Language consists entirely of fictions of this kind.

Humans who had undergone the revolution, then, no longer had to stage a 'song and dance' each time they needed to appear persuasive. Costly ritual performance remained necessary, but only because each individual's initiation into and subsequent commitment to the speech community could be signalled in no other way. Once such commitment had *already* been displayed, coalition members could cut their costs, replacing indexical

display with a repertoire of conventionally agreed shorthands (see Knight 1998, 1999, 2000). Since these low-cost abbreviations – 'words' or 'proto-words' – were tokens in the first instance of group-level contractual phenomena, they could be honest without having to be grounded in anything real. Reality-defying performances upholding community-wide moral contracts are familiar to anthropologists as 'religion' (Rappaport 1999). Once humans had established such traditions, they found themselves communicating within a shared moral universe – a socially constructed virtual reality – of their own making.

Conclusion

The 'human revolution' culminated in something remarkable – the establishment of the rule of law. Apes do not live under such conditions. When they signal, consequently, they must intervene in reality. There is no other universe in which they *can* intervene. An animal can make a difference only physically, only with its body – with signals that are inseparable from its body. Chimpanzee waa-barks and pant-hoots are examples of this. They are indices of bodily and emotional states – direct behavioural interventions, with direct behavioural impact and consequences.

By contrast, a human linguistic utterance – a 'speech act' – is an intervention in a different kind of reality, known by philosophers as 'institutional' reality. Institutional facts exist because it is collectively believed that they do. Examples are money, marriage, supernatural potency and underworlds (Searle 1996). A speech act, like a move in a board game, is internal to this level of reality. Nothing happens physically, but there is a shift in perspective, a shift within the institutional domain. Things are seen differently, and to that extent reality has changed. When human life became subject to the rule of law, this kind of reality entered the scene. Language first emerged in the form of cryptic 'nods' and 'winks' – mutually understood signs – for navigating within this novel domain. Entities of this kind were no longer evolving in a Darwinian environment. The laws of signal evolution therefore no longer applied. Wastefulness in signals (Zahavi 1991) was no longer under positive selection. Instead, the demand was for cognitive efficiency and transparency (Steels 1997, Steels et al. 2002). The paradoxes of language evolution correspondingly dissolved.

Respect for the law cannot be explained by this or that instinct or cognitive module. Where strategies provoke counter-strategies, contrasting behavioural outcomes necessarily emerge on the basis of identical genes. Hunters and gatherers did not become self-organised gradually, through 'descent with modification'. They established the rule of law in the only way they could. For the individuals concerned, it would have been all or nothing. In one small population at least, they turned the world upside down quite suddenly – through strategies of reverse dominance (Boehm 1993, 1994, 1997, 2001) culminating in the transcendence of Darwinian social norms.

Language is dependent on civilised, rule-governed behaviour. This cannot be assumed; it must be explained. Ancestral humans surely had good Darwinian reasons to band together in enforcing the rule of law. Any explanation must therefore be in terms of standard Darwinian theory.

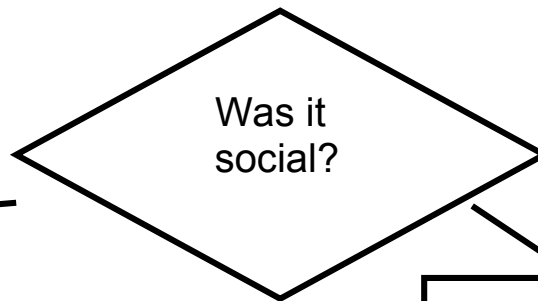When natural selection produced language, it produced something special

Did anything special happen?
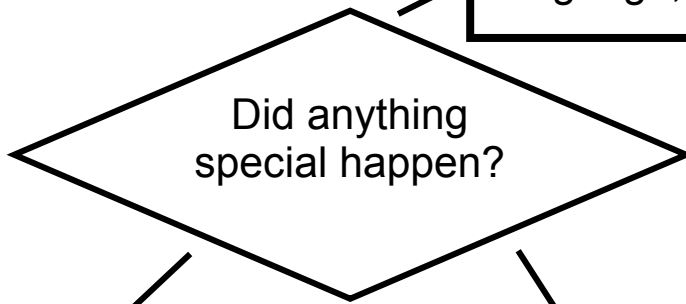
Nothing special
(Pinker)

Something revolutionary happened!
(Chomsky)
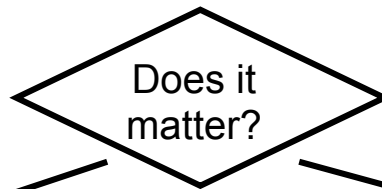
Does it matter?

No
(Chomsky)

Yes, it matters
(most others?)

Was it social?

No
(Bickerton, Hauser, Fitch)

YES

(Rousseau, Marx and Engels, Vygotsky, Tomasello, Knight)

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